BLOWOUT PREVENTER (BOP)
FAILURE MODE EFFECT CRITICALITY ANALYSIS (FMECA) – 2
FOR
THE BUREAU OF SAFETY AND ENVIRONMENTAL ENFORCEMENT

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SUMMARY

As part of the Blowout Preventer (BOP) Maintenance and Inspection for Deepwater Operations study (Bureau of Safety and Environmental Enforcement [BSEE] contract number M11PC00027), American Bureau of Shipping (ABS) and ABSG Consulting Inc. (ABS Consulting) performed a Failure Mode, Effect, and Criticality Analysis (FMECA) on specific BOP subsystems and equipment. There were three FMECAs performed with three different teams of operators, drilling contractors and original equipment manufacturers. This is the draft report of the FMECA conducted with Team 2 and represents the study deliverable associated with Task 6.2.2.1 as outlined in the contract.

This report presents the objective and scope of the FMECA study, FMECA methodology, FMECA results/worksheets and discusses major findings of the two workshops (Functional-level and Equipment-level) that were conducted on a selected BOP and associated equipment (Class VII BOP, 6 Rams,1 Annular) that met the study's criteria (refer to Section 1.2 Analysis Scope for more detail).

The objectives of the FMECA analysis were to (1) establish the relationship between a specific subsystem/equipment failure and a loss of system functionality, (2) identify the critical failures by using risk-ranking methods, and (3) align the current maintenance, inspection, and testing (MIT) practices and their associated frequencies with each functional failure and the associated subsystem and equipment failures.

Section 2 of the report outlines the methodology used to conduct the FMECA. The FMECA was conducted in two phases, functional-level and equipment-level. The functional-level (top-down) FMECA was conducted to identify the functional failures that could degrade the BOP functions. The equipment-level (bottom-up) FMECA was conducted to identify the impact of major equipment and component failures on the BOP performance by evaluating equipment-level failure modes, identifying specific equipment-level causes, identifying the safeguards to prevent or detect the failure modes, and ranking the criticality of failure modes. In addition, the equipment-level FMECA was used to align MIT activities with equipment-level failure modes and specific equipment failures.

In preparation for the FMECA, ABS Consulting engineers identified potential functional failures and equipment-level failure modes to help guide the analysis team. Functional- and equipment-level FMECA sessions were held with BOP subject matter experts from the original equipment manufacturer (OEM), drilling contractor, and operator. ABS Consulting and ABS engineers facilitated and documented the analysis using ABS Consulting's Enterprise LEADER software tool.

The team identified the eight BOP functions in American Petroleum Institute (API) Recommended Practices (RP) 53, Third Edition, Section 7.1.3, and one additional function prior to the FMECA analysis to meet the above objectives. During the FMECA session, it was determined that the "shear the drill pipe and seal the wellbore" function needed to be broken down into three functions based on differing operating conditions. The following 11 BOP functions were considered in the functional-level FMECA:

1. Close and seal on the drill pipe and allow circulation on demand.
2. Close and seal on open hole and allow volumetric well control operations on demand.
3. Strip the drill string using the annular BOP(s).
4. Hang-off the drill pipe on a ram BOP and control the wellbore.
5. Controlled operation – Shear the drill pipe and seal the wellbore.
6. Emergency Operation – Auto-Shear – Shear the drill pipe and seal the wellbore.
7. Emergency Operation – Emergency Disconnect System (EDS) – Shear the drill pipe and seal the wellbore.
8. Disconnect the lower marine-riser package (LMRP)/BOP.
9. Circulate the well after drill pipe disconnect.
10. Circulate across the BOP stack to remove trapped gas.
11. Connect BOP and LMRP at landing (not included API recommended practices [RP] 53).

During the functional-level FMECA, the analysis team evaluated these 11 BOP functions and their 52 associated functional failures. Each function and its associated functional failures were evaluated in detail by identifying (1) the potential end effects resulting from the functional failure, (2) equipment-level causes and failure modes potentially resulting in the functional failure, and (3) safeguards used to prevent and/or detect the potential functional failure. Appendix A presents the Functional-level FMECA worksheets, Appendix B presents the Equipment-level FMECA worksheets.

For the equipment-level FMECA, the analysis team and industry participants (IP) identified and evaluated the following 3 major BOP subsystems and 21 major equipment categories:

1. Surface Control System
    1.1. Hydraulic Power Unit (HPU)
    1.2. Power
    1.3. Multiplex (MUX) System and Communication Cables
    1.4. Hydraulic Supply
    1.5. Control Panels
    1.6. Accumulators – Surface
    1.7. Fluid Reservoir Unit
    1.8. Secondary & Emergency Control Systems

2. Subsea Control System
   2.1. Blue and Yellow Control Systems – Electrical Section
   2.2. Blue and Yellow Control Systems – Hydraulics
   2.3. Accumulators
   2.4. Emergency Control Systems (ECS)
   2.5. Hydraulic Supply, Rigid Conduit and Manifold

3. BOP Stack
   3.1. Annulars
   3.2. Blind Shear Ram
   3.3. Casing Shear Ram
   3.4. Pipe and Test Rams
   3.5. Choke and Kill Lines and Valves
   3.6. Connectors
   3.7. Autoshear System
   3.8. Remote operated vehicle (ROV) Intervention Interface

Note:

1- *For the purpose of this study the "BOP System" is the first level of indenture in the BOP hierarchy (e.g. Surface Control System, Subsea Control System, BOP Stack) and "Major BOP Component" is considered the second level of indenture (e.g. MUX System, Annular).*

2- *The above naming convention was adopted during the FMECA sessions and are used throughout this FMECA report and may differ slightly from industry subsystem or equipment naming convention; see Table1-1 for additional information*

Boundaries were established to further define the major equipment items by identifying all of the components included with each major equipment item.

During the equipment-level FMECA meetings, the analysis team evaluated each major equipment item by first identifying potential equipment-level failure modes and then postulating on specific equipment failure causes resulting in each failure mode. The team then identified the potential effects resulting from each failure mode. The effects were then identified and classified into various BOP functional failures. Based on this classification the equipment-level failure modes and BOP were linked with a corresponding BOP functional failure. Once these links were established, the analysis team identified any safeguards that are currently in place to detect, prevent or mitigate the failure mode. The analysis team then identified specific MIT practices currently employed to prevent or detect the specific equipment failure causes.

In order to establish the potential risk of each equipment level failure mode, the analysis team used a Risk Priority Number (RPN) scoring methodology. The identified failure mode effects were ranked according to their severity, occurrence, and detection. The RPN for each effect (functional failure) was determined and recorded. The severity rankings were based on the worst-case end effect of each functional failure assuming that there is no redundancy. The occurrence rankings were based on the frequency of the failure mode occurring, giving credit for any system redundancy in the system(s).

Finally, the detection rankings were based on the probability of the failure mode being detected by current protections (e.g. alarms) and/or current MIT practices. Appendix B contains the results of the equipment-level FMECA.

Section 3 of this report contains the analysis results. The analysis team identified and evaluated 132 functional and 144 equipment failure modes. Even though each equipment item and its mode of failure will affect the functionality of the BOP to a certain degree, the FMECA team identified the following equipment items as the most critical items contributing to the BOP's potential functional failure:

- Choke & Kill Lines & Valves
- Blind Shear Ram
- Casing Shear Ram
- Pipe & Test Rams
- Autoshear Systems
- Connectors
- Control Panels
- Blue & Yellow Control Systems - Hydraulics
- Accumulator-Subsea

Table S-1 highlights the top 15% of the equipment failures that could potentially result in a severe impact on functionality of the BOP.

Table S-1: Failure Modes with Highest RPN

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
Choke & Kill Lines & Valves - BOP Stack	Plugged	10	4	4	160	4
Blind Shear Ram - BOP Stack	External Leak/ Rupture	9	5	3	135	1
Blind Shear Ram - BOP Stack	Mechanical Failure	9	5	3	135	1
Blind Shear Ram - BOP Stack	Wear	9	5	3	135	1
Casing Shear Ram - BOP Stack	External Leak/ Rupture	9	5	3	135	1

Table S-1: Failure Modes with Highest RPN (cont'd)

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
Casing Shear Ram - BOP Stack	Mechanical Failure	9	5	3	135	1
Casing Shear Ram - BOP Stack	Wear	9	5	3	135	1
Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	9	5	3	135	1
Choke & Kill Lines & Valves - BOP Stack	Mechanical Failure	9	5	3	135	1
Pipe & Test Rams - BOP Stack	External Leak/ Rupture	9	5	3	135	1
Pipe & Test Rams - BOP Stack	Mechanical Failure	9	5	3	135	1
Autoshear System - BOP Stack	Mechanical Failure	9	2	7	126	1
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Corrosion/ Erosion	9	2	7	126	1
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	9	2	7	126	1
Connectors - BOP Stack	Mechanical Failure	9	2	7	126	1
Hydraulic Supply: Rigid	Corrosion/ Erosion	9	2	7	126	1

Table S-1: Failure Modes with Highest RPN (cont'd)

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Mechanical Failure	9	2	7	126	1
Accumulators - Subsea Control Systems	External Leak/ Rupture	10	2	6	120	2
Accumulators - Subsea Control Systems	Internal Leak	10	2	6	120	2
Accumulators - Subsea Control Systems	Loss of Function (general)	10	2	6	120	2
Accumulators - Subsea Control Systems	Mechanical Failure	10	2	6	120	2
Accumulators - Subsea Control Systems	Wear	10	2	6	120	2
Autoshear System - BOP Stack	Mechanical Failure	10	2	6	120	2
Blind Shear Ram - BOP Stack	External Leak/ Rupture	10	2	6	120	4
Blind Shear Ram - BOP Stack	Wear	10	2	6	120	4
Blind Shear Ram - BOP Stack	Mechanical Failure	10	2	6	120	3
Blind Shear Ram - BOP Stack	Corrosion/ Erosion	10	2	6	120	2

Table S-1: Failure Modes with Highest RPN (cont'd)

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
Blind Shear Ram - BOP Stack	Internal Leak	10	2	6	120	2
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Corrosion/ Erosion	10	2	6	120	2
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak/ Rupture	10	2	6	120	2
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Internal Leak	10	2	6	120	2
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	10	2	6	120	2
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Plugged	10	2	6	120	2

The Choke & Kill Lines & Valves - BOP Stack was the highest ranked piece of equipment that could have an effect on the BOP's functionality and operation. The team identified 6 functional failures that contributed to the failure of the Choke & Kill Lines & Valves - BOP Stack. The result of these failure modes could potentially reduce or eliminate the associated equipment functionality and possibly a loss of BOP operation.

As identified above, the Blind Shear Ram is ranked as the second ranked piece of equipment whose failure could potentially have a severe effect on the BOP's overall ability to function properly when demanded. Even though the occurrence of such a failure is identified as being fairly low (i.e., less than one event every 5 years to one event every 10 years), the high severity and high detection (i.e., hard to detect) increase the risk of such a failure. Therefore the Blind Shear Ram is considered to be the most critical piece of equipment that could lead to the loss of the primary function of the BOP. In this study, "loss of primary function of the BOP" is defined as controlling the well.

The high severity rating in this case is attributed to the fact that the failure of the Blind Shear Ram will diminish or eliminate the last protection for controlling the well (i.e. loss of primary function of the BOP). The high detection rating is due to the low chance of discovering such a failure during normal BOP operation. For example, mechanical failures might not be detected during normal BOP operation and could only be discovered during a major preventive or planned maintenance. As indicated in the above table, the Blind Shear Ram failure modes resulted in 18 functional failures that could potentially result in the loss of BOP operation

According to the findings of this study, it appears that the highest critical failures are associated with the detectability of these failures. A piece of equipment might function properly during a function test or pressure test, but a hidden or dormant failure could occur because of the frequency of the test or after the tests are conducted. Additionally, some failure modes simply cannot be detected during normal testing and these types of failures may not be fully discovered until there is a real demand or the equipment is pulled from the well and inspected during major preventive maintenance.

When comparing these highly ranked failure modes with the lower ranked failure modes, it is evident that the rigorous MIT activities increase the detectability of the failures, therefore resulting in lower criticality or RPN.

During the FMECA study, the causes of each failure mode were identified. Depending on the equipment and the failure mode, components or other failure causes such as SEM communication, bolts, seals, packing elements, insufficient volume, clogged lines, loss of signal, regulators, SPM valves, shuttle valves, and filters were considered (see Appendix B for more detail). The team identified and aligned the MIT activities for each failure mode and its causes.

The occurrence and detection rankings of the failure modes are a good indication of these facts. After aligning the MIT activities with the failure modes, it was evident that there are sufficient indication and detection factors in place for mitigating the failures or reducing the criticality.

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LIST OF ACRONYMS

ABS	—	American Bureau of Shipping
ABS Consulting	—	ABSG Consulting Inc.
API	—	American Petroleum Institute
BSEE	—	Bureau of Safety and Environmental Enforcement
BOP	—	Blowout Preventer
EDS	—	Emergency Disconnect System
FMECA	—	Failure Mode, Effect, and Criticality Analysis
HPU	—	Hydraulic Power Unit
IP	—	Industry Participant
MIT	—	Maintenance, Inspection, and Testing
MUX	—	Multiplex
LMRP	—	Lower Marine-Riser Package
OEM	—	Original Equipment Manufacturer
ROV	—	Remote Operated Vehicle
RP	—	Recommended Practices
RPN	—	Risk Priority Number

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1.0 INTRODUCTION

As part of the Blowout Preventer (BOP) Maintenance and Inspection for Deepwater Operations study (Bureau of Safety and Environmental Enforcement [BSEE] contract number M11PC00027), American Bureau of Shipping (ABS) and ABSG Consulting Inc. (ABS Consulting) performed a Failure Mode, Effect and Criticality Analysis on specific BOP subsystems and equipment. This report represents the first draft Failure Mode, Effect, and Criticality Analysis (FMECA) deliverable of the study associated with Task 6.2.2.1 as outlined in the contract.

Three FMECAs were performed with three different analysis teams. Each analysis team included personnel from a BOP original equipment manufacturer (OEM), drilling contractor, and an operator, with the condition that these three industry participants (IPs) have a working relationship and operate a drilling rig using the BOP equipment manufactured by the OEM participating in the FMECA sessions.

This report presents the objective and scope of the FMECA study, FMECA methodology and worksheets and the results of the functional- and equipment-level FMECAs that were conducted on a Class VII BOP with six rams and one annular. This section details the FMECA objectives, scope, and analysis team participants.

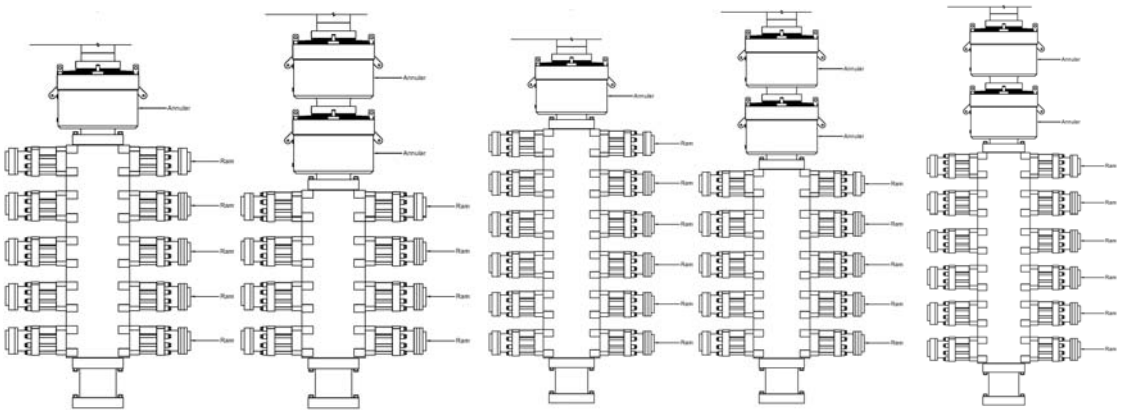
1.1 OBJECTIVES

The objectives of the FMECA were to (1) establish the relationship between a specific subsystem/equipment failure and a loss of system functionality, (2) identify the critical failures by using risk-ranking methods, and (3) align the current maintenance, inspection, and testing (MIT) practices and their associated frequencies with each functional failure and the associated subsystem and equipment failures.

1.2 ANALYSIS SCOPE

The scope of this effort was the analysis of a selected BOP and associated equipment from one of the OEMs, drilling contractors and operators participating in the study that meets the following criteria:

- Operation Location – Gulf of Mexico (majority of the operation and maintenance to be from the Gulf of Mexico)
- Operating Depth – 5,000 Feet and Deeper
- BOP Configurations:
  - **Class VI BOP,** five ram configuration and single annular or a four ram and dual annular
  - **Class VII BOP,** five ram configuration and dual annular or a six ram and single annular
  - **Class VIII BOP,** six ram configuration and dual annular(ram configurations can consist of a combination of blind/shear ram, non-sealing casing ram and pipe ram preventers)



Class VI BOP Class VII BOP Class VIII BOP

The analysis included the compilation of information from IPs, followed by the review and analysis of the selected BOP and associated control systems used by the driller.

The analytical scope for the functional-level FMECA consisted for the evaluation of the eight BOP functions specified in American Petroleum Institute (API) recommended practices (RP) 53 Standard, Section 7.1.3, and the additional functions identified by the analysis team. During the FMECA session, it was determined that the "shear the drill pipe and seal the wellbore" function needed to be broken down into three functions based on differing operating condition/logic. A total of 11 major BOP functions and 52 functional failures were identified and agreed upon. The following BOP functions were evaluated in this study:

1. Close and seal on the drill pipe and allow circulation on demand.
2. Close and seal on open hole and allow volumetric well control operations on demand.
3. Strip the drill string using the annular BOP(s).
4. Hang-off the drill pipe on a ram BOP and control the wellbore.
5. Controlled operation – Shear the drill pipe and seal the wellbore.
6. Emergency operation – Auto-Shear – Shear the drill pipe and seal the wellbore.
7. Emergency operation – Emergency Disconnect System (EDS) – Shear the drill pipe and seal the wellbore.
8. Disconnect the Lower Marine-Riser Package (LMRP)/BOP.
9. Circulate the well after drill pipe disconnect.
10. Circulate across the BOP stack to remove trapped gas.
11. Connect BOP and LMRP at Landing (not included in API RP 53 Standard).

For the equipment-level FMECA, the BOP was divided into 3 major BOP subsystems and 21 major equipment items. The following represents the selected functions and BOP systems/equipment for the FMECA assessment:

1. Surface Control System
   1.1. Hydraulic Power Unit
   1.2. Power
   1.3. Multiplex System and Communication Cables
   1.4. Hydraulic Supply
   1.5. Control Panels
   1.6. Accumulators – Surface
   1.7. Fluid Reservoir Unit
   1.8. Secondary and Emergency Control System
2. Subsea Control System
   2.1. Blue and Yellow Control Systems – Electrical
   2.2. Blue and Yellow Control Systems – Hydraulic
   2.3. Accumulators – Subsea
   2.4. Emergency Control Systems (ECS)
   2.5. Hydraulic Supply: Rigid Conduit and Manifold
3. BOP Stack
   3.1. Annulars
   3.2. Blind Shear Ram
   3.3. Shear Ram (Casing)
   3.4. Pipe and Test Rams
   3.5. Choke and Kill Lines and Valves
   3.6. Connectors
   3.7. Autoshear System
   3.8. Remote operated vehicle (ROV) Intervention Interface

In addition, boundaries were established for each major equipment item to identify all of the specific components to be included with each major equipment item. Table 1-1 lists the boundaries used in this specific analysis.

Table 1-1: Equipment-Level FMECA Major Component Boundaries

Major Component	Specific Components Included With Major Component Boundary
Surface Control System	
Hydraulic Power Unit (HPU)	HPU including three HPU pumps and associated piping and regulators
Power	Power including Blue & Yellow Power Distribution Panels, Power Isolation J-box; Blue & Yellow UPSs, Blue & Yellow Subsea Transformers, and blue and yellow distribution panels, umbilical J-box; and connections to associated cabinets and equipment (e.g., MUX, control panels)
Multiplex (MUX) System Communication Cables	MUX System, including Central Control Unit with process array, blue & yellow processor array, and associated equipment and cabinets; MUX cable reels and MUX cables (to connections with Blue & Yellow Pods)
Hydraulic Supply	Hydraulic Supply including blue & yellow hotline reels, hotline hoses (to connection at Blue & Yellow Pods) and rigid conduit (to connection with subsea accumulator system)
Control Panels	Control Panels including driller's panel with system controller and tool pusher's panel with system controller
Accumulators – Surface	Accumulators - Surface including one 300 gallon, 5K rack; one 180 gallon 5K accumulator rack and associated ball valve; and connectors to HPU
Fluid Reservoir Unit	Fluid Reservoir Unit, including 650 gallon. glycol, 550 gallon concentrate, and 1350 gallon mixed fluid reservoirs; glycol, concentrate, and mixed fluid pumps; and associated piping, and mixing system
Secondary & Emergency Control Systems	Secondary & Emergency Control Units with process array, blue & yellow processor array, and associated equipment and cabinets; MUX cable reels and MUX cables, UPS
Subsea Control System	
Blue & Yellow Control Systems – Electrical	Blue & Yellow Control Systems including MUX control, MUX POD power & communication, hydraulic connections within the pod
Blue & Yellow Control Systems – Hydraulics	Blue & Yellow Control Systems , E/H section (hydraulics, power, communication, SEM interface, pressure, temperature, and water sensors, transformer, pod cabling, solenoid boards, solenoids)

Table 1-1: Equipment-Level FMECA Major Component Boundaries (cont'd)

Major Component	Specific Components Included With Major Component Boundary
Accumulators – Subsea	Accumulators - Subsea including associated hydraulic piping and connections such as MUX pod and rigid conduit connections, 16x 80gallon bottles
EDS	Secondary & Emergency Control Systems - Subsea including POD angle sensor, inclinometer, acoustic, and deadman
Hydraulic Supply, Rigid Conduit, and Manifold	Lower Valve Section including regulators and SPM valves to the shuttle valve, Rigid conduit, crossover
BOP Stack	
Annulars	Blowout preventer that uses a shaped elastomeric sealing element to seal the space between the tubular and the wellbore or an open hole, including both lower and upper annulars and hydraulic supply
Blind Shear Ram	Ram BOP whose Ram Blocks incorporate a cutting blade to shear the pipe and sealing elements to contain well bore pressure upon shearing of the pipe, including hydraulic supply
Shear Ram	Ram BOP whose Ram Blocks incorporate a cutting blade to cut casing and/or heavier grade tubulars within a specific range. They do not seal the well bore.
Pipe & Test Rams	**Pipe Ram:** A closing and sealing component in a ram blowout preventer that seals around the outside diameter of a tubular in the wellbore. **Test Ram**: A Variable Bore Ram located in the lower most Ram Cavity with ram block installed in inverted position to seal pressure from the top and enable testing of the BOP Stack without running a Test Tool.
Choke & Kill Lines & Valves	Valves and pipes assembly enabling communication to or from the well bore to the surface C&K manifold to circulate well, control kicks or kill well. Choke & Kill Lines & Valves on both LMRP & Stack.
Connectors	Connectors at Wellhead and LMRP/BOP Stack and Hydraulic Actuators
Autoshear System	Autoshear trigger valve, SPM valve
ROV Intervention Interface	Shuttle valve, piping

1.3 FMECA TEAM MEMBERS AND MEETING SCHEDULE

The analysis team for this study included personnel from three IPs, ABS, and ABS Consulting. The IPs participating included one or more representatives from an OEM, drilling contractor, and operator. These individuals provided knowledge of the design, engineering, operation, and maintenance of the BOP being evaluated. Table 1-2 lists the functional positions for the IP personnel who participated in this study.

Table 1-2: IP FMECA Team Members

IP Organization	Position/Expertise
BOP OEM	Engineering Manager, Drilling Products
	Manager, Reliability Engineering/Drilling and Production
	Electrical Engineering Manager, Drilling and Production
	Sub Section Manager, Stacks, Mechanical Controls and Risers
Drilling Contractor	Director, Subsea Operation Manager
Operator	Well Technology

In addition to the IP representatives, personnel from ABS and ABS Consulting participated in the FMECA sessions. Specifically, ABS personnel provided knowledge of the overall BOP operations and class society and regulatory requirements applicable to BOP design and operation. ABS Consulting personnel facilitated and documented the FMECA study. Table 1-3 lists the ABS and ABS Consulting personnel participating in this study.

Table 1-3: ABS and ABS Consulting FMECA Team Members

Name	Organization	Title	Study Role
David Cherbonnier	ABS	Staff Consultant, Corporate Offshore Technology	Subsea Engineer
Randy Montgomery	ABS Consulting	Senior Director, Integrity Management	Project Technical Lead
Farzin Nouri	ABS Consulting	Senior Risk and Reliability Engineer	Workshop Facilitator
Philip Howard	ABS Consulting	Lead Engineer	Workshop Scribe

To prepare for the FMECA studies, ABS and ABS Consulting held a FMECA kickoff meeting with the IPs on December 6 and 7, 2011. The purposes of the kickoff meeting were to discuss the FMECA analysis approach and the analysis scope to help ensure that all participants have the same level of understanding of the FMECA procedures.

The functional-level FMECA study was conducted by the analysis team during sessions held on September 18 through 20, 2012. During this meeting, the analysis team members were provided an introduction to FMECA methodology and procedures and then performed the functional-level FMECA. The equipment-level FMECA was conducted during sessions held on October 1 through 5, 2012.

1.4 REPORT ORGANIZATION

Section 2 of this report provides an overview of the methodology used to analyze the BOP's selected functions and equipment to determine the critical failure modes and their effects. Section 3 discusses the results of the effort. Appendix A contains the functional-level FMECA worksheets and Appendix B contains the equipment-level FMECA worksheets.

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2.0 ANALYSIS METHODOLOGY

In order to evaluate BOP MIT practices, reduce the risk of failures and improve the reliability of BOP performance, it is essential to identify the BOP's critical failure modes and their effects. Therefore, ABS and ABS Consulting selected and employed both functional- and equipment-level FMECA methodologies to evaluate BOP functions and identify specific subsystem and equipment failures of interest as outlined in Section 1.2, Analysis Scope.

This analysis methodology was chosen because it provided a means to establish a relationship among (1) BOP functions, (2) BOP equipment failures, and (3) BOP MIT practices by

- Identifying the potential effects resulting from deviations to BOP functions (i.e., functional failures) and equipment-level failure modes causing the BOP functional failures.
- Identifying the potential functional failures resulting from BOP equipment failure modes and specific equipment failures causing the BOP equipment failure modes.
- Linking specific equipment failures to BOP functional failures.
- Identifying and aligning the MIT activities (Indication / Protection / Maintenance) currently provided for preventing specific equipment failures resulting in BOP functional failures and their potential end effects.
- Risk-ranking the equipment-level failure modes.

2.1 ANALYSIS APPROACH

FMECA is an inductive reasoning approach that (1) considers how the functional failures of each system function or the failure modes of each component could result in system performance problems and (2) helps evaluate safeguards that are in place (including engineered protections & monitoring systems, human actions, and maintenance activities) to prevent, detect or mitigate such problems. The main focus of a FMECA is to establish the cause-and-effect relationship between potential equipment failures, functional failures, and the end effect of those failures, and to evaluate the criticality of the postulated functional failure/failure mode.

Figure 2-1 represents the general FMECA steps used in evaluating the BOP system. Specifically, this study employed both functional- and equipment-level FMECA approaches (see Step 3) with the explicit purpose of transitioning the functional-level FMECA to a more detailed level to better ensure the alignment of MIT activities with specific equipment failures and link the specific equipment failures with their potential impact of BOP performance via functional failures. This FMECA approach is very similar to the approach employed in many classical reliability-centered maintenance approaches, which have the overall objective of determining the optimal maintenance strategy for preserving system functionality via detection and prevention of equipment failures.

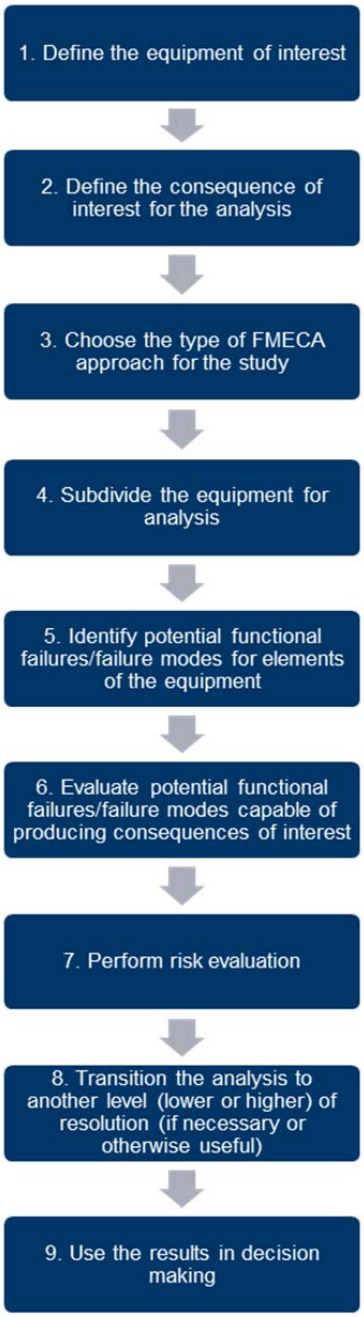

Figure 2-1. General FMECA Approach

2.2 ANALYSIS PROCEDURES

This section summarizes the procedures and specific tools used in performing the functional- and equipment-level FMECAs. In addition, the risk priority number approach that was used to risk rank the functional failure effects and equipment failure mode pairs has been provided. More explanation on the ranking method is given in Section 2.2.3.

2.2.1 Functional Level (Top-Down) FMECA

The functional-level FMECA was performed by analyzing each function and its associated functional failures. The functional-level FMECA process is illustrated in Figure 2-2. In executing this procedure, the following operating modes were applied:

- Normal Drilling
- Kick Control
- Emergency Operation (e.g., disconnect)
- Riding the Storm

In addition, the following are consequences of interest for identifying end effects of interest during the functional-level FMECA:

- Safety Effects
  - Inability to Control or Correct a Well Kick (or other BOP function)
  - Potential Release of Hydrocarbon to the Atmosphere Resulting in Potential Fire, Explosion, and/or Exposure to Toxic Materials Causing Injury or Worse
- Environmental Effects
  - Inability to Control or Correct a Well Kick (or other BOP function)
  - Potential Release of Hydrocarbons to the environment resulting in a Minor, Significant, Small (<1,000 bbls), Medium (1,000 to 10,000 bbl.), or Large (>10,000 bbl.) Spill/Atmospheric Release
- Significant Downtime
  - Failures Requiring Pulling of the LMRP or BOP Stack
  - Downtime Exceeding 5 Days

In evaluating potential end effects, the team evaluated the severities based on worst-case end effects assuming that available safeguards do not prevent or mitigate the end effects. Therefore, the end effects represent the potential severity and conservatively overstate the expected consequences.

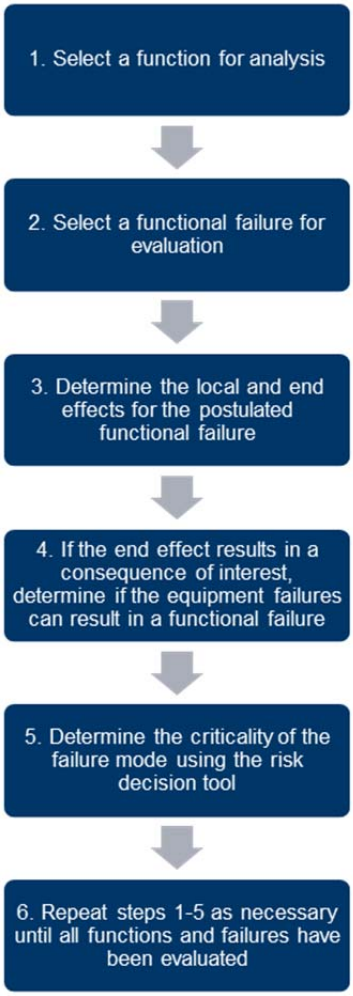

Figure 2-2. Functional-level FMECA Procedure

Specifically during the functional-level FMECA, the analysis team evaluated 11 BOP functions and 48 associated functional failures. Table 2-1 list the functions and functional failures evaluated.

During the functional-level FMECA workshop, the analysis team evaluated each of the above-mentioned functions and functional failures in detail by identifying (1) the potential end effects resulting from the functional failures, (2) the equipment-level causes and failure modes resulting in each potential functional failure, and (3) the safeguards used to prevent or detect the potential functional failure and its associated equipment-level causes. These evaluations were recorded in tabular format using the Enterprise LEADER software. The equipment-level causes and failure modes were then studied in detail during the equipment-level FMECA workshop.

Table 2-1: Functions and Functional Failures

No.	Function	Functional Failure Modes
1	Close and seal on the drill pipe and allow circulation on demand	Failure to close on drill pipe through annular(s)
		Failure to close on drill pipe through pipe rams
		Failure to seal or partial seal on drill pipe through annular(s)
		Failure to seal or partial seal on drill pipe through pipe rams
		Unintentional closing / opening
		Failure to open/close fail-safe valves to seal
		Closes too slowly
		Loss of containment
2	Close and seal on open hole and allow volumetric well control operations on demand	Failure to close on open hole through blind-shear rams or annular
		Unintentional closing / opening
		Failure to open/close fail-safe valves
		Closes too slowly
		Loss of containment
3	Strip the drill string using the annular BOP(s)	Failure to close annulars
		Failure to maintain stripping pressure
		Failure to seal
4	Hang-off the drill pipe on a ram BOP and control the wellbore	Failure of hang-off ram to close
		Failure to maintain closing pressure
		Failure to maintain locking
5	Controlled Operation-Shear the drill pipe and seal the wellbore	Failure to close
		Failure to shear the drill pipe
		Failure to seal the wellbore
		Unintentional closing / opening
		Closes too slowly
		Loss of containment
6	Emergency Operation-Auto shear- Shear the drill pipe and seal the wellbore	Failure to arm
		Failure to close
		Failure to shear the drill pipe
		Failure to seal the wellbore
		Unintentional closing / opening
		Closes too slowly
		Loss of containment
7	Emergency Operation: EDS - Disconnect from the stack	Failure to receive EDS signal
		Failure to disconnect the LMRP
		Unintentional disconnect from riser
8	Controlled Operation - Disconnect the LMRP from the Lower BOP stack	Failure to disconnect the LMRP
		Unintentional disconnect of the LMRP

Table 2-1: Functions and Functional Failures (cont'd)

No.	Function	Functional Failure Modes
9	Circulate the well after drill pipe disconnect	Failure to circulate
		Failure to circulate at desired flow rate
		Failure to open/close fail-safe valves
		Failure to seal wellbore after drill pipe disconnect
		Loss of containment
10	Circulate across the BOP stack to remove trapped gas	Failure to circulate
		Failure to circulate at desired flow rate
		Failure to open/close fail-safe valves to seal
		Loss of containment
11	Connect BOP and LMRP at landing	Inadequate BOP connection
		Inadequate LMRP connection

2.2.2 Equipment Level (Bottom-Up) FMECA

The equipment-level FMECA was performed by analyzing each major component with its associated sub-components using equipment-level failure modes. Figure 2-3 outlines the equipment-level FMECA process.

The analysis team evaluated the 20 major equipment items and their associated sub-components listed in Table 1-1.

To evaluate each equipment item, a list of the general failure modes was developed during the FMECA kick-off meeting and is provided in Table 2-2. During the equipment-level FMECA, the analysis team modified these general equipment failure modes to describe the means in which each major component can fail.

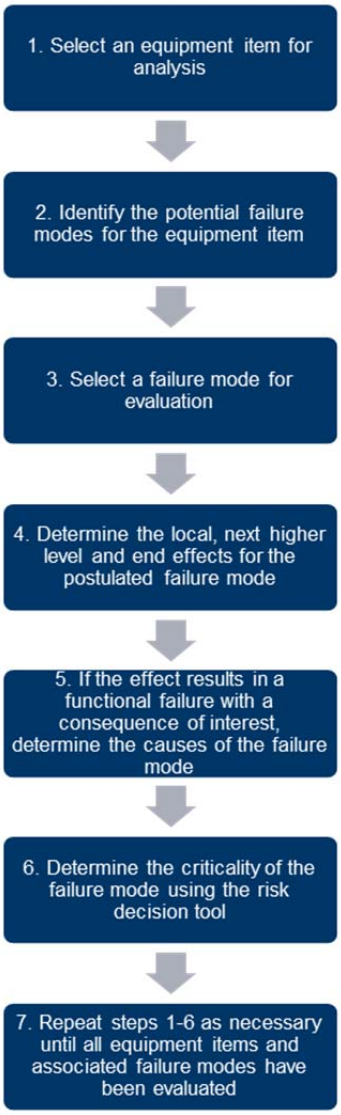

Figure 2-3. FMECA Bottom-up Procedures

Table 2-2: General Equipment Failure Modes

Mechanical Failures	Electrical/Electronic Failure
External leak/rupture	Loss of, or degraded power
Internal leak	Fails with no output signal/no communication
Plugged	Fails with low or high output signal
Mechanical failure (e.g., fracture, galling, fatigue)	Erratic output
Corrosion/erosion	Fails to respond to input
Wear/mechanical damage	Processing error (e.g., calculation error, sequence error)
Loss of function (general)	Short
Loss of hydraulic power	Loss of function (general)

Once a major component's failure modes were identified, the analysis team evaluated each equipment-level failure mode by:

1. Postulating on specific equipment causes resulting in the failure mode and
2. Then identifying the potential effects resulting from each failure mode.

The equipment-level effects were identified as BOP functional failures and then electronically linked in Enterprise LEADER to establish the relationship between specific equipment-level failure modes and BOP functions. Once these links were established, the analysis team identified any safeguards that are currently in place to prevent or detect or mitigate the failure mode before the end effects associated with the BOP functional failure are realized. Next, the analysis team identified specific MIT practices currently employed to prevent or detect the specific equipment causes. These evaluations, along with criticality rankings described below, were recorded in tabular format using the Enterprise LEADER software.

2.2.3 Evaluation and Ranking of Equipment Failure Modes (Criticality/Risk Ranking)

To provide a consistent means to evaluate the relative criticality of BOP subsystem/component failures and to help judge the sufficiency of MIT activities performed to prevent and detect the failures, a risk priority number ranking scheme based the following factors was employed:

- Frequency of Failure of the Major Equipment Failure Mode
- Level of Redundancy to Prevent Specific Failure from Resulting in Complete Loss of Safety Critical Functions
- Ability to Detect and Prevent the Failure Mode via MIT Practices (Indication / Protection / Maintenance column in Appendix B)
- Severity of End Effect for Each BOP Functional Failure

A Risk Priority Number (RPN) ranking for each functional failure associated with an equipment-level failure mode was based on the product of the following three independent factors:

- Severity Rating – This rating assesses the severity of worst-case end effect for a given functional failure. (Note: The functional failure end effects documented in the functional-level FMECA were used to determine this rating assuming no redundancies are present.)
- Occurrence Rating – This rating assesses the likelihood of the failure mode resulting in the functional failure and its stated end effect. This rating takes into consideration any safeguards that are in place to detect, prevent or mitigate the failure mode from resulting in the functional failure. These are the Protection (P) items in the Indication / Protection / Maintenance column of Appendix B. The presence of redundant components and systems is explicitly considered in this rating.

- Detection Rating – This rating assesses the likelihood of the current applicable inspection and maintenance activities to detect the failure mode before it results in the functional failure. These ratings are based on the Indication (I) and Maintenance (M) items from the Indication / Protection / Maintenance column of Appendix B.

The severity, occurrence, and detection ratings are provided in Tables 2-3 through 2-5, respectively. These ratings were then used to calculate a single RPN ranking for each functional failure effect and equipment failure mode pair (i.e., RPN ranking for each functional failure associated with an equipment-level failure mode) using the following equation:

RPN = Severity Rating X Occurrence Rating X Detection Rating

The individual RPN rankings provide a relative ranking of the risk associated with a given functional failure effect-equipment failure mode pair. Thereby, providing a means to identify the most critical equipment-level failure modes in overall BOP performance, as well as, identifying the more critical failure modes associated with a specific BOP functional failure.

Table 2-3: Severity Ratings

Severity Rank	Significance	Personnel	Environment	Down Time
1	Does not affect BOP functionality; no impact on safety and environment.	No impact	No impact	No downtime, repair can be done while drilling continues.
2	Does not affect BOP functionality but needs to be corrected; no impact on safety and environment.	No impact	No impact	No downtime, repair can be done at next opportunity, drilling continues.
3	Partial loss of BOP function; no loss of well control.	No impact	No impact	Downtime of less than a shift, stop drilling, intervene and repair.
4	Partial loss of BOP function; no loss of well control.	No impact	No impact	Downtime between a shift and 24 hours, stop drilling, intervene and repair.
5	Partial loss of BOP primary function if not corrected immediately.	No impact	No impact	Downtime between 1 and 7 days - stop drilling, intervene and repair (surface only).

Table 2-3: Severity Ratings (cont'd)

Severity Rank	Significance	Personnel	Environment	Down Time
6	Partial loss of BOP primary function if not corrected immediately.	Minor Injury; no recordable lost time	Minor external subsea leak (e.g., C&K connector leak)	Downtime between 8 and 21 days - stop drilling, intervene and repair (surface only).
7	Loss of BOP primary function.	Minor Injury; some lost time.	Significant external subsea leak (e.g., major connector leak)	Pulling LMRP only.
8	Loss of BOP primary function.	Serious Injury; significant lost time.	<1000 BBL	Pulling LMRP/BOP stack.
9	Loss of BOP primary function.	Single Fatality; multiple serious injuries.	>1000BBL	Shut down of operations; drilling stopped and major regulatory implications; changes to drilling schedule > 3 months.
10	Loss of BOP primary function.	Multiple fatalities and injuries.	>10,000BBL and severe environmen-tal damage over a large area.	Shut down of operations; drilling stopped and major regulatory implications; total loss of asset.

Table 2-4: Occurrence Ratings

Occurrence Ratings	Frequency/Rig Yr.	Occurrence
10	>50+ events/ rig yr.	Once a week or more often
9	<50 events /rig yr. to 10 events /rig yr.	Less than once a week to once a month
8	<10 events /rig yr. to 4 events /rig yr.	Less than once a month to once a quarter
7	<4 events /rig yr. to 2 events /yr.	Less than once a quarter to twice a year
6	<2 events /rig yr. to 1 event/yr.	Less than twice a year to once a year
5	<1 event /rig yr. to 1 events every 2 years	Less than once a year to once every 2 years
4	<1 event every 2 years to 1 event every 5 years	Less than once every 2 years to once every 5 years
3	<1 event every 5 years to 1 event every 10 years	Less than once every 5 years to once every 10 years
2	<1 event every 10 years to 1 event every 100 years	Less than once every 10 years to 10% chance every 10 years of operation
1	<1 event every 100 years	Less than 1% chance every 10 years of operation

Table 2-5: Detection Ratings

Detection Rating	Detection	Likelihood of Detection
1	Almost Certain	Very high probability of detection (>90% probability of detection) by design controls (redundant or independent self-diagnostic capability, independent alarms) will certainly detect failures
2	Very High	High probability of detection (50 to 90% of detection) by design controls (single device self-diagnostic capability, single alarms, visual monitoring, leak monitoring, loss of fluid etc.) will certainly detect failures
3	High	Probability of detection via weekly on-stream tests/inspections will provide immediate detection of the failure
4	Moderately high	Probability of detection via monthly on-stream tests/inspections will provide immediate detection of the failure
5	Moderate	Probability of detection via quarterly on-stream tests/inspections will provide immediate detection of the failure
6	Low	Can only be detected during routine inspections/tests while the BOP is pulled from the well
7-8	Very Low	Can only be detected during major PMs while the BOP is pulled from the well
9	Remote	Can only be detected and/or corrected during major overhaul or rebuilding-type activities
10	Absolute Uncertainty	Currently no design controls or maintenance techniques in place

3.0 FMECA RESULTS

This section summarizes the results of the FMECA analysis—specifically, the results of the functional-level and equipment-level FMECAs which are provided in tabular format in Appendices A and B, respectively. These appendices also include a description of the FMECA table information.

In addition to the tabular results provided in the above-mentioned appendices, the following tables provide a more detailed look at the most critical failure modes based on the RPN rankings. Each of the following tables presents the results against a specific set of criteria described below. The complete data from which these tables have been derived is provided in Appendices C and D, which are essentially a reformatted presentation of Appendix B. In each of the following tables, the shaded column indicates the sorting order.

Table 3-1 presents the top 15% of failure modes with the highest RPN score. RPN scores from the FMECA range from 6–160, with the top 15% ranging from 120–160. Tables 3-1a and 3-1b present the same data but are sorted differently; Table 3-1a is sorted by RPN and Table 3-1b is sorted by Major Equipment/Subsystem. Table 3-1 represents what are considered to be the most critical failure modes. It should be noted that each failure mode may be associated with multiple effects/functional failures as shown in the last column of the tables. Table 3-1b suggests that failures of the - Choke & Kill lines & valves, Surface Accumulators, Blind Shear Ram and Casing Shear Ram are the most dominant equipment of concern.

Table 3-1a: Failure Modes with Highest RPN – Sorted by RPN

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
Choke & Kill Lines & Valves - BOP Stack	Plugged	10	4	4	160	4
Blind Shear Ram - BOP Stack	External Leak/Rupture	9	5	3	135	1
Blind Shear Ram - BOP Stack	Mechanical Failure	9	5	3	135	1
Blind Shear Ram - BOP Stack	Wear	9	5	3	135	1
Casing Shear Ram - BOP Stack	External Leak/Rupture	9	5	3	135	1

Table 3-1a: Failure Modes with Highest RPN – Sorted by RPN (cont'd)

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
Casing Shear Ram - BOP Stack	Mechanical Failure	9	5	3	135	1
Casing Shear Ram - BOP Stack	Wear	9	5	3	135	1
Choke & Kill Lines & Valves - BOP Stack	External Leak/Rupture	9	5	3	135	1
Choke & Kill Lines & Valves - BOP Stack	Mechanical Failure	9	5	3	135	1
Pipe & Test Rams - BOP Stack	External Leak/Rupture	9	5	3	135	1
Pipe & Test Rams - BOP Stack	Mechanical Failure	9	5	3	135	1
Autoshear System - BOP Stack	Mechanical Failure	9	2	7	126	1
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Corrosion/Erosion	9	2	7	126	1
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	9	2	7	126	1
Connectors - BOP Stack	Mechanical Failure	9	2	7	126	1

Table 3-1a: Failure Modes with Highest RPN – Sorted by RPN (cont'd)

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Corrosion/Erosion	9	2	7	126	1
Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Mechanical Failure	9	2	7	126	1
Accumulators - Subsea Control Systems	External Leak/Rupture	10	2	6	120	2
Accumulators - Subsea Control Systems	Internal Leak	10	2	6	120	2
Accumulators - Subsea Control Systems	Loss of Function (general)	10	2	6	120	2
Accumulators - Subsea Control Systems	Mechanical Failure	10	2	6	120	2
Accumulators - Subsea Control Systems	Wear	10	2	6	120	2
Autoshear System - BOP Stack	Mechanical Failure	10	2	6	120	2
Blind Shear Ram - BOP Stack	External Leak/Rupture	10	2	6	120	4

Table 3-1a: Failure Modes with Highest RPN – Sorted by RPN (cont'd)

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
Blind Shear Ram - BOP Stack	Wear	10	2	6	120	4
Blind Shear Ram - BOP Stack	Mechanical Failure	10	2	6	120	3
Blind Shear Ram - BOP Stack	Corrosion/Erosion	10	2	6	120	2
Blind Shear Ram - BOP Stack	Internal Leak	10	2	6	120	2
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Corrosion/Erosion	10	2	6	120	2
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak/Rupture	10	2	6	120	2
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Internal Leak	10	2	6	120	2
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	10	2	6	120	2

Table 3-1a: Failure Modes with Highest RPN – Sorted by RPN (cont'd)

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Plugged	10	2	6	120	2

Table 3-1b: Failure Modes with Highest RPN – Sorted by Major Component/Subsystem

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
Accumulators - Subsea Control Systems	External Leak/ Rupture	10	2	6	120	2
Accumulators - Subsea Control Systems	Internal Leak	10	2	6	120	2
Accumulators - Subsea Control Systems	Mechani-cal Failure	10	2	6	120	2
Accumulators - Subsea Control Systems	Wear	10	2	6	120	2
Accumulators - Subsea Control Systems	Loss of function (general)	10	2	6	120	2
Autoshear System - BOP Stack	Mechani-cal Failure	9	2	7	126	1
Blind Shear Ram - BOP Stack	External Leak/ Rupture	9	5	3	135	1
Blind Shear Ram - BOP Stack	Mechani-cal Failure	9	5	3	135	1
Blind Shear Ram - BOP Stack	Wear	9	5	3	135	1
Blind Shear Ram - BOP Stack	External Leak/ Rupture	10	4	2	120	4
Blind Shear Ram - BOP Stack	Wear	10	4	2	120	4

Table 3-1b: Failure Modes with Highest RPN – Sorted by Major Component/Subsystem (cont'd)

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechani-cal Failure	9	2	7	126	1
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Erosion/ Corrosion	9	2	7	126	1
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Plugged	10	2	6	120	2
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechani-cal Failure	10	2	6	120	2
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Corrosion/ Erosion	10	2	6	120	2
Casing Shear Ram - BOP Stack	External Leak/ Rupture	9	5	3	135	1
Casing Shear Ram - BOP Stack	Mechani-cal Failure	9	5	3	135	1
Casing Shear Ram - BOP Stack	Wear	9	5	3	135	1
Choke & Kill Lines & Valves - BOP Stack	Erratic output	10	4	4	160	4
Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	9	5	3	135	1
Choke & Kill Lines & Valves - BOP Stack	Mechani-cal Failure	9	5	3	135	1

Table 3-1b: Failure Modes with Highest RPN – Sorted by Major Component/Subsystem (cont'd)

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
Connectors - BOP Stack	Mechani-cal Failure	9	2	7	126	1
Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Mechani-cal Failure	9	2	7	126	1
Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Erosion/ Corrosion	9	2	7	126	1
Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External Leak	10	2	6	120	2
Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Internal Leak	10	2	6	120	2
Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Plugged	10	2	6	120	2

Table 3-1b: Failure Modes with Highest RPN – Sorted by Major Component/Subsystem (cont'd)

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Mechani-cal Failure	10	2	6	120	2
Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Erosion/ Corrosion	10	2	6	120	2
Pipe & Test Rams - BOP Stack	External Leak/ Rupture	9	5	3	135	1
Pipe & Test Rams - BOP Stack	Mechani-cal Failure	9	5	3	135	1

Table 3-2 shows the equipment failure modes which could lead to the worst potential end effects. These are the failure modes with a severity ranking greater than or equal to 10. Severity results from this FMECA range from 2 – 10.

Table 3-2: Failure Modes with Severity ≥ 10

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
Choke & Kill Lines & Valves - BOP Stack	Plugged	10	4	4	160	4
HPU - Surface Control Systems	External Leak / Rupture	10	4	4	160	1
Blind Shear Ram - BOP Stack	Corrosion/ Erosion	10	2	6	120	2

Table 3-2: Failure Modes with Severity ≥ 10 (cont'd)

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Corrosion/ Erosion	10	2	6	120	2
Casing Shear Ram - BOP Stack	Corrosion/ Erosion	10	2	6	120	2
Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Corrosion/ Erosion	10	2	6	120	2
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak/ Rupture	10	2	6	120	2
Accumulators - Subsea Control Systems	External Leak/ Rupture	10	2	6	120	2
Blind Shear Ram - BOP Stack	External Leak/ Rupture	10	2	6	120	2
Blind Shear Ram - BOP Stack	External Leak/ Rupture	10	4	3	120	2
Casing Shear Ram - BOP Stack	External Leak/ Rupture	10	2	6	120	2
Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	10	4	3	120	2

Table 3-2: Failure Modes with Severity ≥ 10 (cont'd)

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	10	4	3	120	1
Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External Leak/ Rupture	10	2	6	120	2
Accumulators - Subsea Control Systems	Internal Leak	10	2	6	120	2
Blind Shear Ram - BOP Stack	Internal Leak	10	2	6	120	2
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Internal Leak	10	2	6	120	2
Casing Shear Ram - BOP Stack	Internal Leak	10	2	6	120	2
Choke & Kill Lines & Valves - BOP Stack	Internal Leak	10	4	3	120	1
Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Internal leak	10	2	6	120	1
Accumulators - Subsea Control Systems	Loss of Function (general)	10	2	6	120	2

Table 3-2: Failure Modes with Severity ≥ 10 (cont'd)

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
Hydraulic Supply - Surface Control Systems	Loss of Function (general)	10	2	6	120	2
Accumulators - Subsea Control Systems	Mechanical Failure	10	2	6	120	2
Autoshear System - BOP Stack	Mechanical Failure	10	2	6	120	2
Blind Shear Ram - BOP Stack	Mechanical Failure	10	2	6	120	3
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	10	2	6	120	2
Casing Shear Ram - BOP Stack	Mechanical Failure	10	2	6	120	2
Casing Shear Ram - BOP Stack	Mechanical Failure	10	4	3	120	2
Choke & Kill Lines & Valves - BOP Stack	Mechanical Failure	10	4	3	120	2
Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Mechanical Failure	10	2	6	120	2

3-2: Failure Modes with Severity ≥ 10 (cont'd)

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Plugged	10	2	6	120	2
Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Plugged	10	2	6	120	2
Accumulators - Subsea Control Systems	Wear	10	2	6	120	2
Blind Shear Ram - BOP Stack	Wear	10	2	6	120	2
Blind Shear Ram - BOP Stack	Wear	10	4	3	120	1
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	10	2	6	120	1
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	10	2	6	120	1
Casing Shear Ram - BOP Stack	Mechanical Failure	10	2	6	120	2

3-2: Failure Modes with Severity ≥ 10 (cont'd)

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
Casing Shear Ram - BOP Stack	Mechanical Failure	10	4	3	120	2
Choke & Kill Lines & Valves - BOP Stack	Mechanical Failure	10	4	3	120	2
Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Mechanical Failure	10	2	6	120	2
Casing Shear Ram - BOP Stack	Mechanical Failure	10	4	3	120	2
Choke & Kill Lines & Valves - BOP Stack	Mechanical Failure	10	4	3	120	2
Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Mechanical Failure	10	2	6	120	2
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Plugged	10	2	6	120	2
Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Plugged	10	2	6	120	2

Table 3-2: Failure Modes with Severity ≥ 10 (cont'd)

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
Accumulators - Subsea Control Systems	Wear	10	2	6	120	2
Blind Shear Ram - BOP Stack	Wear	10	2	6	120	2
Casing Shear Ram - BOP Stack	Wear	10	2	6	120	4
Choke & Kill Lines & Valves - BOP Stack	Wear	10	4	3	120	2
Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	10	3	3	90	1
Choke & Kill Lines & Valves - BOP Stack	Internal Leak	10	3	3	90	1
HPU - Surface Control Systems	Internal Leak	10	3	3	90	5
HPU - Surface Control Systems	Plugged	10	3	3	90	4
Choke & Kill Lines & Valves - BOP Stack	Wear	10	3	3	90	4
Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	10	4	2	80	1
Choke & Kill Lines & Valves - BOP Stack	Internal Leak	10	4	2	80	1

Table 3-2: Failure Modes with Severity ≥ 10 (cont'd)

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
HPU - Surface Control Systems	Mechanical Failure	10	4	2	80	4
Choke & Kill Lines & Valves - BOP Stack	Wear	10	4	2	80	1
Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	10	4	2	80	1
HPU - Surface Control Systems	External Leak/ Rupture	10	3	2	60	6
HPU - Surface Control Systems	Loss of function (general)	10	3	2	60	6
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Corrosion/ Erosion	10	2	2	40	1
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak / Rupture	10	2	2	40	2
Annulars - BOP Stack	External Leak/ Rupture	10	2	2	40	11
Blind Shear Ram - BOP Stack	External Leak/ Rupture	10	2	2	40	3

Table 3-2: Failure Modes with Severity ≥ 10 (cont'd)

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
Casing Shear Ram - BOP Stack	External Leak/ Rupture	10	2	2	40	1
Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	10	2	2	40	1
Hydraulic Supply - Surface Control Systems	External Leak/ Rupture	10	4	1	40	1
Annulars - BOP Stack	Internal Leak	10	2	2	40	1
Blind Shear Ram - BOP Stack	Internal Leak	10	2	2	40	1
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Internal Leak	10	2	2	40	1
Connectors - BOP Stack	Internal Leak	10	2	2	40	1
Hydraulic Supply - Surface Control Systems	Loss of Function (general)	10	2	2	40	1
Annulars - BOP Stack	Mechanical Failure	10	2	2	40	1
Blind Shear Ram - BOP Stack	Mechanical Failure	10	2	2	40	3

Table 3-2: Failure Modes with Severity ≥ 10 (cont'd)

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	10	2	2	40	1
Casing Shear Ram - BOP Stack	Mechanical Failure	10	2	2	40	1
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Plugged	10	2	2	40	1
Blind Shear Ram - BOP Stack	Wear	10	2	2	40	3
Casing Shear Ram - BOP Stack	Wear	10	2	2	40	1
Choke & Kill Lines & Valves - BOP Stack	Wear	10	2	2	40	1
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak / Rupture	10	3	1	30	1
Autoshear System - BOP Stack	External Leak/ Rupture	10	3	1	30	1

Table 3-2: Failure Modes with Severity ≥ 10 (cont'd)

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	10	3	1	30	2
HPU - Surface Control Systems	External Leak/ Rupture	10	3	1	30	1
Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External leak/ Rupture	10	3	1	30	2
Autoshear System - BOP Stack	Internal Leak	10	3	1	30	1
Autoshear System - BOP Stack	Mechanical Failure	10	3	1	30	1
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Corrosion/ Erosion	10	2	1	20	2
Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Corrosion/ Erosion	10	1	2	20	1
Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Erratic output	10	2	1	20	3

Table 3-2: Failure Modes with Severity ≥ 10 (cont'd)

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
Control Panels - Surface Control Systems	Erratic output	10	2	1	20	3
EDS - Subsea Control Systems	Erratic output	10	2	1	20	2
MUX System - Surface Control Systems	Erratic output (Network)	10	2	1	20	3
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak / Rupture	10	2	1	20	2
Accumulators - Subsea Control Systems	External Leak/ Rupture	10	2	1	20	2
Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	10	2	1	20	1
Connectors - BOP Stack	External Leak/ Rupture	10	1	2	20	1
Fluid Reservoir Unit - Surface Control Systems	External Leak/ Rupture	10	1	2	20	1
Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External leak/rupture	10	2	1	20	2

Table 3-2: Failure Modes with Severity ≥ 10 (cont'd)

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
Control Panels - Surface Control Systems	Fails to respond (with no output signal/com-munication or to input)	10	2	1	20	6
EDS - Subsea Control Systems	Fails to respond to input	10	2	1	20	2
MUX System - Surface Control Systems	Fails to respond to input	10	2	1	20	3
Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Fails to respond to input - Electrical	10	2	1	20	3
Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Fails with no output signal/com-munication	10	2	1	20	3
EDS - Subsea Control Systems	Fails with no output signal/com-munication	10	2	1	20	2
MUX System - Surface Control Systems	Fails with no output signal/com-munication	10	2	1	20	3

Table 3-2: Failure Modes with Severity ≥ 10 (cont'd)

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
Secondary & Emergency Control Systems - Surface Control Systems	Fails with no output signal/com-munication (Includes Short)	10	2	1	20	3
Accumulators - Subsea Control Systems	Internal Leak	10	2	1	20	3
Annulars - BOP Stack	Internal Leak	10	2	1	20	7
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Internal Leak	10	2	1	20	3
Choke & Kill Lines & Valves - BOP Stack	Internal Leak	10	2	1	20	1
Connectors - BOP Stack	Internal Leak	10	2	1	20	1
Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Internal leak	10	2	1	20	2
ROV Intervention Interface - BOP Stack	Loss of Function	10	1	2	20	1

Table 3-2: Failure Modes with Severity ≥ 10 (cont'd)

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
Secondary & Emergency Control Systems - Surface Control Systems	Loss of function (general)	10	2	1	20	3
Accumulators - Subsea Control Systems	Loss of Function (general)	10	2	1	20	3
Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Loss of function (general)	10	2	1	20	3
Control Panels - Surface Control Systems	Loss of function (general)	10	2	1	20	3
EDS - Subsea Control Systems	Loss of function (general)	10	2	1	20	2
Fluid Reservoir Unit - Surface Control Systems	Loss of Function (general)	10	1	2	20	1
Hydraulic Supply - Surface Control Systems	Loss of Function (general)	10	1	2	20	1
MUX System - Surface Control Systems	Loss of function (general)	10	2	1	20	2

Table 3-2: Failure Modes with Severity ≥ 10 (cont'd)

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
Power - Surface Control Systems	Loss of Power (UPS Shuts down with power degradation)	10	2	1	20	3
Secondary & Emergency Control Systems - Surface Control Systems	Loss of, or Degraded Power	10	2	1	20	3
Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Loss of, or Degraded Power	10	2	1	20	3
Control Panels - Surface Control Systems	Loss of, or Degraded Power	10	2	1	20	3
EDS - Subsea Control Systems	Loss of, or Degraded Power	10	2	1	20	2
Accumulators - Subsea Control Systems	Mechanical Failure	10	1	2	20	2
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	10	2	1	20	3

Table 3-2: Failure Modes with Severity ≥ 10 (cont'd)

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
Fluid Reservoir Unit - Surface Control Systems	Mechanical Failure	10	1	2	20	1
Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Mechanical Failure	10	2	1	20	2
Fluid Reservoir Unit - Surface Control Systems	Mechanical Failure	10	1	2	20	1
Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Mechanical Failure	10	2	1	20	1
Fluid Reservoir Unit - Surface Control Systems	Plugged	10	1	2	20	1
Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Plugged	10	2	1	20	2
EDS - Subsea Control Systems	Processing error	10	2	1	20	1
Control Panels - Surface Control Systems	Short	10	2	1	20	3

Table 3-2: Failure Modes with Severity ≥ 10 (cont'd)

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
MUX System - Surface Control Systems	Short	10	2	1	20	3
Accumulators - Subsea Control Systems	Wear	10	2	1	20	3
Choke & Kill Lines & Valves - BOP Stack	Wear	10	1	2	20	1
Power - Surface Control Systems	Electrical Short	10	1	1	10	1
Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Erratic output	10	1	1	10	1
Control Panels - Surface Control Systems	Erratic output	10	1	1	10	1
MUX System - Surface Control Systems	Erratic output (Network)	10	1	1	10	2
MUX System - Surface Control Systems	Fails to respond to input	10	1	1	10	1

Table 3-2: Failure Modes with Severity ≥ 10 (cont'd)

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Fails to respond to input - Electrical	10	1	1	10	1
Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Fails with no output signal/com-munication	10	1	1	10	1
MUX System - Surface Control Systems	Fails with no output signal/com-munication	10	1	1	10	1
Secondary & Emergency Control Systems - Surface Control Systems	Fails with no output signal/com-munication (Includes Short)	10	1	1	10	1
Secondary & Emergency Control Systems - Surface Control Systems	Loss of function (general)	10	1	1	10	1
Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Loss of function (general)	10	1	1	10	1

Table 3-2: Failure Modes with Severity ≥ 10 (cont'd)

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
Control Panels - Surface Control Systems	Loss of function (general)	10	1	1	10	1
Power - Surface Control Systems	Loss of Power (UPS Shuts down with power degradation)	10	1	1	10	1
Secondary & Emergency Control Systems - Surface Control Systems	Loss of, or Degraded Power	10	1	1	10	1
Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Loss of, or Degraded Power	10	1	1	10	1
Control Panels - Surface Control Systems	Loss of, or Degraded Power	10	1	1	10	1
Control Panels - Surface Control Systems	Short	10	1	1	10	1
MUX System - Surface Control Systems	Short	10	1	1	10	1

Table 3-3 shows the equipment failure modes with an occurrence ranking greater than or equal to 5. These are the most frequently occurring equipment failures. Occurrence results from this FMECA range from 1–4. The Blind Shear Ram contributes to the most functional failures.

Table 3-3: Failure Modes with Occurrence ≥ 5

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
EDS - Subsea Control Systems	Ground Fault	2	7	1	14	1
Pipe & Test Rams - BOP Stack	External Leak/ Rupture	9	5	3	135	1
Pipe & Test Rams - BOP Stack	Mechanical Failure	9	5	3	135	1
Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	9	5	3	135	1
Choke & Kill Lines & Valves - BOP Stack	Mechanical Failure	9	5	3	135	1
Casing Shear Ram - BOP Stack	External Leak/ Rupture	9	5	3	135	1
Casing Shear Ram - BOP Stack	Mechanical Failure	9	5	3	135	1
Casing Shear Ram - BOP Stack	Wear	9	5	3	135	1
Blind Shear Ram - BOP Stack	External Leak/ Rupture	9	5	3	135	1
Blind Shear Ram - BOP Stack	Mechanical Failure	9	5	3	135	1
Blind Shear Ram - BOP Stack	Wear	9	5	3	135	1
Casing Shear Ram - BOP Stack	Wear	8	5	2	80	1
Casing Shear Ram - BOP Stack	Mechanical Failure	8	5	2	80	1
Blind Shear Ram - BOP Stack	External Leak/ Rupture	8	5	2	80	1
Blind Shear Ram - BOP Stack	Internal Leak	8	5	2	80	1
Blind Shear Ram - BOP Stack	Mechanical Failure	8	5	2	80	1

Table 3-3: Failure Modes with Occurrence ≥ 5 (cont'd)

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
Blind Shear Ram - BOP Stack	Wear	8	5	2	80	1
Connectors - BOP Stack	External Leak/ Rupture	2	5	3	30	1
Connectors - BOP Stack	Loss of Function (general)	2	5	3	30	1
Connectors - BOP Stack	Mechanical Failure	2	5	3	30	1

Table 3-4 shows the equipment failure modes with a detection ranking greater than or equal to 6, which are the hardest to detect. This list helps identify the equipment-level failure modes for which additional MIT activities may be needed. Detection results from this FMECA range from 1–10. Hydraulic supply: Rigid Conduit and Manifold and Connectors have the worst detectability followed by casing shear ram and surface hydraulic supply

Table 3-4: Failure Modes with Detection ≥ 6

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Corrosion/ Erosion	9	2	7	126	1
Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Mechanical Failure	9	2	7	126	1
Connectors - BOP Stack	Mechanical Failure	9	2	7	126	1
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Corrosion/ Erosion	9	2	7	126	1

Table 3-4: Failure Modes with Detection ≥ 6 (cont'd)

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	9	2	7	126	1
Autoshear System - BOP Stack	Mechanical Failure	9	2	7	126	1
Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Corrosion/ Erosion	10	2	6	120	2
Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External leak/ Rupture	10	2	6	120	2
Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Internal leak	10	2	6	120	2
Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Mechanical Failure	10	2	6	120	2
Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Plugged	10	2	6	120	2
Hydraulic Supply - Surface Control Systems	Loss of Function (general)	10	2	6	120	2

Table 3-4: Failure Modes with Detection ≥ 6 (cont'd)

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
Casing Shear Ram - BOP Stack	Corrosion/ Erosion	10	2	6	120	2
Casing Shear Ram - BOP Stack	External Leak/ Rupture	10	2	6	120	2
Casing Shear Ram - BOP Stack	Internal Leak	10	2	6	120	2
Casing Shear Ram - BOP Stack	Mechanical Failure	10	2	6	120	2
Casing Shear Ram - BOP Stack	Wear	10	2	6	120	2
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Corrosion/ Erosion	10	2	6	120	2
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak/ Rupture	10	2	6	120	2
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Internal Leak	10	2	6	120	2
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	10	2	6	120	2
Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Plugged	10	2	6	120	2
Blind Shear Ram - BOP Stack	Corrosion/ Erosion	10	2	6	120	2

Table 3-4: Failure Modes with Detection ≥ 6 (cont'd)

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
Blind Shear Ram - BOP Stack	External Leak/ Rupture	10	2	6	120	2
Blind Shear Ram - BOP Stack	Internal Leak	10	2	6	120	2
Blind Shear Ram - BOP Stack	Mechanical Failure	10	2	6	120	2
Blind Shear Ram - BOP Stack	Wear	10	2	6	120	2
Autoshear System - BOP Stack	Mechanical Failure	10	2	6	120	2
Accumulators - Subsea Control Systems	External Leak/Ruptu re	10	2	6	120	2
Accumulators - Subsea Control Systems	Internal Leak	10	2	6	120	2
Accumulators - Subsea Control Systems	Loss of Function (general)	10	2	6	120	2
Accumulators - Subsea Control Systems	Mechanical Failure	10	2	6	120	2
Accumulators - Subsea Control Systems	Wear	10	2	6	120	2
Connectors - BOP Stack	Internal Leak	9	1	6	54	2
Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	9	1	6	54	2
Choke & Kill Lines & Valves - BOP Stack	Wear	5	1	6	54	2

Table 3-5 shows the equipment failure modes with a severity ranking of 10, an occurrence ranking greater than or equal to 4 and a detection ranking less than or equal to 5. These are the equipment failures that occur most frequently and could result in the highest severity but are easy to detect.

Table 3-5: Failure Modes with S = 10, O ≥ 4, and D ≤ 5

Major Component/ Subsystem	Failure Mode	Severity (S)	Occurrence (O)	Detection (D)	RPN (SxOxD)	# of Effects (Functional Failures)
Choke & Kill Lines & Valves - BOP Stack	Plugged	10	4	4	160	4
Choke & Kill Lines & Valves - BOP Stack	Mechanical Failure	10	4	3	120	2
Choke & Kill Lines & Valves - BOP Stack	Wear	10	4	3	120	2
Casing Shear Ram - BOP Stack	Wear	10	4	3	120	1
Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	10	4	3	120	1
Choke & Kill Lines & Valves - BOP Stack	Internal Leak	10	4	3	120	2
Casing Shear Ram - BOP Stack	External Leak/ Rupture	10	4	3	120	2
Casing Shear Ram - BOP Stack	Mechanical Failure	10	4	3	120	2
Blind Shear Ram - BOP Stack	Wear	10	4	3	120	2
Blind Shear Ram - BOP Stack	Mechanical Failure	10	4	3	120	1
Blind Shear Ram - BOP Stack	External Leak/ Rupture	10	4	3	120	2
HPU - Surface Control Systems	Mechanical Failure	10	4	2	80	2

Equipment failure modes with a severity ranking of 10, an occurrence ranking greater than or equal to 3 and detection ranking greater than 5 are also of interest. These are the equipment failures that occur most frequently and could result in the highest severity and are the hardest to detect. No failures in the FMECA meet this criterion.

The effect of each equipment level failure is linked to a functional failure. Table 3-6 lists the top 25% of effects/functional failures with the highest average RPN for all of the equipment failures associated with that functional failure. External Leak - Loss of containment - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.8.1) has the six worst average RPN scores.

Table 3-6: Functional Failures with Highest Average RPN

Effect	# of Occurrences	Cumulative FF RPN	Average FF RPN
External Leak - Loss of containment - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.8.1)	14	1606	115
Actuates Too Slowly on Demand - Closes too slowly - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.6.1)	4	457	114
Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	38	4340	114
Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	38	4340	114
Failure to Actuate Under Fail-safe Conditions - Failure to open / close fail-safe valves - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.6.1)	8	900	113
External Leak - Loss of containment - Circulate the well after drill pipe disconnect (linked to 1.9.5.1)	13	1368	105
External Leak - Loss of containment - Circulate across the BOP stack to remove trapped gas - (linked to 1.10.4.1)	13	1288	99
Inability to Operate C&K Valves as Needed - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.3)	3	240	80
Failure to Engage Lock on Hang-off Ram - Failure to maintain locking - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.3.1)	6	480	80
Failure to Provide Control Signal to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.1)	18	1296	72

Table 3-6: Functional Failures with Highest Average RPN (cont'd)

Effect	# of Occurrences	Cumulative FF RPN	Average FF RPN
Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	25	1609	64
Failure to Adequately Seal under Fail-safe Condition - Failure to open / close fail-safe valves to seal - Circulate across the BOP stack to remove trapped gas (linked to 1.10.3.2)	4	240	60
Failure to Adequately Seal under Fail-safe Conditions - Failure to open / close fail-safe valves to seal - Circulate the well after drill pipe disconnect (linked to 1.9.3.2)	4	240	60

Table 3-7 lists the top 25% of effects/functional failures that are most frequently linked to equipment failures. Failing to supply hydraulic fluid and pressure to annulars is by far the most frequently occurring functional failure.

Table 3-7: Functional Failures with Greatest Occurrences Due to Equipment Failures

Effect	# of Occurrences	Cumulative FF RPN	Average FF RPN
Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	42	2668	56
Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	47	1854	39
Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	42	1626	39
Failure to Supply Hydraulic Fluid & Pressure to Annular/ Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	43	1028	24
Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	42	1493	36
Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	42	1170	28

Table 3-7: Functional Failures with Greatest Occurrences Due to Equipment Failures (cont'd)

Effect	# of Occurrences	Cumulative FF RPN	Average FF RPN
Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	39	1980	51
Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	39	636	16
Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	39	636	16
Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	38	4340	114
Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	38	4340	114
Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	37	420	11
Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	36	900	25

4.0 CONCLUSIONS

The initial assessment showed that based on the criticality ranking, the following equipment and their failure modes were identified as the top 25% of the critical items contributing to the BOP's potential functional failure:

- Choke & Kill Lines & Valves - BOP Stack
- Blind Shear Ram - BOP Stack
- Casing Shear Ram - BOP Stack
- Casing Shear Ram - BOP Stack
- Casing Shear Ram - BOP Stack
- Pipe & Test Rams - BOP Stack
- Pipe & Test Rams - BOP Stack
- Autoshear System - BOP Stack
- Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems
- Connectors - BOP Stack
- Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems
- Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems
- Accumulators - Subsea Control Systems

The top 10% of equipment by RPN, as discussed, are - Choke & Kill lines & valves, , Blind Shear Ram and Casing Shear Ram.

The MIT data and the failure data provided by the drilling contractor and the OEM were reviewed against the FMECA results. The findings are presented in Section 3 of this report.

This preliminary FMECA analysis and assessment report is submitted for review by the IPs. The final report may bear the modifications suggested during the review process.

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Appendix A – Functional-Level FMECA Tables

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Appendix B – Equipment-Level FMECA Tables

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Appendix C – All Data Sorted By RPN

APPENDIX A
FUNCTIONAL-LEVEL FMECA WORKSHEETS

1- Functional level FMECA

1- Close and seal on the drill pipe and allow circulation on demand

1.1.1	Functional Failure:	Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Failure to Provide Control Signal to Annular or C&K Valves When Demanded	Short - MUX System - Surface Control Systems (linked to 2.1.3.7) Loss of function (general) - MUX System - Surface Control Systems (linked to 2.1.3.8) Fails with no output signal/communication - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.2) Loss of Power (UPS Shuts down with power degradation) - Power - Surface Control Systems (linked to 2.1.2.1) Electrical Short - Power - Surface Control Systems (linked to 2.1.2.5) Erratic output (Network) - MUX System - Surface Control Systems (linked to 2.1.3.4) Fails to respond to input - MUX System - Surface Control Systems (linked to 2.1.3.5) Fails to respond (with no output signal/communication or to input) - Control Panels - Surface Control Systems (linked to 2.1.5.2) Erratic output - Control Panels - Surface Control Systems (linked to 2.1.5.4) Wiring harness fails Loss of, or Degraded Power - Control Panels - Surface Control Systems (linked to 2.1.5.1) Fails with no output signal/communication - MUX System - Surface Control Systems (linked to 2.1.3.2) Fails to respond to input - Control Panels - Surface Control Systems (linked to 2.1.5.5) Short - Control Panels - Surface Control Systems (linked to 2.1.5.7) Erratic output - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.3) Fails to respond to input - Electrical - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.4) Loss of function (general) - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.7) Loss of function (general) - Control Panels - Surface Control Systems (linked to 2.1.5.8)	Atypical current reading across solenoid coil Type (I, P or M): I Flashing red screen on touch screen alerts to a communications failure Type (I, P or M): I No or low flow meter readings Type (I, P or M): I Pod mismatch & alarm Type (I, P or M): I Visible effects, such as mud flow on rig floor, as an indication of failure to close annulars Type (I, P or M): I Redundant mechanical systems and components Type (I, P or M): P Redundant touch screen, controllers, control pods, cables, powers supplies, SEM exist Type (I, P or M): P Function test annular every 7 days Type (I, P or M): M Function tests between wells and upon latch-up Type (I, P or M): M	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated

1.1.1	Functional Failure:	Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Loss of, or Degraded Power - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.1)		
2	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded	Internal Leak - HPU - Surface Control Systems (linked to 2.1.1.2) Internal Leak - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.2) Plugged - HPU - Surface Control Systems (linked to 2.1.1.3) Mechanical Failure - HPU - Surface Control Systems (linked to 2.1.1.4) Plugged - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.3) Internal Leak - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.2) Plugged - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.3) Mechanical Failure - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.4) Loss of Function - ROV Intervention Interface - BOP Stack (linked to 2.3.8.3) Loss of Function (general) - HPU - Surface Control Systems (linked to 2.1.1.7) Loss of Function (general) - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.7) External Leak / Rupture - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.1) Plugged - Annulars - BOP Stack - (linked to 2.3.1.3) Internal Leak - Connectors - BOP Stack (linked to 2.3.6.2) External Leak/Rupture - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.1) Internal Leak - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.2) Mechanical Failure - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.4) Wear - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.5) Loss of Function (general) - Surface Control	HPU pumps running constantly Type (I, P or M): I There are manual indicators on valves that the ROV can read Type (I, P or M): I Accumulators with stored hydraulic pressure energy act as backup Type (I, P or M): P Design includes margin of safety (conduits work at 5k psi, max @ 7.5k psi) Type (I, P or M): P Multiple annulars & rams Type (I, P or M): P Redundant conduit lines exist, with the additional ability to isolate the leaking line and cross-connect via conduit manifold Type (I, P or M): P Redundant pods provide the same functions Type (I, P or M): P Redundant pumping capability through three 100% capacity pumps Type (I, P or M): P There are redundant hydraulic pressure regulators Type (I, P or M): P Controlled function tests ("soak test") between wells Type (I, P or M): M Filters are replaced frequently as a preventive measure Type (I, P or M): M ROV inspection every 3 days Type (I, P or M): M The systems/components involved have maintenance programs and undergo regular inspection and maintenance Type (I, P or M): M Weekly BOP function test Type (I, P or M): M	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated

1.1.1	Functional Failure:	Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Systems - Accumulators - Surface (linked to 2.1.6.7) Mechanical Failure - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.4) Loss of Function (general) - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.7) Plugged - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.3) Corrosion/Erosion - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.6) External Leak/Rupture - Accumulators - Subsea Control Systems (linked to 2.2.3.1) Internal Leak - Accumulators - Subsea Control Systems (linked to 2.2.3.2) Mechanical Failure - Accumulators - Subsea Control Systems (linked to 2.2.3.4) Wear - Accumulators - Subsea Control Systems (linked to 2.2.3.5) Corrosion/Erosion - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.6) Wear - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.5) External Leak/Rupture - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.1) Mechanical Failure - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.4) Loss of Function (general) - Accumulators - Subsea Control Systems (linked to 2.2.3.7) Internal leak - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.2) Plugged - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.3) Wear - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.5) Mechanical Failure - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.4) External Leak/Rupture - Choke & Kill Lines &		

1.1.1	Functional Failure:	Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Valves - BOP Stack (linked to 2.3.5.1) External Leak/Rupture - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.1) External Leak/Rupture - Annulars - BOP Stack (linked to 2.3.1.1) External Leak/Rupture - HPU - Surface Control Systems (linked to 2.1.1.1) External Leak/Rupture - HPU - Surface Control Systems (linked to 2.1.1.1) External Leak/Rupture - Connectors - BOP Stack (linked to 2.3.6.1) External leak/rupture - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.1) Internal Leak - Annulars - BOP Stack (linked to 2.3.1.2)		
3	Failure to Close Annular on Demand	External Leak/Rupture - Annulars - BOP Stack (linked to 2.3.1.1)	Hydraulic fluid flow is monitored via flow meters Type (I, P or M): I Wellbore flow indicates failure to close Type (I, P or M): I There are multiple annulars, with redundant pipe rams as backup, to ensure closure Type (I, P or M): P Maintenance/overhaul of annulars is performed at the completion of every well Type (I, P or M): M	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated
4	Inability to Operate (an individual) C&K Valves as Needed	Internal Leak - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.2) Wear - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.5) External Leak/Rupture - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.1)	Deadheading of hydraulic pumps Type (I, P or M): I Increasing system hydraulic pressure Type (I, P or M): I Flow meter reading is monitored (volume and time required to actuate are known. Too high a volume indicates a leak. Too long a time indicates galling or leak.) Type (I, P or M): I Pressure test of chambers is conducted at end of well Type (I, P or M): M Shell test using end of tail rod between wells, on surface Type (I, P or M): M Weekly function test of stack and control valves	Significant down time that impacts operations

1.1.1	Functional Failure:	Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
			Type (I, P or M): M Wellbore test are conducted between wells and every 14 days while drilling Type (I, P or M): M	

1.1.2	Functional Failure:	Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Failure to Provide Control Signal to Pipe Ram or C&K Valves When Demanded	Wiring harness fails Electrical Short - Power - Surface Control Systems (linked to 2.1.2.5) Erratic output (Network) - MUX System - Surface Control Systems (linked to 2.1.3.4) Fails to respond to input - MUX System - Surface Control Systems (linked to 2.1.3.5) Short - MUX System - Surface Control Systems (linked to 2.1.3.7) Loss of function (general) - MUX System - Surface Control Systems (linked to 2.1.3.8) Loss of Power (UPS Shuts down with power degradation) - Power - Surface Control Systems (linked to 2.1.2.1) Fails to respond (with no output signal/communication or to input) - Control Panels - Surface Control Systems (linked to 2.1.5.2) Erratic output - Control Panels - Surface Control Systems (linked to 2.1.5.4) Loss of, or Degraded Power - Control Panels - Surface Control Systems (linked to 2.1.5.1) Fails with no output signal/communication - MUX System - Surface Control Systems (linked to 2.1.3.2) Fails to respond to input - Control Panels - Surface Control Systems (linked to 2.1.5.5) Short - Control Panels - Surface Control Systems (linked to 2.1.5.7) Fails to respond to input - Electrical - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.4) Loss of function (general) - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.7) Fails with no output signal/communication - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.2) Loss of function (general) - Control Panels - Surface Control Systems (linked to 2.1.5.8) Erratic output - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.3)	C&K valves are redundant and have fail-safe design Type (I, P or M): P ROV intervention will enable closure of one of the pipe rams Type (I, P or M): P There are multiple annulars, with redundant pipe rams as backup, to ensure closure Type (I, P or M): P	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated

1.1.2	Functional Failure:	Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Loss of, or Degraded Power - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.1)		
2	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded	Internal Leak - HPU - Surface Control Systems (linked to 2.1.1.2) Plugged - HPU - Surface Control Systems (linked to 2.1.1.3) Mechanical Failure - HPU - Surface Control Systems (linked to 2.1.1.4) Internal Leak - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.2) Plugged - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.3) Plugged - Annulars - BOP Stack - (linked to 2.3.1.3) Loss of Function (general) - HPU - Surface Control Systems (linked to 2.1.1.7) Mechanical Failure - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.4) External Leak/Rupture - Accumulators - Subsea Control Systems (linked to 2.2.3.1) Internal Leak - Connectors - BOP Stack (linked to 2.3.6.2) Loss of Function (general) - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.7) External Leak/Rupture - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.1) Internal Leak - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.2) Mechanical Failure - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.4) Wear - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.5) Loss of Function (general) - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.7) Plugged - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.3) Plugged - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.3) Internal Leak - Accumulators - Subsea Control	C&K valves are redundant and have fail-safe design Type (I, P or M): P ROV intervention will enable closure of one of the pipe rams Type (I, P or M): P There are multiple annulars, with redundant pipe rams as backup, to ensure closure Type (I, P or M): P	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated

1.1.2	Functional Failure:	Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Systems (linked to 2.2.3.2) Mechanical Failure - Accumulators - Subsea Control Systems (linked to 2.2.3.4) Wear - Accumulators - Subsea Control Systems (linked to 2.2.3.5) Internal leak - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.2) Corrosion/Erosion - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.6) External Leak/Rupture - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.1) Loss of Function (general) - Accumulators - Subsea Control Systems (linked to 2.2.3.7) Plugged - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.3) Mechanical Failure - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.4) Loss of Function - ROV Intervention Interface - BOP Stack (linked to 2.3.8.3) Mechanical Failure - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.4) Wear - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.5) External Leak / Rupture - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.1) External Leak/Rupture - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.1) Mechanical Failure - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.4) External Leak/Rupture - Connectors - BOP Stack (linked to 2.3.6.1) External Leak/Rupture - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.1) External leak/rupture - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.1) External Leak/Rupture - Annulars - BOP Stack (linked to 2.3.1.1)		

1.1.2	Functional Failure:	Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		External Leak/Rupture - HPU - Surface Control Systems (linked to 2.1.1.1) Internal Leak - Annulars - BOP Stack (linked to 2.3.1.2)		
3	Failure to Close Pipe Ram on Demand	Shaft seal leaks with higher wellbore pressure than operating pressure to close side of piston Internal Leak - Connectors - BOP Stack (linked to 2.3.6.2) Wear - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.5) External Leak/Rupture - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.1) External Leak/Rupture - Annulars - BOP Stack (linked to 2.3.1.1) Internal Leak - Annulars - BOP Stack (linked to 2.3.1.2)	C&K valves are redundant and have fail-safe design Type (I, P or M): P ROV intervention will enable closure of one of the pipe rams Type (I, P or M): P There are multiple annulars, with redundant pipe rams as backup, to ensure closure Type (I, P or M): P	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated
4	Inability to Operate C&K Valves as Needed	Seal between head case and body fails Internal Leak - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.2) Wear - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.5) External Leak/Rupture - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.1)	Deadheading of hydraulic pumps Type (I, P or M): I Flow meter reading is monitored (volume and time required to actuate are known. Too high a volume indicates a leak. Too long a time indicates galling or leak.) Type (I, P or M): I Increasing system hydraulic pressure Type (I, P or M): I Pressure test of chambers is conducted at end of well Type (I, P or M): M Shell test using end of tail rod between wells, on surface Type (I, P or M): M Weekly function test of stack and control valves Type (I, P or M): M Wellbore test are conducted between wells and every 14 days while drilling Type (I, P or M): M	Significant down time that impacts operations
5	Failure to Open Pipe Ram on Demand (as part of the well control effort)	Ram mechanism fails	Hydraulic fluid flow meter reading(s) indicate pipe ram position Type (I, P or M): I Increased drag on drill pipe indicates a closed or partially closed ram Type (I, P or M): I	Significant down time that impacts operations

1.1.2	Functional Failure:	Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
			Wellbore flow provides indication of pipe ram position Type (I, P or M): I Annual inspection of ram foot Type (I, P or M): M Between well maintenance Type (I, P or M): M Weekly function test of pipe rams Type (I, P or M): M	

1.1.3	Functional Failure:	Failure to seal or partial seal on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Failure of Annular to Seal on Demand	Inadequate hydraulic operating pressure Mechanical Failure - Annulars - BOP Stack (linked to 2.3.1.4) Wear - Annulars - BOP Stack (linked to 2.3.1.5)	Wellbore flow provides indication of problem Type (I, P or M): I There are multiple annulars, with redundant pipe rams as backup, to ensure closure Type (I, P or M): P Pressure test every 14 days Type (I, P or M): M Rebuild annulars between each well with the following replacement sequence: new to lower, existing lower to upper, and existing upper removed Type (I, P or M): M	Some down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with small to medium impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with small to medium impact Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated
2	Failure to Maintain Adequate Sealing Pressure on Annular	Internal Leak - HPU - Surface Control Systems (linked to 2.1.1.2) Internal Leak - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.2) Loss of Function (general) - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.7) Mechanical Failure - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.4) External Leak/Rupture - Accumulators - Subsea Control Systems (linked to 2.2.3.1) External Leak/Rupture - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.1) Corrosion/Erosion - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.6) Mechanical Failure - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.4) External Leak / Rupture - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.1) Loss of Function (general) - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.7) External leak/rupture - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.1)	Check valves in rigid conduit help maintain hydraulic pressure Type (I, P or M): P Redundant pod provides backup in case of functional failures in the active one Type (I, P or M): P There are redundant banks of accumulators (surface and subsea). Each bank provides stored hydraulic supply and energy. Type (I, P or M): P Accumulators are tested weekly for proper function Type (I, P or M): M Test connector/chamber check valves Type (I, P or M): M	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated
3	Inability to Operate C&K Valves as needed	Internal Leak - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.2) Wear - Choke & Kill Lines & Valves - BOP Stack	Deadheading of hydraulic pumps Type (I, P or M): I Flow meter reading is monitored (volume and time required to actuate are known. Too high a	Significant down time that impacts operations

1.1.3	Functional Failure:	Failure to seal or partial seal on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		(linked to 2.3.5.5) External Leak/Rupture - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.1)	volume indicates a leak. Too long a time indicates galling or leak.) Type (I, P or M): I Increasing system hydraulic pressure Type (I, P or M): I Pressure test of chambers is conducted at end of well Type (I, P or M): M Shell test using end of tail rod between wells, on surface Type (I, P or M): M Weekly function test of stack and control valves Type (I, P or M): M Wellbore test are conducted between wells and every 14 days while drilling Type (I, P or M): M	

1.1.4	Functional Failure:	Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Failure of Pipe Ram to Seal on Demand	Pipe and ram size mismatch Mechanical damage Trash in the well (swarf, concrete, etc.) Internal Leak - HPU - Surface Control Systems (linked to 2.1.1.2) Plugged - HPU - Surface Control Systems (linked to 2.1.1.3) Mechanical Failure - HPU - Surface Control Systems (linked to 2.1.1.4) Internal Leak - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.2) Loss of Function (general) - HPU - Surface Control Systems (linked to 2.1.1.7) Loss of Function (general) - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.7) External Leak/Rupture - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.1) Internal Leak - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.2) Mechanical Failure - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.4) Wear - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.5) Loss of Function (general) - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.7) Corrosion/Erosion - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.6) Internal Leak - Accumulators - Subsea Control Systems (linked to 2.2.3.2) Plugged - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.3) Mechanical Failure - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.4) External Leak/Rupture - Accumulators - Subsea Control Systems (linked to 2.2.3.1) Mechanical Failure - Accumulators - Subsea Control Systems (linked to 2.2.3.4)	Wellbore flow indicates failure to close Type (I, P or M): I Dimensional inspection of seal plate and wear plate is performed regularly (frequency varies from between well inspection to annual inspection) Type (I, P or M): P There are multiple annulars, with redundant pipe rams as backup, to ensure closure Type (I, P or M): P Maintenance/overhaul of annulars is performed at the completion of every well Type (I, P or M): M Wellbore test are conducted between wells and every 14 days while drilling Type (I, P or M): M	Some down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with small to medium impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with small to medium impact Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated

1.1.4	Functional Failure:	Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Wear - Accumulators - Subsea Control Systems (linked to 2.2.3.5) Internal leak - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.2) Internal Leak - Pipe & Test Rams - BOP Stack (linked to 2.3.4.2) External Leak/Rupture - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.1) Plugged - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.3) External Leak/Rupture - Pipe & Test Rams - BOP Stack (linked to 2.3.4.1) Corrosion/Erosion - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.6) Wear - Pipe & Test Rams - BOP Stack (linked to 2.3.4.5) External Leak / Rupture - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.1) Loss of Function (general) - Accumulators - Subsea Control Systems (linked to 2.2.3.7) Mechanical Failure - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.4) Corrosion/Erosion - Pipe & Test Rams - BOP Stack (linked to 2.3.4.6) External leak/rupture - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.1) External Leak/Rupture - HPU - Surface Control Systems (linked to 2.1.1.1)		
2	Failure to Maintain Adequate Sealing Pressure on Pipe Ram	Seals on the chamber ring fail to allow the transfer ring to move freely & doesn't allow the springs to fully engage clutch Wear on packers on ram blocks Motion compensator fails to prevent excessive wear on ram blocks Internal Leak - HPU - Surface Control Systems (linked to 2.1.1.2) Plugged - HPU - Surface Control Systems (linked	A multi position locking (MPL) mechanism offers redundant and diverse means of backing-up ram/sealing function Type (I, P or M): P Motion compensator for drill string helps to avoid excess wear on seals Type (I, P or M): P Rams are periodically lock tested on surface (without closing pressure)	Some down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with small to medium impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with small to medium impact Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated

1.1.4	Functional Failure:	Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		to 2.1.1.3) Mechanical Failure - HPU - Surface Control Systems (linked to 2.1.1.4) Loss of Function (general) - HPU - Surface Control Systems (linked to 2.1.1.7) Loss of Function (general) - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.7) External Leak/Rupture - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.1) Internal Leak - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.2) Corrosion/Erosion - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.6) Internal Leak - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.2) Mechanical Failure - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.4) Wear - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.5) Loss of Function (general) - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.7) Internal Leak - Accumulators - Subsea Control Systems (linked to 2.2.3.2) Internal leak - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.2) Mechanical Failure - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.4) External Leak / Rupture - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.1) Internal Leak - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.2) Mechanical Failure - Accumulators - Subsea Control Systems (linked to 2.2.3.4) Wear - Accumulators - Subsea Control Systems (linked to 2.2.3.5) Plugged - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to	Type (I, P or M): M Wellbore test are conducted between wells and every 14 days while drilling Type (I, P or M): M	

1.1.4	Functional Failure:	Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		2.2.2.3) External Leak/Rupture - Accumulators - Subsea Control Systems (linked to 2.2.3.1) Mechanical Failure - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.4) Loss of Function (general) - Accumulators - Subsea Control Systems (linked to 2.2.3.7) Plugged - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.3) Corrosion/Erosion - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.6) External Leak/Rupture - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.1) Loss of Function (general) - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.7) External leak/rupture - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.1) External Leak/Rupture - HPU - Surface Control Systems (linked to 2.1.1.1)		
3	Inability to Operate C&K Valves as Needed	Internal Leak - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.2) Wear - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.5) External Leak/Rupture - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.1)	Deadheading of hydraulic pumps Type (I, P or M): I Flow meter reading is monitored (volume and time required to actuate are known. Too high a volume indicates a leak. Too long a time indicates galling or leak.) Type (I, P or M): I Increasing system hydraulic pressure Type (I, P or M): I Pressure test of chambers is conducted at end of well Type (I, P or M): M Shell test using end of tail rod between wells, on surface Type (I, P or M): M Weekly function test of stack and control valves Type (I, P or M): M Wellbore test are conducted between wells and every 14 days while drilling Type (I, P or M): M	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated

1.1.5	Functional Failure:	Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Unintentional Operation	Fails with no output - Power - Surface Control Systems (linked to 2.1.2.2) Loss of Function - Power - Surface Control Systems (linked to 2.1.2.6) Mechanical Failure - MUX System - Surface Control Systems (linked to 2.1.3.9) Corrosion/Erosion - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.6) Erratic output (Erratic, Intermittent) - Power - Surface Control Systems (linked to 2.1.2.3) Ground Faults - Power - Surface Control Systems (linked to 2.1.2.7) Short - MUX System - Surface Control Systems (linked to 2.1.3.7) Ground Fault - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.6) Internal Leak - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.2) Plugged - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.3) Electrical Short - Power - Surface Control Systems (linked to 2.1.2.5) Loss of function (general) - MUX System - Surface Control Systems (linked to 2.1.3.8) Loss of Power (UPS Shuts down with power degradation) - Power - Surface Control Systems (linked to 2.1.2.1) Loss of subsea transformer - Power - Surface Control Systems (linked to 2.1.2.8) Erratic output (Network) - MUX System - Surface Control Systems (linked to 2.1.3.4) Fails with no output signal/communication - MUX System - Surface Control Systems (linked to 2.1.3.2) Loss of, or Degraded Power - Control Panels - Surface Control Systems (linked to 2.1.5.1) Fails to respond to input - MUX System - Surface Control Systems (linked to 2.1.3.5) Fails to respond (with no output signal/communication or to input) - Control Panels - Surface Control Systems (linked to	The hydraulic system has built-in redundancy Type (I, P or M): P There are multiple annulars, with redundant pipe rams as backup, to ensure closure Type (I, P or M): P Pressure test of chambers is conducted at end of well Type (I, P or M): M Shell test using end of tail rod between wells, on surface Type (I, P or M): M Weekly function test of stack and control valves Type (I, P or M): M Wellbore test are conducted between wells and every 14 days while drilling Type (I, P or M): M	Significant down time that impacts operations Potential to overpressure standpipe and/or manifold leading to hydrocarbon release, fire, or explosion

1.1.5	Functional Failure:	Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		2.1.5.2) Erratic output - Control Panels - Surface Control Systems (linked to 2.1.5.4) Fails to respond to input - Electrical - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.4) Loss of function (general) - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.7) Mechanical Failure - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.4) Fails to respond to input - Control Panels - Surface Control Systems (linked to 2.1.5.5) Short - Control Panels - Surface Control Systems (linked to 2.1.5.7) Loss of function (general) - Control Panels - Surface Control Systems (linked to 2.1.5.8) Fails with no output signal/communication - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.2) Erratic output - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.3) Wear - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.5) External Leak/Rupture - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.1) Loss of, or Degraded Power - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.1)		
2	Unintentional Opening	No scenarios resulting in unintentional opening during 'Close and seal on the drill pipe and allow circulation on demand'		

1.1.6	Functional Failure:	Failure to open / close fail-safe valves - Close and seal on the drill pipe and allow circulation on demand		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Failure to Actuate Under Fail-safe Conditions	Mechanical Failure - Connectors - BOP Stack (linked to 2.3.6.4) Corrosion/Erosion - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.6) Mechanical Failure - Autoshear System - BOP Stack (linked to 2.3.7.4) Mechanical Failure - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.4) Mechanical Failure - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.4) Corrosion/Erosion - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.6) Mechanical Failure - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.4) Wear - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.5)	Close manual valves at choke manifold on surface Type (I, P or M): P Redundant valves in series on stack Type (I, P or M): P Valves close via hydraulic/or spring if hydraulic open pressure bleeds Type (I, P or M): P Maintenance/overhaul of annulars is performed at the completion of every well. Between well maintenance - specifically tested for proper operation Type (I, P or M): M	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated
2	Failure to Adequately Seal Under Fail-safe Conditions	No scenarios resulting in failure to adequately seal under fail-safe conditions during 'Close and seal on the drill pipe and allow circulation on demand'		

1.1.7	Functional Failure:	Closes too slowly - Close and seal on the drill pipe and allow circulation on demand		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Actuates Too Slowly on Demand	Air in hydraulic system Plugged - HPU - Surface Control Systems (linked to 2.1.1.3) Mechanical Failure - HPU - Surface Control Systems (linked to 2.1.1.4) Plugged - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.3) Loss of Function (general) - HPU - Surface Control Systems (linked to 2.1.1.7) Loss of Function (general) - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.7) External Leak / Rupture - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.1) External Leak/Rupture - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.1) Internal Leak - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.2) Mechanical Failure - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.4) Wear - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.5) Loss of Function (general) - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.7) Internal Leak - Accumulators - Subsea Control Systems (linked to 2.2.3.2) Plugged - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.3) Mechanical Failure - Accumulators - Subsea Control Systems (linked to 2.2.3.4) Plugged - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.3) External Leak/Rupture - Accumulators - Subsea Control Systems (linked to 2.2.3.1) Wear - Accumulators - Subsea Control Systems (linked to 2.2.3.5) Loss of Function (general) - Accumulators - Subsea Control Systems (linked to 2.2.3.7) External Leak/Rupture - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.1)	Hydraulic fluid flow meter Type (I, P or M): I Wellbore flow Type (I, P or M): I Redundant annulars with redundant pipe rams Type (I, P or M): P Redundant controls Type (I, P or M): P Maintenance/overhaul at end of every well for annulars Type (I, P or M): M	Increased influx of hydrocarbons into Riser resulting in safety (fire/explosion) and/or environmental effects Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated

1.1.7	Functional Failure:	Closes too slowly - Close and seal on the drill pipe and allow circulation on demand		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		External Leak/Rupture - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.1) Plugged - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.3) Loss of Function (general) - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.7) Mechanical Failure - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.4) External leak/rupture - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.1) External Leak/Rupture - HPU - Surface Control Systems (linked to 2.1.1.1)		

1.1.8	Functional Failure:	Loss of containment - Close and seal on the drill pipe and allow circulation on demand		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	External Leak	Mechanical Failure - Blind Shear Ram - BOP Stack (linked to 2.3.2.4) External Leak/Rupture - Casing Shear Ram - BOP Stack (linked to 2.3.3.1) External Leak/Rupture - Blind Shear Ram - BOP Stack (linked to 2.3.2.1) Mechanical Failure - Pipe & Test Rams - BOP Stack (linked to 2.3.4.4) Loss of Function (general) - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.7) Wear - Casing Shear Ram - BOP Stack (linked to 2.3.3.5) Wear - Blind Shear Ram - BOP Stack (linked to 2.3.2.5) External Leak/Rupture - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.1) Mechanical Failure - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.4) Mechanical Failure - Casing Shear Ram - BOP Stack (linked to 2.3.3.4) External Leak/Rupture - Pipe & Test Rams - BOP Stack (linked to 2.3.4.1) External Leak/Rupture - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.1) External leak/rupture - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.1) External Leak/Rupture - Annulars - BOP Stack (linked to 2.3.1.1)	Connectors tested with casing test & blind shear ram test Type (I, P or M): M Pressure test every 14 days Type (I, P or M): M ROV inspection every 3 days Type (I, P or M): M	Potential for the release of significant amount of hydrocarbon to the environment Drilling mud spill to the environment Potential for Fire/Explosion, with severity depending on location. (For example, if failed at choke manifold connection, large fire could result.) If loss of containment is at wellhead connector, it could result in a medium release to the environment due to limited mitigation options
2	Rupture	Not credible causes resulting in rupture during 'Close and seal on the drill pipe and allow circulation on demand'		

2- Close and seal on open hole and allow volumetric well control operations, on demand

1.2.1	Functional Failure:	Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Failure to Provide Control Signal to Annular / Blind-Shear Ram or C&K Valves When Demanded	Wiring harness fails Loss of Power (UPS Shuts down with power degradation) - Power - Surface Control Systems (linked to 2.1.2.1) Electrical Short - Power - Surface Control Systems (linked to 2.1.2.5) Erratic output (Network) - MUX System - Surface Control Systems (linked to 2.1.3.4) Short - MUX System - Surface Control Systems (linked to 2.1.3.7) Fails with no output signal/communication - MUX System - Surface Control Systems (linked to 2.1.3.2) Fails to respond to input - MUX System - Surface Control Systems (linked to 2.1.3.5) Loss of function (general) - MUX System - Surface Control Systems (linked to 2.1.3.8) Loss of, or Degraded Power - Control Panels - Surface Control Systems (linked to 2.1.5.1) Fails to respond (with no output signal/communication or to input) - Control Panels - Surface Control Systems (linked to 2.1.5.2) Erratic output - Control Panels - Surface Control Systems (linked to 2.1.5.4) Fails to respond to input - Electrical - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.4) Loss of function (general) - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.7) Fails to respond to input - Control Panels - Surface Control Systems (linked to 2.1.5.5) Short - Control Panels - Surface Control Systems (linked to 2.1.5.7) Loss of function (general) - Control Panels - Surface Control Systems (linked to 2.1.5.8) Erratic output - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.3) Fails with no output signal/communication - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.2)	Atypical current across solenoid coil Type (I, P or M): I Communications failure via flashing red screen on touch screen Type (I, P or M): I Mud on rig floor Type (I, P or M): I No flow in flow meters Type (I, P or M): I Pod mismatch & alarm Type (I, P or M): I Redundant mechanicals Type (I, P or M): P Redundant touch screen, controllers, control pods, cables, powers supplies, SEM Type (I, P or M): P Function test (or obtain waiver) blind shear ram every 7 days (used to be every 30 days, recent BSEE regulation change in last 6 months) Type (I, P or M): M Function tests between wells and upon latch-up Type (I, P or M): M	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated

1.2.1	Functional Failure:	Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Loss of, or Degraded Power - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.1)		
2	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves	Internal Leak - HPU - Surface Control Systems (linked to 2.1.1.2) Internal Leak - Blind Shear Ram - BOP Stack (linked to 2.3.2.2) Plugged - HPU - Surface Control Systems (linked to 2.1.1.3) Mechanical Failure - HPU - Surface Control Systems (linked to 2.1.1.4) Plugged - Annulars - BOP Stack - (linked to 2.3.1.3) Internal Leak - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.2) Plugged - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.3) Loss of Function (general) - HPU - Surface Control Systems (linked to 2.1.1.7) Internal Leak - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.2) External Leak/Rupture - Blind Shear Ram - BOP Stack (linked to 2.3.2.1) Loss of Function (general) - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.7) Internal Leak - Connectors - BOP Stack (linked to 2.3.6.2) External Leak / Rupture - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.1) External Leak/Rupture - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.1) Internal Leak - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.2) Mechanical Failure - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.4) Wear - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.5) Loss of Function (general) - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.7) Mechanical Failure - Fluid Reservoir Unit -	HPU pumps running constantly Type (I, P or M): I Manual indicators on valves that the ROV can read Type (I, P or M): I Design margin/safety factors (conduits work at 5k, max @ 7.5k) Type (I, P or M): P Multiple annulars & rams Type (I, P or M): P Multiple annulars capable of closing hole. Additional rams are not an option without a drill string Type (I, P or M): P Multiple pumps (1 pump needed, 3 pumps present) Type (I, P or M): P Redundant conduit lines with ability to isolate leaking line and cross-connect via conduit manifold Type (I, P or M): P Redundant functions between pods Type (I, P or M): P Redundant regulators Type (I, P or M): P Accumulators with stored energy Type (I, P or M): P Filter replacement frequency Type (I, P or M): M Maintenance programs Type (I, P or M): M ROV inspection every 3 days Type (I, P or M): M SOAK test between wells Type (I, P or M): M Weekly BOP function test Type (I, P or M): M	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated

1.2.1	Functional Failure:	Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Surface Control Systems (linked to 2.1.7.4) Mechanical Failure - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.4) Corrosion/Erosion - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.6) Internal Leak - Accumulators - Subsea Control Systems (linked to 2.2.3.2) Plugged - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.3) Mechanical Failure - Accumulators - Subsea Control Systems (linked to 2.2.3.4) Wear - Accumulators - Subsea Control Systems (linked to 2.2.3.5) Mechanical Failure - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.4) Mechanical Failure - Blind Shear Ram - BOP Stack (linked to 2.3.2.4) Wear - Blind Shear Ram - BOP Stack (linked to 2.3.2.5) External Leak/Rupture - Accumulators - Subsea Control Systems (linked to 2.2.3.1) Loss of Function (general) - Accumulators - Subsea Control Systems (linked to 2.2.3.7) Corrosion/Erosion - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.6) External Leak/Rupture - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.1) Plugged - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.3) External Leak/Rupture - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.1) Plugged - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.3) External Leak/Rupture - Connectors - BOP Stack (linked to 2.3.6.1) Loss of Function (general) - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.7)		

1.2.1	Functional Failure:	Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Mechanical Failure - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.4) Wear - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.5) External Leak/Rupture - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.1) External leak/rupture - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.1) External Leak/Rupture - HPU - Surface Control Systems (linked to 2.1.1.1) Internal Leak - Annulars - BOP Stack (linked to 2.3.1.2)		
3	Failure to Close Annular / Blind-Shear Ram on Demand	Internal Leak - Annulars - BOP Stack (linked to 2.3.1.2) Internal Leak - Blind Shear Ram - BOP Stack (linked to 2.3.2.2) External Leak/Rupture - Blind Shear Ram - BOP Stack (linked to 2.3.2.1) Internal Leak - Connectors - BOP Stack (linked to 2.3.6.2) External Leak/Rupture - Annulars - BOP Stack (linked to 2.3.1.1) Wear - Blind Shear Ram - BOP Stack (linked to 2.3.2.5) Shaft seal leaks with higher wellbore pressure than operating pressure to close side of piston Mechanical Failure - Blind Shear Ram - BOP Stack (linked to 2.3.2.4) External Leak/Rupture - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.1) Wear - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.5)	Hydraulic fluid flow meter Type (I, P or M): I Wellbore flow Type (I, P or M): I Other pipe rams & annular Type (I, P or M): P Redundant controls Type (I, P or M): P Redundant annulars with redundant pipe rams Type (I, P or M): P Redundancy with fail-safe valves Type (I, P or M): P ROV intervention - will close 1 of the pipe rams Type (I, P or M): P The only redundancies in this case are 2 annulars and 1 blind shear ram. The other pipe rams are not usable without the drill string in place. Type (I, P or M): P Maintenance/overhaul at end of every well for annulars Type (I, P or M): M	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated
4	Failure of Annular / Blind-Shear Ram to Seal on Demand	Incorrect annular seal (bag) based on drilling mud Age/storage related failure of seal (UV & Heat) Washout of seal Internal Leak - HPU - Surface Control Systems (linked to 2.1.1.2) Plugged - HPU - Surface Control Systems (linked	Wellbore flow Type (I, P or M): I Dimensional inspection of seal plate and wear plate (frequency varies from between well, to annually) Type (I, P or M): P Redundant annulars	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact Down time, after well control issue is resolved,

1.2.1	Functional Failure:	Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		to 2.1.1.3) External Leak/Rupture - HPU - Surface Control Systems (linked to 2.1.1.1) Mechanical Failure - HPU - Surface Control Systems (linked to 2.1.1.4) Mechanical Failure - Annulars - BOP Stack - (linked to 2.3.1.4) Loss of Function (general) - HPU - Surface Control Systems (linked to 2.1.1.7) Internal Leak - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.2) Internal leak - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.2) Loss of Function (general) - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.7) External Leak/Rupture - Blind Shear Ram - BOP Stack (linked to 2.3.2.1) External Leak / Rupture - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.1) External Leak/Rupture - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.1) Internal Leak - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.2) Mechanical Failure - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.4) Wear - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.5) Loss of Function (general) - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.7) Mechanical Failure - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.4) Corrosion/Erosion - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.6) Internal Leak - Accumulators - Subsea Control Systems (linked to 2.2.3.2) Mechanical Failure - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Type (I, P or M): P Redundant Rams Type (I, P or M): P End of well maintenance Type (I, P or M): M Fourteen day functional testing of blind shears Type (I, P or M): M Pressure test of annulars every 14 days Type (I, P or M): M Rebuild annulars between each well with replacement (New lower, lower to upper & upper to junk) Type (I, P or M): M	to repair an individual C&K valve that cannot be operated

1.2.1	Functional Failure:	Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		(linked to 2.2.5.4) External Leak/Rupture - Annulars - BOP Stack (linked to 2.3.1.1) Plugged - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.3) Mechanical Failure - Accumulators - Subsea Control Systems (linked to 2.2.3.4) Wear - Accumulators - Subsea Control Systems (linked to 2.2.3.5) Wear - Blind Shear Ram - BOP Stack (linked to 2.3.2.5) External Leak/Rupture - Accumulators - Subsea Control Systems (linked to 2.2.3.1) Loss of Function (general) - Accumulators - Subsea Control Systems (linked to 2.2.3.7) Corrosion/Erosion - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.6) External Leak/Rupture - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.1) Plugged - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.3) Mechanical Failure - Blind Shear Ram - BOP Stack (linked to 2.3.2.4) External leak/rupture - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.1) Internal Leak - Annulars - BOP Stack (linked to 2.3.1.2) Wear - Annulars - BOP Stack (linked to 2.3.1.5)		
5	Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram	Internal Leak - HPU - Surface Control Systems (linked to 2.1.1.2) Plugged - HPU - Surface Control Systems (linked to 2.1.1.3) External Leak/Rupture - HPU - Surface Control Systems (linked to 2.1.1.1) Mechanical Failure - HPU - Surface Control Systems (linked to 2.1.1.4) External Leak/Rupture - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.1)	Wellbore flow Type (I, P or M): I Dimensional inspection of seal plate and wear plate (frequency varies from between well, to annually) Type (I, P or M): P Redundant annulars Type (I, P or M): P Redundant Rams Type (I, P or M): P End of well maintenance	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated

1.2.1	Functional Failure:	Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Internal Leak - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.2) External Leak/Rupture - Blind Shear Ram - BOP Stack (linked to 2.3.2.1) External Leak / Rupture - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.1) Internal Leak - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.2) Mechanical Failure - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.4) Loss of Function (general) - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.7) Internal leak - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.2) Wear - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.5) Loss of Function (general) - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.7) Mechanical Failure - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.4) Mechanical Failure - Annulars - BOP Stack - (linked to 2.3.1.4) Wear - Annulars - BOP Stack (linked to 2.3.1.5) Mechanical Failure - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.4) Corrosion/Erosion - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.6) Internal Leak - Accumulators - Subsea Control Systems (linked to 2.2.3.2) Plugged - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.3) Mechanical Failure - Accumulators - Subsea Control Systems (linked to 2.2.3.4) Wear - Accumulators - Subsea Control Systems (linked to 2.2.3.5)	Type (I, P or M): M Fourteen day functional testing of blind shears Type (I, P or M): M Pressure test of annulars every 14 days Type (I, P or M): M Rebuild annulars between each well with replacement (New lower, lower to upper & upper to junk) Type (I, P or M): M	

1.2.1	Functional Failure:	Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		External Leak/Rupture - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.1) Incorrect annular seal (bag) based on drilling mud Age/storage related failure of seal (UV & Heat) Washout of seal External Leak/Rupture - Accumulators - Subsea Control Systems (linked to 2.2.3.1) Loss of Function (general) - Accumulators - Subsea Control Systems (linked to 2.2.3.7) Corrosion/Erosion - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.6) Plugged - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.3) Wear - Blind Shear Ram - BOP Stack (linked to 2.3.2.5) Mechanical Failure - Blind Shear Ram - BOP Stack (linked to 2.3.2.4) External leak/rupture - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.1) Loss of Function (general) - HPU - Surface Control Systems (linked to 2.1.1.7) External Leak/Rupture - Annulars - BOP Stack (linked to 2.3.1.1) Internal Leak - Annulars - BOP Stack (linked to 2.3.1.2)		

1.2.1	Functional Failure:	Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
6	Inability to Operate C&K Valves as Needed	Internal Leak - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.2) External Leak/Rupture - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.1) Wear - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.5)	Deadheading of pump Type (I, P or M): I Flow meter (volume to actuate is known, should go 0 to 0.7 to 0 in ~ 5 seconds) If too high = leak. If long time = galling or leak Type (I, P or M): I Increasing pressure Type (I, P or M): I Pressure test chambers at end of well Type (I, P or M): P Shell test using end of tail rod between wells, on surface Type (I, P or M): M Weekly function test of stack Type (I, P or M): M Wellbore test between wells and 14 while subsea Type (I, P or M): M	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated

1.2.2	Functional Failure:	Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Unintentional Closing	Fails with no output - Power - Surface Control Systems (linked to 2.1.2.2) Erratic output (Erratic, Intermittent) - Power - Surface Control Systems (linked to 2.1.2.3) Loss of Function - Power - Surface Control Systems (linked to 2.1.2.6) Mechanical Failure - MUX System - Surface Control Systems (linked to 2.1.3.9) Ground Faults - Power - Surface Control Systems (linked to 2.1.2.7) Electrical Short - Power - Surface Control Systems (linked to 2.1.2.5) Loss of subsea transformer - Power - Surface Control Systems (linked to 2.1.2.8) Erratic output (Network) - MUX System - Surface Control Systems (linked to 2.1.3.4) Loss of Power (UPS Shuts down with power degradation) - Power - Surface Control Systems (linked to 2.1.2.1) Fails with no output signal/communication - MUX System - Surface Control Systems (linked to 2.1.3.2) Short - MUX System - Surface Control Systems (linked to 2.1.3.7) Loss of function (general) - MUX System - Surface Control Systems (linked to 2.1.3.8) Ground Fault - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.6) Loss of, or Degraded Power - Control Panels - Surface Control Systems (linked to 2.1.5.1) Fails to respond to input - Electrical - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.4) Loss of function (general) - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.7) Fails to respond to input - MUX System - Surface Control Systems (linked to 2.1.3.5) Fails to respond (with no output signal/communication or to input) - Control Panels - Surface Control Systems (linked to 2.1.5.2)	Redundant BOPs Type (I, P or M): P Redundancy in hydraulic system Type (I, P or M): P Standard pressure/functional testing Type (I, P or M): M	Down time with potential impact on operation Potential to overpressure standpipe and manifold, leading to gas migration and/or fire and/or explosion

1.2.2	Functional Failure:	Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Erratic output - Control Panels - Surface Control Systems (linked to 2.1.5.4) Fails to respond to input - Control Panels - Surface Control Systems (linked to 2.1.5.5) Short - Control Panels - Surface Control Systems (linked to 2.1.5.7) Loss of function (general) - Control Panels - Surface Control Systems (linked to 2.1.5.8) Erratic output - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.3) Fails with no output signal/communication - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.2) Loss of, or Degraded Power - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.1)		
2	Unintentional Opening	No credible causes resulting in unintentional opening during 'Close and seal on open hole and allow volumetric well control operations on demand'		

1.2.3	Functional Failure:	Failure to open/close fail-safe valves - Close and seal on open hole and allow volumetric well control operations on demand		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Failure to Actuate Under Fail-safe Conditions	No credible causes resulting in a failure to actuate under fail-safe conditions during 'Close and seal on open hole and allow volumetric well control operations on demand'		
2	Failure to Adequately Seal Under Fail-safe Conditions	No credible causes resulting in failure to adequately seal under fail-safe conditions during 'Close and seal on open hole and allow volumetric well control operations on demand'		

1.2.4	Functional Failure:	Closes too slowly - Close and seal on open hole and allow volumetric well control operations on demand		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Actuates Too Slowly on Demand	No credible causes resulting in Actuates Too Slowly on Demand during 'Close and seal on open hole and allow volumetric well control operations on demand'		

1.2.5	Functional Failure:	Loss of containment - Close and seal on open hole and allow volumetric well control operations on demand		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	External Leak	No credible causes resulting in an external leak during 'Close and seal on open hole and allow volumetric well control operations on demand'		
2	Rupture	No credible causes resulting in a rupture during 'Close and seal on open hole and allow volumetric well control operations on demand'		

3- Strip the drill string using the annular BOP(s)

1.3.1	Functional Failure:	Failure to close annulars - Strip the drill string using the annular BOP(s)		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Failure to Provide Control Signal to Annulars When Demanded	Electrical Short - Power - Surface Control Systems (linked to 2.1.2.5) Loss of Power (UPS Shuts down with power degradation) - Power - Surface Control Systems (linked to 2.1.2.1) Erratic output (Network) - MUX System - Surface Control Systems (linked to 2.1.3.4) Fails with no output signal/communication - MUX System - Surface Control Systems (linked to 2.1.3.2) Loss of, or Degraded Power - Control Panels - Surface Control Systems (linked to 2.1.5.1) Fails to respond to input - Electrical - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.4) Loss of function (general) - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.7) Fails to respond to input - MUX System - Surface Control Systems (linked to 2.1.3.5) Short - MUX System - Surface Control Systems (linked to 2.1.3.7) Loss of function (general) - MUX System - Surface Control Systems (linked to 2.1.3.8) Fails to respond (with no output signal/communication or to input) - Control Panels - Surface Control Systems (linked to 2.1.5.2) Erratic output - Control Panels - Surface Control Systems (linked to 2.1.5.4) Wiring harness fails Fails to respond to input - Control Panels - Surface Control Systems (linked to 2.1.5.5) Short - Control Panels - Surface Control Systems (linked to 2.1.5.7) Loss of function (general) - Control Panels - Surface Control Systems (linked to 2.1.5.8) Erratic output - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.3) Loss of, or Degraded Power - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.1)	Wellbore flow Type (I, P or M): I From drillers chair/console it is two switches that are both covered Type (I, P or M): P Redundant annulars Type (I, P or M): P Redundant Rams Type (I, P or M): P Two hand operation, Password, confirmation Type (I, P or M): P Pressure test every 14 days Type (I, P or M): M Rebuild annulars between each well with replacement (New lower, lower to upper & upper to junk) Type (I, P or M): M	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated

1.3.1	Functional Failure:	Failure to close annulars - Strip the drill string using the annular BOP(s)		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Fails with no output signal/communication - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.2)		
2	Failure to Supply Hydraulic Fluid & Pressure to Annulars	Internal Leak - HPU - Surface Control Systems (linked to 2.1.1.2) Plugged - HPU - Surface Control Systems (linked to 2.1.1.3) External Leak/Rupture - HPU - Surface Control Systems (linked to 2.1.1.1) Mechanical Failure - HPU - Surface Control Systems (linked to 2.1.1.4) Loss of Function (general) - HPU - Surface Control Systems (linked to 2.1.1.7) Plugged - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.3) Internal Leak - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.2) Internal Leak - Connectors - BOP Stack (linked to 2.3.6.2) External Leak / Rupture - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.1) Internal Leak - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.2) Loss of Function (general) - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.7) Plugged - Annulars - BOP Stack - (linked to 2.3.1.3) Mechanical Failure - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.4) Internal leak - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.2) Internal Leak - Annulars - BOP Stack (linked to 2.3.1.2) Mechanical Failure - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.4) External Leak/Rupture - Annulars - BOP Stack (linked to 2.3.1.1) External Leak/Rupture - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.1)	HPU pumps running constantly Type (I, P or M): I Manual indicators on valves that the ROV can read Type (I, P or M): I Accumulators with stored energy Type (I, P or M): P Design margin/safety factors (conduits work at 5k, max @ 7.5k) Type (I, P or M): P Multiple annulars & rams Type (I, P or M): P Multiple pumps (1 pump needed, 3 pumps present) Type (I, P or M): P Redundant conduit lines with ability to isolate leaking line and cross-connect via conduit manifold Type (I, P or M): P Redundant functions between pods Type (I, P or M): P Redundant regulators Type (I, P or M): P Filter replacement frequency Type (I, P or M): M Maintenance programs Type (I, P or M): M ROV inspection every 3 days Type (I, P or M): M SOAK test between wells Type (I, P or M): M Weekly BOP function test Type (I, P or M): M	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated

1.3.1	Functional Failure:	Failure to close annulars - Strip the drill string using the annular BOP(s)		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Internal Leak - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.2) Mechanical Failure - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.4) Wear - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.5) Loss of Function (general) - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.7) Plugged - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.3) Mechanical Failure - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.4) Corrosion/Erosion - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.6) Internal Leak - Accumulators - Subsea Control Systems (linked to 2.2.3.2) External Leak/Rupture - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.1) External Leak/Rupture - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.1) Plugged - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.3) Mechanical Failure - Accumulators - Subsea Control Systems (linked to 2.2.3.4) Wear - Accumulators - Subsea Control Systems (linked to 2.2.3.5) External Leak/Rupture - Accumulators - Subsea Control Systems (linked to 2.2.3.1) Loss of Function (general) - Accumulators - Subsea Control Systems (linked to 2.2.3.7) Corrosion/Erosion - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.6) External Leak/Rupture - Connectors - BOP Stack (linked to 2.3.6.1) Plugged - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.3) Mechanical Failure - Choke & Kill Lines & Valves -		

1.3.1	Functional Failure:	Failure to close annulars - Strip the drill string using the annular BOP(s)		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		BOP Stack (linked to 2.3.5.4) Loss of Function (general) - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.7) Loss of Function - ROV Intervention Interface - BOP Stack (linked to 2.3.8.3) External Leak/Rupture - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.1) External leak/rupture - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.1) Wear - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.5)		
3	Failure to Close Annulars on Drill String on Demand	External Leak/Rupture - Annulars - BOP Stack (linked to 2.3.1.1)	Hydraulic fluid flow meter Type (I, P or M): I Wellbore flow Type (I, P or M): I Redundant annulars with redundant pipe rams Type (I, P or M): P Redundant controls Type (I, P or M): P Maintenance/overhaul at end of every well for annulars Type (I, P or M): M	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated

1.3.2	Functional Failure:	Failure to maintain stripping pressure - Strip the drill string using the annular BOP(s)		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Failure to Maintain Hydraulic Fluid & Pressure to Annulars	Internal Leak - HPU - Surface Control Systems (linked to 2.1.1.2) Loss of Function (general) - HPU - Surface Control Systems (linked to 2.1.1.7) External Leak / Rupture - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.1) Internal Leak - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.2) Internal Leak - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.2) Internal leak - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.2) Mechanical Failure - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.4) Corrosion/Erosion - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.6) External Leak/Rupture - Accumulators - Subsea Control Systems (linked to 2.2.3.1) Plugged - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.3) Corrosion/Erosion - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.6) Loss of Function (general) - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.7) External leak/rupture - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.1)	Flow (returns through riser) of well Type (I, P or M): I Pressure readings on annular Type (I, P or M): I Accumulators Type (I, P or M): P Check valves in rigid conduit Type (I, P or M): P Second annular Type (I, P or M): P Redundant pods Type (I, P or M): P Test connector/chamber check valves Type (I, P or M): M Test performed every 14 days Type (I, P or M): M Weekly function test Type (I, P or M): M	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated

1.3.3	Functional Failure:	Failure to seal - Strip the drill string using the annular BOP(s)		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Failure of Annulars to Seal on Demand	Incorrect annular seal (bag) based on drilling mud Inadequate operating pressure Mechanical Failure - Annulars - BOP Stack (linked to 2.3.1.4) Wear - Annulars - BOP Stack (linked to 2.3.1.5) External Leak/Rupture - Annulars - BOP Stack (linked to 2.3.1.1)	Wellbore flow Type (I, P or M): I Ability to increase operating pressure Type (I, P or M): P Redundant annulars Type (I, P or M): P Redundant Rams Type (I, P or M): P Pressure test every 14 days Type (I, P or M): M Rebuild annulars between each well with replacement (New lower, lower to upper & upper to junk) Type (I, P or M): M	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated
2	Failure to Maintain Sealing Pressure on Annulars	Incorrect annular seal (bag) based on drilling mud Mechanical Failure - Annulars - BOP Stack (linked to 2.3.1.4) Inadequate operating pressure Wear - Annulars - BOP Stack (linked to 2.3.1.5) External Leak/Rupture - Annulars - BOP Stack (linked to 2.3.1.1)	Wellbore flow Type (I, P or M): I Ability to increase operating pressure Type (I, P or M): P Redundant annulars Type (I, P or M): P Rams are a back up and can be used to seal around drill pipe Type (I, P or M): P Redundant Rams Type (I, P or M): P Pressure test every 14 days Type (I, P or M): M Rebuild annulars between each well with replacement (New lower, lower to upper & upper to junk) Type (I, P or M): M	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated

4- Hang-off the drill pipe on a ram BOP and control the wellbore

1.4.1	Functional Failure:	Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Failure to Provide Control Signal to Hang-off Ram When Demanded	Wiring harness fails Loss of Power (UPS Shuts down with power degradation) - Power - Surface Control Systems (linked to 2.1.2.1) Electrical Short - Power - Surface Control Systems (linked to 2.1.2.5) Fails to respond to input - Electrical - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.4) Loss of function (general) - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.7) Fails with no output signal/communication - MUX System - Surface Control Systems (linked to 2.1.3.2) Erratic output (Network) - MUX System - Surface Control Systems (linked to 2.1.3.4) Loss of, or Degraded Power - Control Panels - Surface Control Systems (linked to 2.1.5.1) Short - MUX System - Surface Control Systems (linked to 2.1.3.7) Fails to respond to input - MUX System - Surface Control Systems (linked to 2.1.3.5) Loss of function (general) - MUX System - Surface Control Systems (linked to 2.1.3.8) Fails to respond (with no output signal/communication or to input) - Control Panels - Surface Control Systems (linked to 2.1.5.2) Erratic output - Control Panels - Surface Control Systems (linked to 2.1.5.4) Fails to respond to input - Control Panels - Surface Control Systems (linked to 2.1.5.5) Short - Control Panels - Surface Control Systems (linked to 2.1.5.7) Loss of function (general) - Control Panels - Surface Control Systems (linked to 2.1.5.8) Fails with no output signal/communication - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.2) Erratic output - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.3)	Redundancy of annular and redundant pipe rams Type (I, P or M): P Redundancy with fail-safe valves Type (I, P or M): P ROV intervention - will close 1 of the pipe rams Type (I, P or M): P	Potential down time that can impact operation No well control issues identified for this condition due to other available options

1.4.1	Functional Failure:	Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Loss of, or Degraded Power - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.1)		
2	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram	Internal Leak - HPU - Surface Control Systems (linked to 2.1.1.2) Plugged - HPU - Surface Control Systems (linked to 2.1.1.3) External Leak/Rupture - HPU - Surface Control Systems (linked to 2.1.1.1) Mechanical Failure - HPU - Surface Control Systems (linked to 2.1.1.4) Loss of Function (general) - HPU - Surface Control Systems (linked to 2.1.1.7) Internal Leak - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.2) Plugged - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.3) External Leak / Rupture - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.1) Internal Leak - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.2) Loss of Function (general) - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.7) Mechanical Failure - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.4) Internal leak - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.2) Plugged - Annulars - BOP Stack - (linked to 2.3.1.3) Internal Leak - Connectors - BOP Stack (linked to 2.3.6.2) Plugged - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.3) External Leak/Rupture - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.1) Internal Leak - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.2) Mechanical Failure - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.4)	Redundancy of annular and redundant pipe rams Type (I, P or M): P Redundancy with fail-safe valves Type (I, P or M): P ROV intervention - will close 1 of the pipe rams Type (I, P or M): P	Potential down time that can impact operation No well control issues identified for this condition due to other available options

1.4.1	Functional Failure:	Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Wear - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.5) Loss of Function (general) - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.7) External Leak/Rupture - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.1) Mechanical Failure - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.4) External Leak/Rupture - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.1) Corrosion/Erosion - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.6) Internal Leak - Accumulators - Subsea Control Systems (linked to 2.2.3.2) Mechanical Failure - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.4) Plugged - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.3) Mechanical Failure - Accumulators - Subsea Control Systems (linked to 2.2.3.4) Wear - Accumulators - Subsea Control Systems (linked to 2.2.3.5) External Leak/Rupture - Accumulators - Subsea Control Systems (linked to 2.2.3.1) Loss of Function (general) - Accumulators - Subsea Control Systems (linked to 2.2.3.7) Corrosion/Erosion - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.6) Plugged - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.3) External Leak/Rupture - Connectors - BOP Stack (linked to 2.3.6.1) Mechanical Failure - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.4) External Leak/Rupture - Annulars - BOP Stack (linked to 2.3.1.1) Loss of Function - ROV Intervention Interface -		

1.4.1	Functional Failure:	Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		BOP Stack (linked to 2.3.8.3) External Leak/Rupture - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.1) External leak/rupture - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.1) Wear - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.5) Loss of Function (general) - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.7) Internal Leak - Annulars - BOP Stack (linked to 2.3.1.2)		
3	Failure to Close Hang-off Ram on Demand	Shaft seal leaks with higher wellbore pressure than operating pressure to close side of piston Internal Leak - Annulars - BOP Stack (linked to 2.3.1.2) Internal Leak - Connectors - BOP Stack (linked to 2.3.6.2) External Leak/Rupture - Annulars - BOP Stack (linked to 2.3.1.1) External Leak/Rupture - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.1) Wear - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.5)	Other pipe rams & annular Type (I, P or M): P Redundancy of annular and redundant pipe rams Type (I, P or M): P Redundancy with fail-safe valves Type (I, P or M): P ROV intervention - will close 1 of the pipe rams Type (I, P or M): P	Potential down time that can impact operation No well control issues identified for this condition due to other available options

1.4.2	Functional Failure:	Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Failure to Maintain Closing Pressure on Hang-off Ram	Motion compensator fails to prevent excessive wear on ram blocks Internal Leak - HPU - Surface Control Systems (linked to 2.1.1.2) External Leak/Rupture - HPU - Surface Control Systems (linked to 2.1.1.1) Plugged - HPU - Surface Control Systems (linked to 2.1.1.3) Mechanical Failure - HPU - Surface Control Systems (linked to 2.1.1.4) Loss of Function (general) - HPU - Surface Control Systems (linked to 2.1.1.7) Wear - Casing Shear Ram - BOP Stack (linked to 2.3.3.5) Wear - Pipe & Test Rams - BOP Stack (linked to 2.3.4.5) External Leak / Rupture - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.1) Internal Leak - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.2) Loss of Function (general) - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.7) Internal leak - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.2) External Leak/Rupture - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.1) Internal Leak - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.2) Mechanical Failure - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.4) External Leak/Rupture - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.1) Plugged - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.3) Wear - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.5) Loss of Function (general) - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.7)	Motion compensator for drill string to avoid excess wear on seals Type (I, P or M): P MPL on rams Type (I, P or M): P Multi position locking (MPL) Type (I, P or M): P Redundant rams to hang-off Type (I, P or M): P Lock test on surface (without closing pressure) Type (I, P or M): M Wellbore tests Type (I, P or M): M	Potential down time/operational hit due to loss of the drillpipe in the hole and having to pull the pipe

1.4.2	Functional Failure:	Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Mechanical Failure - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.4) Corrosion/Erosion - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.6) Wear - Blind Shear Ram - BOP Stack (linked to 2.3.2.5) External leak/rupture - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.1) External Leak/Rupture - Connectors - BOP Stack (linked to 2.3.6.1)		

1.4.3	Functional Failure:	Failure to maintain locking - Hang-off the drill pipe on a ram BOP and control the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Failure to Engage Lock on Hang-off Ram	Internal Leak - Blind Shear Ram - BOP Stack (linked to 2.3.2.2) External Leak/Rupture - Blind Shear Ram - BOP Stack (linked to 2.3.2.1) Wear - Casing Shear Ram - BOP Stack (linked to 2.3.3.5) Wear - Blind Shear Ram - BOP Stack (linked to 2.3.2.5) Mechanical Failure - Casing Shear Ram - BOP Stack (linked to 2.3.3.4) Mechanical Failure - Blind Shear Ram - BOP Stack (linked to 2.3.2.4)	Pipe has dropped down the hole Type (I, P or M): I Rams are periodically lock tested on surface (without closing pressure) Type (I, P or M): M Signature tests using low pressure (i.e., 50 psi) to test ram drag between wells. Use hot-line to ram to test pressure required to close ram. Expectation is that pressure will stay low during test, until rams are fully closed. Type (I, P or M): M Surface pressure tests on the ram Type (I, P or M): M Wellbore test are conducted between wells and every 14 days while drilling Type (I, P or M): M	Potential down time/operational hit due to loss of the drillpipe in the hole and having to pull the pipe

5- Controlled operation - Shear the drill pipe and seal the wellbore

1.5.1	Functional Failure:	Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Failure to Provide Control Signal to Shear Ram When Demanded	Wiring harness fails Loss of Power (UPS Shuts down with power degradation) - Power - Surface Control Systems (linked to 2.1.2.1) Electrical Short - Power - Surface Control Systems (linked to 2.1.2.5) Fails to respond to input - Electrical - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.4) Loss of function (general) - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.7) Fails with no output signal/communication - MUX System - Surface Control Systems (linked to 2.1.3.2) Erratic output (Network) - MUX System - Surface Control Systems (linked to 2.1.3.4) Loss of, or Degraded Power - Control Panels - Surface Control Systems (linked to 2.1.5.1) Short - MUX System - Surface Control Systems (linked to 2.1.3.7) Fails to respond to input - MUX System - Surface Control Systems (linked to 2.1.3.5) Loss of function (general) - MUX System - Surface Control Systems (linked to 2.1.3.8) Fails to respond (with no output signal/communication or to input) - Control Panels - Surface Control Systems (linked to 2.1.5.2) Erratic output - Control Panels - Surface Control Systems (linked to 2.1.5.4) Fails to respond to input - Control Panels - Surface Control Systems (linked to 2.1.5.5) Short - Control Panels - Surface Control Systems (linked to 2.1.5.7) Loss of function (general) - Control Panels - Surface Control Systems (linked to 2.1.5.8) Erratic output - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.3) Loss of, or Degraded Power - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.1)	E/H backup Type (I, P or M): P Redundancy of annular and redundant pipe rams Type (I, P or M): P Redundancy with fail-safe valves Type (I, P or M): P ROV intervention - will close 1 of the pipe rams Type (I, P or M): P	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated

1.5.1	Functional Failure:	Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Fails with no output signal/communication - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.2)		
2	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram	Internal Leak - HPU - Surface Control Systems (linked to 2.1.1.2) Plugged - HPU - Surface Control Systems (linked to 2.1.1.3) Mechanical Failure - HPU - Surface Control Systems (linked to 2.1.1.4) Loss of Function (general) - HPU - Surface Control Systems (linked to 2.1.1.7) Plugged - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.3) External Leak / Rupture - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.1) Internal Leak - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.2) Loss of Function (general) - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.7) Internal Leak - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.2) Plugged - Annulars - BOP Stack - (linked to 2.3.1.3) Internal Leak - Annulars - BOP Stack (linked to 2.3.1.2) Mechanical Failure - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.4) Internal leak - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.2) Plugged - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.3) Internal Leak - Connectors - BOP Stack (linked to 2.3.6.2) External Leak/Rupture - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.1) Mechanical Failure - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.4) External Leak/Rupture - Surface Control Systems	Redundancy of annular and redundant pipe rams Type (I, P or M): P Redundancy with fail-safe valves Type (I, P or M): P ROV intervention - will close 1 of the pipe rams Type (I, P or M): P	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated

1.5.1	Functional Failure:	Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		- Accumulators - Surface (linked to 2.1.6.1) Internal Leak - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.2) Mechanical Failure - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.4) Wear - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.5) Loss of Function (general) - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.7) Corrosion/Erosion - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.6) Internal Leak - Accumulators - Subsea Control Systems (linked to 2.2.3.2) Mechanical Failure - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.4) Mechanical Failure - Accumulators - Subsea Control Systems (linked to 2.2.3.4) Wear - Accumulators - Subsea Control Systems (linked to 2.2.3.5) External Leak/Rupture - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.1) External Leak/Rupture - Accumulators - Subsea Control Systems (linked to 2.2.3.1) Loss of Function (general) - Accumulators - Subsea Control Systems (linked to 2.2.3.7) Plugged - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.3) Plugged - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.3) Corrosion/Erosion - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.6) Mechanical Failure - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.4) External Leak/Rupture - Annulars - BOP Stack (linked to 2.3.1.1) External leak/rupture - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.1)		

1.5.1	Functional Failure:	Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		External Leak/Rupture - HPU - Surface Control Systems (linked to 2.1.1.1) External Leak/Rupture - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.1) Wear - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.5) External Leak/Rupture - Connectors - BOP Stack (linked to 2.3.6.1) Loss of Function - ROV Intervention Interface - BOP Stack (linked to 2.3.8.3) Loss of Function (general) - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.7)		

1.5.2	Functional Failure:	Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Failure to Shear Pipe	Having incorrect space out/non-shearables across the rams Internal Leak - HPU - Surface Control Systems (linked to 2.1.1.2) External Leak/Rupture - HPU - Surface Control Systems (linked to 2.1.1.1) Plugged - HPU - Surface Control Systems (linked to 2.1.1.3) Mechanical Failure - HPU - Surface Control Systems (linked to 2.1.1.4) Loss of Function (general) - HPU - Surface Control Systems (linked to 2.1.1.7) Corrosion/Erosion - Casing Shear Ram - BOP Stack (linked to 2.3.3.6) Corrosion/Erosion - Blind Shear Ram - BOP Stack (linked to 2.3.2.6) Internal Leak - Casing Shear Ram - BOP Stack (linked to 2.3.3.2) External Leak / Rupture - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.1) Loss of Function (general) - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.7) Internal Leak - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.2) External Leak/Rupture - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.1) Internal Leak - Blind Shear Ram - BOP Stack (linked to 2.3.2.2) External Leak/Rupture - Blind Shear Ram - BOP Stack (linked to 2.3.2.1) External Leak/Rupture - Casing Shear Ram - BOP Stack (linked to 2.3.3.1) Internal Leak - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.2) Plugged - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.3) External Leak/Rupture - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.1)	Improper gallon count on hydraulics & flow meter Type (I, P or M): I No change in string weight (likely first indication) Type (I, P or M): I Wellbore flow Type (I, P or M): I All operators have been upgraded to 5k psi pipe rams Type (I, P or M): P Open shear, move pipe and re-attempt shear Type (I, P or M): P Other shear rams (priority would be casing shears & then blind shear rams) Type (I, P or M): P Planning of contingencies before putting non-shearables down the hole Type (I, P or M): P Rotate the drill pipe and pull (twist off pipe) Type (I, P or M): P Annual inspection of shear rams and shear-ram blocks & blades. Replace blades after shearing, or every 5 years for full NDT and certification. Type (I, P or M): M Shear tests performed for variety of pipe used/provided. Sent specimen with higher elongation % for testing. Rental pipe requires certification of properties and shearability. Subsea shearing tests were performed as validation, post-Macondo Type (I, P or M): M Tests performed to validate shearability of off-centered pipe Type (I, P or M): M	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated

1.5.2	Functional Failure:	Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Internal leak - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.2) Mechanical Failure - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.4) Wear - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.5) Loss of Function (general) - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.7) Mechanical Failure - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.4) Corrosion/Erosion - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.6) Internal Leak - Accumulators - Subsea Control Systems (linked to 2.2.3.2) Mechanical Failure - Accumulators - Subsea Control Systems (linked to 2.2.3.4) Wear - Accumulators - Subsea Control Systems (linked to 2.2.3.5) Mechanical Failure - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.4) Wear - Casing Shear Ram - BOP Stack (linked to 2.3.3.5) External Leak/Rupture - Accumulators - Subsea Control Systems (linked to 2.2.3.1) Wear - Blind Shear Ram - BOP Stack (linked to 2.3.2.5) Loss of Function (general) - Accumulators - Subsea Control Systems (linked to 2.2.3.7) Plugged - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.3) Mechanical Failure - Blind Shear Ram - BOP Stack (linked to 2.3.2.4) Mechanical Failure - Casing Shear Ram - BOP Stack (linked to 2.3.3.4) Corrosion/Erosion - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.6)		

1.5.2	Functional Failure:	Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		External leak/rupture - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.1)		

1.5.3	Functional Failure:	Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Failure of Shear Ram to Seal On Demand	Shear seat not in correct location Obstruction of sealing surface Trash in the well (swarf, concrete, etc.) Internal Leak - HPU - Surface Control Systems (linked to 2.1.1.2) External Leak/Rupture - HPU - Surface Control Systems (linked to 2.1.1.1) Plugged - HPU - Surface Control Systems (linked to 2.1.1.3) Mechanical Failure - HPU - Surface Control Systems (linked to 2.1.1.4) Loss of Function (general) - HPU - Surface Control Systems (linked to 2.1.1.7) External Leak/Rupture - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.1) Corrosion/Erosion - Blind Shear Ram - BOP Stack (linked to 2.3.2.6) Corrosion/Erosion - Casing Shear Ram - BOP Stack (linked to 2.3.3.6) External Leak / Rupture - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.1) Internal Leak - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.2) Loss of Function (general) - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.7) Internal Leak - Blind Shear Ram - BOP Stack (linked to 2.3.2.2) Having incorrect space out/non-shearables across the rams Internal Leak - Casing Shear Ram - BOP Stack (linked to 2.3.3.2) External Leak/Rupture - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.1) Plugged - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.3) Internal leak - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.2)	Improper gallon count on hydraulics & flow meter Type (I, P or M): I No change in string weight (likely first indication) Type (I, P or M): I Wellbore flow Type (I, P or M): I All operators have been upgraded to 5k psi pipe rams Type (I, P or M): P Dimensional inspection of seal plate and wear plate (frequency varies from between well, to annually) Type (I, P or M): P Open shear, move pipe and re-attempt shear Type (I, P or M): P Other shear rams (priority would be casing shears & then blind shear rams) Type (I, P or M): P Planning of contingencies before putting non-shearables down the hole Type (I, P or M): P Redundant pipe rams and annulars Type (I, P or M): P Rotate the drill pipe and pull (twist off pipe) Type (I, P or M): P Annual inspection of shear rams and shear-ram blocks & blades. Replace blades after shearing, or every 5 years for full NDT and certification. Type (I, P or M): M End of well maintenance Type (I, P or M): M Fourteen day functional testing of blind shears Type (I, P or M): M Shear tests performed for variety of pipe used/provided. Sent specimen with higher elongation % for testing. Rental pipe requires certification of properties and shearability. Subsea shearing tests were performed as validation, post-Macondo Type (I, P or M): M Tests performed to validate shearability of off-centered pipe Type (I, P or M): M	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated

1.5.3	Functional Failure:	Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		External Leak/Rupture - Blind Shear Ram - BOP Stack (linked to 2.3.2.1) External Leak/Rupture - Casing Shear Ram - BOP Stack (linked to 2.3.3.1) Internal Leak - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.2) Mechanical Failure - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.4) Wear - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.5) Loss of Function (general) - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.7) Mechanical Failure - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.4) Corrosion/Erosion - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.6) Internal Leak - Accumulators - Subsea Control Systems (linked to 2.2.3.2) Mechanical Failure - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.4) External Leak/Rupture - Accumulators - Subsea Control Systems (linked to 2.2.3.1) Mechanical Failure - Accumulators - Subsea Control Systems (linked to 2.2.3.4) Wear - Accumulators - Subsea Control Systems (linked to 2.2.3.5) Wear - Casing Shear Ram - BOP Stack (linked to 2.3.3.5) Loss of Function (general) - Accumulators - Subsea Control Systems (linked to 2.2.3.7) Plugged - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.3) Mechanical Failure - Blind Shear Ram - BOP Stack (linked to 2.3.2.4) Wear - Blind Shear Ram - BOP Stack (linked to 2.3.2.5) Mechanical Failure - Casing Shear Ram - BOP Stack (linked to 2.3.3.4)		

1.5.3	Functional Failure:	Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Corrosion/Erosion - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.6) External leak/rupture - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.1)		
2	Failure to Maintain Sealing Pressure on Shear Ram	Internal Leak - HPU - Surface Control Systems (linked to 2.1.1.2) External Leak/Rupture - HPU - Surface Control Systems (linked to 2.1.1.1) Plugged - HPU - Surface Control Systems (linked to 2.1.1.3) Mechanical Failure - HPU - Surface Control Systems (linked to 2.1.1.4) Loss of Function (general) - HPU - Surface Control Systems (linked to 2.1.1.7) External Leak / Rupture - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.1) Internal Leak - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.2) External Leak/Rupture - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.1) Internal Leak - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.2) Loss of Function (general) - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.7) Mechanical Failure - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.4) External Leak/Rupture - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.1) Plugged - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.3) Internal leak - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.2) External Leak/Rupture - Blind Shear Ram - BOP Stack (linked to 2.3.2.1) Motion compensator fails to prevent excessive wear on ram blocks	Motion compensator for drill string to avoid excess wear on seals Type (I, P or M): P MPL Type (I, P or M): P Multiposition locking (MPL) Type (I, P or M): P Lock test on surface (without closing pressure) Type (I, P or M): M Wellbore tests Type (I, P or M): M	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated

1.5.3	Functional Failure:	Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Mechanical Failure - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.4) External Leak/Rupture - Casing Shear Ram - BOP Stack (linked to 2.3.3.1) Wear - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.5) Loss of Function (general) - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.7) Corrosion/Erosion - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.6) Wear - Casing Shear Ram - BOP Stack (linked to 2.3.3.5) Mechanical Failure - Blind Shear Ram - BOP Stack (linked to 2.3.2.4) Mechanical Failure - Casing Shear Ram - BOP Stack (linked to 2.3.3.4) Wear - Blind Shear Ram - BOP Stack (linked to 2.3.2.5) External leak/rupture - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.1) External Leak/Rupture - Connectors - BOP Stack (linked to 2.3.6.1)		

1.5.4	Functional Failure:	Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Unintentional Closing	Internal Leak - Autoshear System - BOP Stack (linked to 2.3.7.2) External Leak/Rupture - Autoshear System - BOP Stack (linked to 2.3.7.1) Mechanical Failure - Autoshear System - BOP Stack (linked to 2.3.7.4)	No known single failure (i.e., arm solenoid then fire solenoid) Type (I, P or M): P Weekly BOP function test Type (I, P or M): M	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated
2	Unintentional Opening	External Leak/Rupture - HPU - Surface Control Systems (linked to 2.1.1.1) Internal Leak - HPU - Surface Control Systems (linked to 2.1.1.2) Plugged - HPU - Surface Control Systems (linked to 2.1.1.3) Mechanical Failure - HPU - Surface Control Systems (linked to 2.1.1.4) Loss of Function (general) - HPU - Surface Control Systems (linked to 2.1.1.7) External Leak / Rupture - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.1) Internal Leak - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.2) Loss of Function (general) - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.7) External Leak/Rupture - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.1) Plugged - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.3) External Leak/Rupture - Blind Shear Ram - BOP Stack (linked to 2.3.2.1) External Leak/Rupture - Casing Shear Ram - BOP Stack (linked to 2.3.3.1) External Leak/Rupture - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.1) Internal Leak - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.2) Mechanical Failure - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.4)	Flow meter, if closely monitoring Type (I, P or M): I Procedural steps to check control system status of ram/valve location prior to latch back Type (I, P or M): P	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact

1.5.4	Functional Failure:	Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Wear - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.5) Loss of Function (general) - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.7) Mechanical Failure - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.4) Corrosion/Erosion - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.6) Wear - Casing Shear Ram - BOP Stack (linked to 2.3.3.5) Mechanical Failure - Blind Shear Ram - BOP Stack (linked to 2.3.2.4) Wear - Blind Shear Ram - BOP Stack (linked to 2.3.2.5) Mechanical Failure - Casing Shear Ram - BOP Stack (linked to 2.3.3.4)		

1.5.5	Functional Failure:	Closes too slowly - Controlled operation - Shear the drill pipe and seal the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Actuates Too Slowly on Demand	Plugged - HPU - Surface Control Systems (linked to 2.1.1.3) Plugged - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.3) Plugged - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.3) Plugged - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.3)	Gallon count Type (I, P or M): I Hydraulic flow meter Type (I, P or M): I String weight indicator Type (I, P or M): I High pressure close option Type (I, P or M): P Weekly function tests Type (I, P or M): M	If drillpipe has not been sheared, and is still moving, joint could damage shear ram resulting in serious operational issues Likelihood of additional influx of hydrocarbons into Riser resulting in severe safety/environmental effects Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated

1.5.6	Functional Failure:	Loss of containment - Controlled operation - Shear the drill pipe and seal the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	External Leak	External Leak/Rupture - HPU - Surface Control Systems (linked to 2.1.1.1) External Leak / Rupture - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.1) External leak/rupture - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.1) External Leak/Rupture - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.1)	Hydraulic fluid flow meter Type (I, P or M): I Wellbore flow Type (I, P or M): I Redundant annulars with redundant pipe rams Type (I, P or M): P Redundant controls Type (I, P or M): P ROV intervention Type (I, P or M): P Maintenance/overhaul at end of every well for annulars Type (I, P or M): M	Likelihood of additional influx of hydrocarbons into Riser resulting in severe safety/environmental effects Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated
2	Rupture	No credible causes resulting in rupture during 'Controlled operation - Shear the drill pipe and seal the wellbore'		Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact

6- Emergency Operation: Auto-Shear - Shear the drill pipe and seal the wellbore

1.6.1	Functional Failure:	Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Failure to Provide Control Signal	Loss of, or Degraded Power - Secondary & Emergency Control Systems - Surface Control Systems (linked to 2.1.8.1) Loss of Power (UPS Shuts down with power degradation) - Power - Surface Control Systems (linked to 2.1.2.1) Electrical Short - Power - Surface Control Systems (linked to 2.1.2.5) Fails to respond to input - Electrical - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.4) Loss of function (general) - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.7) Wiring harness fails Fails with no output signal/communication - MUX System - Surface Control Systems (linked to 2.1.3.2) Erratic output (Network) - MUX System - Surface Control Systems (linked to 2.1.3.4) Loss of, or Degraded Power - Control Panels - Surface Control Systems (linked to 2.1.5.1) Short - MUX System - Surface Control Systems (linked to 2.1.3.7) Fails to respond to input - MUX System - Surface Control Systems (linked to 2.1.3.5) Loss of function (general) - MUX System - Surface Control Systems (linked to 2.1.3.8) Fails to respond (with no output signal/communication or to input) - Control Panels - Surface Control Systems (linked to 2.1.5.2) Fails with no output signal/communication (Includes Short) - Secondary & Emergency Control Systems - Surface Control Systems (linked to 2.1.8.2) Erratic output - Control Panels - Surface Control Systems (linked to 2.1.5.4) Fails to respond to input - Control Panels - Surface Control Systems (linked to 2.1.5.5) Short - Control Panels - Surface Control Systems (linked to 2.1.5.7)	No electrical feedback (pod mismatch) that the solenoid operated Type (I, P or M): I Redundant touch screen, controllers, control pods, cables, powers supplies, SEM exist Type (I, P or M): P ROV has the ability to arm the system subsea Type (I, P or M): P Autoshear is rebuilt every year Type (I, P or M): M Subsea testing occurs once the BOP is latched-up Type (I, P or M): M Surface testing between every well Type (I, P or M): M	Down time/operational impact as this action is completed after landing BOP. If re-arming fails, operations will stop and the cause(s) investigated

1.6.1	Functional Failure:	Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Loss of function (general) - Secondary & Emergency Control Systems - Surface Control Systems (linked to 2.1.8.3) Loss of function (general) - Control Panels - Surface Control Systems (linked to 2.1.5.8) Fails with no output signal/communication - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.2) Erratic output - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.3) Loss of, or Degraded Power - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.1)		

1.6.2	Functional Failure:	Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram	External Leak/Rupture - HPU - Surface Control Systems (linked to 2.1.1.1) Internal Leak - HPU - Surface Control Systems (linked to 2.1.1.2) Plugged - HPU - Surface Control Systems (linked to 2.1.1.3) Mechanical Failure - HPU - Surface Control Systems (linked to 2.1.1.4) Loss of Function (general) - HPU - Surface Control Systems (linked to 2.1.1.7) External Leak / Rupture - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.1) Loss of Function (general) - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.7) Internal Leak - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.2) Plugged - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.3) Internal Leak - Blind Shear Ram - BOP Stack (linked to 2.3.2.2) Internal Leak - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.2) Mechanical Failure - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.4) Internal Leak - Casing Shear Ram - BOP Stack (linked to 2.3.3.2) External Leak/Rupture - Autoshear System - BOP Stack (linked to 2.3.7.1) External Leak/Rupture - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.1) Internal Leak - Connectors - BOP Stack (linked to 2.3.6.2) Plugged - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.3) Internal leak - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.2) External Leak/Rupture - Blind Shear Ram - BOP Stack (linked to 2.3.2.1)	Redundancy of annular and redundant pipe rams Type (I, P or M): P Redundancy with fail-safe valves Type (I, P or M): P ROV intervention - will close 1 of the pipe rams Type (I, P or M): P	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated

1.6.2	Functional Failure:	Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Mechanical Failure - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.4) Internal Leak - Accumulators - Subsea Control Systems (linked to 2.2.3.2) Mechanical Failure - Accumulators - Subsea Control Systems (linked to 2.2.3.4) External Leak/Rupture - Casing Shear Ram - BOP Stack (linked to 2.3.3.1) Wear - Casing Shear Ram - BOP Stack (linked to 2.3.3.5) External Leak/Rupture - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.1) Internal Leak - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.2) Mechanical Failure - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.4) Wear - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.5) Loss of Function (general) - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.7) External Leak/Rupture - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.1) Corrosion/Erosion - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.6) External Leak/Rupture - Accumulators - Subsea Control Systems (linked to 2.2.3.1) Wear - Accumulators - Subsea Control Systems (linked to 2.2.3.5) Mechanical Failure - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.4) Internal Leak - Autoshear System - BOP Stack (linked to 2.3.7.2) Plugged - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.3) Loss of Function (general) - Accumulators - Subsea Control Systems (linked to 2.2.3.7)		

1.6.2	Functional Failure:	Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Plugged - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.3) Corrosion/Erosion - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.6) Wear - Blind Shear Ram - BOP Stack (linked to 2.3.2.5) Mechanical Failure - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.4) Loss of Function - ROV Intervention Interface - BOP Stack (linked to 2.3.8.3) External leak/rupture - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.1) Wear - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.5) Loss of Function (general) - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.7) External Leak/Rupture - Connectors - BOP Stack (linked to 2.3.6.1) External Leak/Rupture - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.1)		
2	Failure to initiate autoshear sequence	Internal Leak - HPU - Surface Control Systems (linked to 2.1.1.2) External Leak/Rupture - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.1) Internal Leak - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.2) Wear - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.5) External Leak / Rupture - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.1) Loss of Function (general) - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.7) Internal Leak - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.2) External Leak/Rupture - Autoshear System - BOP Stack (linked to 2.3.7.1)	If ROV is present, pressure decrease in accumulator will be evident Type (I, P or M): I If testing, indicators exist on surface (MUX alarms) Type (I, P or M): I ROV can arm and close the rams subsea Type (I, P or M): P Testing of system between wells on surface Type (I, P or M): M Testing of system once latched-up Type (I, P or M): M	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated

1.6.2	Functional Failure:	Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Internal leak - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.2) Mechanical Failure - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.4) Internal Leak - Accumulators - Subsea Control Systems (linked to 2.2.3.2) Corrosion/Erosion - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.6) External Leak/Rupture - Accumulators - Subsea Control Systems (linked to 2.2.3.1) Wear - Accumulators - Subsea Control Systems (linked to 2.2.3.5) Loss of Function (general) - Accumulators - Subsea Control Systems (linked to 2.2.3.7) Mechanical Failure - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.4) Internal Leak - Autoshear System - BOP Stack (linked to 2.3.7.2) Mechanical Failure - Autoshear System - BOP Stack (linked to 2.3.7.4) Plugged - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.3) Corrosion/Erosion - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.6) External leak/rupture - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.1)		

1.6.3	Functional Failure:	Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram	Non-shearable in the way External Leak/Rupture - HPU - Surface Control Systems (linked to 2.1.1.1) Plugged - HPU - Surface Control Systems (linked to 2.1.1.3) Mechanical Failure - HPU - Surface Control Systems (linked to 2.1.1.4) Loss of Function (general) - HPU - Surface Control Systems (linked to 2.1.1.7) External Leak / Rupture - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.1) Loss of Function (general) - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.7) Plugged - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.3) External Leak/Rupture - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.1) Plugged - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.3) Internal Leak - Accumulators - Subsea Control Systems (linked to 2.2.3.2) Mechanical Failure - Accumulators - Subsea Control Systems (linked to 2.2.3.4) External Leak/Rupture - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.1) Internal Leak - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.2) Mechanical Failure - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.4) Wear - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.5) Loss of Function (general) - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.7) Plugged - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.3) Wear - Accumulators - Subsea Control Systems (linked to 2.2.3.5) Internal Leak - Autoshear System - BOP Stack (linked to 2.3.7.2)	Deadheading of pump Type (I, P or M): I Flow meter (volume to actuate is known, should go 0 to 0.7 to 0 in ~ 5 seconds) If too high = leak. If long time = galling or leak Type (I, P or M): I Increasing pressure Type (I, P or M): I Pressure test chambers at end of well Type (I, P or M): M Shell test using end of tail rod between wells, on surface Type (I, P or M): M Weekly function test of stack Type (I, P or M): M Wellbore test between wells and 14 while subsea Type (I, P or M): M	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated

1.6.3	Functional Failure:	Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		External Leak/Rupture - Accumulators - Subsea Control Systems (linked to 2.2.3.1) Loss of Function (general) - Accumulators - Subsea Control Systems (linked to 2.2.3.7) External Leak/Rupture - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.1) External Leak/Rupture - Autoshear System - BOP Stack (linked to 2.3.7.1) Plugged - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.3) Mechanical Failure - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.4) External leak/rupture - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.1) Loss of Function (general) - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.7)		
2	Failure to Shear Pipe	Having incorrect space out/non-shearables across the rams External Leak/Rupture - HPU - Surface Control Systems (linked to 2.1.1.1) Internal Leak - HPU - Surface Control Systems (linked to 2.1.1.2) Plugged - HPU - Surface Control Systems (linked to 2.1.1.3) Mechanical Failure - HPU - Surface Control Systems (linked to 2.1.1.4) Loss of Function (general) - HPU - Surface Control Systems (linked to 2.1.1.7) External Leak / Rupture - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.1) Corrosion/Erosion - Casing Shear Ram - BOP Stack (linked to 2.3.3.6) Corrosion/Erosion - Blind Shear Ram - BOP Stack (linked to 2.3.2.6) Loss of Function (general) - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.7) Internal Leak - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.2)	Improper gallon count on hydraulics & flow meter Type (I, P or M): I No change in string weight (likely first indication) Type (I, P or M): I Wellbore flow Type (I, P or M): I All operators have been upgraded to 5k psi pipe rams Type (I, P or M): P Other shear rams (priority would be casing shears & then blind shear rams) Type (I, P or M): P Open shear, move pipe and re-attempt shear Type (I, P or M): P Planning of contingencies before putting non-shearables down the hole Type (I, P or M): P Annual inspection of shear rams and shear-ram blocks & blades. Replace blades after shearing, or every 5 years for full NDT and certification. Type (I, P or M): M Tests performed to validate shearability of off-centered pipe Type (I, P or M): M	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated

1.6.3	Functional Failure:	Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Internal Leak - Blind Shear Ram - BOP Stack (linked to 2.3.2.2) External Leak/Rupture - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.1) Plugged - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.3) Internal leak - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.2) Internal Leak - Casing Shear Ram - BOP Stack (linked to 2.3.3.2) External Leak/Rupture - Casing Shear Ram - BOP Stack (linked to 2.3.3.1) Mechanical Failure - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.4) Internal Leak - Accumulators - Subsea Control Systems (linked to 2.2.3.2) External Leak/Rupture - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.1) Internal Leak - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.2) Mechanical Failure - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.4) Wear - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.5) Loss of Function (general) - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.7) Corrosion/Erosion - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.6) Mechanical Failure - Accumulators - Subsea Control Systems (linked to 2.2.3.4) Wear - Casing Shear Ram - BOP Stack (linked to 2.3.3.5) External Leak/Rupture - Accumulators - Subsea Control Systems (linked to 2.2.3.1) Wear - Accumulators - Subsea Control Systems (linked to 2.2.3.5)	Shear tests performed for variety of pipe used/provided. Sent specimen with higher elongation % for testing. Rental pipe requires certification of properties and shearability. Subsea shearing tests were performed as validation, post-Macondo Type (I, P or M): M	

1.6.3	Functional Failure:	Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Loss of Function (general) - Accumulators - Subsea Control Systems (linked to 2.2.3.7) Mechanical Failure - Blind Shear Ram - BOP Stack (linked to 2.3.2.4) Mechanical Failure - Casing Shear Ram - BOP Stack (linked to 2.3.3.4) External Leak/Rupture - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.1) Plugged - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.3) Corrosion/Erosion - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.6) External leak/rupture - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.1) External Leak/Rupture - Blind Shear Ram - BOP Stack (linked to 2.3.2.1)		

1.6.4	Functional Failure:	Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Failure of Shear Ram to Seal On Demand	External Leak/Rupture - HPU - Surface Control Systems (linked to 2.1.1.1) Internal Leak - HPU - Surface Control Systems (linked to 2.1.1.2) Plugged - HPU - Surface Control Systems (linked to 2.1.1.3) Mechanical Failure - HPU - Surface Control Systems (linked to 2.1.1.4) Loss of Function (general) - HPU - Surface Control Systems (linked to 2.1.1.7) Shear seat not in correct location Obstruction of sealing surface Trash in the well (swarf, concrete, etc.) Having incorrect space out/non-shearables across the rams External Leak / Rupture - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.1) External Leak/Rupture - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.1) Internal Leak - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.2) Corrosion/Erosion - Blind Shear Ram - BOP Stack (linked to 2.3.2.6) Internal Leak - Blind Shear Ram - BOP Stack (linked to 2.3.2.2) Loss of Function (general) - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.7) Corrosion/Erosion - Casing Shear Ram - BOP Stack (linked to 2.3.3.6) Plugged - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.3) External Leak/Rupture - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.1) Internal leak - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.2) External Leak/Rupture - Casing Shear Ram - BOP Stack (linked to 2.3.3.1)	ROV confirmation if present Type (I, P or M): I Maintenance and testing program on BOP and autoshear functionality previously listed Type (I, P or M): M	Significant down time that impacts operation, if still latched to rig Release of hydrocarbons to air or sea potentially resulting in spill with large impact, if still latched to rig Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact, if still latched to rig Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated, if still latched to rig Release of hydrocarbons to air or sea potentially resulting in spill with large impact Significant down time that impacts operation, if unlatched from the rig

1.6.4	Functional Failure:	Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Internal Leak - Casing Shear Ram - BOP Stack (linked to 2.3.3.2) Mechanical Failure - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.4) Internal Leak - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.2) Mechanical Failure - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.4) Wear - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.5) Loss of Function (general) - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.7) Corrosion/Erosion - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.6) Internal Leak - Accumulators - Subsea Control Systems (linked to 2.2.3.2) Mechanical Failure - Accumulators - Subsea Control Systems (linked to 2.2.3.4) Mechanical Failure - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.4) Mechanical Failure - Autoshear System - BOP Stack (linked to 2.3.7.4) External Leak/Rupture - Accumulators - Subsea Control Systems (linked to 2.2.3.1) Wear - Accumulators - Subsea Control Systems (linked to 2.2.3.5) Mechanical Failure - Blind Shear Ram - BOP Stack (linked to 2.3.2.4) Wear - Casing Shear Ram - BOP Stack (linked to 2.3.3.5) Loss of Function (general) - Accumulators - Subsea Control Systems (linked to 2.2.3.7) Plugged - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.3) Wear - Blind Shear Ram - BOP Stack (linked to 2.3.2.5) Mechanical Failure - Casing Shear Ram - BOP Stack (linked to 2.3.3.4)		

1.6.4	Functional Failure:	Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		External leak/rupture - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.1) Corrosion/Erosion - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.6) External Leak/Rupture - Blind Shear Ram - BOP Stack (linked to 2.3.2.1)		
2	Failure to Maintain Sealing Pressure on Shear Ram	External Leak/Rupture - HPU - Surface Control Systems (linked to 2.1.1.1) Internal Leak - HPU - Surface Control Systems (linked to 2.1.1.2) Plugged - HPU - Surface Control Systems (linked to 2.1.1.3) Mechanical Failure - HPU - Surface Control Systems (linked to 2.1.1.4) Loss of Function (general) - HPU - Surface Control Systems (linked to 2.1.1.7) External Leak / Rupture - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.1) Corrosion/Erosion - Blind Shear Ram - BOP Stack (linked to 2.3.2.6) Shear seat not in correct location Obstruction of sealing surface Internal Leak - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.2) Trash in the well (swarf, concrete, etc.) Having incorrect space out/non-shearables across the rams Loss of Function (general) - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.7) Plugged - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.3) Internal Leak - Blind Shear Ram - BOP Stack (linked to 2.3.2.2) Corrosion/Erosion - Casing Shear Ram - BOP Stack (linked to 2.3.3.6) External Leak/Rupture - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.1)	ROV confirmation if present Type (I, P or M): I MPL Type (I, P or M): P Remaining accumulator pressure Type (I, P or M): P Maintenance and testing program on BOP and autoshear functionality previously listed Type (I, P or M): M	Significant down time that impacts operation, if still latched to rig Release of hydrocarbons to air or sea potentially resulting in spill with large impact, if still latched to rig Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact, if still latched to rig Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated, if still latched to rig Release of hydrocarbons to air or sea potentially resulting in spill with large impact Significant down time that impacts operation, if unlatched from the rig

1.6.4	Functional Failure:	Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Internal Leak - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.2) External Leak/Rupture - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.1) Internal Leak - Casing Shear Ram - BOP Stack (linked to 2.3.3.2) Mechanical Failure - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.4) Internal leak - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.2) External Leak/Rupture - Casing Shear Ram - BOP Stack (linked to 2.3.3.1) Internal Leak - Accumulators - Subsea Control Systems (linked to 2.2.3.2) Mechanical Failure - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.4) Wear - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.5) Loss of Function (general) - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.7) Corrosion/Erosion - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.6) External Leak/Rupture - Accumulators - Subsea Control Systems (linked to 2.2.3.1) Mechanical Failure - Accumulators - Subsea Control Systems (linked to 2.2.3.4) Mechanical Failure - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.4) Mechanical Failure - Blind Shear Ram - BOP Stack (linked to 2.3.2.4) Wear - Casing Shear Ram - BOP Stack (linked to 2.3.3.5) Wear - Accumulators - Subsea Control Systems (linked to 2.2.3.5) Loss of Function (general) - Accumulators - Subsea Control Systems (linked to 2.2.3.7) Mechanical Failure - Casing Shear Ram - BOP Stack (linked to 2.3.3.4)		

1.6.4	Functional Failure:	Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Plugged - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.3) Wear - Blind Shear Ram - BOP Stack (linked to 2.3.2.5) Mechanical Failure - Autoshear System - BOP Stack (linked to 2.3.7.4) External leak/rupture - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.1) Corrosion/Erosion - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.6) External Leak/Rupture - Blind Shear Ram - BOP Stack (linked to 2.3.2.1)		

1.6.5	Functional Failure:	Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Unintentional Closing	Autoshear system activates/shears when intentionally disarmed Loss of Function (general) - Autoshear System - BOP Stack (linked to 2.3.7.7) Corrosion/Erosion - Autoshear System - BOP Stack (linked to 2.3.7.6)	If latched, stack accumulator pressure alarm Type (I, P or M): I If latched, annulars MAY still be an option Type (I, P or M): P Specific arm/disarm procedures from OEM Type (I, P or M): P Autoshear is rebuilt every year Type (I, P or M): M Autoshear surface testing to ensure it will fire when conditions are met & also to ensure it will not fire unless all proper conditions are met prior to firing Type (I, P or M): M	Significant down time that impacts operation, if still latched to rig Release of hydrocarbons to air or sea potentially resulting in spill with large impact, if still latched to rig Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact, if still latched to rig Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated, if still latched to rig Release of hydrocarbons to air or sea potentially resulting in spill with large impact Significant down time that impacts operation, if unlatched from the rig
2	Unintentional Opening	If not properly closed & blocked, system will return to last known state (what the control system thinks it was), which could be open, when reconnecting to BOP External Leak/Rupture - HPU - Surface Control Systems (linked to 2.1.1.1) Internal Leak - HPU - Surface Control Systems (linked to 2.1.1.2) Plugged - HPU - Surface Control Systems (linked to 2.1.1.3) Mechanical Failure - HPU - Surface Control Systems (linked to 2.1.1.4) Loss of Function (general) - HPU - Surface Control Systems (linked to 2.1.1.7) External Leak / Rupture - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.1) External Leak/Rupture - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.1) Internal Leak - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.2) Plugged - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.3) Mechanical Failure - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.4) Internal Leak - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.2)	Flow meter, if closely monitoring Type (I, P or M): I Procedural steps to check control system status of ram/valve location prior to latch back Type (I, P or M): P	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated

1.6.5	Functional Failure:	Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Loss of Function (general) - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.7) Plugged - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.3) External Leak/Rupture - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.1) Mechanical Failure - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.4) External Leak/Rupture - Casing Shear Ram - BOP Stack (linked to 2.3.3.1) Wear - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.5) Loss of Function (general) - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.7) Corrosion/Erosion - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.6) Mechanical Failure - Blind Shear Ram - BOP Stack (linked to 2.3.2.4) Mechanical Failure - Casing Shear Ram - BOP Stack (linked to 2.3.3.4) Wear - Casing Shear Ram - BOP Stack (linked to 2.3.3.5) External Leak/Rupture - Blind Shear Ram - BOP Stack (linked to 2.3.2.1) Wear - Blind Shear Ram - BOP Stack (linked to 2.3.2.5)		

1.6.6	Functional Failure:	Closes too slowly - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Actuates Too Slowly on Demand	Air in hydraulic system Plugged - HPU - Surface Control Systems (linked to 2.1.1.3) Plugged - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.3) Plugged - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.3) Plugged - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.3)	Autoshear maintenance and testing program Type (I, P or M): M	If drillpipe has not been sheared, and is still moving, joint could damage shear ram resulting in serious operational issues Likelihood of additional influx of hydrocarbons into Riser resulting in severe safety/environmental effects Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated

1.6.7	Functional Failure:	Loss of containment - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	External Leak	External Leak/Rupture - HPU - Surface Control Systems (linked to 2.1.1.1) External Leak / Rupture - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.1) External leak/rupture - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.1) External Leak/Rupture - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.1)	ROV Intervention Type (I, P or M): P BOP maintenance and testing programs previously stated Type (I, P or M): M	Significant down time that impacts operation, if still latched to rig Release of hydrocarbons to air or sea potentially resulting in spill with large impact, if still latched to rig Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact, if still latched to rig Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated, if still latched to rig Release of hydrocarbons to air or sea potentially resulting in spill with large impact Significant down time that impacts operation, if unlatched from the rig
2	Rupture	Snagging the BOP when pulling away and damaging the wellhead	LMRP & BOP High-angle release design Type (I, P or M): P Riser recoil devices Type (I, P or M): P	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact

7- Emergency Operation: EDS - Disconnect from the stack

1.7.1	Functional Failure:	Failure to receive EDS signal - Emergency Operation: EDS - Disconnect from the stack		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Failure to provide control signal, when demanded	Erratic output - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.3) Loss of Power (UPS Shuts down with power degradation) - Power - Surface Control Systems (linked to 2.1.2.1) Electrical Short - Power - Surface Control Systems (linked to 2.1.2.5) Erratic output (Network) - MUX System - Surface Control Systems (linked to 2.1.3.4) Fails to respond to input - MUX System - Surface Control Systems (linked to 2.1.3.5) Fails to respond (with no output signal/communication or to input) - Control Panels - Surface Control Systems (linked to 2.1.5.2) Loss of, or Degraded Power - Secondary & Emergency Control Systems - Surface Control Systems (linked to 2.1.8.1) Processing error - EDS - Subsea Control Systems (linked to 2.2.4.5) Processing error - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.5) Erratic output - Control Panels - Surface Control Systems (linked to 2.1.5.4) Fails to respond to input - Electrical - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.4) Loss of, or Degraded Power - Control Panels - Surface Control Systems (linked to 2.1.5.1) Fails to respond to input - Control Panels - Surface Control Systems (linked to 2.1.5.5) Short - Control Panels - Surface Control Systems (linked to 2.1.5.7) Erratic output - EDS - Subsea Control Systems (linked to 2.2.4.3) Wiring harness fails Fails with no output signal/communication - MUX System - Surface Control Systems (linked to 2.1.3.2) Loss of function (general) - Control Panels - Surface Control Systems (linked to 2.1.5.8)	Atypical current across solenoid coil Type (I, P or M): I Communications failure via flashing red screen on touch screen Type (I, P or M): I Mud on rig floor Type (I, P or M): I No LMRP separate signal Type (I, P or M): I No flow in flow meters Type (I, P or M): I Pod mismatch & alarm Type (I, P or M): I Redundant mechanicals Type (I, P or M): P Redundant touch screen, controllers, control pods, cables, powers supplies, SEM Type (I, P or M): P Between well surface (4 dry fires from different stations, SEMs, Pods. Live fire from driller's pod) Type (I, P or M): M Function test annular every 7 days Type (I, P or M): M Function tests between wells and upon latch-up Type (I, P or M): M Live subsea on commissioning and every 5 years (per pending API S53) Type (I, P or M): M	Severe operational problems, including equipment damage Environmental impact includes filling riser with mud, if stack is pulled over and well head is damaged Potential injuries on rig due to number of actions automatically occurring on the rig floor, moon pool, riser tensioners, as a result of EDS actuation

1.7.1	Functional Failure:	Failure to receive EDS signal - Emergency Operation: EDS - Disconnect from the stack		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Loss of function (general) - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.7) Fails with no output signal/communication - Subsea Control Systems - EDS (linked to 2.2.4.2) Ground Fault - EDS - Subsea Control Systems (linked to 2.2.4.6) Short - MUX System - Surface Control Systems (linked to 2.1.3.7) Loss of, or Degraded Power - EDS - Subsea Control Systems (linked to 2.2.4.1) Loss of function (general) - MUX System - Surface Control Systems (linked to 2.1.3.8) Fails with no output signal/communication (Includes Short) - Secondary & Emergency Control Systems - Surface Control Systems (linked to 2.1.8.2) Fails to respond to input - EDS - Subsea Control Systems (linked to 2.2.4.4) Loss of function (general) - EDS - Subsea Control Systems (linked to 2.2.4.7) Loss of function (general) - Secondary & Emergency Control Systems - Surface Control Systems (linked to 2.1.8.3) Loss of, or Degraded Power - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.1) Fails with no output signal/communication - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.2)		

1.7.2	Functional Failure:	Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Failure to Provide Disconnect Signal (automatically)	Wiring harness fails Loss of, or Degraded Power - Secondary & Emergency Control Systems - Surface Control Systems (linked to 2.1.8.1) Erratic output - EDS - Subsea Control Systems (linked to 2.2.4.3) Loss of Power (UPS Shuts down with power degradation) - Power - Surface Control Systems (linked to 2.1.2.1) Electrical Short - Power - Surface Control Systems (linked to 2.1.2.5) Fails to respond to input - Electrical - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.4) Loss of function (general) - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.7) Fails with no output signal/communication - MUX System - Surface Control Systems (linked to 2.1.3.2) Erratic output (Network) - MUX System - Surface Control Systems (linked to 2.1.3.4) Loss of, or Degraded Power - Control Panels - Surface Control Systems (linked to 2.1.5.1) Short - MUX System - Surface Control Systems (linked to 2.1.3.7) Fails to respond to input - MUX System - Surface Control Systems (linked to 2.1.3.5) Loss of, or Degraded Power - EDS - Subsea Control Systems (linked to 2.2.4.1) Loss of function (general) - MUX System - Surface Control Systems (linked to 2.1.3.8) Fails to respond (with no output signal/communication or to input) - Control Panels - Surface Control Systems (linked to 2.1.5.2) Fails with no output signal/communication (Includes Short) - Secondary & Emergency Control Systems - Surface Control Systems (linked to 2.1.8.2) Fails to respond to input - EDS - Subsea Control Systems (linked to 2.2.4.4)	Communications failure via flashing red screen on touch screen Type (I, P or M): I Pod mismatch and alarm Type (I, P or M): I E/H Backup Type (I, P or M): P Plugs in well Type (I, P or M): P Redundant mechanicals Type (I, P or M): P Redundant touch screen, controllers, control pods, cables, powers supplies, SEM Type (I, P or M): P ROV Intervention Type (I, P or M): P Pulling BOP Type (I, P or M): M	Severe operational problems, including equipment damage Environmental impact includes filling riser with mud, if stack is pulled over and well head is damaged Potential injuries on rig due to number of actions automatically occurring on the rig floor, moon pool, riser tensioners, as a result of EDS actuation

1.7.2	Functional Failure:	Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Erratic output - Control Panels - Surface Control Systems (linked to 2.1.5.4) Loss of function (general) - EDS - Subsea Control Systems (linked to 2.2.4.7) Fails with no output signal/communication - Subsea Control Systems - EDS (linked to 2.2.4.2) Fails to respond to input - Control Panels - Surface Control Systems (linked to 2.1.5.5) Loss of function (general) - Secondary & Emergency Control Systems - Surface Control Systems (linked to 2.1.8.3) Short - Control Panels - Surface Control Systems (linked to 2.1.5.7) Loss of function (general) - Control Panels - Surface Control Systems (linked to 2.1.5.8) Erratic output - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.3) Loss of, or Degraded Power - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.1) Fails with no output signal/communication - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.2)		
2	Failure LMRP / BOP to Connect or Disengage	Wear - Connectors - BOP Stack (linked to 2.3.6.5) Mechanical Failure - Connectors - BOP Stack (linked to 2.3.6.4) Loss of Function (general) - Connectors - BOP Stack (linked to 2.3.6.7) Corrosion/Erosion - Connectors - BOP Stack (linked to 2.3.6.6) Internal Leak - Connectors - BOP Stack (linked to 2.3.6.2) External Leak/Rupture - Connectors - BOP Stack (linked to 2.3.6.1)	No LMRP separation indication from LMRP Type (I, P or M): I Surge/retry unlatch option is only possible by swapping pods/SEMs Type (I, P or M): I Weight on hook Type (I, P or M): I Surge with greater pressure Type (I, P or M): P Between well maintenance (clean, grease, inspect, pressure, & minimum unlock pressure test) Type (I, P or M): M Five year inspection of connectors Type (I, P or M): M Wellbore test every 14 days Type (I, P or M): M	Severe operational problems, including equipment damage Environmental impact includes filling riser with mud, if stack is pulled over and well head is damaged Potential injuries on rig due to number of actions automatically occurring on the rig floor, moon pool, riser tensioners, as a result of EDS actuation

1.7.2	Functional Failure:	Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
3	Failure of Hydraulic Fluid to disconnect	External Leak/Rupture - HPU - Surface Control Systems (linked to 2.1.1.1) Internal Leak - HPU - Surface Control Systems (linked to 2.1.1.2) Plugged - HPU - Surface Control Systems (linked to 2.1.1.3) Mechanical Failure - HPU - Surface Control Systems (linked to 2.1.1.4) Loss of Function (general) - HPU - Surface Control Systems (linked to 2.1.1.7) External Leak / Rupture - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.1) Internal Leak - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.2) Internal Leak - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.2) Plugged - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.3) Mechanical Failure - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.4) Plugged - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.3) Internal Leak - Blind Shear Ram - BOP Stack (linked to 2.3.2.2) Internal Leak - Casing Shear Ram - BOP Stack (linked to 2.3.3.2) External Leak/Rupture - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.1) Loss of Function (general) - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.7) Mechanical Failure - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.4) Internal leak - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.2) Internal Leak - Connectors - BOP Stack (linked to 2.3.6.2)	Manual indicators on valves that the ROV can read Type (I, P or M): I HPU pumps running constantly Type (I, P or M): I Multiple pumps (1 pump needed, 3 pumps present) Type (I, P or M): P Accumulators with stored energy Type (I, P or M): P Design margin/safety factors (conduits work at 5k, max @ 7.5k) Type (I, P or M): P Multiple annulars & rams Type (I, P or M): P Redundant conduit lines with ability to isolate leaking line and cross-connect via conduit manifold Type (I, P or M): P Redundant functions between pods Type (I, P or M): P Redundant regulators Type (I, P or M): P Filter replacement frequency Type (I, P or M): M Maintenance programs Type (I, P or M): M ROV inspection every 3 days Type (I, P or M): M SOAK test between wells Type (I, P or M): M Weekly BOP function test Type (I, P or M): M	Severe operational problems, including equipment damage Environmental impact includes filling riser with mud, if stack is pulled over and well head is damaged Potential injuries on rig due to number of actions automatically occurring on the rig floor, moon pool, riser tensioners, as a result of EDS actuation

1.7.2	Functional Failure:	Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Corrosion/Erosion - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.6) External Leak/Rupture - Accumulators - Subsea Control Systems (linked to 2.2.3.1) Internal Leak - Accumulators - Subsea Control Systems (linked to 2.2.3.2) Mechanical Failure - Accumulators - Subsea Control Systems (linked to 2.2.3.4) Mechanical Failure - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.4) External Leak/Rupture - Casing Shear Ram - BOP Stack (linked to 2.3.3.1) External Leak/Rupture - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.1) Internal Leak - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.2) Mechanical Failure - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.4) Wear - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.5) Loss of Function (general) - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.7) Plugged - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.3) External Leak/Rupture - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.1) Wear - Accumulators - Subsea Control Systems (linked to 2.2.3.5) Loss of Function (general) - Accumulators - Subsea Control Systems (linked to 2.2.3.7) Plugged - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.3) Mechanical Failure - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.4) Loss of Function - ROV Intervention Interface - BOP Stack (linked to 2.3.8.3)		

1.7.2	Functional Failure:	Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		External leak/rupture - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.1) Corrosion/Erosion - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.6) Loss of Function (general) - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.7) External Leak/Rupture - Blind Shear Ram - BOP Stack (linked to 2.3.2.1) Wear - Blind Shear Ram - BOP Stack (linked to 2.3.2.5) Wear - Casing Shear Ram - BOP Stack (linked to 2.3.3.5) Wear - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.5) External Leak/Rupture - Connectors - BOP Stack (linked to 2.3.6.1) External Leak/Rupture - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.1)		
4	Moves too slowly to disconnect	External Leak/Rupture - HPU - Surface Control Systems (linked to 2.1.1.1) Plugged - HPU - Surface Control Systems (linked to 2.1.1.3) Mechanical Failure - HPU - Surface Control Systems (linked to 2.1.1.4) Loss of Function (general) - HPU - Surface Control Systems (linked to 2.1.1.7) External Leak/Rupture - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.1) External Leak / Rupture - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.1) Internal Leak - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.2) Mechanical Failure - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.4) Wear - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.5)	HPU pumps running constantly Type (I, P or M): I Manual indicators on valves that the ROV can read Type (I, P or M): I Accumulators with stored energy Type (I, P or M): P Design margin/safety factors (conduits work at 5k, max @ 7.5k) Type (I, P or M): P E/H backup Type (I, P or M): P Pod/SEM redundancy Type (I, P or M): P Multiple annulars & rams Type (I, P or M): P Multiple pumps (1 pump needed, 3 pumps present) Type (I, P or M): P	Severe operational problems, including equipment damage Environmental impact includes filling riser with mud, if stack is pulled over and well head is damaged Potential injuries on rig due to number of actions automatically occurring on the rig floor, moon pool, riser tensioners, as a result of EDS actuation

1.7.2	Functional Failure:	Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Loss of Function (general) - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.7) Plugged - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.3) Plugged - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.3) External Leak/Rupture - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.1) Loss of Function (general) - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.7) External Leak/Rupture - Accumulators - Subsea Control Systems (linked to 2.2.3.1) Internal Leak - Accumulators - Subsea Control Systems (linked to 2.2.3.2) Mechanical Failure - Accumulators - Subsea Control Systems (linked to 2.2.3.4) Plugged - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.3) Wear - Accumulators - Subsea Control Systems (linked to 2.2.3.5) Loss of Function (general) - Accumulators - Subsea Control Systems (linked to 2.2.3.7) Mechanical Failure - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.4) External Leak/Rupture - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.1) External leak/rupture - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.1) Plugged - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.3) Loss of Function (general) - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.7)	Possibility to use stack accumulator (ruin 5k stab though) Type (I, P or M): P Redundant conduit lines with ability to isolate leaking line and cross-connect via conduit manifold Type (I, P or M): P Redundant functions between pods Type (I, P or M): P Redundant regulators Type (I, P or M): P ROV intervention Type (I, P or M): P Filter replacement frequency Type (I, P or M): M Maintenance programs Type (I, P or M): M ROV inspection every 3 days Type (I, P or M): M SOAK test between wells Type (I, P or M): M Weekly BOP function test Type (I, P or M): M	

1.7.3	Functional Failure:	Unintentional disconnect of the riser - Emergency Operation: EDS - Disconnect from the stack		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Spurious Automatic EDS Signal	No credible causes resulting in spurious automatic disconnect signal during 'Emergency Operation: EDS - Disconnect from the stack'	Visual indicators of it happening (mud volumes, tensioners...) Type (I, P or M): I Weight indicator changes Type (I, P or M): I Implementation of latest Engineering Bulletin Type (I, P or M): P	Severe operational problems, including equipment damage Environmental impact includes filling riser with mud, if stack is pulled over and well head is damaged
2	Unintentional Manual Disconnect Signal	No credible causes resulting in Unintentional Manual Disconnect Signal during 'Emergency Operation: EDS - Disconnect from the stack'	From drillers chair/console it is two switches that are both covered Type (I, P or M): P Two hand operation, Password, confirmation Type (I, P or M): P	

8- Controlled Operation - Disconnect the LMRP from the Lower BOP stack

1.8.1	Functional Failure:	Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Failure to Provide Disconnect Signal (automatically or manually)	Wiring harness fails Loss of, or Degraded Power - Secondary & Emergency Control Systems - Surface Control Systems (linked to 2.1.8.1) Loss of Power (UPS Shuts down with power degradation) - Power - Surface Control Systems (linked to 2.1.2.1) Electrical Short - Power - Surface Control Systems (linked to 2.1.2.5) Fails to respond to input - Electrical - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.4) Loss of function (general) - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.7) Fails with no output signal/communication - MUX System - Surface Control Systems (linked to 2.1.3.2) Erratic output (Network) - MUX System - Surface Control Systems (linked to 2.1.3.4) Short - MUX System - Surface Control Systems (linked to 2.1.3.7) Loss of, or Degraded Power - Control Panels - Surface Control Systems (linked to 2.1.5.1) Erratic output - EDS - Subsea Control Systems (linked to 2.2.4.3) Fails to respond to input - MUX System - Surface Control Systems (linked to 2.1.3.5) Loss of function (general) - MUX System - Surface Control Systems (linked to 2.1.3.8) Loss of, or Degraded Power - EDS - Subsea Control Systems (linked to 2.2.4.1) Fails to respond (with no output signal/communication or to input) - Control Panels - Surface Control Systems (linked to 2.1.5.2) Fails with no output signal/communication (Includes Short) - Secondary & Emergency Control Systems - Surface Control Systems (linked to 2.1.8.2) Fails to respond to input - EDS - Subsea Control Systems (linked to 2.2.4.4)	Atypical current across solenoid coil Type (I, P or M): I Communications failure via flashing red screen on touch screen Type (I, P or M): I No flow in flow meters Type (I, P or M): I Pod mismatch & alarm Type (I, P or M): I E/H Backup Type (I, P or M): P Plugs in well Type (I, P or M): P Redundant mechanicals Type (I, P or M): P Redundant touch screen, controllers, control pods, cables, powers supplies, SEM Type (I, P or M): P ROV Intervention Type (I, P or M): P Function tests between wells and upon latch-up Type (I, P or M): M Pulling BOP Type (I, P or M): M	Significant down time that impacts operation

1.8.1	Functional Failure:	Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Erratic output - Control Panels - Surface Control Systems (linked to 2.1.5.4) Loss of function (general) - EDS - Subsea Control Systems (linked to 2.2.4.7) Fails to respond to input - Control Panels - Surface Control Systems (linked to 2.1.5.5) Fails with no output signal/communication - Subsea Control Systems - EDS (linked to 2.2.4.2) Short - Control Panels - Surface Control Systems (linked to 2.1.5.7) Loss of function (general) - Secondary & Emergency Control Systems - Surface Control Systems (linked to 2.1.8.3) Loss of function (general) - Control Panels - Surface Control Systems (linked to 2.1.5.8) Loss of, or Degraded Power - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.1) Erratic output - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.3) Fails with no output signal/communication - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.2)		
2	Failure of LMRP / BOP Connector to Disengage	Wear - Connectors - BOP Stack (linked to 2.3.6.5) Mechanical Failure - Connectors - BOP Stack (linked to 2.3.6.4) Corrosion/Erosion - Connectors - BOP Stack (linked to 2.3.6.6) Internal Leak - Connectors - BOP Stack (linked to 2.3.6.2) External Leak/Rupture - Connectors - BOP Stack (linked to 2.3.6.1)	No LMRP separation indication from LMRP Type (I, P or M): I ROV observation Type (I, P or M): I Weight on hook Type (I, P or M): I Pull BOP with LMRP Type (I, P or M): P Surge with greater pressure Type (I, P or M): P Between well maintenance (clean, grease, inspect, pressure, & minimum unlock pressure test) Type (I, P or M): M Five year inspection of latch mechanism Type (I, P or M): M Wellbore test every 14 days Type (I, P or M): M	Significant down time that impacts operation Potential Safety issue whose impact depends on the cause for the disconnect, for example due to impending weather hazard

1.8.1	Functional Failure:	Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
3	Failure of Hydraulic Fluid to Disconnect	External Leak/Rupture - HPU - Surface Control Systems (linked to 2.1.1.1) Internal Leak - HPU - Surface Control Systems (linked to 2.1.1.2) Plugged - HPU - Surface Control Systems (linked to 2.1.1.3) Mechanical Failure - HPU - Surface Control Systems (linked to 2.1.1.4) Loss of Function (general) - HPU - Surface Control Systems (linked to 2.1.1.7) External Leak / Rupture - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.1) Internal Leak - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.2) Internal Leak - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.2) Plugged - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.3) Internal Leak - Blind Shear Ram - BOP Stack (linked to 2.3.2.2) External Leak/Rupture - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.1) Mechanical Failure - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.4) Mechanical Failure - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.4) Internal Leak - Casing Shear Ram - BOP Stack (linked to 2.3.3.2) Plugged - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.3) Internal leak - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.2) Corrosion/Erosion - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.6) External Leak/Rupture - Casing Shear Ram - BOP Stack (linked to 2.3.3.1)	HPU pumps running constantly Type (I, P or M): I Manual indicators on valves that the ROV can read Type (I, P or M): I Accumulators with stored energy Type (I, P or M): P Design margin/safety factors (conduits work at 5k, max @ 7.5k) Type (I, P or M): P E/H backup Type (I, P or M): P Multiple annulars & rams Type (I, P or M): P Multiple pumps (1 pump needed, 3 pumps present) Type (I, P or M): P Pull entire stack Type (I, P or M): P Possibility to use stack accumulator (ruin 5k stab though) Type (I, P or M): P Redundant conduit lines with ability to isolate leaking line and cross-connect via conduit manifold Type (I, P or M): P Redundant functions between pods Type (I, P or M): P Redundant regulators Type (I, P or M): P ROV intervention Type (I, P or M): P Filter replacement frequency Type (I, P or M): M Maintenance programs Type (I, P or M): M ROV inspection every 3 days Type (I, P or M): M SOAK test between wells Type (I, P or M): M Weekly BOP function test Type (I, P or M): M	Significant down time that impacts operation Potential Safety issue whose impact depends on the cause for the disconnect, for example due to impending weather hazard

1.8.1	Functional Failure:	Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		External Leak/Rupture - Accumulators - Subsea Control Systems (linked to 2.2.3.1) Loss of Function (general) - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.7) Internal Leak - Accumulators - Subsea Control Systems (linked to 2.2.3.2) Mechanical Failure - Accumulators - Subsea Control Systems (linked to 2.2.3.4) Mechanical Failure - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.4) External Leak/Rupture - Autoshear System - BOP Stack (linked to 2.3.7.1) External Leak/Rupture - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.1) Internal Leak - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.2) Mechanical Failure - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.4) Wear - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.5) Loss of Function (general) - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.7) Wear - Accumulators - Subsea Control Systems (linked to 2.2.3.5) Loss of Function (general) - Accumulators - Subsea Control Systems (linked to 2.2.3.7) Internal Leak - Connectors - BOP Stack (linked to 2.3.6.2) Loss of Function - ROV Intervention Interface - BOP Stack (linked to 2.3.8.3) External Leak/Rupture - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.1) Plugged - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.3) External leak/rupture - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.1) Plugged - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.3) Corrosion/Erosion - Hydraulic Supply: Rigid		

1.8.1	Functional Failure:	Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.6) Mechanical Failure - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.4) Loss of Function (general) - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.7) External Leak/Rupture - Blind Shear Ram - BOP Stack (linked to 2.3.2.1) Wear - Blind Shear Ram - BOP Stack (linked to 2.3.2.5) Wear - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.5) External Leak/Rupture - Connectors - BOP Stack (linked to 2.3.6.1) Wear - Casing Shear Ram - BOP Stack (linked to 2.3.3.5) External Leak/Rupture - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.1)		
4	Moves too slowly to disconnect	External Leak/Rupture - HPU - Surface Control Systems (linked to 2.1.1.1) Plugged - HPU - Surface Control Systems (linked to 2.1.1.3) Mechanical Failure - HPU - Surface Control Systems (linked to 2.1.1.4) External Leak/Rupture - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.1) Loss of Function (general) - HPU - Surface Control Systems (linked to 2.1.1.7) External Leak / Rupture - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.1) Internal Leak - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.2) Mechanical Failure - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.4) Wear - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.5) Loss of Function (general) - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.7)	E/H Backup Type (I, P or M): I ROV Intervention Type (I, P or M): I	No effects of interest as long as the connector unlocks and disconnects

1.8.1	Functional Failure:	Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Plugged - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.3) External Leak/Rupture - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.1) External Leak/Rupture - Accumulators - Subsea Control Systems (linked to 2.2.3.1) Loss of Function (general) - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.7) Internal Leak - Accumulators - Subsea Control Systems (linked to 2.2.3.2) Mechanical Failure - Accumulators - Subsea Control Systems (linked to 2.2.3.4) Plugged - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.3) Wear - Accumulators - Subsea Control Systems (linked to 2.2.3.5) Loss of Function (general) - Accumulators - Subsea Control Systems (linked to 2.2.3.7) External Leak/Rupture - Autoshear System - BOP Stack (linked to 2.3.7.1) Internal Leak - Autoshear System - BOP Stack (linked to 2.3.7.2) External Leak/Rupture - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.1) Plugged - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.3) External leak/rupture - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.1) Plugged - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.3) Mechanical Failure - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.4) Loss of Function (general) - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.7)		

1.8.2	Functional Failure:	Unintentional disconnect of the LMRP Controlled Operation - Disconnect the LMRP from the Lower BOP stack		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Spurious Automatic Disconnect Signal	No credible causes resulting in spurious automatic disconnect signal during 'Disconnect the LMRP from the Lower BOP stack'	Implementation of latest Engineering Bulletin Type (I, P or M): P	Significant down time that impacts operation Environmental impact in the form of mud release
2	Unintentional Manual Disconnect Signal	No credible causes resulting in Unintentional Manual Disconnect Signal during 'Disconnect the LMRP from the Lower BOP Stack'	From drillers chair/console it is two switches that are both covered Type (I, P or M): P Two hand operation, Password, confirmation Type (I, P or M): P	

9- Circulate the well after drill pipe disconnect

1.9.1	Functional Failure:	Failure to circulate - Circulate the well after drill pipe disconnect		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Failure to Provide Control Signal to C&K Valves when Demanded	Wiring harness fails Loss of Power (UPS Shuts down with power degradation) - Power - Surface Control Systems (linked to 2.1.2.1) Electrical Short - Power - Surface Control Systems (linked to 2.1.2.5) Fails to respond to input - Electrical - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.4) Loss of function (general) - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.7) Fails with no output signal/communication - MUX System - Surface Control Systems (linked to 2.1.3.2) Erratic output (Network) - MUX System - Surface Control Systems (linked to 2.1.3.4) Loss of, or Degraded Power - Secondary & Emergency Control Systems - Surface Control Systems (linked to 2.1.8.1) Short - MUX System - Surface Control Systems (linked to 2.1.3.7) Loss of, or Degraded Power - Control Panels - Surface Control Systems (linked to 2.1.5.1) Fails to respond to input - MUX System - Surface Control Systems (linked to 2.1.3.5) Loss of function (general) - MUX System - Surface Control Systems (linked to 2.1.3.8) Fails to respond (with no output signal/communication or to input) - Control Panels - Surface Control Systems (linked to 2.1.5.2) Erratic output - Control Panels - Surface Control Systems (linked to 2.1.5.4) Fails with no output signal/communication (Includes Short) - Secondary & Emergency Control Systems - Surface Control Systems (linked to 2.1.8.2) Fails to respond to input - Control Panels - Surface Control Systems (linked to 2.1.5.5) Short - Control Panels - Surface Control Systems (linked to 2.1.5.7) Loss of function (general) - Secondary &	Communications failure via flashing red screen on touch screen Type (I, P or M): I Atypical current across solenoid coil Type (I, P or M): I No flow in flow meters Type (I, P or M): I Pod mismatch & alarm Type (I, P or M): I Multiple (4) inlets below the blind shear rams for circulation if one is lost Type (I, P or M): P Redundant mechanicals Type (I, P or M): P Redundant touch screen, controllers, control pods, cables, powers supplies, SEM Type (I, P or M): P Function tests between wells and upon latch-up Type (I, P or M): M	Significant down time that impacts operation

1.9.1	Functional Failure:	Failure to circulate - Circulate the well after drill pipe disconnect		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Emergency Control Systems - Surface Control Systems (linked to 2.1.8.3) Loss of function (general) - Control Panels - Surface Control Systems (linked to 2.1.5.8) Loss of, or Degraded Power - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.1) Erratic output - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.3) Fails with no output signal/communication - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.2)		
2	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves	External Leak/Rupture - HPU - Surface Control Systems (linked to 2.1.1.1) Internal Leak - HPU - Surface Control Systems (linked to 2.1.1.2) Plugged - HPU - Surface Control Systems (linked to 2.1.1.3) Mechanical Failure - HPU - Surface Control Systems (linked to 2.1.1.4) Loss of Function (general) - HPU - Surface Control Systems (linked to 2.1.1.7) External Leak / Rupture - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.1) Internal Leak - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.2) Internal Leak - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.2) Plugged - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.3) Mechanical Failure - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.4) Mechanical Failure - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.4) Internal leak - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.2) Corrosion/Erosion - Blue & Yellow Control	HPU pumps running constantly Type (I, P or M): I Deadhead pumps / rupture disc rupture on pump Type (I, P or M): I Manual indicators on valves that the ROV can read Type (I, P or M): I Redundant conduit lines with ability to isolate leaking line and cross-connect via conduit manifold Type (I, P or M): P Multiple annulars & rams Type (I, P or M): P Redundant functions between pods Type (I, P or M): P Multiple pumps (1 pump needed, 3 pumps present) Type (I, P or M): P Accumulators with stored energy Type (I, P or M): P Design margin/safety factors (conduits work at 5k, max @ 7.5k) Type (I, P or M): P Redundant regulators Type (I, P or M): P ROV inspection every 3 days Type (I, P or M): M Filter replacement frequency Type (I, P or M): M Maintenance programs	Significant down time that impacts operation

1.9.1	Functional Failure:	Failure to circulate - Circulate the well after drill pipe disconnect		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.6) External Leak/Rupture - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.1) External Leak/Rupture - Accumulators - Subsea Control Systems (linked to 2.2.3.1) Loss of Function (general) - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.7) Internal Leak - Accumulators - Subsea Control Systems (linked to 2.2.3.2) Mechanical Failure - Accumulators - Subsea Control Systems (linked to 2.2.3.4) Mechanical Failure - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.4) External Leak/Rupture - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.1) Internal Leak - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.2) Wear - Accumulators - Subsea Control Systems (linked to 2.2.3.5) Plugged - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.3) Mechanical Failure - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.4) Wear - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.5) Loss of Function (general) - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.7) External Leak/Rupture - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.1) Loss of Function (general) - Accumulators - Subsea Control Systems (linked to 2.2.3.7) External leak/rupture - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.1) Plugged - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.3) Internal Leak - Connectors - BOP Stack (linked to 2.3.6.2)	Type (I, P or M): M Weekly BOP function test Type (I, P or M): M SOAK test between wells Type (I, P or M): M	

1.9.1	Functional Failure:	Failure to circulate - Circulate the well after drill pipe disconnect		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Loss of Function - ROV Intervention Interface - BOP Stack (linked to 2.3.8.3) Plugged - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.3) Loss of Function (general) - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.7) Corrosion/Erosion - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.6) Mechanical Failure - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.4) External Leak/Rupture - Connectors - BOP Stack (linked to 2.3.6.1) External Leak/Rupture - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.1) Wear - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.5)		
3	Inability to Operate C&K Valves as Needed	Internal Leak - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.2) External Leak/Rupture - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.1) Wear - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.5)	Deadheading of pump Type (I, P or M): I Flow meter (volume to actuate is known, should go 0 to 0.7 to 0 in ~ 5 seconds) If too high = leak. If long time = galling or leak Type (I, P or M): I Increasing pressure Type (I, P or M): I Same pressure readings from BOP bore indicators same as from C&K lines once open Type (I, P or M): I Pressure test chambers at end of well Type (I, P or M): M Shell test using end of tail rod between wells, on surface Type (I, P or M): M Weekly function test of stack Type (I, P or M): M Wellbore test between wells and 14 while subsea Type (I, P or M): M	Significant down time that impacts operation

1.9.2	Functional Failure:	Failure to circulate the well at the desired flow rate - Circulate the well after drill pipe disconnect		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Degraded Flow Pressure	Fail-safe valves fail to open completely Large diameter tools in the well that cause increase in differential pressure and forced to pump at slower rate	Higher circulating pressure/ lower flow rates Type (I, P or M): I Circulate through the C&K valves daily Type (I, P or M): M Flush C&K valves 2x daily Type (I, P or M): M	Significant down time that impacts operation
2	Restricted Flow Path	No credible causes resulting in restricted flow path during 'circulate the well after drill pipe disconnect'		

1.9.3	Functional Failure:	Failure to open / close fail-safe valves to seal - Circulate the well after drill pipe disconnect		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Failure to Actuate under Fail-safe Conditions	Broken springs = it will not close without hydraulic assistance Mechanical interference (debris, galling) Wellbore pressure above the closing pressure	Continued flow/return to the surface Type (I, P or M): I Redundant/2 valves Type (I, P or M): P Maintenance & testing between each well Type (I, P or M): M	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact
2	Failure to Adequately Seal under Fail-safe Conditions	Internal Leak - Annulars - BOP Stack (linked to 2.3.1.2) Internal Leak - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.2) External Leak/Rupture - Annulars - BOP Stack (linked to 2.3.1.1) Wear - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.5)	Continued flow/return to the surface Type (I, P or M): I Redundant/2 valves Type (I, P or M): P Maintenance & testing between each well Type (I, P or M): M	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact

1.9.4	Functional Failure:	Failure to seal wellbore - Circulate the well after drill pipe disconnect		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Failure to Provide Control Signal to C&K Valves when Demanded	Loss of Power (UPS Shuts down with power degradation) - Power - Surface Control Systems (linked to 2.1.2.1) Electrical Short - Power - Surface Control Systems (linked to 2.1.2.5) Erratic output - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.3) Fails to respond to input - Electrical - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.4) Loss of function (general) - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.7) Wiring harness fails Fails with no output signal/communication - MUX System - Surface Control Systems (linked to 2.1.3.2) Erratic output (Network) - MUX System - Surface Control Systems (linked to 2.1.3.4) Short - MUX System - Surface Control Systems (linked to 2.1.3.7) Loss of, or Degraded Power - Control Panels - Surface Control Systems (linked to 2.1.5.1) Loss of, or Degraded Power - Secondary & Emergency Control Systems - Surface Control Systems (linked to 2.1.8.1) Fails to respond to input - MUX System - Surface Control Systems (linked to 2.1.3.5) Loss of function (general) - MUX System - Surface Control Systems (linked to 2.1.3.8) Fails to respond (with no output signal/communication or to input) - Control Panels - Surface Control Systems (linked to 2.1.5.2) Erratic output - Control Panels - Surface Control Systems (linked to 2.1.5.4) Fails with no output signal/communication (Includes Short) - Secondary & Emergency Control Systems - Surface Control Systems (linked to 2.1.8.2) Fails to respond to input - Control Panels - Surface Control Systems (linked to 2.1.5.5)	Atypical current across solenoid coil Type (I, P or M): I Communications failure via flashing red screen on touch screen Type (I, P or M): I No flow in flow meters Type (I, P or M): I Pod mismatch & alarm Type (I, P or M): I Multiple (4) inlets below the blind shear rams for circulation if one is lost Type (I, P or M): P Redundant mechanicals Type (I, P or M): P Redundant touch screen, controllers, control pods, cables, powers supplies, SEM Type (I, P or M): P Function tests between wells and upon latch-up Type (I, P or M): M	Significant down time that impacts operation

1.9.4	Functional Failure:	Failure to seal wellbore - Circulate the well after drill pipe disconnect		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Loss of function (general) - Secondary & Emergency Control Systems - Surface Control Systems (linked to 2.1.8.3) Short - Control Panels - Surface Control Systems (linked to 2.1.5.7) Loss of function (general) - Control Panels - Surface Control Systems (linked to 2.1.5.8) Loss of, or Degraded Power - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.1) Fails with no output signal/communication - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.2)		
2	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves	External Leak/Rupture - HPU - Surface Control Systems (linked to 2.1.1.1) Internal Leak - HPU - Surface Control Systems (linked to 2.1.1.2) Plugged - HPU - Surface Control Systems (linked to 2.1.1.3) Mechanical Failure - HPU - Surface Control Systems (linked to 2.1.1.4) Loss of Function (general) - HPU - Surface Control Systems (linked to 2.1.1.7) External Leak / Rupture - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.1) Internal Leak - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.2) Plugged - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.3) Internal Leak - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.2) Mechanical Failure - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.4) Corrosion/Erosion - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.6) Internal leak - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.2)	Deadhead pumps / rupture disc rupture on pump Type (I, P or M): I HPU pumps running constantly Type (I, P or M): I Manual indicators on valves that the ROV can read Type (I, P or M): I Accumulators with stored energy Type (I, P or M): P Design margin/safety factors (conduits work at 5k, max @ 7.5k) Type (I, P or M): P Multiple annulars & rams Type (I, P or M): P Multiple pumps (1 pump needed, 3 pumps present) Type (I, P or M): P Redundant conduit lines with ability to isolate leaking line and cross-connect via conduit manifold Type (I, P or M): P Redundant functions between pods Type (I, P or M): P Redundant regulators Type (I, P or M): P Filter replacement frequency Type (I, P or M): M ROV inspection every 3 days Type (I, P or M): M Maintenance programs	Significant down time that impacts operation

1.9.4	Functional Failure:	Failure to seal wellbore - Circulate the well after drill pipe disconnect		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		External Leak/Rupture - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.1) External Leak/Rupture - Accumulators - Subsea Control Systems (linked to 2.2.3.1) Internal Leak - Accumulators - Subsea Control Systems (linked to 2.2.3.2) Mechanical Failure - Accumulators - Subsea Control Systems (linked to 2.2.3.4) Loss of Function (general) - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.7) Wear - Accumulators - Subsea Control Systems (linked to 2.2.3.5) Mechanical Failure - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.4) External Leak/Rupture - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.1) Internal Leak - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.2) Mechanical Failure - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.4) Wear - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.5) Loss of Function (general) - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.7) External Leak/Rupture - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.1) Mechanical Failure - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.4) Loss of Function (general) - Accumulators - Subsea Control Systems (linked to 2.2.3.7) External leak/rupture - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.1) Plugged - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.3) Plugged - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.3) Plugged - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.3)	Type (I, P or M): M Weekly BOP function test Type (I, P or M): M SOAK test between wells Type (I, P or M): M	

1.9.4	Functional Failure:	Failure to seal wellbore - Circulate the well after drill pipe disconnect		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Loss of Function (general) - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.7) Corrosion/Erosion - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.6) Mechanical Failure - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.4) Loss of Function - ROV Intervention Interface - BOP Stack (linked to 2.3.8.3) External Leak/Rupture - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.1) Wear - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.5) External Leak/Rupture - Connectors - BOP Stack (linked to 2.3.6.1) Internal Leak - Connectors - BOP Stack (linked to 2.3.6.2)		
3	Inability to Operate C&K Valves as Needed	Internal Leak - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.2) External Leak/Rupture - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.1) Wear - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.5)	Deadheading of pump Type (I, P or M): I Flow meter (volume to actuate is known, should go 0 to 0.7 to 0 in ~ 5 seconds) If too high = leak. If long time = galling or leak Type (I, P or M): I Increasing pressure Type (I, P or M): I Same pressure readings from BOP bore indicators same as from C&K lines once open Type (I, P or M): I Pressure test chambers at end of well Type (I, P or M): M Shell test using end of tail rod between wells, on surface Type (I, P or M): M Weekly function test of stack Type (I, P or M): M Wellbore test between wells and 14 while subsea Type (I, P or M): M	Significant down time that impacts operation

1.9.5	Functional Failure:	Loss of containment - Circulate the well after drill pipe disconnect		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	External Leak	C&K connector spool fails (washout in bends) Vibration on surface (rig floor) choke manifold - bolts backed out External Leak/Rupture - Casing Shear Ram - BOP Stack (linked to 2.3.3.1) External Leak/Rupture - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.1) Mechanical Failure - Blind Shear Ram - BOP Stack (linked to 2.3.2.4) Loss of Function (general) - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.7) Mechanical Failure - Casing Shear Ram - BOP Stack (linked to 2.3.3.4) External leak/rupture - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.1) Plugged - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.3) External Leak/Rupture - Blind Shear Ram - BOP Stack (linked to 2.3.2.1) Wear - Blind Shear Ram - BOP Stack (linked to 2.3.2.5) Mechanical Failure - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.4) Wear - Casing Shear Ram - BOP Stack (linked to 2.3.3.5) External Leak/Rupture - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.1) Wear - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.5)	Potential isolation of leak depending on location Type (I, P or M): P Connectors tested with casing test & blind shear ram test Type (I, P or M): M Pressure test every 14 days Type (I, P or M): M ROV inspection every 3 days Type (I, P or M): M	Environmental impact in the form of drilling mud spilled into the ocean Release of hydrocarbons to air or sea, potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire or explosion (large fire if the failure is at the choke manifold connection)
2	Rupture	No credible causes resulting in rupture during 'Circulate the well after drill pipe disconnect'		

10- Circulate across the BOP stack to remove trapped gas

1.10.1	Functional Failure:	Failure to circulate - Circulate across the BOP stack to remove trapped gas		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Failure to Provide Control Signal to C&K Valves when Demanded	Loss of Power (UPS Shuts down with power degradation) - Power - Surface Control Systems (linked to 2.1.2.1) Electrical Short - Power - Surface Control Systems (linked to 2.1.2.5) Wiring harness fails Erratic output - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.3) Fails to respond to input - Electrical - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.4) Loss of function (general) - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.7) Fails with no output signal/communication - MUX System - Surface Control Systems (linked to 2.1.3.2) Erratic output (Network) - MUX System - Surface Control Systems (linked to 2.1.3.4) Loss of, or Degraded Power - Control Panels - Surface Control Systems (linked to 2.1.5.1) Loss of, or Degraded Power - Secondary & Emergency Control Systems - Surface Control Systems (linked to 2.1.8.1) Fails to respond to input - MUX System - Surface Control Systems (linked to 2.1.3.5) Short - MUX System - Surface Control Systems (linked to 2.1.3.7) Loss of function (general) - MUX System - Surface Control Systems (linked to 2.1.3.8) Fails to respond (with no output signal/communication or to input) - Control Panels - Surface Control Systems (linked to 2.1.5.2) Erratic output - Control Panels - Surface Control Systems (linked to 2.1.5.4) Fails with no output signal/communication (Includes Short) - Secondary & Emergency Control Systems - Surface Control Systems (linked to 2.1.8.2) Fails to respond to input - Control Panels - Surface Control Systems (linked to 2.1.5.5)	Atypical current across solenoid coil Type (I, P or M): I Communications failure via flashing red screen on touch screen Type (I, P or M): I No flow in flow meters Type (I, P or M): I Pod mismatch & alarm Type (I, P or M): I Multiple (4) inlets below the blind shear rams for circulation if one is lost Type (I, P or M): P Redundant mechanicals Type (I, P or M): P Redundant touch screen, controllers, control pods, cables, powers supplies, SEM Type (I, P or M): P Function tests between wells and upon latch-up Type (I, P or M): M	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated

1.10.1	Functional Failure:	Failure to circulate - Circulate across the BOP stack to remove trapped gas		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Loss of function (general) - Secondary & Emergency Control Systems - Surface Control Systems (linked to 2.1.8.3) Short - Control Panels - Surface Control Systems (linked to 2.1.5.7) Loss of function (general) - Control Panels - Surface Control Systems (linked to 2.1.5.8) Loss of, or Degraded Power - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.1) Fails with no output signal/communication - Blue & Yellow Control Systems - Electrical - Subsea Control Systems (linked to 2.2.1.2)		
2	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves	External Leak/Rupture - HPU - Surface Control Systems (linked to 2.1.1.1) Internal Leak - HPU - Surface Control Systems (linked to 2.1.1.2) Plugged - HPU - Surface Control Systems (linked to 2.1.1.3) Mechanical Failure - HPU - Surface Control Systems (linked to 2.1.1.4) Loss of Function (general) - HPU - Surface Control Systems (linked to 2.1.1.7) External Leak / Rupture - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.1) Internal Leak - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.2) Plugged - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.3) Mechanical Failure - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.4) Corrosion/Erosion - Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems (linked to 2.2.2.6) Internal leak - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.2) External Leak/Rupture - Accumulators - Subsea Control Systems (linked to 2.2.3.1)	Deadhead pumps / rupture disc rupture on pump Type (I, P or M): I HPU pumps running constantly Type (I, P or M): I Manual indicators on valves that the ROV can read Type (I, P or M): I Accumulators with stored energy Type (I, P or M): P Design margin/safety factors (conduits work at 5k, max @ 7.5k) Type (I, P or M): P Multiple annulars & rams Type (I, P or M): P Multiple pumps (1 pump needed, 3 pumps present) Type (I, P or M): P Redundant conduit lines with ability to isolate leaking line and cross-connect via conduit manifold Type (I, P or M): P Redundant functions between pods Type (I, P or M): P Redundant regulators Type (I, P or M): P Filter replacement frequency Type (I, P or M): M Maintenance programs Type (I, P or M): M ROV inspection every 3 days	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated

1.10.1	Functional Failure:	Failure to circulate - Circulate across the BOP stack to remove trapped gas		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Internal Leak - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.2) External Leak/Rupture - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.1) Internal Leak - Accumulators - Subsea Control Systems (linked to 2.2.3.2) Loss of Function (general) - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.7) Mechanical Failure - Accumulators - Subsea Control Systems (linked to 2.2.3.4) Wear - Accumulators - Subsea Control Systems (linked to 2.2.3.5) Mechanical Failure - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.4) Mechanical Failure - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.4) Loss of Function (general) - Accumulators - Subsea Control Systems (linked to 2.2.3.7) External leak/rupture - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.1) Plugged - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.3) External Leak/Rupture - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.1) Internal Leak - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.2) Mechanical Failure - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.4) Wear - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.5) Loss of Function (general) - Surface Control Systems - Accumulators - Surface (linked to 2.1.6.7) External Leak/Rupture - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.1) Plugged - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.3) Loss of Function (general) - Fluid Reservoir Unit - Surface Control Systems (linked to 2.1.7.7)	Type (I, P or M): M SOAK test between wells Type (I, P or M): M Weekly BOP function test Type (I, P or M): M	

1.10.1	Functional Failure:	Failure to circulate - Circulate across the BOP stack to remove trapped gas		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
		Plugged - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.3) Corrosion/Erosion - Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems (linked to 2.2.5.6) Mechanical Failure - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.4) Loss of Function - ROV Intervention Interface - BOP Stack (linked to 2.3.8.3) External Leak/Rupture - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.1) Wear - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.5) External Leak/Rupture - Connectors - BOP Stack (linked to 2.3.6.1) Internal Leak - Connectors - BOP Stack (linked to 2.3.6.2)		
3	Inability to Operate C&K Valves as Needed	Internal Leak - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.2) External Leak/Rupture - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.1) Wear - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.5)	Deadheading of pump Type (I, P or M): I Flow meter (volume to actuate is known, should go 0 to 0.7 to 0 in ~ 5 seconds) If too high = leak. If long time = galling or leak Type (I, P or M): I Increasing pressure Type (I, P or M): I Same pressure readings from BOP bore indicators same as from C&K lines once open Type (I, P or M): I Pressure test chambers at end of well Type (I, P or M): M Shell test using end of tail rod between wells, on surface Type (I, P or M): M Weekly function test of stack Type (I, P or M): M Wellbore test between wells and 14 while subsea Type (I, P or M): M	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact Down time, after well control issue is resolved, to repair an individual C&K valve that cannot be operated

1.10.2	Functional Failure:	Failure to circulate at desired flow rate - Circulate across the BOP stack to remove trapped gas		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Degraded Flow Pressure	Fail-safe valves fail to open completely Large diameter tools in the well that cause increase in differential pressure and forced to pump at slower rate	Higher circulating pressure/ lower flow rates Type (I, P or M): I Circulate through the C&K valves daily Type (I, P or M): M Flush C&K valves 2x daily Type (I, P or M): M	Significant down time that impacts operation
2	Restricted Flow Path	No credible cause resulting in restricted flow path during 'Circulate across the BOP stack to remove trapped gas'		

1.10.3	Functional Failure:	Failure to open / close fail-safe valves to seal - Circulate across the BOP stack to remove trapped gas		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Failure to Actuate under Fail-safe Conditions	Broken springs = it will not close without hydraulic assistance Mechanical interference (debris, galling) Wellbore pressure above the closing pressure	Continued flow/return to the surface Type (I, P or M): I Redundant/2 valves Type (I, P or M): P Maintenance & testing between each well Type (I, P or M): M	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact
2	Failure to Adequately Seal under Fail-safe Condition	External Leak/Rupture - Annulars - BOP Stack (linked to 2.3.1.1) Internal Leak - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.2) Wear - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.5) Internal Leak - Annulars - BOP Stack (linked to 2.3.1.2)	Continued flow/return to the surface Type (I, P or M): I Redundant/2 valves Type (I, P or M): P Maintenance & testing between each well Type (I, P or M): M	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire/explosion hazard with large impact

1.10.4	Functional Failure:	Loss of containment - Circulate across the BOP stack to remove trapped gas -		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	External Leak	C&K connector spool fails (washout in bends) Vibration on surface (rig floor) choke manifold - bolts backed out External Leak/Rupture - Pipe & Test Rams - BOP Stack (linked to 2.3.4.1) External Leak/Rupture - Annulars - BOP Stack (linked to 2.3.1.1) External Leak/Rupture - Casing Shear Ram - BOP Stack (linked to 2.3.3.1) External Leak/Rupture - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.1) Loss of Function (general) - Hydraulic Supply - Surface Control Systems (linked to 2.1.4.7) Mechanical Failure - Casing Shear Ram - BOP Stack (linked to 2.3.3.4) Internal Leak - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.2) External Leak/Rupture - Blind Shear Ram - BOP Stack (linked to 2.3.2.1) Wear - Blind Shear Ram - BOP Stack (linked to 2.3.2.5) Mechanical Failure - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.4) Wear - Casing Shear Ram - BOP Stack (linked to 2.3.3.5) External Leak/Rupture - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.1) Wear - Choke & Kill Lines & Valves - BOP Stack (linked to 2.3.5.5)	Potential isolation of leak depending on location Type (I, P or M): P Connectors tested with casing test & blind shear ram test Type (I, P or M): M Pressure test every 14 days Type (I, P or M): M ROV inspection every 3 days Type (I, P or M): M	Environmental impact in the form of drilling mud spilled into the ocean Release of hydrocarbons to air or sea, potentially resulting in spill with large impact Release of hydrocarbons to atmosphere potentially resulting in fire or explosion (large fire if the failure is at the choke manifold connection)
2	Rupture	No credible causes resulting in rupture during 'Circulate across the BOP stack to remove trapped gas'		

11- Connect BOP and LMRP at Landing

1.11.1	Functional Failure:	Inadequate BOP Connection - Connect BOP and LMRP at Landing		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Failure of Wellhead Connector to Properly Lock and Seal	Poor wellhead surface (not cleaned) Damaged seal areas or gaskets External Leak/Rupture - Connectors - BOP Stack (linked to 2.3.6.1) Loss of Function (general) - Connectors - BOP Stack (linked to 2.3.6.7) Mechanical Failure - Connectors - BOP Stack (linked to 2.3.6.4)	Flow meter Type (I, P or M): I Overpull (pull on BOP/wellhead to ensure connection) Type (I, P or M): I Place resilient (metal gasket with elastomeric component) seal on wellhead and/or BOP Type (I, P or M): P Clean wellhead mating surface with ROV prior to landing Type (I, P or M): M New metal gasket for each landing Type (I, P or M): M ROV Type (I, P or M): M Test the BOP using a test plug in the wellhead to the maximum pressure the BOP will be tested Type (I, P or M): M	There is only potential operational impact/delay, as the well is secure prior to landing BOP under this scenario.
2	Failure of Connector Integrity	Differential pressure between wellbore and sea External Leak/Rupture - Connectors - BOP Stack (linked to 2.3.6.1) Poor wellhead surface (not cleaned) Damaged seal areas or gaskets Mechanical Failure - Connectors - BOP Stack (linked to 2.3.6.4) Loss of Function (general) - Connectors - BOP Stack (linked to 2.3.6.7)	Lock indicator Type (I, P or M): I Loss of mud volume in trip tank Type (I, P or M): I POCV Type (I, P or M): I Between well clean, grease, inspect Type (I, P or M): M Chamber test (i.e. wellbore test) Type (I, P or M): M Five year inspection of latch Type (I, P or M): M Minimum unlock pressure on surface Type (I, P or M): M New gaskets Type (I, P or M): M Pressure test every 14 days (if no test ram, connector is tested) Type (I, P or M): M Required ROV inspection every 3 day, however ROV is subsea more often Type (I, P or M): M Tested on surface and subsea Type (I, P or M): M	If the well has been secured prior to landing BOP, there is only potential operational impact/delay. If the well has not been secured previously, there is potential for spill to the environment.

1.11.2	Functional Failure:	Inadequate LMRP Connection - Connect BOP and LMRP at Landing		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
1	Failure of LMRP Connector to Properly Lock and Seal (auxiliary connections)	Open C&K lines can pull seals off Incorrect alignment External Leak/Rupture - Connectors - BOP Stack (linked to 2.3.6.1) Poor wellhead surface (not cleaned) Damaged seal areas or gaskets Mechanical Failure - Connectors - BOP Stack (linked to 2.3.6.4) Loss of Function (general) - Connectors - BOP Stack (linked to 2.3.6.7)	Flow meter Type (I, P or M): I Key slots Type (I, P or M): I Overpull Type (I, P or M): I Pressure tests Type (I, P or M): M ROV inspection of connection & frame Type (I, P or M): M	There is only potential operational impact/delay, as the well is secure prior to landing BOP under this scenario. NOTE: Other connections being made between LMRP and BOP include main connection, C&K lines, 5k stab, pob wedges to lower stack.
2	Failure of Connector Integrity	External Leak/Rupture - Connectors - BOP Stack (linked to 2.3.6.1) Open C&K lines can pull seals off Incorrect alignment Poor wellhead surface (not cleaned) Damaged seal areas or gaskets Mechanical Failure - Connectors - BOP Stack (linked to 2.3.6.4) Loss of Function (general) - Connectors - BOP Stack (linked to 2.3.6.7)	Flow meter Type (I, P or M): I Key slots Type (I, P or M): I Lock indicator Type (I, P or M): I Loss of mud volume in trip tank Type (I, P or M): I Overpull Type (I, P or M): I POCV Type (I, P or M): I Required ROV inspection every 3 day, however ROV is subsea more often Type (I, P or M): I Between well clean, grease, inspect Type (I, P or M): M Chamber test Type (I, P or M): M Five year inspection of latch Type (I, P or M): M Minimum unlock pressure on surface Type (I, P or M): M New gaskets Type (I, P or M): M Pressure test every 14 days (if no test ram, connector is tested) Type (I, P or M): M ROV inspection of connection & frame Type (I, P or M): M	Significant down time that impacts operation Release of hydrocarbons to air or sea potentially resulting in spill with large impact

1.11.2	Functional Failure:	Inadequate LMRP Connection - Connect BOP and LMRP at Landing		
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**End Effects**
			Tested on surface and subsea Type (I, P or M): M	

APPENDIX B
EQUIPMENT-LEVEL FMECA WORKSHEETS

2- Equipment level FMECA

1- Surface Control Systems

2.1.1	Equipment:	HPU - Surface Control Systems		HPU, including three HPU pumps and associated piping and regulators				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
1	External Leak/ Rupture	Pump leaks Valve leaks Connections/flanges leak Piping fails Valve fails (ball, check, needle, relief) Seal/joint leaks	Frequent cycling of pumps on/off Type (I, P or M): I Low pressure alarms Type (I, P or M): I Visual indication by presence of fluid on rig Type (I, P or M): I Isolate problematic pump and continue operations with remaining pumps Type (I, P or M): P Located in climate controlled HPU room out of weather Type (I, P or M): P Daily inspection/walk through of HPU room/system Type (I, P or M): M Pumps on OEM-based maintenance schedule Type (I, P or M): M Strainers checked on regular basis (weekly) Type (I, P or M): M Surface draw down, before BOP deployment, after latch-up, every 6 months subsea Type (I, P or M): M System pump-up capacity tested between wells (30 minutes for single pump, 15 minutes for complete system) Type (I, P or M): M	Additional wear on pumps due to more frequent pump cycling (system would not be run to this point, pump isolated and removed from service/problem corrected) [Local Effects]	1	1	1	
				Continuous pumps running [Local Effects]	1	1	1	
				Increased time to return to system pressure [Local Effects]	1	1	1	
				Truncate pipe on surface, preventing fluid supply to accumulators [Local Effects]	1	1	1	
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves	8	3	2	48

2.1.1	Equipment:	HPU - Surface Control Systems		HPU, including three HPU pumps and associated piping and regulators				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				When Demanded - Failure to close and seal on the drill pipe and allow circulation on demand due to failure to close on drill pipe through annular(s) (1.1) (linked to 1.1.1.2)				
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	48
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	3	2	48
				Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
				Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	3	2	54
				Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and	9	3	2	54

2.1.1	Equipment:	HPU - Surface Control Systems		HPU, including three HPU pumps and associated piping and regulators				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)				
				Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	3	2	54
				Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	3	2	54
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	2	48
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	3	2	48
				Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	8	3	2	48
				Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	3	2	36

2.1.1	Equipment:	HPU - Surface Control Systems		HPU, including three HPU pumps and associated piping and regulators				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	3	2	36
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	3	2	36
				Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	3	2	36
				External Leak - Loss of containment - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.6.1)	10	3	1	30
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	3	2	54
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
				Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	3	2	54

2.1.1	Equipment:	HPU - Surface Control Systems		HPU, including three HPU pumps and associated piping and regulators				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	3	2	60
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	3	2	60
				Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	3	2	60
				External Leak - Loss of containment - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.7.1)	10	3	2	60
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	3	2	54
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	3	2	42
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect	9	3	2	54

2.1.1	Equipment:	HPU - Surface Control Systems		HPU, including three HPU pumps and associated piping and regulators				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				the LMRP from the Lower BOP stack (linked to 1.8.1.4)				
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	3	2	36
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	3	2	36
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	3	2	60
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	10	3	2	60
2	Internal Leak	Pump degrades (internal leak) - Wear of metal to metal seals Check valve leaks Relief valve leaks SPM valve vents Pilot valve leaks (surface SPM valve control) Regulator leaks Closed isolation valves (ball valves) Regulator fails Valve fails (ball, check, needle, relief) Trigger valve (SPM valve) does not open	Potentially notice on drawdown test Type (I, P or M): I Pressure fluctuation Type (I, P or M): I Time to return to system pressure Type (I, P or M): I Redundancy in system that minor leakage would have minimal effect on system Type (I, P or M): P	Increased time to return to system pressure [Local Effects]	1	1	1	
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close	8	3	3	72

2.1.1	Equipment:	HPU - Surface Control Systems		HPU, including three HPU pumps and associated piping and regulators				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)				
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	3	3	72
				Failure to Maintain Adequate Sealing Pressure on Annular - Failure to seal or partial seal on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.3.2)	9	3	3	81
				Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	3	81
				Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	3	3	81
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	3	3	81
				Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular -	9	3	3	81

2.1.1	Equipment:	HPU - Surface Control Systems		HPU, including three HPU pumps and associated piping and regulators				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)				
				Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	3	3	81
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
				Failure to Maintain Hydraulic Fluid & Pressure to Annulars - Failure to maintain stripping pressure - Strip the drill string using the annular BOP(s) (linked to 1.3.2.1)	9	3	3	81
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	3	3	81
				Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	8	3	3	72
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	3	3	54
				Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe	6	3	3	54

2.1.1	Equipment:	HPU - Surface Control Systems		HPU, including three HPU pumps and associated piping and regulators				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				and seal the wellbore (linked to 1.5.2.1)				
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	3	3	54
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	3	3	54
				Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	3	3	54
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	3	3	81
				Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	10	3	3	90
				Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	3	3	81
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	3	3	90

2.1.1	Equipment:	HPU - Surface Control Systems		HPU, including three HPU pumps and associated piping and regulators				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	3	3	90
				Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	3	3	90
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	3	3	90
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	3	3	63
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	3	3	54
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	3	3	54
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	3	3	90
3	Plugged	Contamination/filtering Filter media plugs Strainer basket plugs	Differential pressure monitors on filter housing (Alarmed) Type (I, P or M): I	Cavitation in pump [Local Effects]	1	1	1	

2.1.1	Equipment:	HPU - Surface Control Systems		HPU, including three HPU pumps and associated piping and regulators				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
		Organic fouling Restriction in system (filter, hose, ID of fitting)	Fluid properties to prevent organic growth Type (I, P or M): P Mix system filtration Type (I, P or M): P Mix system recirculation to prevent precipitation Type (I, P or M): P Redundant flow paths Type (I, P or M): P Relief valves in system Type (I, P or M): P HPU fluid sampling (daily)/analysis (monthly) Type (I, P or M): M Filters are replaced between wells Type (I, P or M): M Regular cleaning of strainers, remove & rinse (weekly) Type (I, P or M): M					
				Increased HP-side pressure [Local Effects]	1	1	1	
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	3	72
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	3	3	72
				Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	3	81

2.1.1	Equipment:	HPU - Surface Control Systems		HPU, including three HPU pumps and associated piping and regulators				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	3	3	81
				Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	3	81
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	3	3	81
				Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	3	3	81
				Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	3	3	81
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72

2.1.1	Equipment:	HPU - Surface Control Systems		HPU, including three HPU pumps and associated piping and regulators				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	3	3	72
				Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	8	3	3	72
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	3	3	72
				Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	3	3	54
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	3	3	54
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	3	3	54
				Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	3	3	54

2.1.1	Equipment:	HPU - Surface Control Systems		HPU, including three HPU pumps and associated piping and regulators				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Actuates Too Slowly on Demand - Closes too slowly - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.5.1)	8	3	3	72
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	3	3	81
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	3	81
				Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	3	3	81
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	3	3	90
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	3	3	90
				Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	3	3	90
				Actuates Too Slowly on Demand - Closes too slowly - Emergency	9	3	3	81

2.1.1	Equipment:	HPU - Surface Control Systems		HPU, including three HPU pumps and associated piping and regulators				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.6.1)				
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	3	3	81
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	3	81
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	3	3	63
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	3	81
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	3	3	54
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	3	3	54
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	3	3	90

2.1.1	Equipment:	HPU - Surface Control Systems		HPU, including three HPU pumps and associated piping and regulators				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
4	Mechanical Failure	Valve fails Rods fail Belt fails Motor fails Pipe works fails Pump fails Pump fails due to wear	Alarms Type (I, P or M): I Audible indication Type (I, P or M): I External Leak Type (I, P or M): I Insufficient pressure Type (I, P or M): I Pump running continuously Type (I, P or M): I Second/Third HPU pumps trip when not expected Type (I, P or M): I Redundant flow paths Type (I, P or M): P	SPM valve failure can lead to loss of hydraulic supply to stack [Local Effects]	1	1	1	
				System pressure not achieved (increase time to achieve system pressure) [Local Effects]	1	1	1	
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	4	2	64
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	4	2	64
				Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	4	2	72
				Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on	9	4	2	72

2.1.1	Equipment:	HPU - Surface Control Systems		HPU, including three HPU pumps and associated piping and regulators				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)				
				Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	4	2	72
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	4	2	72
				Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	4	2	72
				Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	4	2	72
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	4	2	64

2.1.1	Equipment:	HPU - Surface Control Systems		HPU, including three HPU pumps and associated piping and regulators				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	4	2	64
				Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	8	4	2	64
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	4	2	48
				Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	4	2	48
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	4	2	48
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	4	2	48
				Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	4	2	48
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe	9	4	2	72

2.1.1	Equipment:	HPU - Surface Control Systems		HPU, including three HPU pumps and associated piping and regulators				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				and seal the wellbore (linked to 1.6.2.1)				
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	4	2	72
				Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	4	2	72
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	4	2	80
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	4	2	80
				Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	4	2	80
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	4	2	72
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	4	2	72

2.1.1	Equipment:	HPU - Surface Control Systems		HPU, including three HPU pumps and associated piping and regulators				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	4	2	56
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	4	2	72
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	4	2	48
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	4	2	48
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	4	2	80
5	Wear	No credible causes resulting in wear of the HPU - Surface Control Systems						
6	Corrosion/Erosion	No credible causes resulting in corrosion/erosion of the HPU - Surface Control Systems	Fluid sampling/testing Type (I, P or M): M Pipe wall thickness testing Type (I, P or M): M Stainless steel piping Type (I, P or M): P					
7	Loss of Function (general)	Pump fails due to wear Regulator fails Pump leaks Valve leaks Connections/flanges leak	Alarms Type (I, P or M): I Audible indication Type (I, P or M): I Differential pressure monitors on filter housing (Alarmed)	Additional wear on pumps due to more frequent pump cycling (system would not be run to this point, pump isolated and removed from service/problem corrected) [Local Effects]	1	1	1	

2.1.1	Equipment:	HPU - Surface Control Systems		HPU, including three HPU pumps and associated piping and regulators				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
		Piping fails Relief valve leaks SPM valve vents Pilot valve leaks (surface SPM valve control) Check valve leaks Pump leaks (internal) - wear of metal to metal seals Regulator leaks Closed isolation valves (ball valves) Filter media plugs Strainer baskets plug Organic fouling Valve fails Rods break Belt fails Motor fails Valve fails (ball, check, needle, relief) Trigger valve (SPM valve) does not open Seal/joint leaks	Type (I, P or M): I External Leak Type (I, P or M): I Frequent cycling of pumps on/off Type (I, P or M): I Insufficient pressure Type (I, P or M): I Low pressure alarms Type (I, P or M): I Potentially notice on drawdown test Type (I, P or M): I Pressure fluctuation Type (I, P or M): I Pump running continuously Type (I, P or M): I Second/Third HPU pumps trip when not expected Type (I, P or M): I Time to return to system pressure Type (I, P or M): I Visual indication by presence of fluid on rig Type (I, P or M): I Fluid properties to prevent organic growth Type (I, P or M): P Isolate problematic pump and continue operations with remaining pumps Type (I, P or M): P Located in climate controlled HPU room out of weather Type (I, P or M): P Mix system filtration Type (I, P or M): P Mix system recirculation to prevent precipitation Type (I, P or M): P Redundancy in system that minor leakage would have minimal effect on system				

2.1.1	Equipment:	HPU - Surface Control Systems		HPU, including three HPU pumps and associated piping and regulators				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
			Type (I, P or M): P Redundant flow paths Type (I, P or M): P Relief valves in system Type (I, P or M): P Daily inspection/walk through of HPU room/system Type (I, P or M): M Filters are replaced between wells Type (I, P or M): M HPU fluid sampling (daily)/analysis (monthly) Type (I, P or M): M Pumps on OEM-based maintenance schedule Type (I, P or M): M Regular cleaning of strainers, remove & rinse (weekly) Type (I, P or M): M Strainers checked on regular basis (weekly) Type (I, P or M): M System pump-up capacity tested between wells (30 minutes for single pump, 15 minutes for complete system) Type (I, P or M): M Surface drawdown, before BOP deployment, after latch-up, every 6 months subsea Type (I, P or M): M				
				Cavitation in pump [Local Effects]	1	1	1	
				Continuous pumps running [Local Effects]	1	1	1	
				Increased HP-side pressure [Local Effects]	1	1	1	
				Increased time to return to system pressure [Local Effects]	1	1	1	

2.1.1	Equipment:	HPU - Surface Control Systems		HPU, including three HPU pumps and associated piping and regulators				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				SPM valve failure can lead to loss of hydraulic supply to stack [Local Effects]	1	1	1	
				System pressure not achieved (increase time to achieve system pressure) [Local Effects]	1	1	1	
				Truncate pipe on surface, preventing fluid supply to accumulators [Local Effects]	1	1	1	
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	48
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	3	2	48
				Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
				Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	3	2	54
				Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54

2.1.1	Equipment:	HPU - Surface Control Systems		HPU, including three HPU pumps and associated piping and regulators				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	3	2	54
				Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	3	2	54
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	2	48
				Failure to Maintain Hydraulic Fluid & Pressure to Annulars - Failure to maintain stripping pressure - Strip the drill string using the annular BOP(s) (linked to 1.3.2.1)	8	3	2	48
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	3	2	48
				Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	8	3	2	48

2.1.1	Equipment:	HPU - Surface Control Systems		HPU, including three HPU pumps and associated piping and regulators				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	3	2	36
				Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	3	2	36
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	3	2	36
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	3	2	36
				Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	3	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	3	2	54
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54

2.1.1	Equipment:	HPU - Surface Control Systems		HPU, including three HPU pumps and associated piping and regulators				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	3	2	54
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	3	2	60
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	3	2	60
				Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	3	2	60
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	3	2	54
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	3	2	42
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect	9	3	2	54

2.1.1	Equipment:	HPU - Surface Control Systems		HPU, including three HPU pumps and associated piping and regulators				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				the LMRP from the Lower BOP stack (linked to 1.8.1.4)				
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	3	2	36
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	3	2	36
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	3	2	60
				Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	10	3	2	60

2.1.2	Equipment:	Power - Surface Control Systems		Power including Blue & Yellow Power Distribution Panels, Power Isolation J-box; Blue & Yellow UPSs, Blue & Yellow Subsea Transformers, and yellow and blue distribution panels, umbilical J-box; and connections to associated cabinets and equipment (e.g., MUX, control panels)				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
1	Loss of Power (UPS Shuts down with power degradation)	Distribution panel fails Transformer (in UPS and in subsea power control system) fails UPS fails Power cable fails Breaker fails UPS Battery fails (only a problem if power is also lost) Electronics fail Loss of Power	Substantial alarms/notifications Type (I, P or M): I E/H Backup Type (I, P or M): P Second UPS Type (I, P or M): P Batteries are replaced on a regular basis (3 years, design life = 8 years, recommend replace every 4 to 6 years) Type (I, P or M): M Daily, the UPS runs a battery test. Type (I, P or M): M Rig does test between well to ensure UPSs will continue to run and support panels for 2 hour period Type (I, P or M): M	A UPS is a tertiary redundancy with a second UPS and rig power. [Local Effects]	1	1	1	
				Input/output transformers are single points of failure for the UPS. [Local Effects]	1	1	1	
				Inverter feeds battery and load. Loss of Inverter switches system to battery power. Auto switch to direct pass-through. Manual switch if autoswitch fails. [Local Effects]	1	1	1	
				Lose a piece of UPS but not have power loss (battery, converter, rectifier). [Local Effects]	1	1	1	
				Loss of redundancy. [Local Effects]	1	1	1	
				Per API 16D, as long as 1 UPS is fully functional, full redundancy exists. [Local Effects]	1	1	1	
				UPSs are collocated in the same room with both UPSs, CCUs, PDPs, and E/H backup. [Local Effects]	1	1	1	

2.1.2	Equipment:	Power - Surface Control Systems		Power including Blue & Yellow Power Distribution Panels, Power Isolation J-box; Blue & Yellow UPSs, Blue & Yellow Subsea Transformers, and yellow and blue distribution panels, umbilical J-box; and connections to associated cabinets and equipment (e.g., MUX, control panels)				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Provide Control Signal to Annular or C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.1)	9	2	1	18
				Failure to Provide Control Signal to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.1)	9	2	4	72
				Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
				Failure to Provide Control Signal to Annular / Blind-Shear Ram or C&K Valves When Demanded - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.1)	9	2	1	18
				Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
				Failure to Provide Control Signal to Annulars When Demanded - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.1)	9	2	1	18

2.1.2	Equipment:	Power - Surface Control Systems		Power including Blue & Yellow Power Distribution Panels, Power Isolation J-box; Blue & Yellow UPSs, Blue & Yellow Subsea Transformers, and yellow and blue distribution panels, umbilical J-box; and connections to associated cabinets and equipment (e.g., MUX, control panels)				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Provide Control Signal to Hang-off Ram When Demanded - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.1)	9	2	2	36
				Failure to Provide Control Signal to Shear Ram When Demanded - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.1)	9	1	4	36
				Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20
				Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16

2.1.2	Equipment:	Power - Surface Control Systems		Power including Blue & Yellow Power Distribution Panels, Power Isolation J-box; Blue & Yellow UPSs, Blue & Yellow Subsea Transformers, and yellow and blue distribution panels, umbilical J-box; and connections to associated cabinets and equipment (e.g., MUX, control panels)				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10
2	Fails with no output	Cable fails PDP Source select switch (One for each Blue & Yellow Pod) fails Breaker fails Electronics fail	Alarms in all panels Type (I, P or M): I Loss of Pod power for that side Type (I, P or M): I Redundant UPS and other power supplies Type (I, P or M): P Quarterly electrical system maintenance (visually inspect, tighten connections, rust/corrosion, general condition, transformer condition, clean with vacuum/low pressure air) Type (I, P or M): M	If no redundant power source exists, no alarms will be indicated (no power). [Local Effects]	1	1	1	
				Input/output transformers are single points of failure for the UPS. [Local Effects]	1	1	1	
				Inverter feeds battery and load. Loss of intverter switches system to battery power. Autoswitch to direct pass-through. Manual switch if autoswitch fails. [Local Effects]	1	1	1	
				Lose a piece of UPS but not have power loss (battery, converter, rectifier). UPS automatically switch to reserve line. [Local Effects]	1	1	1	
				Loss of redundancy [Local Effects]	1	1	1	

2.1.2	Equipment:	Power - Surface Control Systems		Power including Blue & Yellow Power Distribution Panels, Power Isolation J-box; Blue & Yellow UPSs, Blue & Yellow Subsea Transformers, and yellow and blue distribution panels, umbilical J-box; and connections to associated cabinets and equipment (e.g., MUX, control panels)				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Per API 16D, as long as 1 UPS is fully functional, full redundancy exists. [Local Effects]	1	1	1	
				UPS is a tertiary redundancy with a second UPS and rig power. [Local Effects]	1	1	1	
				UPSs are collocated in the same room with both UPSs, CCUs, PDPs, and E/H backup. [Local Effects]	1	1	1	
				Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
				Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
3	Erratic output (Erratic, Intermittent)	Loose connections Electronics fail	Quarterly electrical system maintenance (visually inspect, tighten connections, rust/corrosion, general condition, transformer condition, clean with vacuum/low pressure air) Type (I, P or M): M	Arcing/Sparking [Local Effects]	1	1	1	
				Panels that go on and off [Local Effects]	1	1	1	
				Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	3	2	1	6

2.1.2	Equipment:	Power - Surface Control Systems		Power including Blue & Yellow Power Distribution Panels, Power Isolation J-box; Blue & Yellow UPSs, Blue & Yellow Subsea Transformers, and yellow and blue distribution panels, umbilical J-box; and connections to associated cabinets and equipment (e.g., MUX, control panels)				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	3	2	1	6
4	Fails to Respond to Input	No credible causes resulting in fails to respond of the Power - Surface Control Systems						
5	Electrical Short	Cabling fails Mechanical component (i.e., selector switch) fails in a panel Connector fails Connector fails due to grounding Electronics fail	Coordinated overcurrent protection system Type (I, P or M): P Redundancy in power distribution system/paths Type (I, P or M): P Quarterly electrical system maintenance (visually inspect, tighten connections, rust/corrosion, general condition, transformer condition, clean with vacuum/low pressure air) Type (I, P or M): M	A UPS is a tertiary redundancy with a second UPS and rig power. [Local Effects]	1	1	1	
				If no redundant power source exists, no alarms will be indicated (no power). [Local Effects]	1	1	1	
				Input/output transformers are single points of failure for the UPS. [Local Effects]	1	1	1	
				Inverter feeds battery and load. Loss of inverter switches system to battery power. Autoswitch to direct pass-through. Manual switch if autoswitch fails. [Local Effects]	1	1	1	
				Lose a piece of UPS but not have power loss (battery, converter, rectifier). UPS automatically switch to reserve line. [Local Effects]	1	1	1	
				Loss of redundancy. [Local	1	1	1	

2.1.2	Equipment:	Power - Surface Control Systems		Power including Blue & Yellow Power Distribution Panels, Power Isolation J-box; Blue & Yellow UPSs, Blue & Yellow Subsea Transformers, and yellow and blue distribution panels, umbilical J-box; and connections to associated cabinets and equipment (e.g., MUX, control panels)				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Effects]				
				Per API 16D, as long as 1 UPS is fully functional, full redundancy exists. [Local Effects]	1	1	1	
				UPSs are collocated in the same room with both UPSs, CCUs, PDPs, and E/H backup. [Local Effects]	1	1	1	
				Failure to Provide Control Signal to Annular or C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.1)	9	2	1	18
				Failure to Provide Control Signal to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.1)	9	2	4	72
				Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
				Failure to Provide Control Signal to Annular / Blind-Shear Ram or C&K Valves When Demanded - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.1)	9	2	1	18

2.1.2	Equipment:	Power - Surface Control Systems		Power including Blue & Yellow Power Distribution Panels, Power Isolation J-box; Blue & Yellow UPSs, Blue & Yellow Subsea Transformers, and yellow and blue distribution panels, umbilical J-box; and connections to associated cabinets and equipment (e.g., MUX, control panels)				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
				Failure to Provide Control Signal to Annulars When Demanded - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.1)	9	2	1	18
				Failure to Provide Control Signal to Hang-off Ram When Demanded - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.1)	9	2	2	36
				Failure to Provide Control Signal to Shear Ram When Demanded - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.1)	9	1	4	36
				Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20
				Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20

2.1.2	Equipment:	Power - Surface Control Systems		Power including Blue & Yellow Power Distribution Panels, Power Isolation J-box; Blue & Yellow UPSs, Blue & Yellow Subsea Transformers, and yellow and blue distribution panels, umbilical J-box; and connections to associated cabinets and equipment (e.g., MUX, control panels)				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10
6	Loss of Function	Cable fails PDP Source select switch (One for each Blue & Yellow Pod) fails Breaker fails Electronics fail	Alarms in all panels Type (I, P or M): I Loss of Pod power for that side Type (I, P or M): I Redundant UPS and other power supplies Type (I, P or M): P Quarterly electrical system maintenance (visually inspect, tighten connections, rust/corrosion, general condition, transformer condition, clean with vacuum/low pressure air) Type (I, P or M): M	If no redundant power source exists, no alarms will be indicated (no power). [Local Effects]	1	1	1	
				Input/output transformers are single points of failure for the UPS. [Local Effects]	1	1	1	

2.1.2	Equipment:	Power - Surface Control Systems		Power including Blue & Yellow Power Distribution Panels, Power Isolation J-box; Blue & Yellow UPSs, Blue & Yellow Subsea Transformers, and yellow and blue distribution panels, umbilical J-box; and connections to associated cabinets and equipment (e.g., MUX, control panels)				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Inverter feeds battery and load. Loss of intverter switches system to battery power. Autoswitch to direct pass-through. Manual switch if autoswitch fails. [Local Effects]	1	1	1	
				Lose a piece of UPS but not have power loss (battery, converter, rectifier). UPS automatically switch to reserve line. [Local Effects]	1	1	1	
				Loss of redundancy [Local Effects]	1	1	1	
				Per API 16D, as long as 1 UPS is fully functional, full redundancy exists. [Local Effects]	1	1	1	
				UPS is a tertiary redundancy with a second UPS and rig power. [Local Effects]	1	1	1	
				UPSs are collocated in the same room with both UPSs, CCUs, PDPs, and E/H backup. [Local Effects]	1	1	1	
				Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
				Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36

2.1.2	Equipment:	Power - Surface Control Systems		Power including Blue & Yellow Power Distribution Panels, Power Isolation J-box; Blue & Yellow UPSs, Blue & Yellow Subsea Transformers, and yellow and blue distribution panels, umbilical J-box; and connections to associated cabinets and equipment (e.g., MUX, control panels)				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
7	Ground Faults	Cable/wiring fails due to pinching Water ingress (subsea) Electronics fail	Ground Fault alarm Type (I, P or M): I Quarterly electrical system maintenance (visually inspect, tighten connections, rust/corrosion, general condition, transformer condition, clean with vacuum/low pressure air) Type (I, P or M): M	Alarm indicating ground fault (floats). Second alarm indicated circuit failure. [Local Effects]	1	1	1	
				Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
				Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
8	Loss of subsea transformer	Transformer fails due to electrical short circuit Transformer fails due to mechanical damage Transformer fails due to loose connection Electronics fail	Alarms (pod mismatch, pod communications loss) Type (I, P or M): I Redundant pod with own subsea transformer Type (I, P or M): P Quarterly electrical system maintenance (visually inspect, tighten connections, rust/corrosion, general condition, transformer condition, clean with vacuum/low pressure air) Type (I, P or M): M	Loss of pod corresponding to lost subsea transformer [Local Effects]	1	1	1	
				Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
				Unintentional Closing - Unintentional closing / opening -	6	2	3	36

2.1.2	Equipment:	Power - Surface Control Systems		Power including Blue & Yellow Power Distribution Panels, Power Isolation J-box; Blue & Yellow UPSs, Blue & Yellow Subsea Transformers, and yellow and blue distribution panels, umbilical J-box; and connections to associated cabinets and equipment (e.g., MUX, control panels)				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)				

2.1.3	Equipment:	MUX System - Surface Control Systems		MUX System, including Central Control Unit with process array, blue & yellow processor array, and associate equipment and cabinets; MUX cable reels and MUX cables (to connections with Blue & Yellow Pods)				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
1	Loss of, or Degraded Power	No causes identified resulting in Loss of, or Degraded Power of the MUX System - Surface Control Systems						
2	Fails with no output signal/communication	Media converter fails Cable fails Connection breaks Software fails due to issues/anomalies/bugs Network fails Network switch fails RS-485 communications cards fail Loss of network communications Board in any of the components fails (Driller's panel, CCU, Pod) Electronics fail	Communications alarms (serial and network) Type (I, P or M): I Pod mismatch if a command is attempted Type (I, P or M): I Multiple networks Type (I, P or M): P Multiple operating stations (i.e., can operate Pod commands from CCU directly) Type (I, P or M): P Multiple pods Type (I, P or M): P Pod comms have 4 paths to each (each pod has 2 SEMs, each CCU communicates with both SEMs in both pods) Type (I, P or M): P Redundancies within systems Type (I, P or M): P Quarterly electrical system maintenance (visually inspect, tighten connections, rust/corrosion, general condition, transformer condition, clean with vacuum/low pressure air) Type (I, P or M): M Weekly functional testing - Alternate panels for test execution Type (I, P or M): M	Network outage (worst case is to/from CCU) [Local Effects]	1	1	1	
				NOTE: Network Failures could be local (to one node, more typical) or more global (network 1) [Local Effects]	1	1	1	
				Serial communications outage	1	1	1	

2.1.3	Equipment:	MUX System - Surface Control Systems		MUX System, including Central Control Unit with process array, blue & yellow processor array, and associate equipment and cabinets; MUX cable reels and MUX cables (to connections with Blue & Yellow Pods)				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				(worst case is pod communications) [Local Effects]				
				Failure to Provide Control Signal to Annular or C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.1)	9	2	1	18
				Failure to Provide Control Signal to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.1)	9	2	4	72
				Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
				Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
				Failure to Provide Control Signal to Annular / Blind-Shear Ram or C&K Valves When Demanded - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.1)	9	2	1	18

2.1.3	Equipment:	MUX System - Surface Control Systems		MUX System, including Central Control Unit with process array, blue & yellow processor array, and associate equipment and cabinets; MUX cable reels and MUX cables (to connections with Blue & Yellow Pods)				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
				Failure to Provide Control Signal to Annulars When Demanded - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.1)	9	2	1	18
				Failure to Provide Control Signal to Hang-off Ram When Demanded - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.1)	9	2	2	36
				Failure to Provide Control Signal to Shear Ram When Demanded - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.1)	9	1	4	36
				Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18

2.1.3	Equipment:	MUX System - Surface Control Systems		MUX System, including Central Control Unit with process array, blue & yellow processor array, and associate equipment and cabinets; MUX cable reels and MUX cables (to connections with Blue & Yellow Pods)				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10
3	Fails with low or high output	No credible causes resulting in fails with low or high output of the MUX System - Surface Control Systems						
4	Erratic output (Network)	Connections fails (e.g., loose) Network storm Electronics (device) fail Loss of network communications Electronics fails	Processor load alarm Type (I, P or M): I Closed system (controlled access) - Rig initiated RSN limited to GE access to data logger, which can THEN be routed into QNX. Physical connection must be made on rig by ethernet cable. Type (I, P or M): P Redundant networks Type (I, P or M): P Quarterly electrical system maintenance (visually inspect, tighten connections, rust/corrosion, general condition, transformer condition, clean with vacuum/low pressure air) Type (I, P or M): M Weekly functional testing - Alternate panels for test execution Type (I, P or M): M	Communications loss [Local Effects]	1	1	1	

2.1.3	Equipment:	MUX System - Surface Control Systems		MUX System, including Central Control Unit with process array, blue & yellow processor array, and associate equipment and cabinets; MUX cable reels and MUX cables (to connections with Blue & Yellow Pods)				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Processor loading (slowed network) [Local Effects]	1	1	1	
				Failure to Provide Control Signal to Annular or C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.1)	9	2	1	18
				Failure to Provide Control Signal to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.1)	9	2	4	72
				Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
				Failure to Provide Control Signal to Annular / Blind-Shear Ram or C&K Valves When Demanded - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.1)	9	2	1	18
				Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36

2.1.3	Equipment:	MUX System - Surface Control Systems		MUX System, including Central Control Unit with process array, blue & yellow processor array, and associate equipment and cabinets; MUX cable reels and MUX cables (to connections with Blue & Yellow Pods)				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Provide Control Signal to Annulars When Demanded - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.1)	9	2	1	18
				Failure to Provide Control Signal to Hang-off Ram When Demanded - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.1)	9	2	2	36
				Failure to Provide Control Signal to Shear Ram When Demanded - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.1)	9	1	4	36
				Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20
				Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18

2.1.3	Equipment:	MUX System - Surface Control Systems		MUX System, including Central Control Unit with process array, blue & yellow processor array, and associate equipment and cabinets; MUX cable reels and MUX cables (to connections with Blue & Yellow Pods)				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10
5	Fails to respond to input	Cable fails Connection breaks Software fails due to issues/anomalies/bugs Network fails Network switch fails RS-485 communications cards fail Media converter fails Connections fail (e.g., loose) Network storm Electronics (device) fail UPS fails Distribution panel fails Transformer (in UPS and in subsea power control system) fails Power cable fails Breaker fails UPS battery fails (only a problem if power is also lost) Loss of network communications Board in any of the components fails (Driller's panel, CCU, Pod)	Substantial alarms/notifications Type (I, P or M): I E/H Backup Type (I, P or M): P Multiple networks Type (I, P or M): P Multiple operating stations (i.e., can operate Pod commands from CCU directly) Type (I, P or M): P Multiple pods Type (I, P or M): P Redundancies within systems Type (I, P or M): P Second UPS Type (I, P or M): P Batteries are replaced on a regular basis (3 years, design life = 8 years, recommend replace every 4 to 6 years) Type (I, P or M): M Daily, the UPS runs a battery test. Type (I, P or M): M Pod comms have 4 paths to each (each pod has 2 SEMs, each CCU	Communications loss [Local Effects]	1	1	1	

2.1.3	Equipment:	MUX System - Surface Control Systems		MUX System, including Central Control Unit with process array, blue & yellow processor array, and associate equipment and cabinets; MUX cable reels and MUX cables (to connections with Blue & Yellow Pods)				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
		Electronics fails	communicates with both SEMs in both pods) Type (I, P or M): P Rig does test between well to ensure UPSs will continue to run and support panels for 2 hour period Type (I, P or M): M Communications alarms (serial and network) Type (I, P or M): I Pod mismatch if a command is attempted Type (I, P or M): I Processor load alarm Type (I, P or M): I Closed system (controlled access) - Rig initiated RSN limited to GE access to data logger, which can THEN be routed into QNX. Physical connection must be made on rig by ethernet cable. Type (I, P or M): P Redundant networks Type (I, P or M): P Quarterly electrical system maintenance (visually inspect, tighten connections, rust/corrosion, general condition, transformer condition, clean with vacuum/low pressure air) Type (I, P or M): M Weekly functional testing - Alternate panels for test execution Type (I, P or M): M				
				Input/output transformers are single points of failure for the UPS. [Local Effects]	1	1	1	
				Inverter feeds battery and load. Loss of intverter switches system to battery power. Autoswitch to	1	1	1	

2.1.3	Equipment:	MUX System - Surface Control Systems		MUX System, including Central Control Unit with process array, blue & yellow processor array, and associate equipment and cabinets; MUX cable reels and MUX cables (to connections with Blue & Yellow Pods)				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				direct pass-through. Manual switch if autoswitch fails. [Local Effects]				
				Lose a piece of UPS but not have power loss (battery, converter, rectifier). UPS automatically switch to reserve line. [Local Effects]	1	1	1	
				Loss of redundancy [Local Effects]	1	1	1	
				Network outage (worst case is to/from CCU) [Local Effects]	1	1	1	
				NOTE: Network Failures could be local (to one node, more typical) or more global (network 1) [Local Effects]	1	1	1	
				Processor loading (slowed network) [Local Effects]	1	1	1	
				Per API 16D, as long as 1 UPS is fully functional, full redundancy exists. [Local Effects]	1	1	1	1
				Serial communications outage (worst case is pod communications) [Local Effects]	1	1	1	1
				UPS is a tertiary redundancy with a second UPS and rig power. [Local Effects]	1	1	1	1
				UPSs are collocated in the same room with both UPSs, CCUs, PDPs, and E/H backup. [Local Effects]	1	1	1	1
				Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
				Failure to Provide Control Signal to Annular or C&K Valves When Demanded - Failure to close on	9	2	1	18

2.1.3	Equipment:	MUX System - Surface Control Systems		MUX System, including Central Control Unit with process array, blue & yellow processor array, and associate equipment and cabinets; MUX cable reels and MUX cables (to connections with Blue & Yellow Pods)				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.1)				
				Failure to Provide Control Signal to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.1)	9	2	4	72
				Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
				Failure to Provide Control Signal to Annular / Blind-Shear Ram or C&K Valves When Demanded - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.1)	9	2	1	18
				Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
				Failure to Provide Control Signal to Annulars When Demanded - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.1)	9	2	1	18

2.1.3	Equipment:	MUX System - Surface Control Systems		MUX System, including Central Control Unit with process array, blue & yellow processor array, and associate equipment and cabinets; MUX cable reels and MUX cables (to connections with Blue & Yellow Pods)				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Provide Control Signal to Hang-off Ram When Demanded - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.1)	9	2	2	36
				Failure to Provide Control Signal to Shear Ram When Demanded - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.1)	9	1	4	36
				Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16
				Failure to Provide Control Signal to C&K Valves when Demanded -	10	1	1	10

2.1.3	Equipment:	MUX System - Surface Control Systems		MUX System, including Central Control Unit with process array, blue & yellow processor array, and associate equipment and cabinets; MUX cable reels and MUX cables (to connections with Blue & Yellow Pods)				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)				
6	Processing error	Not applicable for this definition of "MUX System"						
7	Short	MUX Cable fails due to damage Cable fails Software fails due to issues/anomalies/bugs Network fails Network switch fails RS-485 communications cards fail Media converter fails Connection fails (e.g. Broken) MUX cable fails due to a short Loss of network communications Board in any of the components fails (Driller's panel, CCU, Pod) Electronics fail	Communications alarms (serial and network) Type (I, P or M): I Pod mismatch if a command is attempted Type (I, P or M): I Multiple networks Type (I, P or M): P Multiple operating stations (i.e., can operate Pod commands from CCU directly) Type (I, P or M): P Multiple pods Type (I, P or M): P Pod comms have 4 paths to each (each pod has 2 SEMs, each CCU communicates with both SEMs in both pods) Type (I, P or M): P Redundancies within systems Type (I, P or M): P Quarterly electrical system maintenance (visually inspect, tighten connections, rust/corrosion, general condition, transformer condition, clean with vacuum/low pressure air) Type (I, P or M): M Weekly functional testing - Alternate panels for test execution Type (I, P or M): M	Network outage (worst case is to/from CCU) [Local Effects]	1	1	1	
				NOTE: Network Failures could be local (to one node, more typical) or more global (network 1) [Local Effects]	1	1	1	

2.1.3	Equipment:	MUX System - Surface Control Systems		MUX System, including Central Control Unit with process array, blue & yellow processor array, and associate equipment and cabinets; MUX cable reels and MUX cables (to connections with Blue & Yellow Pods)				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Serial communications outage (worst case is pod communications) [Local Effects]	1	1	1	
				Failure to Provide Control Signal to Annular or C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.1)	9	2	1	18
				Failure to Provide Control Signal to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.1)	9	2	4	72
				Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
				Failure to Provide Control Signal to Annular / Blind-Shear Ram or C&K Valves When Demanded - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.1)	9	2	1	18
				Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
				Failure to Provide Control Signal to Annulars When Demanded - Failure to close annulars - Strip	9	2	1	18

2.1.3	Equipment:	MUX System - Surface Control Systems		MUX System, including Central Control Unit with process array, blue & yellow processor array, and associate equipment and cabinets; MUX cable reels and MUX cables (to connections with Blue & Yellow Pods)				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				the drill string using the annular BOP(s) (linked to 1.3.1.1)				
				Failure to Provide Control Signal to Hang-off Ram When Demanded - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.1)	9	2	2	36
				Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20
				Failure to Provide Control Signal to Shear Ram When Demanded - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.1)	9	1	4	36
				Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18

2.1.3	Equipment:	MUX System - Surface Control Systems		MUX System, including Central Control Unit with process array, blue & yellow processor array, and associate equipment and cabinets; MUX cable reels and MUX cables (to connections with Blue & Yellow Pods)				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10
8	Loss of function (general)	Slip ring fails MUX cable fails J-box fails Cables fail Connection fails (e.g., loose) Software fails due to issues/anomalies/bugs Network fails Network switch fails RS-485 communications cards fail Media converter fails Network storm Electronics (device) fail UPS fails Distribution panel fails Transformer (in UPS and in subsea power control system) fails Power cable fails Breaker fails UPS Battery fails (only a problem if power is also lost) MUX cable fails due to a short	Alarms Type (I, P or M): I Redundancy Type (I, P or M): P Between well maintenance on MUX cable Type (I, P or M): M Between well testing on all systems/redundancies Type (I, P or M): M Testing (functional, and subsea testing) Type (I, P or M): M	Network outage (worst case is to/from CCU) [Local Effects]	1	1	1	

2.1.3	Equipment:	MUX System - Surface Control Systems		MUX System, including Central Control Unit with process array, blue & yellow processor array, and associate equipment and cabinets; MUX cable reels and MUX cables (to connections with Blue & Yellow Pods)				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
		Loss of network communications Board in any of the components fails (Driller's panel, CCU, Pod) Electronics fails						
				NOTE: Network Failures could be local (to one node, more typical) or more global (network 1) [Local Effects]	1	1	1	
				Serial communications outage (worst case is pod communications) [Local Effects]	1	1	1	
				Failure to Provide Control Signal to Annular or C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.1)	9	2	1	18
				Failure to Provide Control Signal to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.1)	9	2	4	72
				Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
				Failure to Provide Control Signal to Annular / Blind-Shear Ram or C&K Valves When Demanded - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.1)	9	2	1	18

2.1.3	Equipment:	MUX System - Surface Control Systems		MUX System, including Central Control Unit with process array, blue & yellow processor array, and associate equipment and cabinets; MUX cable reels and MUX cables (to connections with Blue & Yellow Pods)				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
				Failure to Provide Control Signal to Annulars When Demanded - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.1)	9	2	1	18
				Failure to Provide Control Signal to Hang-off Ram When Demanded - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.1)	9	2	2	36
				Failure to Provide Control Signal to Shear Ram When Demanded - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.1)	9	1	4	36
				Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20
				Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20

2.1.3	Equipment:	MUX System - Surface Control Systems		MUX System, including Central Control Unit with process array, blue & yellow processor array, and associate equipment and cabinets; MUX cable reels and MUX cables (to connections with Blue & Yellow Pods)				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10
9	Mechanical Failure	Cable fails due to damage Cable fails due to reel damage Slip ring fails due to damage Electronics fail	MUX cable reels are operated/checked and greased weekly Type (I, P or M): M Subsea engineer visually inspects as part of daily walkthrough Type (I, P or M): M Redundant MUX cable deployment systems (1 for each pod) Type (I, P or M): P	Network outage (worst case is to/from CCU) [Local Effects]	1	1	1	
				NOTE: Network Failures could be local (to one node, more typical) or more global (network 1) [Local Effects]	1	1	1	
				Serial communications outage (worst case is pod communications) [Local Effects]	1	1	1	

2.1.3	Equipment:	MUX System - Surface Control Systems		MUX System, including Central Control Unit with process array, blue & yellow processor array, and associate equipment and cabinets; MUX cable reels and MUX cables (to connections with Blue & Yellow Pods)				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
				Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36

2.1.4	Equipment:	Hydraulic Supply - Surface Control Systems		Hydraulic Supply including blue & yellow hotline reels, hotline hoses (to connection at Blue & Yellow Pods) and rigid conduit (to connection with subsea accumulator system).				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
1	External Leak/Rupture	Rigid pipe hydraulic lines (drape hoses in moon pool) fail Elastomer seals in conduit lines on riser fail Moon Pool drape hoses - Flexible (API 7k) fails Hydraulic line ruptures (rigid pipe) Drape hose fails in moon pool Seal/joint leaks Seal fails on riser where stab is for choke/kill	Frequent cycling of pumps on/off Type (I, P or M): I Low pressure alarms Type (I, P or M): I ROV inspection of riser/BOP every 3 days Type (I, P or M): I Visual indication by presence of fluid on rig/in water by personnel/ROV if sufficient amount exists Type (I, P or M): I Flex hose inspection/testing annually Type (I, P or M): M System pump-up capacity tested between wells (30 minutes for single pump, 15 minutes for complete system) Type (I, P or M): M	Additional wear on pumps due to more frequent pump cycling (system would not be run to this point, pump isolated and removed from service/problem corrected) [Local Effects]	1	1	1	
				Continuous pumps running [Local Effects]	1	1	1	
				Increased time to return to system pressure (only if rupture exists with continuous loss of fluid) [Local Effects]	1	1	1	
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48

2.1.4	Equipment:	Hydraulic Supply - Surface Control Systems		Hydraulic Supply including blue & yellow hotline reels, hotline hoses (to connection at Blue & Yellow Pods) and rigid conduit (to connection with subsea accumulator system).				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Maintain Adequate Sealing Pressure on Annular - Failure to seal or partial seal on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.3.2)	9	2	3	54
				Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
				Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
				Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54
				External Leak - Loss of containment - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.8.1)	8	3	3	72
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
				Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular -	9	1	2	18

2.1.4	Equipment:	Hydraulic Supply - Surface Control Systems		Hydraulic Supply including blue & yellow hotline reels, hotline hoses (to connection at Blue & Yellow Pods) and rigid conduit (to connection with subsea accumulator system).				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)				
				Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
				Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	8	1	2	16
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
				Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
				Failure of Shear Ram to Seal On Demand - Failure to seal the	6	1	1	6

2.1.4	Equipment:	Hydraulic Supply - Surface Control Systems		Hydraulic Supply including blue & yellow hotline reels, hotline hoses (to connection at Blue & Yellow Pods) and rigid conduit (to connection with subsea accumulator system).				
Item	**Failure Mode**	**Causes**	**Indications / Protections / Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)				
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12
				Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	1	4	24
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
				Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	4	1	40
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear	10	4	1	40

2.1.4	Equipment:	Hydraulic Supply - Surface Control Systems		Hydraulic Supply including blue & yellow hotline reels, hotline hoses (to connection at Blue & Yellow Pods) and rigid conduit (to connection with subsea accumulator system).				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				the drill pipe and seal the wellbore (linked to 1.6.4.2)				
				Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	2	2	40
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12

2.1.4	Equipment:	Hydraulic Supply - Surface Control Systems		Hydraulic Supply including blue & yellow hotline reels, hotline hoses (to connection at Blue & Yellow Pods) and rigid conduit (to connection with subsea accumulator system).				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				External Leak - Loss of containment - Circulate the well after drill pipe disconnect (linked to 1.9.5.1)	8	3	3	72
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
				External Leak - Loss of containment - Circulate across the BOP stack to remove trapped gas - (linked to 1.10.4.1)	8	3	3	72
2	Internal Leak	No credible cause resulting in an internal leak of Hydraulic Supply - Surface Control Systems						
3	Plugged	No credible causes resulting in plugging of the Hydraulic Supply - Surface Control Systems						
4	Mechanical Failure	No credible causes resulting in Mechanical Failure of the Hydraulic Supply - Surface Control Systems						
5	Wear	No credible causes resulting in wear of the Hydraulic Supply - Surface Control Systems						
6	Corrosion/Erosion	No credible causes resulting in corrosion/erosion of the Hydraulic Supply - Surface Control Systems						
7	Loss of Function (general)	Rigid pipe hydraulic lines fails Elastomer seals in conduit lines on riser fail Moon Pool drape hoses - Flexible (API 7k) fails Hydraulic line ruptures (rigid pipe) Seal fails on riser where stab is for choke/kill	Frequent cycling of pumps on/off Type (I, P or M): I Low pressure alarms Type (I, P or M): I ROV inspection of riser/BOP every 3 days Type (I, P or M): I Visual indication by presence of fluid on rig/in water by personnel/ROV if sufficient	Additional wear on pumps due to more frequent pump cycling (system would not be run to this point, pump isolated and removed from service/problem corrected) [Local Effects]	1	1	1	

2.1.4	Equipment:	Hydraulic Supply - Surface Control Systems		Hydraulic Supply including blue & yellow hotline reels, hotline hoses (to connection at Blue & Yellow Pods) and rigid conduit (to connection with subsea accumulator system).				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
			amount exists Type (I, P or M): I Flex hose inspection/testing annually Type (I, P or M): M System pump-up capacity tested between wells (30 minutes for single pump, 15 minutes for complete system) Type (I, P or M): M					
				Continuous pumps running [Local Effects]	1	1	1	
				Increased time to return to system pressure (only if rupture exists with continuous loss of fluid) [Local Effects]	1	1	1	
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
				Failure to Maintain Adequate Sealing Pressure on Annular - Failure to seal or partial seal on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.3.2)	9	2	3	54
				Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill	9	3	2	54

2.1.4	Equipment:	Hydraulic Supply - Surface Control Systems		Hydraulic Supply including blue & yellow hotline reels, hotline hoses (to connection at Blue & Yellow Pods) and rigid conduit (to connection with subsea accumulator system).				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				pipe and allow circulation on demand (linked to 1.1.4.1)				
				Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
				Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54
				External Leak - Loss of containment - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.8.1)	8	3	3	72
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
				Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	1	2	18
				Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand	9	1	2	18

2.1.4	Equipment:	Hydraulic Supply - Surface Control Systems		Hydraulic Supply including blue & yellow hotline reels, hotline hoses (to connection at Blue & Yellow Pods) and rigid conduit (to connection with subsea accumulator system).				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				(linked to 1.2.1.5)				
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
				Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	8	1	2	16
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
				Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12

2.1.4	Equipment:	Hydraulic Supply - Surface Control Systems		Hydraulic Supply including blue & yellow hotline reels, hotline hoses (to connection at Blue & Yellow Pods) and rigid conduit (to connection with subsea accumulator system).				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	1	4	24
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
				Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
				Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	2	2	40

2.1.4	Equipment:	Hydraulic Supply - Surface Control Systems		Hydraulic Supply including blue & yellow hotline reels, hotline hoses (to connection at Blue & Yellow Pods) and rigid conduit (to connection with subsea accumulator system).				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
				External Leak - Loss of containment - Circulate the well after drill pipe disconnect (linked to 1.9.5.1)	8	3	3	72
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20

2.1.4	Equipment:	Hydraulic Supply - Surface Control Systems		Hydraulic Supply including blue & yellow hotline reels, hotline hoses (to connection at Blue & Yellow Pods) and rigid conduit (to connection with subsea accumulator system).				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				External Leak - Loss of containment - Circulate across the BOP stack to remove trapped gas - (linked to 1.10.4.1)	8	3	3	72

2.1.5	Equipment:	Control Panels - Surface Control Systems		Control Panels including drillers panel with system controller and tool pushers panel with system controller				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
1	Loss of, or Degraded Power	Power isolation J-box in driller's panel (monitors purge process/condition in panel) fails Power source fails Transformer(s) fails Connection fails AC Transfer switch fails Loss of Power Electronics fail	Redundant displays Type (I, P or M): P Redundant nodes (computers) Type (I, P or M): P Redundant power supplies within the panels Type (I, P or M): P Two independent and redundant driller's panels where operations could continue in the event of the loss of one train Type (I, P or M): P Quarterly electrical system maintenance (visually inspect, tighten connections, rust/corrosion, general condition, transformer condition, clean with vacuum/low pressure air) Type (I, P or M): M	Loss of a CCU (CCU required in this configuration due to setup and only way to communicated to pod control) [Local Effects]	1	1	1	
				Loss of Driller's Panel (higher temperature due to other factors, loss of rig air, opened panel door, etc.) [Local Effects]	1	1	1	
				Loss of Tool Pusher's Panel (per API only 2 panels are required, however its failure will result in down time and reporting to BSEE) [Local Effects]	1	1	1	
				Failure to Provide Control Signal to Annular or C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.1)	9	2	1	18

2.1.5	Equipment:	Control Panels - Surface Control Systems		Control Panels including drillers panel with system controller and tool pushers panel with system controller				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Provide Control Signal to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.1)	9	2	4	72
				Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
				Failure to Provide Control Signal to Annular / Blind-Shear Ram or C&K Valves When Demanded - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.1)	9	2	1	18
				Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
				Failure to Provide Control Signal to Annulars When Demanded - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.1)	9	2	1	18
				Failure to Provide Control Signal to Hang-off Ram When Demanded - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.1)	9	2	2	36
				Failure to Provide Control Signal to Shear Ram When Demanded - Failure to close - Controlled	9	1	4	36

2.1.5	Equipment:	Control Panels - Surface Control Systems		Control Panels including drillers panel with system controller and tool pushers panel with system controller				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.1)				
				Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20
				Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10

2.1.5	Equipment:	Control Panels - Surface Control Systems		Control Panels including drillers panel with system controller and tool pushers panel with system controller				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
2	Fails to respond (with no output signal/communication or to input)	Touch screen (no input to node) fails Network fails Software fails due to issues/anomalies/bugs Computer fails I/O board fails Loss of Touch Screen Loss of network communications Board in any of the components fails (Driller's panel, CCU, Pod) Electronics fail	Alarms Type (I, P or M): I Visual indication Type (I, P or M): I Redundant panels/stations Type (I, P or M): P Redundant screens Type (I, P or M): P Quarterly maintenance Type (I, P or M): M	Loss of a CCU [Local Effects]	1	1	1	
				Loss of Driller's Panel [Local Effects]	1	1	1	
				Loss of Tool Pusher's Panel [Local Effects]	1	1	1	
				Failure to Provide Control Signal to Annular or C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.1)	9	2	1	18
				Failure to Provide Control Signal to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.1)	9	2	4	72
				Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
				Failure to Provide Control Signal to Annular / Blind-Shear Ram or C&K Valves When Demanded - Failure to close on open hole through	9	2	1	18

2.1.5	Equipment:	Control Panels - Surface Control Systems		Control Panels including drillers panel with system controller and tool pushers panel with system controller				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.1)				
				Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
				Failure to Provide Control Signal to Annulars When Demanded - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.1)	9	2	1	18
				Failure to Provide Control Signal to Hang-off Ram When Demanded - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.1)	9	2	2	36
				Failure to Provide Control Signal to Shear Ram When Demanded - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.1)	9	1	4	36
				Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20
				Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically) - Failure to	10	2	1	20

2.1.5	Equipment:	Control Panels - Surface Control Systems		Control Panels including drillers panel with system controller and tool pushers panel with system controller				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)				
				Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10
3	Fails with low or high output	No credible causes resulting in fails with low or high output of the Control Panels - Surface Control Systems						
4	Erratic output	Floating electronics (digital I/O components) fails Connections fail (e.g., loose) Network storm Electronics (device) fail I/O board fails Loss of network communications Electronics fails	Design change/EB to correct issue Type (I, P or M): P Rig disconnect from BOP Type (I, P or M): P	No effect as the issue should be fixed as a result of implementing the EB. [Local Effects]	1	1	1	
				Failure to Provide Control Signal to Annular or C&K Valves When Demanded - Failure to close on	9	2	1	18

2.1.5	Equipment:	Control Panels - Surface Control Systems		Control Panels including drillers panel with system controller and tool pushers panel with system controller				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.1)				
				Failure to Provide Control Signal to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.1)	9	2	4	72
				Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
				Failure to Provide Control Signal to Annular / Blind-Shear Ram or C&K Valves When Demanded - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.1)	9	2	1	18
				Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
				Failure to Provide Control Signal to Annulars When Demanded - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.1)	9	2	1	18
				Failure to Provide Control Signal to Hang-off Ram When Demanded - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore	9	2	2	36

2.1.5	Equipment:	Control Panels - Surface Control Systems		Control Panels including drillers panel with system controller and tool pushers panel with system controller				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				(linked to 1.4.1.1)				
				Failure to Provide Control Signal to Shear Ram When Demanded - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.1)	9	1	4	36
				Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20
				Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16

2.1.5	Equipment:	Control Panels - Surface Control Systems		Control Panels including drillers panel with system controller and tool pushers panel with system controller				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10
5	Fails to respond to input	Touch screen fails Cable fails Connection fails (e.g., loose/broken) Software fails due to issues/anomalies/bugs Network fails Network switch fails RS-485 communications cards fail Media converter fails Network storm Electronics (device) fail UPS fails Distribution panel fails Transformers fail (in UPS and in subsea power control system) Power cable fails Breakers fail UPS Battery fail (only a problem if power is also lost) Loss of Power Loss of network communications Board in any of the components fails (Driller's panel, CCU, Pod) Electronics fail	Alarms Type (I, P or M): I Visual indication Type (I, P or M): I Redundant panels/stations Type (I, P or M): P Redundant screens Type (I, P or M): P Quarterly maintenance Type (I, P or M): M	Failure to Provide Control Signal to Annular or C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.1)	9	2	1	18
				Failure to Provide Control Signal to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.1)	9	2	4	72

2.1.5	Equipment:	Control Panels - Surface Control Systems		Control Panels including drillers panel with system controller and tool pushers panel with system controller				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
				Failure to Provide Control Signal to Annular / Blind-Shear Ram or C&K Valves When Demanded - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.1)	9	2	1	18
				Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
				Failure to Provide Control Signal to Annulars When Demanded - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.1)	9	2	1	18
				Failure to Provide Control Signal to Hang-off Ram When Demanded - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.1)	9	2	2	36
				Failure to Provide Control Signal to Shear Ram When Demanded - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.1)	9	1	4	36

2.1.5	Equipment:	Control Panels - Surface Control Systems		Control Panels including drillers panel with system controller and tool pushers panel with system controller				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20
				Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10
6	Processing error	Software fails due to anomalies (not addressed)						
7	Short	Cabling fails	Coordinated overcurrent	If no redundant power source	1	1	1	

2.1.5	Equipment:	Control Panels - Surface Control Systems		Control Panels including drillers panel with system controller and tool pushers panel with system controller				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
		Mechanical component (i.e., selector switch) fails in a panel Connectors fail Connector fails Electronics fail	protection system Type (I, P or M): P Redundancy in power distribution system/paths Type (I, P or M): P Quarterly electrical system maintenance (visually inspect, tighten connections, rust/corrosion, general condition, transformer condition, clean with vacuum/low pressure air) Type (I, P or M): M	exists, no alarms will be indicated (no power). [Local Effects]				
				Input/output transformers are single points of failure for the UPS. [Local Effects]	1	1	1	
				Inverter feeds battery and load. Loss of intverter switches system to battery power. Autoswitch to direct pass-through. Manual switch if autoswitch fails. [Local Effects]	1	1	1	
				Lose a piece of UPS but not have power loss (battery, converter, rectifier). UPS automatically switch to reserve line. [Local Effects]	1	1	1	
				Loss of redundancy [Local Effects]	1	1	1	
				Per API 16D, as long as 1 UPS is fully functional, full redundancy exists. [Local Effects]	1	1	1	
				UPS is a tertiary redundancy with a second UPS and rig power. [Local Effects]	1	1	1	
				UPSs are collocated in the same room with both UPSs, CCUs, PDPs, and E/H backup. [Local Effects]	1	1	1	

2.1.5	Equipment:	Control Panels - Surface Control Systems		Control Panels including drillers panel with system controller and tool pushers panel with system controller				
Item	**Failure Mode**	**Causes**	**Indications / Protections / Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
				Failure to Provide Control Signal to Annular or C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.1)	9	2	1	18
				Failure to Provide Control Signal to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.1)	9	2	4	72
				Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
				Failure to Provide Control Signal to Annular / Blind-Shear Ram or C&K Valves When Demanded - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.1)	9	2	1	18
				Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
				Failure to Provide Control Signal to	9	2	1	18

2.1.5	Equipment:	Control Panels - Surface Control Systems		Control Panels including drillers panel with system controller and tool pushers panel with system controller				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Annulars When Demanded - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.1)				
				Failure to Provide Control Signal to Hang-off Ram When Demanded - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.1)	9	2	2	36
				Failure to Provide Control Signal to Shear Ram When Demanded - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.1)	9	1	4	36
				Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16

2.1.5	Equipment:	Control Panels - Surface Control Systems		Control Panels including drillers panel with system controller and tool pushers panel with system controller				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10
8	Loss of function (general)	Touch screen fails (no input to node) Network fails Software fails due to issues/anomalies/bugs Computer fails I/O board fails Loss of network communications Electronics fail	Alarms Type (I, P or M): I Visual indication Type (I, P or M): I Redundant panels/stations Type (I, P or M): P Redundant screens Type (I, P or M): P Quarterly maintenance Type (I, P or M): M	Loss of a CCU [Local Effects]	1	1	1	
				Loss of Driller's Panel [Local Effects]	1	1	1	
				Loss of Tool Pusher's Panel [Local Effects]	1	1	1	
				Failure to Provide Control Signal to Annular or C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.1)	9	2	1	18
				Failure to Provide Control Signal to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.1)	9	2	4	72
				Unintentional Operation - Unintentional closing / opening -	6	2	4	48

2.1.5	Equipment:	Control Panels - Surface Control Systems		Control Panels including drillers panel with system controller and tool pushers panel with system controller				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)				
				Failure to Provide Control Signal to Annular / Blind-Shear Ram or C&K Valves When Demanded - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.1)	9	2	1	18
				Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
				Failure to Provide Control Signal to Annulars When Demanded - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.1)	9	2	1	18
				Failure to Provide Control Signal to Hang-off Ram When Demanded - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.1)	9	2	2	36
				Failure to Provide Control Signal to Shear Ram When Demanded - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.1)	9	1	4	36
				Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20

2.1.5	Equipment:	Control Panels - Surface Control Systems		Control Panels including drillers panel with system controller and tool pushers panel with system controller				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10

2.1.6	Equipment:	Accumulators - Surface - Surface Control Systems		Accumulators - Surface including one 300 gal., 5K rack; one 180 gal 5K accumulator rack and associated ball valve; and connectors to HPU				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
1	External Leak/Rupture	Valve fails (manifold isolation and block & bleed) Piping flange seal leaks Piping fails Pressure gauge fails Gas charging valves fail Accumulator bottles fails Accumulator gas valve leaks Accumulator fails due to insufficient charge Accumulator fails due to insufficient fluid/pressure to complete full/tight closure	Hydraulic fluid on rig Type (I, P or M): I Low accumulator pressure alarms Type (I, P or M): I Subsea Engineer daily walkthrough of room (collocated HPU, FRU, & accumulators) Type (I, P or M): I Unanticipated cycling of HPU/Pumps running Type (I, P or M): I All pipework is secured/protected Type (I, P or M): P Isolate accumulator banks from system and apply pressure to system directly from HPU pumps Type (I, P or M): P Isolation valves Type (I, P or M): P Stack-mounted accumulator bottles Type (I, P or M): P System is located inside, away from elements Type (I, P or M): P Draw down tests between wells Type (I, P or M): M Five year wall thickness tests Type (I, P or M): M Precharge pressure test Type (I, P or M): M	Per regulation, cannot continue operations without surface accumulators (discontinue operations until restored) [Local Effects]	1	1	1	
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure	8	2	3	48

2.1.6	Equipment:	Accumulators - Surface - Surface Control Systems		Accumulators - Surface including one 300 gal., 5K rack; one 180 gal 5K accumulator rack and associated ball valve; and connectors to HPU				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)				
				Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
				Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
				Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
				Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	1	2	18
				Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear	9	1	2	18

2.1.6	Equipment:	Accumulators - Surface - Surface Control Systems		Accumulators - Surface including one 300 gal., 5K rack; one 180 gal 5K accumulator rack and associated ball valve; and connectors to HPU				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)				
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
				Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	8	1	2	16
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
				Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6

2.1.6	Equipment:	Accumulators - Surface - Surface Control Systems		Accumulators - Surface including one 300 gal., 5K rack; one 180 gal 5K accumulator rack and associated ball valve; and connectors to HPU				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12
				Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	1	4	24
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
				Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	5	4	2	40
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
				Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120

2.1.6	Equipment:	Accumulators - Surface - Surface Control Systems		Accumulators - Surface including one 300 gal., 5K rack; one 180 gal 5K accumulator rack and associated ball valve; and connectors to HPU				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
				Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	2	2	40
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the	6	1	2	12

2.1.6	Equipment:	Accumulators - Surface - Surface Control Systems		Accumulators - Surface including one 300 gal., 5K rack; one 180 gal 5K accumulator rack and associated ball valve; and connectors to HPU				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				well after drill pipe disconnect (linked to 1.9.4.2)				
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
2	Internal Leak	Accumulator bottle bladder fails from fatigue, or precharge is too low. Accumulator bladder fails Accumulator fails due to insufficient charge Accumulator fails due to insufficient fluid/pressure to complete full/tight closure	Delta in draw down test end pressure Type (I, P or M): I 60 surface accumulator bottles Type (I, P or M): P Precharge testing Type (I, P or M): M	Insufficient usable volume in system (if unable to complete EDS) [Local Effects]	1	1	1	
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
				Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
				Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe	9	2	3	54

2.1.6	Equipment:	Accumulators - Surface - Surface Control Systems		Accumulators - Surface including one 300 gal., 5K rack; one 180 gal 5K accumulator rack and associated ball valve; and connectors to HPU				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				and allow circulation on demand (linked to 1.1.4.2)				
				Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
				Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	1	2	18
				Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72

2.1.6	Equipment:	Accumulators - Surface - Surface Control Systems		Accumulators - Surface including one 300 gal., 5K rack; one 180 gal 5K accumulator rack and associated ball valve; and connectors to HPU				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
				Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	8	1	2	16
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
				Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12
				Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	1	4	24
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation -	9	1	4	36

2.1.6	Equipment:	Accumulators - Surface - Surface Control Systems		Accumulators - Surface including one 300 gal., 5K rack; one 180 gal 5K accumulator rack and associated ball valve; and connectors to HPU				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)				
				Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	5	4	2	40
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
				Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
				Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	2	2	40
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation:	9	1	3	27

2.1.6	Equipment:	Accumulators - Surface - Surface Control Systems		Accumulators - Surface including one 300 gal., 5K rack; one 180 gal 5K accumulator rack and associated ball valve; and connectors to HPU				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				EDS - Disconnect from the stack (linked to 1.7.2.3)				
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
3	Plugged	Debris		Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	3	2	60

2.1.6	Equipment:	Accumulators - Surface - Surface Control Systems		Accumulators - Surface including one 300 gal., 5K rack; one 180 gal 5K accumulator rack and associated ball valve; and connectors to HPU				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
4	Mechanical Failure	Loss of precharge in a single bottle when bladder and poppet fail Accumulator bladder fails Accumulator fails due to insufficient fluid/pressure to complete full/tight closure	Delta in draw down test end pressure Type (I, P or M): I Sixty surface accumulator bottles Type (I, P or M): P	Insufficient usable volume in system (if unable to complete EDS) [Local Effects]	1	1	1	
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
				Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
				Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
				Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear	9	1	2	18

2.1.6	Equipment:	Accumulators - Surface - Surface Control Systems		Accumulators - Surface including one 300 gal., 5K rack; one 180 gal 5K accumulator rack and associated ball valve; and connectors to HPU				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)				
				Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	1	2	18
				Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
				Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	8	1	2	16
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation -	6	1	4	24

2.1.6	Equipment:	Accumulators - Surface - Surface Control Systems		Accumulators - Surface including one 300 gal., 5K rack; one 180 gal 5K accumulator rack and associated ball valve; and connectors to HPU				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)				
				Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12
				Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	1	4	24
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
				Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18

2.1.6	Equipment:	Accumulators - Surface - Surface Control Systems		Accumulators - Surface including one 300 gal., 5K rack; one 180 gal 5K accumulator rack and associated ball valve; and connectors to HPU				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
				Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	2	2	40
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure	6	1	2	12

2.1.6	Equipment:	Accumulators - Surface - Surface Control Systems		Accumulators - Surface including one 300 gal., 5K rack; one 180 gal 5K accumulator rack and associated ball valve; and connectors to HPU				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)				
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
5	Wear	Ball valve fails due to wear Accumulator bladder fails due to wear Poppet fails due to wear Gas charging valves fail Accumulator bladder fails Accumulator gas valve leaks Accumulators fails due to insufficient charge Accumulator fails due to insufficient fluid/pressure to complete full/tight closure	Between well draw down test Type (I, P or M): M Precharge pressure test Type (I, P or M): M	Down time/System isolation [Local Effects]	1	1	1	
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48

2.1.6	Equipment:	Accumulators - Surface - Surface Control Systems		Accumulators - Surface including one 300 gal., 5K rack; one 180 gal 5K accumulator rack and associated ball valve; and connectors to HPU				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
				Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
				Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
				Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	1	2	18
				Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18

2.1.6	Equipment:	Accumulators - Surface - Surface Control Systems		Accumulators - Surface including one 300 gal., 5K rack; one 180 gal 5K accumulator rack and associated ball valve; and connectors to HPU				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
				Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	8	1	2	16
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
				Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12
				Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the	6	1	4	24

2.1.6	Equipment:	Accumulators - Surface - Surface Control Systems		Accumulators - Surface including one 300 gal., 5K rack; one 180 gal 5K accumulator rack and associated ball valve; and connectors to HPU				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				drill pipe and seal the wellbore (linked to 1.5.4.2)				
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
				Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	5	4	2	40
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
				Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
				Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and	10	2	2	40

2.1.6	Equipment:	Accumulators - Surface - Surface Control Systems		Accumulators - Surface including one 300 gal., 5K rack; one 180 gal 5K accumulator rack and associated ball valve; and connectors to HPU				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				seal the wellbore (linked to 1.6.5.2)				
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20

2.1.6	Equipment:	Accumulators - Surface - Surface Control Systems		Accumulators - Surface including one 300 gal., 5K rack; one 180 gal 5K accumulator rack and associated ball valve; and connectors to HPU				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
6	Corrosion/Erosion	No credible causes resulting in corrosion/erosion of the Accumulators - Surface - Surface Control Systems						
7	Loss of Function (general)	Accumulator bladder fails Accumulator gas valve leaks Valve fails (manifold isolation and block & bleed) Flange seal fails Piping fails Pressure gauges fail Gas charging valves fail Accumulator bottles fail Accumulator bottle bladder fails from fatigue, or precharge is too low. Loss of precharge in a single bottle when bladder and poppet fail Ball valve fails due to wear Accumulator bladder fails due to wear Poppet fails due to wear Accumulators fail due to insufficient charge Accumulator fails due to insufficient fluid/pressure to complete full/tight closure	Hydraulic fluid on rig Type (I, P or M): I Low accumulator pressure alarms Type (I, P or M): I Subsea Engineer daily walkthrough of room (collocated HPU, FRU, & accumulators) Type (I, P or M): I Unanticipated cycling of HPU/Pumps running Type (I, P or M): I All pipework is secured/protected Type (I, P or M): P Isolate accumulator banks from system and apply pressure to system directly from HPU pumps Type (I, P or M): P Isolation valves Type (I, P or M): P Sixty surface accumulator bottles Type (I, P or M): P Stack-mounted accumulator bottles Type (I, P or M): P System is located inside, away from elements Type (I, P or M): P Draw down tests between wells Type (I, P or M): M Five year wall thickness tests Type (I, P or M): M Precharge pressure test Type (I, P or M): M	Down time/System isolation [Local Effects]	1	1	1	
				Insufficient usable volume in system (if unable to complete EDS) [Local Effects]	1	1	1	

2.1.6	Equipment:	Accumulators - Surface - Surface Control Systems		Accumulators - Surface including one 300 gal., 5K rack; one 180 gal 5K accumulator rack and associated ball valve; and connectors to HPU				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Per regulation, cannot continue operations without surface accumulators (discontinue operations until restored) [Local Effects]	1	1	1	
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
				Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
				Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
				Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-	9	1	2	18

2.1.6	Equipment:	Accumulators - Surface - Surface Control Systems		Accumulators - Surface including one 300 gal., 5K rack; one 180 gal 5K accumulator rack and associated ball valve; and connectors to HPU				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)				
				Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	1	2	18
				Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
				Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	8	1	2	16

2.1.6	Equipment:	Accumulators - Surface - Surface Control Systems		Accumulators - Surface including one 300 gal., 5K rack; one 180 gal 5K accumulator rack and associated ball valve; and connectors to HPU				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
				Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12
				Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	1	4	24
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
				Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	5	4	2	40
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency	9	3	2	54

2.1.6	Equipment:	Accumulators - Surface - Surface Control Systems		Accumulators - Surface including one 300 gal., 5K rack; one 180 gal 5K accumulator rack and associated ball valve; and connectors to HPU				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)				
				Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
				Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	2	2	40
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54

2.1.6	Equipment:	Accumulators - Surface - Surface Control Systems		Accumulators - Surface including one 300 gal., 5K rack; one 180 gal 5K accumulator rack and associated ball valve; and connectors to HPU				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20

2.1.7	Equipment:	Fluid Reservoir Unit - Surface Control Systems		Fluid Reservoir Unit, including 650 gal. glycol, 550 gal concentrate, and 1350 gal mixed fluid reservoirs; glycol, concentrate, and mixed fluid pumps; and associated piping,				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
1	External Leak/Rupture	Reservoir/tank leaks Pump leaks Valve leaks (ball, check, needle) Connections/flanges leak Piping fails Pneumatic equipment unit (PNEU) fails due to standard hard pipe PNEU failures Tank drain ball valves leaks Incoming air lubrication valve (LP-1) leaks Valve fails (ball, check, needle, relief) Seal/joint leaks	Low level alarms in tanks Type (I, P or M): I Visual indication of fluid Type (I, P or M): I Periodic maintenance of hydraulic accumulator system (weekly, monthly, quarterly). Some specific to FRU. Type (I, P or M): M	Inadequate fluid supply to HPU [Local Effects]	1	1	1	
				Incorrect mix ratios if leak occurs between concentrate/water tank and mix tank [Local Effects]	1	1	1	
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
				Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to	9	1	2	18

2.1.7	Equipment:	Fluid Reservoir Unit - Surface Control Systems		Fluid Reservoir Unit, including 650 gal. glycol, 550 gal concentrate, and 1350 gal mixed fluid reservoirs; glycol, concentrate, and mixed fluid pumps; and associated piping,				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)				
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
				Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation:	9	1	3	27

2.1.7	Equipment:	Fluid Reservoir Unit - Surface Control Systems		Fluid Reservoir Unit, including 650 gal. glycol, 550 gal concentrate, and 1350 gal mixed fluid reservoirs; glycol, concentrate, and mixed fluid pumps; and associated piping,				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				EDS - Disconnect from the stack (linked to 1.7.2.3)				
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
2	Internal Leak	Pump relief valves leak Pump fails (i.e., internal leak) due to wear of metal to metal seals Regulator leaks Closed isolation valves (ball valves) Flow control valve from Potable	Incorrect fluid composition Type (I, P or M): I Overflow of mix tank Type (I, P or M): I Hydraulic fluid sampled daily, tested monthly Type (I, P or M): M	Incorrect indication of concentration levels [Local Effects]	1	1	1	

2.1.7	Equipment:	Fluid Reservoir Unit - Surface Control Systems		Fluid Reservoir Unit, including 650 gal. glycol, 550 gal concentrate, and 1350 gal mixed fluid reservoirs; glycol, concentrate, and mixed fluid pumps; and associated piping,				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
		water (FC1-1) leaks Regulator fails						
				Failure to Maintain Adequate Sealing Pressure on Annular - Failure to seal or partial seal on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.3.2)	9	2	3	54
				Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
				Failure to Maintain Hydraulic Fluid & Pressure to Annulars - Failure to maintain stripping pressure - Strip the drill string using the annular BOP(s) (linked to 1.3.2.1)	9	2	2	36
3	Plugged	Incoming air filter failsdue to plugging Potable water filter (FL5-1) fails due to plugging Concentrate Supply Filters fail due to plugging Recirculation pump filter fails due to plugging Tank ventilation filters fails due to plugging (i.e., FL8-1,2) Contamination/filtering Filters/strainers fail due to plugging	Differential pressure on recirculation pump Type (I, P or M): I Incorrect mix ratios Type (I, P or M): I Low level on mixed reservoir Type (I, P or M): I Pressurize/collapse tanks Type (I, P or M): I Filters replaced between wells Type (I, P or M): M Sample fluid daily, test monthly Type (I, P or M): M Strainers cleaned weekly Type (I, P or M): M	Inadequate fluid supply to HPU [Local Effects]	1	1	1	
				Incorrect mix ratios if leak occurs between concentrate/water tank and mix tank [Local Effects]	1	1	1	

2.1.7	Equipment:	Fluid Reservoir Unit - Surface Control Systems		Fluid Reservoir Unit, including 650 gal. glycol, 550 gal concentrate, and 1350 gal mixed fluid reservoirs; glycol, concentrate, and mixed fluid pumps; and associated piping,				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
				Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation -	6	1	4	24

2.1.7	Equipment:	Fluid Reservoir Unit - Surface Control Systems		Fluid Reservoir Unit, including 650 gal. glycol, 550 gal concentrate, and 1350 gal mixed fluid reservoirs; glycol, concentrate, and mixed fluid pumps; and associated piping,				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)				
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12

2.1.7	Equipment:	Fluid Reservoir Unit - Surface Control Systems		Fluid Reservoir Unit, including 650 gal. glycol, 550 gal concentrate, and 1350 gal mixed fluid reservoirs; glycol, concentrate, and mixed fluid pumps; and associated piping,				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
4	Mechanical Failure	Pump fails Check valve fails due to loss of (CV3-9) Pneumatic Equipment Unit (PNEU) Supply Ball valve fails Level switch fails Valve fails (ball, check, needle, relief)	Differential pressure on recirculation pump Type (I, P or M): I Incorrect mix ratios Type (I, P or M): I Low level on mixed reservoir Type (I, P or M): I Reduced mixing efficiency Type (I, P or M): I Sample fluid daily, test monthly Type (I, P or M): M	Reduced mixing efficiency [Local Effects]	1	1	1	
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow	9	1	2	18

2.1.7	Equipment:	Fluid Reservoir Unit - Surface Control Systems		Fluid Reservoir Unit, including 650 gal. glycol, 550 gal concentrate, and 1350 gal mixed fluid reservoirs; glycol, concentrate, and mixed fluid pumps; and associated piping,				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				volumetric well control operations on demand (linked to 1.2.1.2)				
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12

2.1.7	Equipment:	Fluid Reservoir Unit - Surface Control Systems		Fluid Reservoir Unit, including 650 gal. glycol, 550 gal concentrate, and 1350 gal mixed fluid reservoirs; glycol, concentrate, and mixed fluid pumps; and associated piping,				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
5	Wear	Fluid Reservoir Unit fails due to insufficient air lubrication Pump fails due to internal wear	Audible indication of pump wear Type (I, P or M): I Incorrect fluid mixing Type (I, P or M): I Quarterly pump oil change, cleaned, inspected Type (I, P or M): M Weekly pump efficiency test Type (I, P or M): M	Reduced mixing efficiency [Local Effects]	1	1	1	
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	2	1	3	6
6	Corrosion/Erosion	No credible causes resulting in corrosion/erosion of the Fluid Reservoir Unit - Surface Control Systems						
7	Loss of Function (general)	Regulator fails Reservoir/tank leaks Pump leaks Valve leaks (ball, check, needle) Connections/flanges leak Piping fails Pneumatic Equipment Unit (PNEU) fails due to loss of air supply Tank drain ball valves leaks	Audible indication of pump wear Type (I, P or M): I Differential pressure on recirculation pump Type (I, P or M): I Incorrect fluid composition Type (I, P or M): I Incorrect mix ratios/fluid mixing Type (I, P or M): I Low level alarm on mixed	Inadequate fluid supply to HPU [Local Effects]	1	1	1	

2.1.7	Equipment:	Fluid Reservoir Unit - Surface Control Systems		Fluid Reservoir Unit, including 650 gal. glycol, 550 gal concentrate, and 1350 gal mixed fluid reservoirs; glycol, concentrate, and mixed fluid pumps; and associated piping,				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
		Incoming air lubrication valve (LP-1) leaks Pump relief valves leak Pump fails (internal leak) due to wear of metal to metal seals Regulator leaks Closed isolation valves (ball valves) Flow control valve from Potable water (FC1-1) fails Filters/strainers fail due to plugging Incoming air filter fails due to plugging Potable water filter (FL5-1) fail due to plugging Concentrate Supply Filters fail due to plugging Recirculation pump filter fails due to plugging Tank ventilation filters fail due to plugging (i.e., FL8-1,2) Pump fails Check valve fails due to loss of (CV3-9) Pneumatic Equipment Unit (PNEU) Supply Ball valve fails Level switch fails Fluid Reservoir Unit fails due to insufficient air lubrication Pump fails due to internal wear Valve fails (ball, check, needle, relief) Seal/joint leaks	reservoir Type (I, P or M): I Low level alarms in tanks Type (I, P or M): I Overflow of mix tank Type (I, P or M): I Pressurize/collapse tanks Type (I, P or M): I Reduced mixing efficiency Type (I, P or M): I Visual indication of fluid Type (I, P or M): I Filters replaced between well Type (I, P or M): M Hydraulic fluid sampled daily, tested monthly Type (I, P or M): M Periodic maintenance of hydraulic accumulator system (weekly, monthly, quarterly). Some specific to FRU. Type (I, P or M): M Quarterly pump oil change, cleaned, inspected Type (I, P or M): M Sample fluid daily, test monthly Type (I, P or M): M Strainers cleaned weekly Type (I, P or M): M Weekly pump efficiency test Type (I, P or M): M					
				Incorrect indication of concentration levels [Local Effects]	1	1	1	
				Incorrect mix ratios if leak occurs between concentrate/water tank	1	1	1	

2.1.7	Equipment:	Fluid Reservoir Unit - Surface Control Systems		Fluid Reservoir Unit, including 650 gal. glycol, 550 gal concentrate, and 1350 gal mixed fluid reservoirs; glycol, concentrate, and mixed fluid pumps; and associated piping,				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				and mix tank [Local Effects]				
				Reduced mixing efficiency [Local Effects]	1	1	1	
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
				Failure to Maintain Adequate Sealing Pressure on Annular - Failure to seal or partial seal on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.3.2)	9	2	3	54
				Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
				Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s)	8	3	3	72

2.1.7	Equipment:	Fluid Reservoir Unit - Surface Control Systems		Fluid Reservoir Unit, including 650 gal. glycol, 550 gal concentrate, and 1350 gal mixed fluid reservoirs; glycol, concentrate, and mixed fluid pumps; and associated piping,				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				(linked to 1.3.1.2)				
				Failure to Maintain Hydraulic Fluid & Pressure to Annulars - Failure to maintain stripping pressure - Strip the drill string using the annular BOP(s) (linked to 1.3.2.1)	9	2	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54
				Failure of Hydraulic Fluid to	7	1	2	14

2.1.7	Equipment:	Fluid Reservoir Unit - Surface Control Systems		Fluid Reservoir Unit, including 650 gal. glycol, 550 gal concentrate, and 1350 gal mixed fluid reservoirs; glycol, concentrate, and mixed fluid pumps; and associated piping,				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)				
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20

2.1.8	Equipment:	Secondary & Emergency Control Systems - Surface Control Systems		Secondary & Emergency Control Systems including associated MUX Control System equipment & Surface ERA				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
1	Loss of, or Degraded Power	UPS fails (own, separate UPS failure) Cable/connection fails (EH panel is located next to EH UPS) Loss of Power	UPS does own self-diagnostic testing, however it is NOT connected to main control system and user would have to be in room to know UPS has a failure Type (I, P or M): I Can directly connect generator power to EH system Type (I, P or M): P Deadman or autoshear (assuming it is armed) Type (I, P or M): P Redundant pods Type (I, P or M): P ROV intervention Type (I, P or M): P EH backup is function tested between wells only Type (I, P or M): M Quarterly maintenance for electrical Type (I, P or M): M	EH backup system would not function (All other primary and secondary means of communications with well and well control have been defeated prior to EH attempt). EH backup would primarily be used in a well control situation, not station keeping where EDS would/could be used [Local Effects]	1	1	1	
				Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20
				Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP -	9	2	1	18

2.1.8	Equipment:	Secondary & Emergency Control Systems - Surface Control Systems		Secondary & Emergency Control Systems including associated MUX Control System equipment & Surface ERA				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)				
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10
2	Fails with no output signal/communication (Includes Short)	Electrical power fails Internal panel fails (electrical or mechanical) MUX cable fails MUX cable fails due to a short	UPS does own self-diagnostic testing, however it is NOT connected to main control system and user would have to be in room to know UPS has a failure Type (I, P or M): I Can directly connect generator power to EH system Type (I, P or M): P Deadman or autoshear (assuming it is armed) Type (I, P or M): P Redundant pods Type (I, P or M): P ROV intervention Type (I, P or M): P EH backup is function tested between wells only Type (I, P or M): M Quarterly maintenance for electrical Type (I, P or M): M	EH backup system would not function (All other primary and secondary means of communications with well and well control have been defeated prior to EH attempt). EH backup would primarily be used in a well control situation, not station keeping where EDS would/could be used [Local Effects]	1	1	1	

2.1.8	Equipment:	Secondary & Emergency Control Systems - Surface Control Systems		Secondary & Emergency Control Systems including associated MUX Control System equipment & Surface ERA				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20
				Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10
3	Loss of function (general)	UPS fails (own, separate UPS failure) Cable/connection fails (EH panel is	UPS does own self-diagnostic testing, however it is NOT connected to main control system and user would have to be in	EH backup system would not function (All other primary and secondary means of communications with well and well	1	1	1	

2.1.8	Equipment:	Secondary & Emergency Control Systems - Surface Control Systems		Secondary & Emergency Control Systems including associated MUX Control System equipment & Surface ERA				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
		located next to EH UPS) Electrical power fails Internal panel fails (electrical or mechanical) MUX cable fails MUX cable fails due to a short	room to know UPS has a failure Type (I, P or M): I EH backup is function tested between wells only Type (I, P or M): M Quarterly maintenance for electrical Type (I, P or M): M Can directly connect generator power to EH system Type (I, P or M): P Deadman or autoshear (assuming it is armed) Type (I, P or M): P Redundant pods Type (I, P or M): P ROV intervention Type (I, P or M): P	control have been defeated prior to EH attempt). EH backup would primarily be used in a well control situation, not station keeping where EDS would/could be used [Local Effects]				
				Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20
				Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18

2.1.8	Equipment:	Secondary & Emergency Control Systems - Surface Control Systems		Secondary & Emergency Control Systems including associated MUX Control System equipment & Surface ERA				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10

2- Subsea Control Systems

2.2.1	Equipment:	Blue & Yellow Control Systems - Electrical - Subsea Control Systems		Blue & Yellow Control Systems including MUX control, MUX POD power & communication, hydraulic connections within the pod, E/H section (hydraulics, power, communication, SEM interface, pressure, temperature, and water sensors, transformer, pod cabling, solenoid boards, solenoids.				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
1	Loss of, or Degraded Power	MUX cable fails Transformer fails Power supply fails Loss of Power due to water ingress Subsea connector fails MUX cable fails due to a short Connector fails due to grounding Loss of Power Connector fails due to mechanical issues Electronics fail	Alarms - Loss of a power supply Type (I, P or M): I Failure of individual functions of a controller do NOT necessarily constitute a failure or loss of the controller or pod's SEM Type (I, P or M): P Redundant pod Type (I, P or M): P Redundant within the pod (with the exception of a connector failure). Multiple power supplies, transformers, controllers in each pod. Type (I, P or M): P Between well surface testing Type (I, P or M): M Weekly BOP function tests Type (I, P or M): M	Degraded control of the pod (Degraded Power) [Local Effects]	1	1	1	
				Loss of control of the pod (Assumes Loss of power) [Local Effects]	1	1	1	
				Failure to Provide Control Signal to Annular or C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.1)	9	2	4	72
				Failure to Provide Control Signal to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.1)	9	2	4	72
				Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe	6	2	4	48

2.2.1	Equipment:	Blue & Yellow Control Systems - Electrical - Subsea Control Systems		Blue & Yellow Control Systems including MUX control, MUX POD power & communication, hydraulic connections within the pod, E/H section (hydraulics, power, communication, SEM interface, pressure, temperature, and water sensors, transformer, pod cabling, solenoid boards, solenoids.				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				and allow circulation on demand (linked to 1.1.5.1)				
				Failure to Provide Control Signal to Annular / Blind-Shear Ram or C&K Valves When Demanded - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.1)	9	2	1	18
				Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
				Failure to Provide Control Signal to Annulars When Demanded - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.1)	9	2	1	18
				Failure to Provide Control Signal to Hang-off Ram When Demanded - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.1)	9	2	2	36
				Failure to Provide Control Signal to Shear Ram When Demanded - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.1)	9	1	4	36
				Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20

2.2.1	Equipment:	Blue & Yellow Control Systems - Electrical - Subsea Control Systems		Blue & Yellow Control Systems including MUX control, MUX POD power & communication, hydraulic connections within the pod, E/H section (hydraulics, power, communication, SEM interface, pressure, temperature, and water sensors, transformer, pod cabling, solenoid boards, solenoids.				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10
2	Fails with no output signal/communication	Controller A/B fails Controller A/B communications fail SEM fails/communications fail I/O board fails Solenoid driver board fails Solenoid fails to fire	Alarms on solenoids, controllers, I/Os Type (I, P or M): I Pod mismatch alarms Type (I, P or M): I For solenoid failure - Annual signature tests, constantly	Controller failure [Local Effects]	1	1	1	

2.2.1	Equipment:	Blue & Yellow Control Systems - Electrical - Subsea Control Systems		Blue & Yellow Control Systems including MUX control, MUX POD power & communication, hydraulic connections within the pod, E/H section (hydraulics, power, communication, SEM interface, pressure, temperature, and water sensors, transformer, pod cabling, solenoid boards, solenoids.				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
		Solenoid fails I/O board fails Electronics fail	monitored Type (I, P or M): I One complete set of solenoid control boards per controller Type (I, P or M): P ROV intervention for critical operations Type (I, P or M): P Two controllers per pod Type (I, P or M): P Two pods Type (I, P or M): P Between well surface testing Type (I, P or M): M Weekly BOP function testing Type (I, P or M): M					
				Pod Failure [Local Effects]	1	1	1	
				Failure to Provide Control Signal to Annular or C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.1)	9	2	1	18
				Failure to Provide Control Signal to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.1)	9	2	4	72
				Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
				Failure to Provide Control Signal to Annular / Blind-Shear Ram or C&K Valves When Demanded - Failure	9	2	1	18

2.2.1	Equipment:	Blue & Yellow Control Systems - Electrical - Subsea Control Systems		Blue & Yellow Control Systems including MUX control, MUX POD power & communication, hydraulic connections within the pod, E/H section (hydraulics, power, communication, SEM interface, pressure, temperature, and water sensors, transformer, pod cabling, solenoid boards, solenoids.				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.1)				
				Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
				Failure to Provide Control Signal to Annulars When Demanded - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.1)	9	2	1	18
				Failure to Provide Control Signal to Hang-off Ram When Demanded - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.1)	9	2	2	36
				Failure to Provide Control Signal to Shear Ram When Demanded - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.1)	9	1	4	36
				Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20
				Failure to provide control signal, when demanded - Failure to receive EDS signal - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.1.1)	10	2	1	20

2.2.1	Equipment:	Blue & Yellow Control Systems - Electrical - Subsea Control Systems		Blue & Yellow Control Systems including MUX control, MUX POD power & communication, hydraulic connections within the pod, E/H section (hydraulics, power, communication, SEM interface, pressure, temperature, and water sensors, transformer, pod cabling, solenoid boards, solenoids.				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10
3	Erratic output	Solenoid fails due to bad connection in solenoid circuit Control system fails due to pinched wire Control system fails due to hydrostatic pressure on some connectors Connector fails due to grounding Connector fails due to mechanical issues Electronics fail	Alarms (Solenoid monitoring) Type (I, P or M): I Pod mismatch & alarm Type (I, P or M): I Voltage monitoring Alarms Type (I, P or M): I Redundant controllers Type (I, P or M): P Redundant pods Type (I, P or M): P Between well testing Type (I, P or M): M	Loss of a single function in a pod [Local Effects]	1	1	1	

2.2.1	Equipment:	Blue & Yellow Control Systems - Electrical - Subsea Control Systems		Blue & Yellow Control Systems including MUX control, MUX POD power & communication, hydraulic connections within the pod, E/H section (hydraulics, power, communication, SEM interface, pressure, temperature, and water sensors, transformer, pod cabling, solenoid boards, solenoids.				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
			Weekly BOP function testing Type (I, P or M): M					
				Failure to Provide Control Signal to Annular or C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.1)	9	2	1	18
				Failure to Provide Control Signal to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.1)	9	2	4	72
				Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
				Failure to Provide Control Signal to Annular / Blind-Shear Ram or C&K Valves When Demanded - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.1)	9	2	1	18
				Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
				Failure to Provide Control Signal to Annulars When Demanded - Failure to close annulars - Strip the drill string using the annular	9	2	1	18

2.2.1	Equipment:	Blue & Yellow Control Systems - Electrical - Subsea Control Systems		Blue & Yellow Control Systems including MUX control, MUX POD power & communication, hydraulic connections within the pod, E/H section (hydraulics, power, communication, SEM interface, pressure, temperature, and water sensors, transformer, pod cabling, solenoid boards, solenoids.				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				BOP(s) (linked to 1.3.1.1)				
				Failure to Provide Control Signal to Hang-off Ram When Demanded - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.1)	9	2	2	36
				Failure to Provide Control Signal to Shear Ram When Demanded - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.1)	9	1	4	36
				Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20
				Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect	8	2	1	16

2.2.1	Equipment:	Blue & Yellow Control Systems - Electrical - Subsea Control Systems		Blue & Yellow Control Systems including MUX control, MUX POD power & communication, hydraulic connections within the pod, E/H section (hydraulics, power, communication, SEM interface, pressure, temperature, and water sensors, transformer, pod cabling, solenoid boards, solenoids.				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				(linked to 1.9.1.1)				
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10
4	Fails to respond to input - Electrical	Controller A/B fails Controller A/B communications fail SEM fails/communications fail Solenoid driver board fails Solenoid fails to fire Solenoid fails I/O board fails Electronics fail	Alarms on solenoids, controllers, I/Os Type (I, P or M): I For solenoid failure - Annual signature tests, constantly monitored Type (I, P or M): I Pod mismatch alarms Type (I, P or M): I One complete set of solenoid control boards per controller Type (I, P or M): P ROV intervention for critical operations Type (I, P or M): P Two controllers per pod Type (I, P or M): P Two pods Type (I, P or M): P Between well surface testing Type (I, P or M): M Weekly BOP function testing Type (I, P or M): M	Controller failure [Local Effects]	1	1	1	
				Pod Failure [Local Effects]	1	1	1	
				Failure to Provide Control Signal to Annular or C&K Valves When Demanded - Failure to close on	9	2	1	18

2.2.1	Equipment:	Blue & Yellow Control Systems - Electrical - Subsea Control Systems		Blue & Yellow Control Systems including MUX control, MUX POD power & communication, hydraulic connections within the pod, E/H section (hydraulics, power, communication, SEM interface, pressure, temperature, and water sensors, transformer, pod cabling, solenoid boards, solenoids.				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.1)				
				Failure to Provide Control Signal to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.1)	9	2	4	72
				Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
				Failure to Provide Control Signal to Annular / Blind-Shear Ram or C&K Valves When Demanded - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.1)	9	2	1	18
				Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
				Failure to Provide Control Signal to Annulars When Demanded - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.1)	9	2	1	18
				Failure to Provide Control Signal to Hang-off Ram When Demanded - Failure of hang-off ram to close - Hang-off the drill pipe on a ram	9	2	2	36

2.2.1	Equipment:	Blue & Yellow Control Systems - Electrical - Subsea Control Systems		Blue & Yellow Control Systems including MUX control, MUX POD power & communication, hydraulic connections within the pod, E/H section (hydraulics, power, communication, SEM interface, pressure, temperature, and water sensors, transformer, pod cabling, solenoid boards, solenoids.				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				BOP and control the wellbore (linked to 1.4.1.1)				
				Failure to Provide Control Signal to Shear Ram When Demanded - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.1)	9	1	4	36
				Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20
				Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect	8	2	1	16

2.2.1	Equipment:	Blue & Yellow Control Systems - Electrical - Subsea Control Systems		Blue & Yellow Control Systems including MUX control, MUX POD power & communication, hydraulic connections within the pod, E/H section (hydraulics, power, communication, SEM interface, pressure, temperature, and water sensors, transformer, pod cabling, solenoid boards, solenoids.				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				(linked to 1.9.4.1)				
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10
5	Processing error	SEM/Controller Lockup = loss of a controller	Alarms on solenoids, controllers, I/Os Type (I, P or M): I For solenoid failure - Annual signature tests, constantly monitored Type (I, P or M): I Pod mismatch alarms Type (I, P or M): I One complete set of solenoid control boards per controller Type (I, P or M): P ROV intervention for critical operations Type (I, P or M): P Two controllers per pod Type (I, P or M): P Two pods Type (I, P or M): P Between well surface testing Type (I, P or M): M Weekly BOP function testing Type (I, P or M): M	Loss of a single controller within a pod [Local Effects]	1	1	1	
				Failure to provide control signal, when demanded - Failure to receive EDS signal - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.1.1)	10	2	1	20
6	Ground Fault	Control system fails due to water ingress Control system fails due to wiring damage	Alarms - Monitoring systems Type (I, P or M): I Loss of function Type (I, P or M): I	Alarm [Local Effects]	1	1	1	

2.2.1	Equipment:	Blue & Yellow Control Systems - Electrical - Subsea Control Systems		Blue & Yellow Control Systems including MUX control, MUX POD power & communication, hydraulic connections within the pod, E/H section (hydraulics, power, communication, SEM interface, pressure, temperature, and water sensors, transformer, pod cabling, solenoid boards, solenoids.				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
		Electronics fail	Redundant Pods Type (I, P or M): P					
				Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
				Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
7	Loss of function (general)	MUX cable fails Transformer fails Power supply fails Control system fails due to water ingress Subsea connector fails Controller A/B fails Controller A/B communications fail SEM fails/communications fail I/O board fails Solenoid driver board fails Solenoid fails to fire Solenoid circuit fails due to bad connection Control system fails due to pinched wire Control system fails due to Hydrostatic pressure on some connectors Solenoid fails MUX cable fails due to a short Connector fails due to grounding Loss of Power	Alarms (Solenoid monitoring) Type (I, P or M): I Alarms - Loss of a power supply Type (I, P or M): I Alarms on solenoids, controllers, I/Os Type (I, P or M): I For solenoid failure - Annual signature tests, constantly monitored Type (I, P or M): I Pod mismatch alarms Type (I, P or M): I Voltage monitoring Alarms Type (I, P or M): I Failure of individual functions of a controller does NOT necessarily constitute a failure or loss of the controller or pod's SEM Type (I, P or M): P One complete set of solenoid control boards per controller Type (I, P or M): P Redundant pods Type (I, P or M): P Redundant within the pod (with	Controller failure [Local Effects]	1	1	1	

2.2.1	Equipment:	Blue & Yellow Control Systems - Electrical - Subsea Control Systems		Blue & Yellow Control Systems including MUX control, MUX POD power & communication, hydraulic connections within the pod, E/H section (hydraulics, power, communication, SEM interface, pressure, temperature, and water sensors, transformer, pod cabling, solenoid boards, solenoids.				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
		I/O board fails Connector fails due to mechanical issues Electronics fail	the exception of a connector failure). Multiple power supplies, transformers, controllers in each pod. Type (I, P or M): P ROV intervention for critical operations Type (I, P or M): P Two controllers per pod Type (I, P or M): P Weekly BOP function tests Type (I, P or M): M Between well surface testing Type (I, P or M): M Between well testing Type (I, P or M): M					
				Degraded control of the pod (Degraded Power) [Local Effects]	1	1	1	
				Loss of control of the pod (Assumes Loss of power) [Local Effects]	1	1	1	
				Loss of a single function in a pod [Local Effects]	1	1	1	
				Pod Failure [Local Effects]	1	1	1	1
				Failure to Provide Control Signal to Annular or C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.1)	9	2	1	18
				Failure to Provide Control Signal to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.1)	9	2	4	72

2.2.1	Equipment:	Blue & Yellow Control Systems - Electrical - Subsea Control Systems		Blue & Yellow Control Systems including MUX control, MUX POD power & communication, hydraulic connections within the pod, E/H section (hydraulics, power, communication, SEM interface, pressure, temperature, and water sensors, transformer, pod cabling, solenoid boards, solenoids.				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
				Failure to Provide Control Signal to Annular / Blind-Shear Ram or C&K Valves When Demanded - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.1)	9	2	1	18
				Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
				Failure to Provide Control Signal to Annulars When Demanded - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.1)	9	2	1	18
				Failure to Provide Control Signal to Hang-off Ram When Demanded - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.1)	9	2	2	36
				Failure to Provide Control Signal to Shear Ram When Demanded - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.1)	9	1	4	36
				Failure to Provide Control Signal - Failure to Arm - Emergency	10	2	1	20

2.2.1	Equipment:	Blue & Yellow Control Systems - Electrical - Subsea Control Systems		Blue & Yellow Control Systems including MUX control, MUX POD power & communication, hydraulic connections within the pod, E/H section (hydraulics, power, communication, SEM interface, pressure, temperature, and water sensors, transformer, pod cabling, solenoid boards, solenoids.				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)				
				Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16
				Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10
8	Fails to send hydraulic pilot signal							

2.2.2	Equipment:	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems		Blue & Yellow Control Systems - Lower Valve Section including regulators and SPM valves				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
1	External Leak / Rupture	Pipe, tubing, valve fails Fittings & Seals (pipe, valve, flow meter etc.) leak Shear seal valve leaks SPM valve leaks Shuttle valve leaks Schrader valve leaks Packer seal leaks Hydraulic cylinder leaks Accumulator leaks Relief valve leaks Regulator leaks Check valve leaks Accumulator fails due to insufficient charge Pod tubing fails/leaks Pod regulator fails SPM Spool valve fails Shear seal valve fails Hydraulic line ruptures (rigid pipe) Shuttle valve fails (doesn't transition/move, stuck, leaks) Check valve fails Regulator fails Trigger valve (SPM valve) fails to open Control system fails due to insufficient charge Accumulator fails due to insufficient fluid/pressure to complete full/tight closure	Low pressure alarms Type (I, P or M): I Pumps running and pump run lights Type (I, P or M): I Pressure transducers/transmitters Type (I, P or M): I Surface and subsea flow meters Type (I, P or M): I Cross connection valve between yellow/blue supply and yellow/blue pods Type (I, P or M): P Redundant pod & pod supply Type (I, P or M): P ROV intervention Type (I, P or M): P Between well Soak test and stump test Type (I, P or M): M Weekly functions tests Type (I, P or M): M Every 6 years complete teardown and rebuild including static seals Type (I, P or M): M Visual inspection between wells Type (I, P or M): M Pod rotation every 2 years (1 year in shop as spare, 2 years on stack, then rebuild valves) Type (I, P or M): M ROV inspection every 3 days Type (I, P or M): M Regulators are rebuilt every year Type (I, P or M): M SPMs rebuilt every 3 years Type (I, P or M): M	Loss of a function [Local Effects]	1	1	1	
				Loss of Pod [Local Effects]	1	1	1	
				Partial loss of manifold functions	1	1	1	

2.2.2	Equipment:	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems		Blue & Yellow Control Systems - Lower Valve Section including regulators and SPM valves				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				[Local Effects]				
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
				Failure to Maintain Adequate Sealing Pressure on Annular - Failure to seal or partial seal on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.3.2)	9	2	3	54
				Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
				Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
				Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear	9	1	2	18

2.2.2	Equipment:	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems		Blue & Yellow Control Systems - Lower Valve Section including regulators and SPM valves				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)				
				Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	1	2	18
				Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
				Failure to Maintain Hydraulic Fluid & Pressure to Annulars - Failure to maintain stripping pressure - Strip the drill string using the annular BOP(s) (linked to 1.3.2.1)	9	2	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
				Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the	8	1	2	16

2.2.2	Equipment:	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems		Blue & Yellow Control Systems - Lower Valve Section including regulators and SPM valves				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				wellbore (linked to 1.4.2.1)				
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
				Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12
				Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	1	4	24
				External Leak - Loss of containment - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.6.1)	10	3	1	30
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
				Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-	10	2	1	20

2.2.2	Equipment:	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems		Blue & Yellow Control Systems - Lower Valve Section including regulators and SPM valves				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)				
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
				Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
				Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	2	2	40
				External Leak - Loss of containment - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.7.1)	10	2	2	40
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27

2.2.2	Equipment:	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems		Blue & Yellow Control Systems - Lower Valve Section including regulators and SPM valves				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
2	Internal Leak	Check valves leak in all regulator circuits (i.e., upper annular pressure increase)...(new drawings have dual checks) Valve leaks Accumulators fail due to bladder rupture Regulator pilot piston seal leaks All check valves leak Check valve 11 leaks	Cannot adjust pilot (pilot piston seal leak) Type (I, P or M): I Low pressure alarms Type (I, P or M): I Manifold pressure monitoring Type (I, P or M): I Pressure transducers/transmitters Type (I, P or M): I Pumps running (flow meters)	Loss of a function [Local Effects]	1	1	1	

2.2.2	Equipment:	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems		Blue & Yellow Control Systems - Lower Valve Section including regulators and SPM valves				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
		Pod regulator fails Check valve fails Accumulator bladder fails Accumulators fails due to insufficient charge Accumulators fails due to insufficient fluid/pressure to complete full/tight closure	Type (I, P or M): I Pumps running and pump run lights Type (I, P or M): I Surface and subsea flow meters Type (I, P or M): I Cross connection valve between yellow/blue supply and yellow/blue pods Type (I, P or M): P Dual check valves on regulator manifolds (not shown on current drawings, but is on Rev. H) Type (I, P or M): P Redundant pod & pod supply Type (I, P or M): P ROV intervention Type (I, P or M): P Between well Soak & Stump tests Type (I, P or M): M Every 6 years complete teardown and rebuild including static seals Type (I, P or M): M Pod rotation every 2 years (1 year in shop as spare, 2 years on stack, then rebuild valves) Type (I, P or M): M Regulators are rebuilt every year Type (I, P or M): M ROV inspection every 3 days Type (I, P or M): M SPMs rebuild every 3 years Type (I, P or M): M Weekly Function test Type (I, P or M): M Visual inspection between wells Type (I, P or M): M					
				Loss of Pod [Local Effects]	1	1	1	
				Partial loss of manifold functions [Local Effects]	1	1	1	

2.2.2	Equipment:	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems		Blue & Yellow Control Systems - Lower Valve Section including regulators and SPM valves				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	48
				Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
				Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
				Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	1	2	18
				Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand	9	1	2	18

2.2.2	Equipment:	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems		Blue & Yellow Control Systems - Lower Valve Section including regulators and SPM valves				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				(linked to 1.2.1.5)				
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
				Failure to Maintain Hydraulic Fluid & Pressure to Annulars - Failure to maintain stripping pressure - Strip the drill string using the annular BOP(s) (linked to 1.3.2.1)	9	2	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
				Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	8	1	2	16
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
				Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled	6	1	2	12

2.2.2	Equipment:	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems		Blue & Yellow Control Systems - Lower Valve Section including regulators and SPM valves				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)				
				Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	1	4	24
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
				Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	10	2	1	20
				Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
				Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to	10	2	2	40

2.2.2	Equipment:	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems		Blue & Yellow Control Systems - Lower Valve Section including regulators and SPM valves				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				1.6.5.2)				
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
3	Plugged	Filter fails due to plugging Plugged/restricted flow solenoid Bladder fails due to restriction in lines Control system failure due to filters being bypassed (fluid not being filtered before valves) Control system fails due to overlubrication of conduit Organic fouling Contamination/filtering Control system fails due to clogged/plugged path (Includes	Duration of function tests (comparison between) Type (I, P or M): I Fluid recirculated in FRU tank, fluid consumption ~1k gal per week Type (I, P or M): I Gallon counts / Flow meters Type (I, P or M): I Automatic bypass on filters Type (I, P or M): P Multiple filters in system between FRU to pod Type (I, P or M): P	Loss of a function [Local Effects]	1	1	1	

2.2.2	Equipment:	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems		Blue & Yellow Control Systems - Lower Valve Section including regulators and SPM valves				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
		filter, piping, tubing, etc.) Control system fails due to restriction in system (filter, hose, ID of fitting)	Redundant pods Type (I, P or M): P Fluid sampled daily, tested monthly Type (I, P or M): M Rigid conduit flushed after landing LMRP, after running riser Type (I, P or M): M Standard Between well & Weekly tests/maintenance (soak, stump, function) Type (I, P or M): M					
				Loss of Pod [Local Effects]	1	1	1	
				Partial loss of manifold functions [Local Effects]	1	1	1	
				Slow response, on demand [Local Effects]	1	1	1	
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	48
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
				Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
				Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams -	9	2	3	54

2.2.2	Equipment:	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems		Blue & Yellow Control Systems - Lower Valve Section including regulators and SPM valves				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)				
				Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	4	108
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
				Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	1	2	18
				Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to	8	1	4	32

2.2.2	Equipment:	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems		Blue & Yellow Control Systems - Lower Valve Section including regulators and SPM valves				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				1.4.1.2)				
				Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	8	1	2	16
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
				Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12
				Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	1	4	24
				Actuates Too Slowly on Demand - Closes too slowly - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.5.1)	8	3	2	48
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation -	9	1	4	36

2.2.2	Equipment:	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems		Blue & Yellow Control Systems - Lower Valve Section including regulators and SPM valves				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)				
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
				Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
				Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	2	2	40
				Actuates Too Slowly on Demand - Closes too slowly - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.6.1)	9	3	4	108
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27

2.2.2	Equipment:	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems		Blue & Yellow Control Systems - Lower Valve Section including regulators and SPM valves				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	4	108
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	4	108
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
4	Mechanical Failure	Hydraulic lines clogged due to particulate Regulator (metal-metal) fails Shear seals (cups, scoring in metal-metal) fail Accumulator bladders fail SPM valve seat or spring fails SPM valve springs fail due to hydrogen embrittlement (environmentally stressed	Low pressure alarms Type (I, P or M): I Pressure transducers/transmitters Type (I, P or M): I Pumps running and pump run lights Type (I, P or M): I Surface and subsea flow meters Type (I, P or M): I Cross connection valve between	Loss of a function [Local Effects]	1	1	1	

2.2.2	Equipment:	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems		Blue & Yellow Control Systems - Lower Valve Section including regulators and SPM valves				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
		corrosion) Shuttle valve stuck Shuttle valve fails to transition/move Shear seal valve fails due to malfunctions Shear seal valve stuck SPM Spool valve fails Pod regulator fails Contamination/filtering Accumulator bladder fails Regulator fails Springs fail Control system fails due to debris in system Valve fails due to binding greater than spring force (=stuck) Control system fails due to hydraulic lock (=stuck) Valve fails open so hydraulic pressure doesn't bleed off (=stuck) Trigger valve spring fails Valve seat fails (assumed trigger valve) Accumulators fails due to insufficient charge Accumulators fails due to insufficient fluid/pressure to complete full/tight closure	yellow/blue supply and yellow/blue pods Type (I, P or M): P Redundant pod & pod supply Type (I, P or M): P ROV intervention Type (I, P or M): P System design (material selection) for environment and reliability Type (I, P or M): P Weekly functions tests Type (I, P or M): M Between well Soak test and stump test Type (I, P or M): M Visual inspection between wells Type (I, P or M): M ROV inspection every 3 days Type (I, P or M): M Pod rotation every 2 years (1 year in shop as spare, 2 years on stack, then rebuild valves) Type (I, P or M): M					
				Loss of Pod [Local Effects]	1	1	1	
				Partial loss of manifold functions [Local Effects]	1	1	1	
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand	8	3	2	36

2.2.2	Equipment:	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems		Blue & Yellow Control Systems - Lower Valve Section including regulators and SPM valves				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				(linked to 1.1.1.2)				
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
				Failure to Maintain Adequate Sealing Pressure on Annular - Failure to seal or partial seal on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.3.2)	9	2	3	54
				Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
				Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
				Failure to Actuate Under Fail-safe Conditions - Failure to open / close fail-safe valves - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.6.1)	9	2	7	126
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18

2.2.2	Equipment:	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems		Blue & Yellow Control Systems - Lower Valve Section including regulators and SPM valves				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	1	2	18
				Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
				Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	8	1	2	16
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
				Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to	6	1	1	6

2.2.2	Equipment:	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems		Blue & Yellow Control Systems - Lower Valve Section including regulators and SPM valves				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				1.5.2.1)				
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12
				Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	1	4	24
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
				Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	10	2	1	20
				Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
				Failure to Maintain Sealing	10	2	6	120

2.2.2	Equipment:	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems		Blue & Yellow Control Systems - Lower Valve Section including regulators and SPM valves				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)				
				Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	2	2	40
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
5	Wear	Not an issue, as components are often swapped before wear becomes a threat/problem. Other relevant causes captured in 2.2.2.4 - Mechanical Failure						

2.2.2	Equipment:	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems		Blue & Yellow Control Systems - Lower Valve Section including regulators and SPM valves				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
6	Corrosion/Erosion	SPM Spool valve fails SPM valve seat or spring fails SPM valve springs fail due to hydrogen embrittlement (environmentally stressed corrosion) Springs fail Trigger valve spring fails Valve seat fails (assumed trigger valve)	Low pressure alarms Type (I, P or M): I Pumps running and pump run lights Type (I, P or M): I Pressure transducers/transmitters Type (I, P or M): I Surface and subsea flow meters Type (I, P or M): I Cross connection valve between yellow/blue supply and yellow/blue pods Type (I, P or M): P Redundant pod & pod supply Type (I, P or M): P ROV intervention Type (I, P or M): P System design (material selection) for environment and reliability Type (I, P or M): P Weekly functions tests Type (I, P or M): M Between well Soak test and stump test Type (I, P or M): M Visual inspection between wells Type (I, P or M): M ROV inspection every 3 days Type (I, P or M): M Pod rotation every 2 years (1 year in shop as spare, 2 years on stack, then rebuild valves) Type (I, P or M): M	Loss of a function [Local Effects]	1	1	1	
				Loss of Pod [Local Effects]	1	1	1	
				Partial loss of manifold functions [Local Effects]	1	1	1	
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe	8	3	2	48

2.2.2	Equipment:	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems		Blue & Yellow Control Systems - Lower Valve Section including regulators and SPM valves				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				and allow circulation on demand (linked to 1.1.1.2)				
				Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
				Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
				Failure to Actuate Under Fail-safe Conditions - Failure to open / close fail-safe valves - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.6.1)	9	2	7	126
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
				Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	1	2	18
				Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric	9	1	2	18

2.2.2	Equipment:	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems		Blue & Yellow Control Systems - Lower Valve Section including regulators and SPM valves				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				well control operations on demand (linked to 1.2.1.5)				
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
				Failure to Maintain Hydraulic Fluid & Pressure to Annulars - Failure to maintain stripping pressure - Strip the drill string using the annular BOP(s) (linked to 1.3.2.1)	9	2	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
				Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	8	1	2	16
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
				Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
				Failure to Maintain Sealing Pressure on Shear Ram - Failure	6	1	2	12

2.2.2	Equipment:	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems		Blue & Yellow Control Systems - Lower Valve Section including regulators and SPM valves				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)				
				Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	1	4	24
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
				Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	10	2	1	20
				Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
				Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and	10	2	2	40

2.2.2	Equipment:	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems		Blue & Yellow Control Systems - Lower Valve Section including regulators and SPM valves				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				seal the wellbore (linked to 1.6.5.2)				
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
7	Loss of Function (general)	Not considered further as potential causes have been reviewed under 2.2.2.1 through 2.2.2.6.						

2.2.3	Equipment:	Accumulators - Subsea Control Systems		Accumulators - Subsea including associated hydraulic piping and connections such as MUX pod and rigid conduit connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
1	External Leak/Rupture	Accumulator gas valve leaks Valve fails (manifold isolation and block & bleed) Flange seal leaks Piping fails Pressure gauges fail Gas charging valves fail Accumulator bottles leak Accumulators fail due to insufficient charge Accumulators fail due to insufficient fluid/pressure to complete full/tight closure	Hydraulic fluid on rig Type (I, P or M): I Low accumulator pressure alarms Type (I, P or M): I Subsea Engineer daily walkthrough of room (collocated HPU, FRU, & accumulators) Type (I, P or M): I Unanticipated cycling of HPU/Pumps running Type (I, P or M): I All pipework is secured/protected Type (I, P or M): P Isolate accumulator banks from system and apply pressure to system directly from HPU pumps Type (I, P or M): P Isolation valves Type (I, P or M): P Stack-mounted accumulator bottles Type (I, P or M): P System is located inside, away from elements Type (I, P or M): P Draw down tests between wells Type (I, P or M): M 5 year wall thickness tests Type (I, P or M): M precharge pressure test Type (I, P or M): M	Per regulation, cannot continue operations without surface accumulators (discontinue operations until restored) [Local Effects]	1	1	1	
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure	8	2	3	48

2.2.3	Equipment:	Accumulators - Subsea Control Systems		Accumulators - Subsea including associated hydraulic piping and connections such as MUX pod and rigid conduit connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)				
				Failure to Maintain Adequate Sealing Pressure on Annular - Failure to seal or partial seal on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.3.2)	9	2	3	54
				Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
				Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
				Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
				Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and	9	1	2	18

2.2.3	Equipment:	Accumulators - Subsea Control Systems		Accumulators - Subsea including associated hydraulic piping and connections such as MUX pod and rigid conduit connections				
Item	**Failure Mode**	**Causes**	**Indications / Protections / Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				allow volumetric well control operations on demand (linked to 1.2.1.4)				
				Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
				Failure to Maintain Hydraulic Fluid & Pressure to Annulars - Failure to maintain stripping pressure - Strip the drill string using the annular BOP(s) (linked to 1.3.2.1)	9	2	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
				Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the	6	1	1	6

2.2.3	Equipment:	Accumulators - Subsea Control Systems		Accumulators - Subsea including associated hydraulic piping and connections such as MUX pod and rigid conduit connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				wellbore (linked to 1.5.3.1)				
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
				Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	10	2	1	20
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
				Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27

2.2.3	Equipment:	Accumulators - Subsea Control Systems		Accumulators - Subsea including associated hydraulic piping and connections such as MUX pod and rigid conduit connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
2	Internal Leak	Accumulator bladder fails Accumulator bottle bladder fails due to fatigue, or precharge is too low. Accumulators fail due to insufficient charge Accumulators fail due to insufficient fluid/pressure to complete full/tight closure	Delta in draw down test end pressure Type (I, P or M): I Sixty surface accumulator bottles Type (I, P or M): P Precharge testing Type (I, P or M): M	Insufficient usable volume in system (if unable to complete EDS) [Local Effects]	1	1	1	

2.2.3	Equipment:	Accumulators - Subsea Control Systems		Accumulators - Subsea including associated hydraulic piping and connections such as MUX pod and rigid conduit connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
				Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
				Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
				Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
				Failure of Annular / Blind-Shear	9	1	2	18

2.2.3	Equipment:	Accumulators - Subsea Control Systems		Accumulators - Subsea including associated hydraulic piping and connections such as MUX pod and rigid conduit connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)				
				Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
				Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6

2.2.3	Equipment:	Accumulators - Subsea Control Systems		Accumulators - Subsea including associated hydraulic piping and connections such as MUX pod and rigid conduit connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
				Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	10	2	1	20
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
				Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27

2.2.3	Equipment:	Accumulators - Subsea Control Systems		Accumulators - Subsea including associated hydraulic piping and connections such as MUX pod and rigid conduit connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
3	Plugged	No credible causes resulting in plugging of the Accumulators - Subsea Control Systems						
4	Mechanical Failure	Accumulator bladder fails Loss of precharge in a single bottle when bladder and poppet fail Accumulators fail due to insufficient fluid/pressure to	Delta in draw down test end pressure Type (I, P or M): I Sixty surface accumulator bottles Type (I, P or M): P Precharge testing	Insufficient usable volume in system (if unable to complete EDS) [Local Effects]	1	1	1	

2.2.3	Equipment:	Accumulators - Subsea Control Systems		Accumulators - Subsea including associated hydraulic piping and connections such as MUX pod and rigid conduit connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
		complete full/tight closure	Type (I, P or M): M					
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
				Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
				Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
				Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18

2.2.3	Equipment:	Accumulators - Subsea Control Systems		Accumulators - Subsea including associated hydraulic piping and connections such as MUX pod and rigid conduit connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	1	2	18
				Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
				Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the	6	1	1	6

2.2.3	Equipment:	Accumulators - Subsea Control Systems		Accumulators - Subsea including associated hydraulic piping and connections such as MUX pod and rigid conduit connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				wellbore (linked to 1.5.3.1)				
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
				Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54

2.2.3	Equipment:	Accumulators - Subsea Control Systems		Accumulators - Subsea including associated hydraulic piping and connections such as MUX pod and rigid conduit connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
5	Wear	Accumulator bladder fails Accumulator gas valve leaks Ball valve fails due to wear Accumulator bladder fails due to wear Poppet fails due to wear Gas charging valve fails due to wear Accumulator fails due to insufficient fluid/pressure to complete full/tight closure Accumulators fail due to insufficient charge	Between well draw down test Type (I, P or M): M Precharge pressure test Type (I, P or M): M	Down time/System isolation [Local Effects]	1	1	1	

2.2.3	Equipment:	Accumulators - Subsea Control Systems		Accumulators - Subsea including associated hydraulic piping and connections such as MUX pod and rigid conduit connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
				Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
				Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
				Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
				Failure of Annular / Blind-Shear	9	1	2	18

2.2.3	Equipment:	Accumulators - Subsea Control Systems		Accumulators - Subsea including associated hydraulic piping and connections such as MUX pod and rigid conduit connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)				
				Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
				Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6

2.2.3	Equipment:	Accumulators - Subsea Control Systems		Accumulators - Subsea including associated hydraulic piping and connections such as MUX pod and rigid conduit connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
				Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	10	2	1	20
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
				Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27

2.2.3	Equipment:	Accumulators - Subsea Control Systems		Accumulators - Subsea including associated hydraulic piping and connections such as MUX pod and rigid conduit connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
6	Corrosion/Erosion	No credible causes resulting in corrosion/erosion of the Accumulators - Subsea Control Systems						
7	Loss of Function (general)	Accumulator bladder fails Accumulator gas valve leaks Valve fails (manifold isolation and block & bleed) Flange seal fails	Hydraulic fluid on rig Type (I, P or M): I Low accumulator pressure alarms Type (I, P or M): I Subsea Engineer daily	Down time/System isolation [Local Effects]	1	1	1	

2.2.3	Equipment:	Accumulators - Subsea Control Systems		Accumulators - Subsea including associated hydraulic piping and connections such as MUX pod and rigid conduit connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
		Piping fails Pressure gauge fails Gas charging valves fail Accumulator bottles fails Accumulator bottle bladder fails due to fatigue, or precharge is too low. Loss of precharge in a single bottle when bladder and poppet fail Ball valve fails due to wear Accumulator bladder fails due to wear Poppet fails due to wear Accumulators fails due to insufficient fluid/pressure to complete full/tight closure Accumulators fails due to insufficient charge	walkthrough of room (collocated HPU, FRU, & accumulators) Type (I, P or M): I Unanticipated cycling of HPU/Pumps running Type (I, P or M): I All pipework is secured/protected Type (I, P or M): P Isolate accumulator banks from system and apply pressure to system directly from HPU pumps Type (I, P or M): P Isolation valves Type (I, P or M): P Sixty surface accumulator bottles Type (I, P or M): P Stack-mounted accumulator bottles Type (I, P or M): P System is located inside, away from elements Type (I, P or M): P Draw down tests between wells Type (I, P or M): M Five year wall thickness tests Type (I, P or M): M precharge pressure test Type (I, P or M): M					
				Insufficient usable volume in system (if unable to complete EDS) [Local Effects]	1	1	1	
				Per regulation, cannot continue operations without surface accumulators (discontinue operations until restored) [Local Effects]	1	1	1	
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe	8	3	2	36

2.2.3	Equipment:	Accumulators - Subsea Control Systems		Accumulators - Subsea including associated hydraulic piping and connections such as MUX pod and rigid conduit connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				and allow circulation on demand (linked to 1.1.1.2)				
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
				Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
				Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
				Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
				Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to	9	1	2	18

2.2.3	Equipment:	Accumulators - Subsea Control Systems		Accumulators - Subsea including associated hydraulic piping and connections such as MUX pod and rigid conduit connections				
Item	**Failure Mode**	**Causes**	**Indications / Protections / Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				1.2.1.4)				
				Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
				Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36

2.2.3	Equipment:	Accumulators - Subsea Control Systems		Accumulators - Subsea including associated hydraulic piping and connections such as MUX pod and rigid conduit connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	10	2	1	20
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
				Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect	7	1	2	14

2.2.3	Equipment:	Accumulators - Subsea Control Systems		Accumulators - Subsea including associated hydraulic piping and connections such as MUX pod and rigid conduit connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)				
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20

2.2.4	Equipment:	EDS - Subsea Control Systems		Secondary and Emergency Disconnect System - Subsea including POD angle sensor, inclinometer, acoustic, and deadman				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
1	Loss of, or Degraded Power	Control system fails due to water ingress Subsea connector fails MUX cable fails Transformer fails Power supply fails MUX cable fails due to a short Connector fails due to grounding Loss of Power Connector fails due to mechanical issues	Alarms - Loss of a power supply Type (I, P or M): I Drill string weight Type (I, P or M): I LMRP separation indication Type (I, P or M): I Redundant pod Type (I, P or M): P Failure of individual functions of a controller do NOT necessarily constitute a failure or loss of the controller or pod's SEM Type (I, P or M): P Redundant within the pod (with the exception of a connector failure). Multiple power supplies, transformers, controllers in each pod. Type (I, P or M): P Between well surface testing Type (I, P or M): M Weekly BOP function tests Type (I, P or M): M	Degraded control of the pod (Degraded Power) [Local Effects]	1	1	1	
				Loss of control of the pod (Assumes Loss of power) [Local Effects]	1	1	1	
				Unable to complete the EDS [Local Effects]	1	1	1	
				Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
				Failure to Provide Disconnect	9	2	1	18

2.2.4	Equipment:	EDS - Subsea Control Systems		Secondary and Emergency Disconnect System - Subsea including POD angle sensor, inclinometer, acoustic, and deadman				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)				
2	Fails with no output signal/communication	Controller A/B fails Controller A/B communications fail SEM fails/communications fail I/O board fails Solenoid driver board fails Solenoid fails to fire Solenoid fails I/O board fails	Alarms on solenoids, controllers, I/Os Type (I, P or M): I For solenoid failure - Annual signature tests, constantly monitored Type (I, P or M): I Pod mismatch alarms Type (I, P or M): I One complete sets of solenoid control boards per controller Type (I, P or M): P ROV intervention for critical operations Type (I, P or M): P Two controllers per pod Type (I, P or M): P Two pods Type (I, P or M): P Between well surface testing Type (I, P or M): M Weekly BOP function testing Type (I, P or M): M	Loss of control of the pod (Assumes Loss of power) [Local Effects]	1	1	1	
				Unable to complete the EDS [Local Effects]	1	1	1	
				Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from	10	2	1	20

2.2.4	Equipment:	EDS - Subsea Control Systems		Secondary and Emergency Disconnect System - Subsea including POD angle sensor, inclinometer, acoustic, and deadman				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				the stack (linked to 1.7.2.1)				
				Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
3	Erratic output	Solenoid fails due to bad connection in circuit Control system fails due to pinched wire Control system fails due to hydrostatic pressure on some connectors Connector fails due to grounding	Alarms (Solenoid monitoring) Type (I, P or M): I Pod mismatch & alarm Type (I, P or M): I Voltage monitoring Alarms Type (I, P or M): I Redundant pods Type (I, P or M): P Redundant controllers Type (I, P or M): P Between well testing Type (I, P or M): M Weekly BOP function testing Type (I, P or M): M	Degraded control of the pod (Degraded Power) [Local Effects]	1	1	1	
				Loss of control of the pod (Assumes Loss of power) [Local Effects]	1	1	1	
				Unable to complete the EDS [Local Effects]	1	1	1	
				Unintentional initiation of EDS was a failure mode corrected by EB. [Local Effects]	1	1	1	
				Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from	10	2	1	20

2.2.4	Equipment:	EDS - Subsea Control Systems		Secondary and Emergency Disconnect System - Subsea including POD angle sensor, inclinometer, acoustic, and deadman				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				the stack (linked to 1.7.2.1)				
				Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
4	Fails to respond to input	Controller A/B fails Controller A/B communications fail SEM fails/communications fail I/O board fails Solenoid driver board fails Solenoid fails to fire Solenoid fails I/O board fails	Alarms on solenoids, controllers, I/Os Type (I, P or M): I For solenoid failure - Annual signature tests, constantly monitored Type (I, P or M): I Pod mismatch alarms Type (I, P or M): I One complete set of solenoid control boards per controller Type (I, P or M): P ROV intervention for critical operations Type (I, P or M): P Two controllers per pod Type (I, P or M): P Two pods Type (I, P or M): P Between well surface testing Type (I, P or M): M Weekly BOP function testing Type (I, P or M): M	Degraded control of the pod (Degraded Power) [Local Effects]	1	1	1	
				Loss of control of the pod (Assumes Loss of power) [Local Effects]	1	1	1	
				Unable to complete the EDS [Local Effects]	1	1	1	
				Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using	10	2	1	20

2.2.4	Equipment:	EDS - Subsea Control Systems		Secondary and Emergency Disconnect System - Subsea including POD angle sensor, inclinometer, acoustic, and deadman				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				the EDS (1.7) (linked to 1.7.1.1)				
				Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
5	Processing error	SEM/Controller Lockup = loss of a controller	Alarms on solenoids, controllers, I/Os Type (I, P or M): I For solenoid failure - Annual signature tests, constantly monitored Type (I, P or M): I Pod mismatch alarms Type (I, P or M): I One complete set of solenoid control boards per controller Type (I, P or M): P ROV intervention for critical operations Type (I, P or M): P Two controllers per pod Type (I, P or M): P Two pods Type (I, P or M): P Between well surface testing Type (I, P or M): M Weekly BOP function testing Type (I, P or M): M	Degraded control of the pod (Degraded Power) [Local Effects]	1	1	1	
				Loss of control of the pod (Assumes Loss of power) [Local Effects]	1	1	1	
				Unable to complete the EDS [Local Effects]	1	1	1	

2.2.4	Equipment:	EDS - Subsea Control Systems		Secondary and Emergency Disconnect System - Subsea including POD angle sensor, inclinometer, acoustic, and deadman				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to provide control signal, when demanded - Failure to receive EDS signal - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.1.1)	10	2	1	20
6	Ground Fault	Control system fails due to water ingress Control system fails due to damaged wiring	Alarms - Monitoring systems Type (I, P or M): I Loss of function Type (I, P or M): I Redundant Pods Type (I, P or M): P	Alarm [Local Effects]	1	1	1	
				Failure to provide control signal, when demanded - Failure to receive EDS signal - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.1.1)	2	7	1	14
7	Loss of function (general)	Transformer fails Power supply fails Control system fails due to water ingress Subsea connector fails Controller A/B fails Controller A/B communications fail SEM failure/communications fail I/O board fails Solenoid driver board fails Solenoid fails to fire Solenoid fails due to bad connection in circuit Control system fails due to pinched wire Control system fails due to hydrostatic pressure on some connectors SEM/Controller Lockup = loss of a controller Solenoid fails MUX cable fails due to a short	Alarms (Solenoid monitoring done continuously) Type (I, P or M): I Alarms - Loss of a power supply Type (I, P or M): I Alarms on solenoids (see No. 19, below), controllers, I/Os Type (I, P or M): I Drill string weight Type (I, P or M): I LMRP separation indication Type (I, P or M): I Pod mismatch alarms Type (I, P or M): I Voltage monitoring Alarms Type (I, P or M): I One complete set of solenoid control boards per controller Type (I, P or M): P Two pods Type (I, P or M): P Redundancy within a pod (with the exception of a connector failure). Multiple power supplies,	Degraded control of the pod (Degraded Power) [Local Effects]	1	1	1	

2.2.4	Equipment:	EDS - Subsea Control Systems		Secondary and Emergency Disconnect System - Subsea including POD angle sensor, inclinometer, acoustic, and deadman				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
		Connector fails due to grounding Loss of Power I/O board fails Connector fails due to mechanical issues	transformers, controllers (2) in each pod. Type (I, P or M): P ROV intervention for critical operations Type (I, P or M): P Failure of individual functions of a controller does NOT necessarily constitute a failure or loss of the controller or pod's SEM Type (I, P or M): P Weekly BOP function tests Type (I, P or M): M Between well surface testing Type (I, P or M): M For solenoid failure - Annual signature tests Type (I, P or M): M					
				Loss of control of the pod (Assumes Loss of power) [Local Effects]	1	1	1	
				Unable to complete the EDS [Local Effects]	1	1	1	
				Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
				Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18

2.2.5	Equipment:	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems						
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
1	External leak/rupture	Pipe, tubing, valve fails Fittings & Seals (pipe, valve, flow meter etc.) fail SPM valve leaks Shuttle valve leaks Hydraulic cylinder leaks Relief valve fails/leaks Regulator leaks Check valve leaks Schrader valve leaks 5k hot stabs fails Hydraulic line ruptures (rigid pipe) SPM Spool valve fails Pod tubing fails/leaks Pod regulator fails Check valve fails Shuttle valve fails (doesn't transition/move, stuck, leaks) Regulator fails Trigger valve (SPM valve) does not open Accumulator fails due to insufficient fluid/pressure to complete full/tight closure Accumulator fails due to insufficient charge Leak of LMRP (set = LMRP failures) LMRP valve fails (manifold isolation and block & bleed) LMRP flange seal fails LMRP pressure gauges fails LMRP gas charging valves fail LMRP accumulator bottles fail LMRP accumulator gas valve leaks LMRP accumulators fail due to	Low pressure alarms Type (I, P or M): I Pumps running and pump run lights Type (I, P or M): I Pressure transducers/transmitters Type (I, P or M): I Surface and subsea flow meters Type (I, P or M): I Cross connection valve between yellow/blue supply and yellow/blue pods Type (I, P or M): P LMRP accumulators Type (I, P or M): P Redundant pods Type (I, P or M): P Redundant pod supply Type (I, P or M): P Stack accumulators & valve from supply to accumulators typically closed Type (I, P or M): P ROV intervention Type (I, P or M): P Weekly functions tests Type (I, P or M): M Between well Soak test and stump test Type (I, P or M): M All stack-mounted controls rebuilt annually (including piping, regulators, check, ball, and SPM valves etc.) Type (I, P or M): M ROV inspection every 3 days Type (I, P or M): M Visual inspection between wells Type (I, P or M): M Filters replaced between wells	Loss of Pod Supply [Local Effects]	1	1	1	

2.2.5	Equipment:	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems						
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
		insufficient charge LMRP accumulators fail due to insufficient fluid/pressure to complete full/tight closure	Type (I, P or M): M					
				Loss of Stack Supply [Local Effects]	1	1	1	
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
				Failure to Maintain Adequate Sealing Pressure on Annular - Failure to seal or partial seal on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.3.2)	9	2	3	54
				Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
				Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
				Actuates Too Slowly on Demand - Closes too slowly - Close and seal	9	3	2	54

2.2.5	Equipment:	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems						
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				on the drill pipe and allow circulation on demand (linked to 1.1.7.1)				
				External Leak - Loss of containment - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.8.1)	8	3	3	72
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
				Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	1	2	18
				Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
				Failure to Maintain Hydraulic Fluid & Pressure to Annulars - Failure to maintain stripping pressure - Strip the drill string using the annular BOP(s) (linked to 1.3.2.1)	8	2	2	32
				Failure to Supply Hydraulic Fluid &	8	1	4	32

2.2.5	Equipment:	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems						
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)				
				Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	8	1	2	16
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
				Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12
				External Leak - Loss of containment - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.6.1)	10	3	1	30
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to	9	1	4	36

2.2.5	Equipment:	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems						
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				1.6.2.1)				
				Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	10	2	1	20
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
				Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
				External Leak - Loss of containment - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.7.1)	10	3	1	30
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
				Moves too slowly to disconnect -	9	3	2	54

2.2.5	Equipment:	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems						
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)				
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
				External Leak - Loss of containment - Circulate the well after drill pipe disconnect (linked to 1.9.5.1)	8	3	3	72
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
2	Internal leak	Valve leaks Accumulators (bladder rupture) fails Rigid conduit pilot operated check valves leak Rigid conduit crossover SPM leak LMRP accumulator charge SPM	Manifold pressure Type (I, P or M): I Pumps running (flow meters) Type (I, P or M): I ROV intervention Type (I, P or M): P All stack-mounted controls rebuilt	Loss of redundancy (pull LMRP) [Local Effects]	1	1	1	

2.2.5	Equipment:	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems						
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
		leaks Accumulators fail due to insufficient fluid/pressure to complete full/tight closure Accumulators fail due to insufficient charge LMRP (set = LMRP failures) leaks	annually (including piping, regulators, check, ball, and SPM valves etc.) Type (I, P or M): M Between well Soak & Stump tests Type (I, P or M): M Weekly Function test Type (I, P or M): M					
				Slower response times for LMRP Functions [Local Effects]	1	1	1	
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	48
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
				Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
				Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
				Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and	9	1	2	18

2.2.5	Equipment:	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems						
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				allow volumetric well control operations on demand (linked to 1.2.1.4)				
				Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
				Failure to Maintain Hydraulic Fluid & Pressure to Annulars - Failure to maintain stripping pressure - Strip the drill string using the annular BOP(s) (linked to 1.3.2.1)	9	2	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
				Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	8	1	2	16
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
				Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to	6	1	1	6

2.2.5	Equipment:	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems						
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				1.5.2.1)				
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
				Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	10	2	1	20
				Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120

2.2.5	Equipment:	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems						
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
3	Plugged	Filter fails due to plugging Bladder fails due to restriction in lines Subsea Control System fails due to filters bypassed (fluid not being filtered before valves) Subsea Control System fails due to overlubrication of conduit Organic fouling Contamination/filtering Subsea Control System fails due to clogged/plugged path (includes filter, piping, tubing, etc.) Subsea Control System fails due to restriction in system (filter, hose,	Fluid recirculated in FRU tank, fluid consumption ~1k gal per week Type (I, P or M): I Gallon counts / Flow meters Type (I, P or M): I Automatic bypass on filters Type (I, P or M): P Multiple filters in system between FRU to pod Type (I, P or M): P Redundant pods and conduits Type (I, P or M): P Fluid sampled daily, tested monthly	Loss of Pod [Local Effects]	1	1	1	

2.2.5	Equipment:	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems						
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
		ID of fitting)	Type (I, P or M): M Rigid conduit flushed after landing LMRP, after running riser Type (I, P or M): M Standard Between well & Weekly tests/maintenance (soak, stump, function) Type (I, P or M): M Time of function tests Type (I, P or M): M					
				Loss of Stack Supply [Local Effects]	1	1	1	
				Loss of redundancy (LMRP) [Local Effects]	1	1	1	
				Slow response, on demand [Local Effects]	1	1	1	
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
				Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
				Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe	9	2	3	54

2.2.5	Equipment:	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems						
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				and allow circulation on demand (linked to 1.1.4.2)				
				Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	4	108
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
				Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	1	2	18
				Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
				Failure to Maintain Hydraulic Fluid & Pressure to Annulars - Failure to maintain stripping pressure - Strip the drill string using the annular BOP(s) (linked to 1.3.2.1)	8	2	2	32
				Failure to Supply Hydraulic Fluid &	8	1	4	32

2.2.5	Equipment:	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems						
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)				
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
				Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
				Actuates Too Slowly on Demand - Closes too slowly - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.5.1)	8	3	2	48
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
				Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	10	2	1	20
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore	9	3	2	54

2.2.5	Equipment:	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems						
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				(linked to 1.6.3.1)				
				Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
				Actuates Too Slowly on Demand - Closes too slowly - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.6.1)	9	3	4	108
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	4	108
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
				Moves too slowly to disconnect - Failure to disconnect the LMRP -	9	3	4	108

2.2.5	Equipment:	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems						
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)				
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
				External Leak - Loss of containment - Circulate the well after drill pipe disconnect (linked to 1.9.5.1)	8	3	3	72
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
4	Mechanical Failure	Hydraulic lines clogged due to particulates Regulator (metal-metal) fails Accumulator bladders fail SPM seat or spring fails SPM springs fails due to hydrogen embrittlement (environmentally stressed corrosion) Regulator fails Shuttle valve fails stuck Shuttle valve fails to transition/move SPM Spool valve fails Accumulator bladder fails Contamination/filtering Springs fail Valve fails in stuck position due to	Low pressure alarms Type (I, P or M): I Pumps running and pump run lights Type (I, P or M): I Pressure transducers/transmitters Type (I, P or M): I Surface and subsea flow meters Type (I, P or M): I Cross connection valve between yellow/blue supply and yellow/blue pods Type (I, P or M): P Design and material selection Type (I, P or M): P Redundant pod supply Type (I, P or M): P ROV intervention Type (I, P or M): P	Loss of a function [Local Effects]	1	1	1	

2.2.5	Equipment:	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems						
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
		binding greater than spring force Subsea Control System fails due to debris in system Subsea Control System fails due to hydraulic lock (=stuck) Valve fails open when hydraulic pressure doesn't bleed off (=stuck) Trigger valve spring fails Valve seat fails (assumed trigger valve) Insufficient accumulator fluid/pressure to complete full/tight closure Accumulators are not sufficiently charged	Weekly functions tests Type (I, P or M): M Between well Soak test and stump test Type (I, P or M): M Visual inspection between wells Type (I, P or M): M ROV inspection every 3 days Type (I, P or M): M SPM valves rebuilt annually Type (I, P or M): M All stack-mounted controls rebuilt annually (including piping, regulators, check, ball, and SPM valves etc.) Type (I, P or M): M					
				Loss of Pod [Local Effects]	1	1	1	
				Partial loss of manifold functions [Local Effects]	1	1	1	
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
				Failure to Maintain Adequate Sealing Pressure on Annular - Failure to seal or partial seal on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.3.2)	9	2	3	54

2.2.5	Equipment:	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems						
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
				Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
				Failure to Actuate Under Fail-safe Conditions - Failure to open / close fail-safe valves - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.6.1)	9	2	7	126
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
				Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	1	2	18
				Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18

2.2.5	Equipment:	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems						
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
				Failure to Maintain Hydraulic Fluid & Pressure to Annulars - Failure to maintain stripping pressure - Strip the drill string using the annular BOP(s) (linked to 1.3.2.1)	8	2	2	32
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
				Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
				Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to	10	2	1	20

2.2.5	Equipment:	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems						
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				1.6.2.2)				
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
5	Wear	No credible causes resulting in wear of the Hydraulic Supply:						

2.2.5	Equipment:	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems						
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
		Rigid Conduit and Manifold - Subsea Control Systems						
6	Corrosion/Erosion	SPM valve seat or spring fails SPM valve springs fails due to hydrogen embrittlement (environmentally stressed corrosion) SPM Spool valve fails Springs fail Trigger valve spring fails Valve seat fails (assumed trigger valve)	Low pressure alarms Type (I, P or M): I Pumps running and pump run lights Type (I, P or M): I Pressure transducers/transmitters Type (I, P or M): I Surface and subsea flow meters Type (I, P or M): I Cross connection valve between yellow/blue supply and yellow/blue pods Type (I, P or M): P Redundant pod & pod supply Type (I, P or M): P ROV intervention Type (I, P or M): P System design (material selection) for environment and reliability Type (I, P or M): P Weekly functions tests Type (I, P or M): M ROV inspection every 3 days Type (I, P or M): M Between well Soak test and stump test Type (I, P or M): M Visual inspection between wells Type (I, P or M): M Pod rotation every 2 years (1 year in shop as spare, 2 years on stack, then rebuild valves) Type (I, P or M): M	Loss of a function [Local Effects]	1	1	1	
				Loss of Pod [Local Effects]	1	1	1	
				Partial loss of manifold functions [Local Effects]	1	1	1	
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves	8	3	2	36

2.2.5	Equipment:	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems						
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)				
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
				Failure to Maintain Adequate Sealing Pressure on Annular - Failure to seal or partial seal on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.3.2)	9	2	3	54
				Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
				Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
				Failure to Actuate Under Fail-safe Conditions - Failure to open / close fail-safe valves - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.6.1)	9	2	7	126
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and	9	1	2	18

2.2.5	Equipment:	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems						
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)				
				Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	1	2	18
				Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
				Failure to Maintain Hydraulic Fluid & Pressure to Annulars - Failure to maintain stripping pressure - Strip the drill string using the annular BOP(s) (linked to 1.3.2.1)	8	2	2	32
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
				Failure to Shear Pipe - Failure to shear the drill pipe - Controlled	6	1	1	6

2.2.5	Equipment:	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems						
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)				
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
				Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	10	2	1	20
				Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27

2.2.5	Equipment:	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems						
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
7	Loss of Function (general)	Not considered further as potential causes have been reviewed under 2.2.5.1 through 2.2.5.5.						

3- BOP Stack

2.3.1	Equipment:	Annulars - BOP Stack		Annulars including both lower and upper annulars, associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
1	External Leak/Rupture	BB Gasket connections (top to flex joint, bottom to connector, blind flanges and gas bleed) fail Head seal leaks to top chamber head, exit through check valve. - Wellbore to environment Upper packer (bag, annular element) fails - Wellbore leakage to riser Lower piston seals fail - Wellbore to closed side of operating system (control fluid) Lower piston seals fail - Hydraulic to wellbore Chamber head seals fail, control open fluid/pressure to environment Shuttle valve leaks Piping connections fail Seals fail due bad seal areas, swarf, dimensional [mismatch] Scoring Wear Key seating Shuttle valve fails (doesn't transition/move, stuck, leaks) Seal damage Wear seal damage/deformation at top and wedges annular piston (larger tools) Piston seal leaks Gasket fails between stack components (Wellhead to Stack to LMRP to Riser) Swarf (metal cuttings from the well) Wear on annular seal (bag) Dimensional discrepancy between ram block and cavity (wear)	Pressure loss in hydraulic system Type (I, P or M): I HPU pumps running Type (I, P or M): I Mud loss Type (I, P or M): I For Asset/Personnel protection, leakage to environment as a protection Type (I, P or M): P Redundant annulars and rams to control pressure Type (I, P or M): P Redundant pods Type (I, P or M): P Hydraulic system testing - Surface and subsea Type (I, P or M): M ROV inspection every 3 days Type (I, P or M): M Weekly function testing Type (I, P or M): M Wellbore testing Type (I, P or M): M Soak and stump tests between wells Type (I, P or M): M Undergoes annual annular replacement for PM (based on calendar date from installation, regardless of service time). Industry practice is TYPICALLY replacement between wells Type (I, P or M): M When an annular is opened, all seals are replaced before return to service Type (I, P or M): M 5 year inspection of BOP Type (I, P or M): M	Control fluid leakage to environment [Local Effects]	1	1	1	

2.3.1	Equipment:	Annulars - BOP Stack		Annulars including both lower and upper annulars, associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Control fluid leakage to wellbore [Local Effects]	1	1	1	
				Wellbore fluid leakage to environment (caught seal failures in surface testing prior to deployment, occurrence decreased if cap to test upper head seal on surface) [Local Effects]	1	1	1	
				Wellbore fluid leakage to controls [Local Effects]	1	1	1	
				Failure to Close Annular / Blind-Shear Ram on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.3)	10	2	2	40
				Failure to Close Annulars on Drill String on Demand - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.3)	8	2	2	32
				Failure of Annulars to Seal on Demand - Failure to seal - Strip the drill string using the annular BOP(s) (linked to 1.3.3.1)	8	2	2	32
				Failure to Maintain Sealing Pressure on Annulars - Failure to seal - Strip the drill string using the annular BOP(s) (linked to 1.3.3.2)	9	2	2	36
				Failure to Close Annular on Demand - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.3)	10	2	2	40
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close	10	2	2	40

2.3.1	Equipment:	Annulars - BOP Stack		Annulars including both lower and upper annulars, associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)				
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	10	2	2	40
				Failure to Close Pipe Ram on Demand - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.3)	10	2	2	40
				External Leak - Loss of containment - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.8.1)	10	2	2	40
				Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	2	2	36
				Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	2	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s)	10	2	2	40

2.3.1	Equipment:	Annulars - BOP Stack		Annulars including both lower and upper annulars, associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				(linked to 1.3.1.2)				
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	10	2	2	40
				Failure to Close Hang-off Ram on Demand - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.3)	10	2	2	40
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	9	2	2	36
				Failure to Adequately Seal under Fail-safe Conditions - Failure to open / close fail-safe valves to seal - Circulate the well after drill pipe disconnect (linked to 1.9.3.2)	10	2	2	40
				Failure to Adequately Seal under Fail-safe Condition - Failure to open / close fail-safe valves to seal - Circulate across the BOP stack to remove trapped gas (linked to 1.10.3.2)	9	2	2	40
				External Leak - Loss of containment - Circulate across the BOP stack to remove trapped gas - (linked to 1.10.4.1)	10	2	2	40
2	Internal Leak	Piston seal fails Dimensional wear Swarf Scoring Shuttle valve fails (doesn't transition/move, stuck, leaks) Wear seal damage/deformation at top and wedges annular piston	Flow meter Type (I, P or M): I HPU pumps running Type (I, P or M): I Pressure loss in hydraulic system Type (I, P or M): I Chamber test to full working pressure (3k) and operating	Degraded function of annular (Depending on severity of leak, on open side of seal, operations could continue after approval from BSEE. Leak on close side is loss of function of annular) [Local Effects]	1	1	1	

2.3.1	Equipment:	Annulars - BOP Stack		Annulars including both lower and upper annulars, associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
		(larger tools) Piston seal leaks Swarf (metal cuttings from the well) Trash in the well (swarf, concrete, etc.)	pressure (1.5k) performed annually per PM, or after annular has been opened Type (I, P or M): P Redundant annulars and rams Type (I, P or M): P Redundant pods Type (I, P or M): P Hydraulic system testing - Surface and subsea Type (I, P or M): M ROV inspection every 3 days Type (I, P or M): M Soak and stump tests between wells Type (I, P or M): M Weekly function testing Type (I, P or M): M Undergoes annual annular replacement for PM (based on calendar date from installation, regardless of service time). Industry practice is TYPICALLY replacement between wells Type (I, P or M): M When an annular is opened, all seals are replaced before return to service Type (I, P or M): M 5 year inspection of BOP Type (I, P or M): M 5 year rebuild on shuttle valves Type (I, P or M): M					
				Loss of function of annular (Severity 9 if during well control without redundancies, 7 if not during well control) [Local Effects]	1	1	1	
				Failure to Close Annular / Blind-Shear Ram on Demand - Failure to close on open hole through blind-shear rams or annular - Close and	10	2	2	40

2.3.1	Equipment:	Annulars - BOP Stack		Annulars including both lower and upper annulars, associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.3)				
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	2	1	16
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	1	16
				Failure to Close Pipe Ram on Demand - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.3)	9	2	1	18
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	10	2	1	20
				Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	10	2	1	20
				Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close	10	2	1	20

2.3.1	Equipment:	Annulars - BOP Stack		Annulars including both lower and upper annulars, associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)				
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	10	2	1	20
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	10	2	1	20
				Failure to Close Hang-off Ram on Demand - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.3)	9	2	1	18
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	9	2	1	18
				Failure to Adequately Seal under Fail-safe Conditions - Failure to open / close fail-safe valves to seal - Circulate the well after drill pipe disconnect (linked to 1.9.3.2)	10	2	1	20
				Failure to Adequately Seal under Fail-safe Condition - Failure to open / close fail-safe valves to seal - Circulate across the BOP stack to remove trapped gas (linked to 1.10.3.2)	10	2	1	20
3	Plugged	Contamination/filtering		Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) -	8	3	2	36

2.3.1	Equipment:	Annulars - BOP Stack		Annulars including both lower and upper annulars, associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)				
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
4	Mechanical Failure	Seal fails due to washout Packer/bag fails Galling between piston and body Galling between piston and sleeve Packer erosion due to wellbore flow	Redundant annulars and rams to control pressure Type (I, P or M): P Redundant pods Type (I, P or M): P Hydraulic system testing - Surface and subsea	Loss of function of annular (Severity 9 if during well control without redundancies, 7 if not during well control) [Local Effects]	1	1	1	

2.3.1	Equipment:	Annulars - BOP Stack		Annulars including both lower and upper annulars, associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
		Incorrect annular seal (bag) for drilling mud being used, resulting in premature failure Wear on annular seal (bag); [assumed same as "packer"]	Type (I, P or M): M Soak and stump tests between wells Type (I, P or M): M Five year inspection of BOP Type (I, P or M): M Wellbore testing Type (I, P or M): M Weekly function testing Type (I, P or M): M When an annular is opened, all seals are replaced before return to service Type (I, P or M): M Undergoes annual annular replacement for PM (based on calendar date from installation, regardless of service time). Industry practice is TYPICALLY replacement between wells Type (I, P or M): M Inspection of wear plates when annular is open. Wear plates replaced on 5 overhaul Type (I, P or M): M Running of Drift Tool through wellbore after performance of weekly function tests Type (I, P or M): M					
				Failure of Annular to Seal on Demand - Failure to seal or partial seal on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.3.1)	9	2	2	36
				Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to	10	2	2	40

2.3.1	Equipment:	Annulars - BOP Stack		Annulars including both lower and upper annulars, associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				1.2.1.4)				
				Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
				Failure of Annulars to Seal on Demand - Failure to seal - Strip the drill string using the annular BOP(s) (linked to 1.3.3.1)	8	2	2	32
				Failure to Maintain Sealing Pressure on Annulars - Failure to seal - Strip the drill string using the annular BOP(s) (linked to 1.3.3.2)	9	2	2	36
5	Wear	Seal fails due to age/storage related issue (UV & heat) Packer/bag fails due to wear from operations (accelerated during stripping) Lower piston seal fails - Wellbore to closed side of operating system (control fluid) Seal fails due to wear on annular seal (bag); [assumed same as "packer"]	Increased operating pressure necessary to close element Type (I, P or M): I Presence of rubber from annular in "Gumbo box" Type (I, P or M): I Chamber test to full working pressure (3k) and operating pressure (1.5k) performed annually per PM, or after annular has been opened Type (I, P or M): P Redundant annulars and rams to control pressure Type (I, P or M): P Redundant pods Type (I, P or M): P Five year dimensional inspection Type (I, P or M): M Hydraulic system testing - Surface and subsea Type (I, P or M): M Undergoes annual annular	Degraded function of annular (still works but requires higher operating pressure or more cycles before successful closure) [Local Effects]	1	1	1	

2.3.1	Equipment:	Annulars - BOP Stack		Annulars including both lower and upper annulars, associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
			replacement for PM (based on calendar date from installation, regardless of service time). Industry practice is TYPICALLY replacement between wells Type (I, P or M): M Wellbore testing Type (I, P or M): M Weekly function testing Type (I, P or M): M Soak and stump tests between wells Type (I, P or M): M					
				Loss of function of annular (Severity 9 if during well control without redundancies, 7 if not during well control) [Local Effects]	1	1	1	
				Failure to Maintain Sealing Pressure on Annulars - Failure to seal - Strip the drill string using the annular BOP(s) (linked to 1.3.3.2)	9	2	2	36
				Failure of Annular to Seal on Demand - Failure to seal or partial seal on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.3.1)	9	2	1	36
				Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	2	1	36
				Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal	9	2	1	36

2.3.1	Equipment:	Annulars - BOP Stack		Annulars including both lower and upper annulars, associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)				
				Failure of Annulars to Seal on Demand - Failure to seal - Strip the drill string using the annular BOP(s) (linked to 1.3.3.1)	9	2	1	36
6	Erosion/Corrosion	No additional causes identified resulting in erosion/corrosion of the Annulars - BOP Stack						
7	Loss of Function (general)	No additional causes identified beyond those reviewed in Annulars - BOP Stack - External Leak/Rupture - Failure of lower piston seals - Hydraulic to wellbore (2.3.1.1-5)						

2.3.2	Equipment:	Blind Shear Ram - BOP Stack		Blind Shear Ram including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
1	External Leak/Rupture	Clutch plate and bearing fails Spring fails to hold clutch plates together/locked Seals on the chamber ring fail to allow the transfer ring to move freely & doesn't allow the springs to fully engage clutch MPL assembly fails due to mechanical issues Anti-rotation pin fails due to shearing off BX Gasket connections (top and bottom and side-outs) fail Scoring Dimensional wear Key seating Bonnet door seals fail Rod packer seal fails Top seal plate fails Fluid hinge seal assembly fails Damage from shearing MPL fails Operating cylinder seal leaks Ram block seals fail Shuttle valve leaks Piping connections fails Seal damage (Elastomer) - Ram block or BOP seal plate Shuttle valve fails (doesn't transition/move, stuck, leaks) Damaged hinge seals fail Cylinder seal fails Bonnet fails on doors Gasket fails between stack components (Wellhead to Stack to LMRP to Riser) Elastomer damage on blind shear	HPU pumps running Type (I, P or M): I Pressure loss in hydraulic system Type (I, P or M): I Mud loss Type (I, P or M): I For Asset/Personnel protection, leakage to environment as a protection Type (I, P or M): P Redundant pods Type (I, P or M): P Redundant annulars and rams to control pressure Type (I, P or M): P Chamber test completed at 5k and operated at 1500 psi Type (I, P or M): P ROV inspection every 3 days Type (I, P or M): M Wellbore testing Type (I, P or M): M Hydraulic system testing - Surface and subsea Type (I, P or M): M Routine function testing (Requirement is weekly however exception from BSEE requested if pipe is across shears at test time) Type (I, P or M): M Soak and stump tests between wells Type (I, P or M): M 5 year inspection and maintenance of BOP Type (I, P or M): M Between Wells - Replace all seals/rubber goods on ram blocks Type (I, P or M): M Annual - Dimensional checks, chamber testing, MPL signature	Control fluid leakage to environment [Local Effects]	1	1	1	

2.3.2	Equipment:	Blind Shear Ram - BOP Stack		Blind Shear Ram including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
		ram Dimensional issues	testing (predictive), MPL bearings replaced, NDT on ram blocks, connecting rods, and blades. Type (I, P or M): M Overhauling nuts replaced every 2 years Type (I, P or M): M Clutch plate replaced every 3 years Type (I, P or M): M					
				Unable to shear tubular [Local Effects]	1	1	1	
				Wellbore fluid leakage to environment [Local Effects]	1	1	1	
				External Leak - Loss of containment - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.8.1)	9	5	3	135
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
				Failure to Close Annular / Blind-Shear Ram on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.3)	10	2	2	40
				Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	10	2	2	40

2.3.2	Equipment:	Blind Shear Ram - BOP Stack		Blind Shear Ram including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
				Failure to Engage Lock on Hang-off Ram - Failure to maintain locking - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.3.1)	8	5	2	80
				Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12
				Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	1	4	24
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36

2.3.2	Equipment:	Blind Shear Ram - BOP Stack		Blind Shear Ram including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
				Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	2	2	40
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
				External Leak - Loss of containment - Circulate the well after drill pipe disconnect (linked to 1.9.5.1)	10	4	3	120
				External Leak - Loss of containment - Circulate across the BOP stack to remove trapped gas	10	4	3	120

2.3.2	Equipment:	Blind Shear Ram - BOP Stack		Blind Shear Ram including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				- (linked to 1.10.4.1)				
2	Internal Leak	Rod piston seals fail Dimensional wear Scoring Shuttle valve fails Transfer piston seals fail Dimensional discrepancy between ram block and cavity (wear) Shuttle valve fails (doesn't transition/move, stuck, leaks) Piston seal leaks Dimensional issues	HPU pumps running Type (I, P or M): I Flow meter Type (I, P or M): I Pressure loss in hydraulic system Type (I, P or M): I Chamber test completed at 5k and operated at 1500 psi Type (I, P or M): P Redundant annulars and rams Type (I, P or M): P Redundant pods Type (I, P or M): P Hydraulic system testing - Surface and subsea Type (I, P or M): M ROV inspection every 3 days Type (I, P or M): M Soak and stump tests between wells Type (I, P or M): M Weekly function testing Type (I, P or M): M 5 year inspection of BOP Type (I, P or M): M 5 year rebuild on shuttle valves Type (I, P or M): M Routine function testing (Requirement is weekly however exception from BSEE requested if pipe is across shears at test time) Type (I, P or M): M Between Wells - Replace all seals/rubber goods on ram blocks Type (I, P or M): M Overhauling nuts replaced every 2 years Type (I, P or M): M Clutch plate replaced every 3	Control fluid leakage to environment [Local Effects]	1	1	1	

2.3.2	Equipment:	Blind Shear Ram - BOP Stack		Blind Shear Ram including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
			years Type (I, P or M): M Annual - Dimensional checks, chamber testing, MPL signature testing (predictive), MPL bearings replaced, NDT on ram blocks, connecting rods, and blades. Type (I, P or M): M					
				Degraded function of ram (Depending on severity of leak, on open side of seal, operations could continue after approval from BSEE. Leak on close side is loss of function of ram) [Local Effects]	1	1	1	
				Loss of function of ram (Severity 9 if during well control without redundancies, 8 if not during well control) [Local Effects]	1	1	1	
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
				Failure to Close Annular / Blind-Shear Ram on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.3)	10	2	2	40
				Failure to Engage Lock on Hang-off Ram - Failure to maintain locking - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.3.1)	8	5	2	80
				Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe	6	1	1	6

2.3.2	Equipment:	Blind Shear Ram - BOP Stack		Blind Shear Ram including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				and seal the wellbore (linked to 1.5.2.1)				
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
				Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14

2.3.2	Equipment:	Blind Shear Ram - BOP Stack		Blind Shear Ram including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
3	Plugged	No credible causes resulting in plugging of the Blind Shear Ram - BOP Stack						
4	Mechanical Failure	Off center loading MPL assembly (springs, etc.) fails Contaminated fluid Galling MPL seizure Shear blade fails Shear blade bolt fails Bonnet fails on doors Ram foot/button breaking off, separating ram block from stem MPL fails to release when needed (=MPL seizure) Off-centered pipe Clutch plate and bearing fails Spring fails to hold clutch plates together/locked Seals on the chamber ring fail to allow the transfer ring to move freely & doesn't allow the springs to fully engage clutch MPL assembly fails due to mechanical issues Anti-rotation pin fails due to shearing off	Mud loss Type (I, P or M): I Pressure loss in hydraulic system Type (I, P or M): I Chamber test completed at 5k and operated at 1500 psi Type (I, P or M): P Redundant annulars and rams Type (I, P or M): P Redundant pods Type (I, P or M): P Hydraulic system testing - Surface and subsea Type (I, P or M): M ROV inspection every 3 days Type (I, P or M): M Soak and stump tests between wells Type (I, P or M): M Wellbore testing Type (I, P or M): M Weekly function testing Type (I, P or M): M 5 year inspection of BOP Type (I, P or M): M Routine function testing (Requirement is weekly however exception from BSEE requested if pipe is across shears at test time) Type (I, P or M): M Between Wells - Replace all seals/rubber goods on ram blocks Type (I, P or M): M Overhauling nuts replaced every 2 years Type (I, P or M): M Thrust plate replaced every 3	Loss of function of ram (Severity 9 if during well control without redundancies, 8 if not during well control) [Local Effects]	1	1	1	

2.3.2	Equipment:	Blind Shear Ram - BOP Stack		Blind Shear Ram including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
			years Type (I, P or M): M Annual - Dimensional checks, chamber testing, MPL signature testing (predictive), MPL bearings replaced, NDT on ram blocks, connecting rods, and blades. Type (I, P or M): M Blades replaced after a shear Type (I, P or M): M					
				External Leak - Loss of containment - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.8.1)	9	5	3	135
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
				Failure to Close Annular / Blind-Shear Ram on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.3)	10	2	2	40
				Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	10	2	2	40
				Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal	9	1	2	18

2.3.2	Equipment:	Blind Shear Ram - BOP Stack		Blind Shear Ram including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)				
				Failure to Engage Lock on Hang-off Ram - Failure to maintain locking - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.3.1)	8	5	2	80
				Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12
				Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	1	4	24
				Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120

2.3.2	Equipment:	Blind Shear Ram - BOP Stack		Blind Shear Ram including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
				Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	2	2	40
				External Leak - Loss of containment - Circulate the well after drill pipe disconnect (linked to 1.9.5.1)	10	4	3	120
5	Wear	Wear on packers on ram blocks Operation/use of ram Dirty fluid Off center loading MPL assembly (springs, etc.) fails Contaminated fluid Galling MPL fails to release when needed (=MPL seizure) Shear blade fails Shear blade bolt fails Bonnet fails on doors Dimensional wear Scoring Shuttle valve fails Rod piston seals fail Transfer piston seals fail Ram foot/button breaking off, separating ram block from stem Seal damage (Elastomer) - Ram block or BOP seal plate Ram blocks fail due to wear	Mud loss Type (I, P or M): I Pressure loss in hydraulic system Type (I, P or M): I Chamber test completed at 5k and operated at 1500 psi Type (I, P or M): P Redundant annulars and rams Type (I, P or M): P Redundant pods Type (I, P or M): P Hydraulic system testing - Surface and subsea Type (I, P or M): M ROV inspection every 3 days Type (I, P or M): M Soak and stump tests between wells Type (I, P or M): M Weekly function testing Type (I, P or M): M Wellbore testing Type (I, P or M): M 5 year inspection of BOP	Control fluid leakage to environment [Local Effects]	1	1	1	

2.3.2	Equipment:	Blind Shear Ram - BOP Stack		Blind Shear Ram including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
		BX Gasket connections (top and bottom and side-outs) fail Ram block seals fail Piping connections fail Key seating Bonnet door seals fail Rod packer seal fails Top seal plate fails Fluid hinge seal assembly fails Damage from shearing Operating cylinder seal leaks Shuttle valve fails (doesn't transition/move, stuck, leaks) Piston seal leaks Damaged hinge seals fails Cylinder seal fails MPL fails to release when needed (=MPL seizure) Bonnet fails on doors Gasket fails between stack components (Wellhead to Stack to LMRP to Riser) Elastomer damage on blind shear ram Dimensional issues Off-centered pipe Clutch plate and bearing fails Spring fails to hold clutch plates together/locked Seals on the chamber ring fail to not allowing the transfer ring to move freely & doesn't allow the springs to fully engage clutch MPL assembly fails due to mechanical issues Anti-rotation pin fails due to shearing off	Type (I, P or M): M Routine function testing (Requirement is weekly however exception from BSEE requested if pipe is across shears at test time) Type (I, P or M): M Between Wells - Replace all seals/rubber goods on ram blocks Type (I, P or M): M Overhauling nuts replaced every 2 years Type (I, P or M): M Thrust plate replaced every 3 years Type (I, P or M): M Annual - Dimensional checks, chamber testing, MPL signature testing (predictive), MPL bearings replaced, NDT on ram blocks, connecting rods, and blades. Type (I, P or M): M Blades replaced after a shear Type (I, P or M): M					

2.3.2	Equipment:	Blind Shear Ram - BOP Stack		Blind Shear Ram including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Degraded function of ram (Depending on severity of leak, on open side of seal, operations could continue after approval from BSEE.) [Local Effects]	1	1	1	
				Loss of function of ram (Severity 9 if during well control without redundancies, 7 if not during well control) [Local Effects]	1	1	1	
				Wellbore fluid leakage to environment [Local Effects]	1	1	1	
				External Leak - Loss of containment - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.8.1)	9	5	3	135
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
				Failure to Close Annular / Blind-Shear Ram on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.3)	10	2	2	40
				Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	10	2	2	40
				Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close	9	1	2	18

2.3.2	Equipment:	Blind Shear Ram - BOP Stack		Blind Shear Ram including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)				
				Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	9	2	1	18
				Failure to Engage Lock on Hang-off Ram - Failure to maintain locking - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.3.1)	8	5	2	80
				Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12
				Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	1	4	24
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe	9	1	4	36

2.3.2	Equipment:	Blind Shear Ram - BOP Stack		Blind Shear Ram including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				and seal the wellbore (linked to 1.6.2.1)				
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
				Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	2	2	40
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
				External Leak - Loss of containment - Circulate the well after drill pipe disconnect (linked to 1.9.5.1)	10	4	3	120
				External Leak - Loss of containment - Circulate across the BOP stack to remove trapped gas - (linked to 1.10.4.1)	10	4	3	120
6	Corrosion/Er	Mud flow	Appropriate material selection	Control fluid leakage to	1	1	1	

2.3.2	Equipment:	Blind Shear Ram - BOP Stack		Blind Shear Ram including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
	osion		(rubber goods) for operating environment Type (I, P or M): P Chamber test completed at 5k and operated at 1500 psi Type (I, P or M): P Enhanced coatings and inlays in some areas Type (I, P or M): P Protection/compatibility studies between rubber goods and various drilling fluids Type (I, P or M): P BOP rinsed as soon as it is pulled from water Type (I, P or M): M Hydraulic system testing - Surface and subsea Type (I, P or M): M ROV inspection every 3 days Type (I, P or M): M Soak and stump tests between wells Type (I, P or M): M Weekly function testing Type (I, P or M): M Wellbore testing Type (I, P or M): M 5 year inspection of BOP Type (I, P or M): M Routine function testing (Requirement is weekly however exception from BSEE requested if pipe is across shears at test time) Type (I, P or M): M Between Wells - Replace all seals/rubber goods on ram blocks Type (I, P or M): M Overhauling nuts replaced every 2 years Type (I, P or M): M	environment [Local Effects]				

2.3.2	Equipment:	Blind Shear Ram - BOP Stack		Blind Shear Ram including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
			Thrust plate replaced every 3 years Type (I, P or M): M Annual - Dimensional checks, chamber testing, MPL signature testing (predictive), MPL bearings replaced, NDT on ram blocks, connecting rods, and blades. Type (I, P or M): M Blades replaced after a shear Type (I, P or M): M					
				Degraded function of ram (Depending on severity of leak, on open side of seal, operations could continue after approval from BSEE.) [Local Effects]	1	1	1	
				Loss of function of ram (Severity 9 if during well control without redundancies, 7 if not during well control) [Local Effects]	1	1	1	
				Wellbore fluid leakage to environment [Local Effects]	1	1	1	
				Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
				Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation -	10	2	6	120

2.3.2	Equipment:	Blind Shear Ram - BOP Stack		Blind Shear Ram including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)				
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
7	Loss of Function (general)	No additional causes beyond those reviewed in Blind Shear RAM - BOP Stack External Leak/Rupture - Dimensional wear (2.3.2.1 - 6)						

2.3.3	Equipment:	Casing Shear Ram - BOP Stack		Shear Ram associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
1	External Leak/Rupture	BX Gasket connections (top and bottom and side-outs) leak Shuttle valve leak Piping connections fail Key seating Bonnet door seals fail Rod packer seal fails Fluid hinge seal assembly fails Damage from shearing MPL fails Operating cylinder seal leaks Clutch plate and bearing fails Shuttle valve fails (doesn't transition/move, stuck, leaks) Damaged hinge seals fail Cylinder seal fails Bonnet fails on doors Gasket fails between stack components (Wellhead to Stack to LMRP to Riser) Spring fails to hold clutch plates together/locked Seals on the chamber ring fail to allow the transfer ring to move freely & doesn't allow the springs to fully engage clutch MPL assembly fails due to mechanical issues Anti-rotation pin fails due to shearing off	Pressure loss in hydraulic system Type (I, P or M): I HPU pumps running Type (I, P or M): I Mud loss Type (I, P or M): I Chamber test completed at 5k and operated at 1500 psi Type (I, P or M): P For Asset/Personnel protection, leakage to environment as a protection Type (I, P or M): P Redundant pods Type (I, P or M): P Redundant annulars and rams to control pressure - this is the only casing shear ram Type (I, P or M): P Between Wells - Replace all seals/rubber goods on door interface Type (I, P or M): M Five year inspection and maintenance of BOP Type (I, P or M): M Hydraulic system testing - Surface and subsea Type (I, P or M): M Soak and stump tests between wells Type (I, P or M): M Routine function testing (Requirement is weekly however exception from BSEE requested if pipe is across shears at test time) Type (I, P or M): M ROV inspection every 3 days Type (I, P or M): M Wellbore testing - Wellbore containing components above	Control fluid leakage to environment [Local Effects]	1	1	1	

2.3.3	Equipment:	Casing Shear Ram - BOP Stack		Shear Ram associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
			casing shear rams Type (I, P or M): M Overhauling nuts replaced every 2 years Type (I, P or M): M Annual - Dimensional checks, chamber testing, MPL signature testing (predictive), MPL bearings replaced, NDT on ram blocks, connecting rods, and blades. Type (I, P or M): M Clutch plate replaced every 3 years Type (I, P or M): M					
				Wellbore fluid leakage to environment [Local Effects]	1	1	1	
				Unable to shear tubular [Local Effects]	1	1	1	
				External Leak - Loss of containment - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.8.1)	9	5	3	135
				Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12
				Unintentional Opening - Unintentional closing / opening -	6	1	4	24

2.3.3	Equipment:	Casing Shear Ram - BOP Stack		Shear Ram associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)				
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
				Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
				Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	2	2	40
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the	7	1	2	14

2.3.3	Equipment:	Casing Shear Ram - BOP Stack		Shear Ram associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Lower BOP stack (linked to 1.8.1.3)				
				External Leak - Loss of containment - Circulate the well after drill pipe disconnect (linked to 1.9.5.1)	10	4	3	120
				External Leak - Loss of containment - Circulate across the BOP stack to remove trapped gas - (linked to 1.10.4.1)	10	4	3	120
2	Internal Leak	Dimensional wear Scoring Shuttle valve fails Rod piston seals fail Transfer piston seals fail Dimensional discrepancy between ram block and cavity (wear) Shuttle valve fails (doesn't transition/move, stuck, leaks) Piston seal leaks	Pressure loss in hydraulic system Type (I, P or M): I HPU pumps running Type (I, P or M): I Chamber test completed at 5k and operated at 1500 psi Type (I, P or M): P Redundant annulars and rams to control pressure - this is the only casing shear ram Type (I, P or M): P Redundant pods Type (I, P or M): P ROV inspection every 3 days Type (I, P or M): M Weekly function testing Type (I, P or M): M Between Wells - Replace all seals/rubber goods on ram blocks Type (I, P or M): M Flow meter Type (I, P or M): M Five year rebuild on shuttle valves Type (I, P or M): M Hydraulic system testing - Surface and subsea Type (I, P or M): M Routine function testing (Requirement is weekly however exception from BSEE requested if	Control fluid leakage to environment [Local Effects]	1	1	1	

2.3.3	Equipment:	Casing Shear Ram - BOP Stack		Shear Ram associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
			pipe is across shears at test time) Type (I, P or M): M Soak and stump tests between wells Type (I, P or M): M Five year inspection and maintenance of BOP Type (I, P or M): M Overhauling nuts replaced every 2 years Type (I, P or M): M Annual - Dimensional checks, chamber testing, MPL signature testing (predictive), MPL bearings replaced, NDT on ram blocks, connecting rods, and blades. Type (I, P or M): M Clutch plate replaced every 3 years Type (I, P or M): M					
				Degraded function of ram (Depending on severity of leak, on open side of seal, operations could continue after approval from BSEE. Leak on close side is loss of function of ram) [Local Effects]	1	1	1	
				Loss of function of ram (Severity 9 if during well control without redundancies, 8 if not during well control) [Local Effects]	1	1	1	
				Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
				Failure to Supply Hydraulic Fluid &	9	1	4	36

2.3.3	Equipment:	Casing Shear Ram - BOP Stack		Shear Ram associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)				
				Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
3	Plugged	No credible causes resulting in plugging of the Casing Shear Ram - BOP Stack						
4	Mechanical Failure	Off center loading MPL Assembly fails (springs, retaining plate, etc.) Contaminated fluid	Pressure loss in hydraulic system Type (I, P or M): I Mud loss Type (I, P or M): I	Degraded function of ram (MPL fails to keep ram closed, but does not prevent ram from closing with full pressure) [Local Effects]	1	1	1	

2.3.3	Equipment:	Casing Shear Ram - BOP Stack		Shear Ram associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
		Wear in overhauling nut to the tail screw - MPL Galling MPL seizure Shear blade fails Shear blade bolt fails Bonnet fails on doors Ram foot/button breaking off, separating ram block from stem MPL fails to release when needed (=MPL seizure) Off-centered pipe Clutch plate and bearing fails Spring fails to hold clutch plates together/locked Seals on the chamber ring fail to allow the transfer ring to move freely & doesn't allow the springs to fully engage clutch MPL assembly due to mechanical issues Anti-rotation pin fails due to shearing off	Chamber test completed at 5k and operated at 1500 psi Type (I, P or M): P Redundant annulars and rams Type (I, P or M): P Redundant pods Type (I, P or M): P Blades replaced after a shear Type (I, P or M): M Five year inspection of BOP Type (I, P or M): M Hydraulic system testing - Surface and subsea Type (I, P or M): M Routine function testing (Requirement is weekly however exception from BSEE requested if pipe is across shears at test time) Type (I, P or M): M Wellbore testing Type (I, P or M): M Weekly function testing Type (I, P or M): M Between Wells - Replace all seals/rubber goods on ram blocks Type (I, P or M): M ROV inspection every 3 days Type (I, P or M): M Soak and stump tests between wells Type (I, P or M): M Overhauling nuts replaced every 2 years Type (I, P or M): M Annual - Dimensional checks, chamber testing, MPL signature testing (predictive), MPL bearings replaced, NDT on ram blocks, connecting rods, and blades. Type (I, P or M): M Clutch plate replaced every 3					

2.3.3	Equipment:	Casing Shear Ram - BOP Stack		Shear Ram associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
			years Type (I, P or M): M					
				Loss of function of ram (Severity 9 if during well control without redundancies, 8 if not during well control) [Local Effects]	1	1	1	
				External Leak - Loss of containment - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.8.1)	9	5	3	135
				Failure to Engage Lock on Hang-off Ram - Failure to maintain locking - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.3.1)	8	5	2	80
				Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12
				Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	1	4	24
				Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore	9	1	2	18

2.3.3	Equipment:	Casing Shear Ram - BOP Stack		Shear Ram associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				(linked to 1.6.3.2)				
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
				Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	2	2	40
				External Leak - Loss of containment - Circulate the well after drill pipe disconnect (linked to 1.9.5.1)	10	4	3	120
				External Leak - Loss of containment - Circulate across the BOP stack to remove trapped gas - (linked to 1.10.4.1)	10	4	3	120
5	Wear	BX Gasket connections (top and bottom and side-outs) fail Operation/use of ram Dirty fluid Wear on packers on ram blocks Wear of ram blocks Piping connections fail Key seating Bonnet door seals fail Rod packer seal fails Fluid hinge seal assembly fails	Pressure loss in hydraulic system Type (I, P or M): I Mud loss Type (I, P or M): I Chamber test completed at 5k and operated at 1500 psi Type (I, P or M): P Redundant pods Type (I, P or M): P Redundant annulars and rams Type (I, P or M): P Between Wells - Replace all seals/rubber goods on ram blocks	Control fluid leakage to environment [Local Effects]	1	1	1	

2.3.3	Equipment:	Casing Shear Ram - BOP Stack		Shear Ram associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
		Damage from shearing MPL fails Operating cylinder seal leaks Dimensional wear Scoring Shuttle valve fails Rod piston seals fail Transfer piston seals fail Off center loading Contaminated fluid Galling MPL fails to release when needed (=MPL seizure) Shear blade fails Shear blade bolt fails Bonnet fails on doors Wear in overhauling nut to the tail screw - MPL Shuttle valve fails (doesn't transition/move, stuck, leaks) Piston seal leaks Cylinder seal fails MPL fails to release when needed (=MPL seizure) Bonnet fails on doors Gasket fails between stack components (Wellhead to Stack to LMRP to Riser) Off-centered pipe Clutch plate and bearing fails Spring fails to hold clutch plates together/locked Seals on the chamber ring fail to allow the transfer ring to move freely & doesn't allow the springs to fully engage clutch MPL assembly fails due to	Type (I, P or M): M Blades replaced after a shear Type (I, P or M): M Five year inspection of BOP Type (I, P or M): M Routine function testing (Requirement is weekly however exception from BSEE requested if pipe is across shears at test time) Type (I, P or M): M ROV inspection every 3 days Type (I, P or M): M Wellbore testing Type (I, P or M): M Weekly function testing Type (I, P or M): M Hydraulic system testing - Surface and subsea Type (I, P or M): M Soak and stump tests between wells Type (I, P or M): M Overhauling nuts replaced every 2 years Type (I, P or M): M Annual - Dimensional checks, chamber testing, MPL signature testing (predictive), MPL bearings replaced, NDT on ram blocks, connecting rods, and blades. Type (I, P or M): M Clutch plate replaced every 3 years Type (I, P or M): M					

2.3.3	Equipment:	Casing Shear Ram - BOP Stack		Shear Ram associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
		mechanical issues Anti-rotation pin fails due to shearing off						
				Degraded function of ram (Depending on severity of leak, on open side of seal, operations could continue after approval from BSEE.) [Local Effects]	1	1	1	
				Loss of function of ram (Severity 9 if during well control without redundancies, 7 if not during well control) [Local Effects]	1	1	1	
				Wellbore fluid leakage to environment [Local Effects]	1	1	1	
				External Leak - Loss of containment - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.8.1)	9	5	3	135
				Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	9	2	1	18
				Failure to Engage Lock on Hang-off Ram - Failure to maintain locking - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.3.1)	8	5	2	80
				Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6

2.3.3	Equipment:	Casing Shear Ram - BOP Stack		Shear Ram associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12
				Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	1	4	24
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
				Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
				Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	2	2	40

2.3.3	Equipment:	Casing Shear Ram - BOP Stack		Shear Ram associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
				External Leak - Loss of containment - Circulate the well after drill pipe disconnect (linked to 1.9.5.1)	10	4	3	120
				External Leak - Loss of containment - Circulate across the BOP stack to remove trapped gas - (linked to 1.10.4.1)	10	4	3	120
6	Corrosion/Erosion	Mud flow	Appropriate material selection (rubber goods/metals) for operating environment...shear blade corrodes, but is inspected for such Type (I, P or M): P Chamber test completed at 5k and operated at 1500 psi Type (I, P or M): P Enhanced coatings and inlays in some areas Type (I, P or M): P Between Wells - Replace all seals/rubber goods on ram blocks Type (I, P or M): M BOP rinsed as soon as they are pulled from water Type (I, P or M): M Five year inspection of BOP Type (I, P or M): M Routine function testing (Requirement is weekly however	Control fluid leakage to environment [Local Effects]	1	1	1	

2.3.3	Equipment:	Casing Shear Ram - BOP Stack		Shear Ram associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
			exception from BSEE requested if pipe is across shears at test time) Type (I, P or M): M Weekly function testing Type (I, P or M): M Wellbore testing Type (I, P or M): M Blades replaced after a shear Type (I, P or M): M ROV inspection every 3 days Type (I, P or M): M Hydraulic system testing - Surface and subsea Type (I, P or M): M Soak and stump tests between wells Type (I, P or M): M Overhauling nuts replaced every 2 years Type (I, P or M): M Annual - Dimensional checks, chamber testing, MPL signature testing (predictive), MPL bearings replaced, NDT on ram blocks, connecting rods, and blades. Type (I, P or M): M Clutch plate replaced every 3 years Type (I, P or M): M				
				Degraded function of ram (Depending on severity of leak, on open side of seal, operations could continue after approval from BSEE.) [Local Effects]	1	1	1	
				Loss of function of ram (Severity 9 if during well control without redundancies, 7 if not during well control) [Local Effects]	1	1	1	
				Wellbore fluid leakage to environment [Local Effects]	1	1	1	

2.3.3	Equipment:	Casing Shear Ram - BOP Stack		Shear Ram associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
				Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
7	Loss of Function (general)	No additional causes identified resulting in Loss of Function of the Casing Shear Ram - BOP Stack						

2.3.4	Equipment:	Pipe & Test Rams - BOP Stack		Pipe & Test Rams including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
1	External Leak/Rupture	Damage from closure on a tool joint Operating cylinder seal leaks BX Gasket connections (top and bottom and side-outs) fail Ram block seals fail Shuttle valve leaks Piping connections fail Scoring Dimensional wear Key seating Bonnet door seals fail Rod packer seal fails Top & Bottom seal plates fail Fluid hinge seal assembly fails Damage from hanging off MPL fails Seal damage (Elastomer) - Ram block or BOP seal plate Shuttle valve fails (doesn't transition/move, stuck, leaks) Damaged hinge seals fail Cylinder seal fails Bonnet fails on doors Gasket fails between stack components (Wellhead to Stack to LMRP to Riser)	Pressure loss in hydraulic system Type (I, P or M): I HPU pumps running Type (I, P or M): I Mud loss Type (I, P or M): I Chamber test completed at 5k and operated at 1500 psi Type (I, P or M): P For Asset/Personnel protection, leakage to environment as a protection Type (I, P or M): P Redundant annulars and rams to control pressure - this is the only casing shear ram Type (I, P or M): P Redundant pods Type (I, P or M): P Annual - Dimensional checks, chamber testing, MPL signature testing (predictive), MPL bearings replaced, NDT on ram blocks, connecting rods. Type (I, P or M): M Between Wells - Replace all seals/rubber goods on ram blocks Type (I, P or M): M Clutch plate replaced every 3 years Type (I, P or M): M Five year inspection and maintenance of BOP Type (I, P or M): M Hydraulic system testing - Surface and subsea Type (I, P or M): M Overhauling nuts replaced every 2 years Type (I, P or M): M ROV inspection every 3 days	Control fluid leakage to environment [Local Effects]	1	1	1	

2.3.4	Equipment:	Pipe & Test Rams - BOP Stack		Pipe & Test Rams including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
			Type (I, P or M): M Routine function testing (Requirement is weekly however exception from BSEE requested if pipe is across shears at test time) Type (I, P or M): M Soak and stump tests between wells Type (I, P or M): M Wellbore testing - Wellbore containing components above casing shear rams Type (I, P or M): M					
				Unable to close and seal on pipe, on demand [Local Effects]	1	1	1	
				Unable to maintain seal with pipe ram [Local Effects]	1	1	1	
				Wellbore fluid leakage to environment [Local Effects]	1	1	1	
				Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
				External Leak - Loss of containment - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.8.1)	9	5	3	135
				External Leak - Loss of containment - Circulate across the BOP stack to remove trapped gas - (linked to 1.10.4.1)	9	3	3	54
2	Internal Leak	Dimensional wear Scoring Shuttle valve fails Rod piston seals fail Transfer piston seals fail Dimensional discrepancy between	Pressure loss in hydraulic system Type (I, P or M): I HPU pumps running Type (I, P or M): I Redundant pods Type (I, P or M): P	Control fluid leakage to environment [Local Effects]	1	1	1	

2.3.4	Equipment:	Pipe & Test Rams - BOP Stack		Pipe & Test Rams including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
		ram block and cavity (wear) Shuttle valve fails (doesn't transition/move, stuck, leaks) Piston seal leaks	Redundant annulars and rams to control pressure - this is the only casing shear ram Type (I, P or M): P Chamber test completed at 5k and operated at 1500 psi Type (I, P or M): P Between Wells - Replace all seals/rubber goods on ram blocks Type (I, P or M): M Flow meter Type (I, P or M): M Five year rebuild on shuttle valves Type (I, P or M): M Weekly function testing Type (I, P or M): M ROV inspection every 3 days Type (I, P or M): M Hydraulic system testing - Surface and subsea Type (I, P or M): M Routine function testing (Requirement is weekly however exception from BSEE requested if pipe is across shears at test time) Type (I, P or M): M Soak and stump tests between wells Type (I, P or M): M 5 year inspection and maintenance of BOP Type (I, P or M): M Overhauling nuts replaced every 2 years Type (I, P or M): M Annual - Dimensional checks, chamber testing, MPL signature testing (predictive), MPL bearings replaced, NDT on ram blocks, connecting rods. Type (I, P or M): M Clutch plate replaced every 3					

2.3.4	Equipment:	Pipe & Test Rams - BOP Stack		Pipe & Test Rams including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
			years Type (I, P or M): M					
				Loss of function of ram (Severity 9 if during well control without redundancies, 8 if not during well control) [Local Effects]	1	1	1	
				Degraded function of ram (Depending on severity of leak, on open side of seal, operations could continue after approval from BSEE. Leak on close side is loss of function of ram) [Local Effects]	1	1	1	
				Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
3	Plugged	No credible causes resulting in plugging of the Pipe & Test Rams - BOP Stack						
4	Mechanical Failure	Off center loading MPL assembly (springs, etc.) fails Contaminated fluid Galling MPL fails to release when needed (=MPL seizure) Bonnet door fails MPL fails to release when needed (=MPL seizure) Bonnet fails on doors Off-centered pipe	Pressure loss in hydraulic system Type (I, P or M): I Mud loss Type (I, P or M): I Chamber test completed at 5k and operated at 1500 psi Type (I, P or M): P Pipe guides to assist pipe to center of rams Type (I, P or M): P Redundant annulars and rams Type (I, P or M): P Redundant pods Type (I, P or M): P Five year inspection of BOP Type (I, P or M): M Per PM, seals are replaced annually. However, typically replaced between wells.	Loss of function of ram (Severity 9 if during well control without redundancies, 8 if not during well control) [Local Effects]	1	1	1	

2.3.4	Equipment:	Pipe & Test Rams - BOP Stack		Pipe & Test Rams including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
			Type (I, P or M): M Weekly function testing Type (I, P or M): M Wellbore testing Type (I, P or M): M Routine function testing (Requirement is weekly however exception from BSEE requested if pipe is across shears at test time) Type (I, P or M): M Between Wells - Replace all seals/rubber goods on ram blocks Type (I, P or M): M ROV inspection every 3 days Type (I, P or M): M Hydraulic system testing - Surface and subsea Type (I, P or M): M Soak and stump tests between wells Type (I, P or M): M Overhauling nuts replaced every 2 years Type (I, P or M): M Annual - Dimensional checks, chamber testing, MPL signature testing (predictive), MPL bearings replaced, NDT on ram blocks, connecting rods, and blades. Type (I, P or M): M Clutch plate replaced every 3 years Type (I, P or M): M				
				External Leak - Loss of containment - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.8.1)	9	5	3	135
5	Wear	Test ram seal plate fails due to exposure to cuttings (more likely seen in longer wells) Operation/use of ram	Pressure loss in hydraulic system Type (I, P or M): I Mud loss Type (I, P or M): I	Control fluid leakage to environment [Local Effects]	1	1	1	

2.3.4	Equipment:	Pipe & Test Rams - BOP Stack		Pipe & Test Rams including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
		Dirty fluid Seal damage (Elastomer) - Ram block or BOP seal plate Wear of ram blocks Wear on packers on ram blocks	Chamber test completed at 5k and operated at 1500 psi Type (I, P or M): P Pipe guides to assist pipe to center of rams Type (I, P or M): P Redundant annulars and rams Type (I, P or M): P Redundant pods Type (I, P or M): P Five year inspection of BOP Type (I, P or M): M Per PM, seals are replaced annually. However, typically replaced between wells. Type (I, P or M): M Wellbore testing Type (I, P or M): M Weekly function testing Type (I, P or M): M Routine function testing (Requirement is weekly however exception from BSEE requested if pipe is across shears at test time) Type (I, P or M): M Between Wells - Replace all seals/rubber goods on ram blocks Type (I, P or M): M ROV inspection every 3 days Type (I, P or M): M Hydraulic system testing - Surface and subsea Type (I, P or M): M Soak and stump tests between wells Type (I, P or M): M Overhauling nuts replaced every 2 years Type (I, P or M): M Annual - Dimensional checks, chamber testing, MPL signature					

2.3.4	Equipment:	Pipe & Test Rams - BOP Stack		Pipe & Test Rams including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
			testing (predictive), MPL bearings replaced, NDT on ram blocks, connecting rods, and blades. Type (I, P or M): M Clutch plate replaced every 3 years Type (I, P or M): M					
				Degraded function of ram (Depending on severity of leak, on open side of seal, operations could continue after approval from BSEE.) [Local Effects]	1	1	1	
				Loss of function of pipe ram (Severity 9 if during well control without redundancies, 8 if not during well control). Test ram severity is up to a 4 to 5, water depth dependent, as a test plug has to be run for pressure tests. [Local Effects]	1	1	1	
				Wellbore fluid leakage to environment [Local Effects]	1	1	1	
				Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
				Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	9	2	1	18
6	Corrosion/Erosion	Mud flow	Pressure loss in hydraulic system Type (I, P or M): I Mud loss Type (I, P or M): I Appropriate material selection (rubber goods/metals) for operating environment.	Control fluid leakage to environment [Local Effects]	1	1	1	

2.3.4	Equipment:	Pipe & Test Rams - BOP Stack		Pipe & Test Rams including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
			Type (I, P or M): P BOP rinsed as soon as they are pulled from water Type (I, P or M): P Chamber test completed at 5k and operated at 1500 psi Type (I, P or M): P Enhanced coatings and inlays in some areas Type (I, P or M): P Pipe guides to assist pipe to center of rams Type (I, P or M): P Protection/compatibility studies between rubber goods and various drilling fluids Type (I, P or M): P Redundant annulars and rams Type (I, P or M): P Redundant pods Type (I, P or M): P Per PM, seals are replaced annually. However, typically replaced between wells. Type (I, P or M): M Wellbore testing Type (I, P or M): M Weekly function testing Type (I, P or M): M 5 year inspection of BOP Type (I, P or M): M Routine function testing (Requirement is weekly however exception from BSEE requested if pipe is across shears at test time) Type (I, P or M): M Between Wells - Replace all seals/rubber goods on ram blocks Type (I, P or M): M ROV inspection every 3 days Type (I, P or M): M				

2.3.4	Equipment:	Pipe & Test Rams - BOP Stack		Pipe & Test Rams including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
			Hydraulic system testing - Surface and subsea Type (I, P or M): M Soak and stump tests between wells Type (I, P or M): M Overhauling nuts replaced every 2 years Type (I, P or M): M Annual - Dimensional checks, chamber testing, MPL signature testing (predictive), MPL bearings replaced, NDT on ram blocks, connecting rods, and blades. Type (I, P or M): M Clutch plate replaced every 3 years Type (I, P or M): M					
				Unable to close and seal on pipe, on demand [Local Effects]	1	1	1	
				Unable to maintain seal with pipe ram [Local Effects]	1	1	1	
				Wellbore fluid leakage to environment [Local Effects]	1	1	1	
				Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
7	Loss of Function (general)	No additional causes beyond those reviewed in Pipe & Test RAMS External Leak/Rupture - Dimensional wear (2.3.4.1-6)						

2.3.5	Equipment:	Choke & Kill Lines & Valves - BOP Stack		Choke & Kill Lines & Valves on both LMRP & Stack including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
1	External Leak/Rupture	BX Gasket connections (top and bottom and side-outs) fail Grease fitting leaks Shuttle valve leaks Piping connections fail Scoring Dimensional wear Bonnet seals fail Stem packing seals fail Operating cylinder seal leaks Shuttle valve fails (doesn't transition/move, stuck, leaks) Stem packing fails Cylinder seal fails Bonnet fails on doors Gasket fails between stack components (Wellhead to Stack to LMRP to Riser) Bleeding off choke & kill valves fail to safe close with loss of hydraulics	Control system fluid counts/flow meter Type (I, P or M): I Pressure loss in hydraulic system Type (I, P or M): I HPU pumps running Type (I, P or M): I Mud loss Type (I, P or M): I Chamber test completed at 3k and operated at 1500 psi Type (I, P or M): P For Asset/Personnel protection, leakage to environment as a protection Type (I, P or M): P Redundant annulars and rams Type (I, P or M): P Redundant pods Type (I, P or M): P Redundant C&K valves Type (I, P or M): P Hydraulic system testing - Surface and subsea Type (I, P or M): M Between wells - grease Type (I, P or M): M C&K valves are cycled & flushed 2x daily Type (I, P or M): M Five year inspection and maintenance of C&K valves Type (I, P or M): M Replace all seals/rubber goods Type (I, P or M): M Routine function testing (Requirement is weekly) Type (I, P or M): M ROV inspection every 3 days Type (I, P or M): M Soak and stump tests between	Control fluid leakage to environment [Local Effects]	1	1	1	

2.3.5	Equipment:	Choke & Kill Lines & Valves - BOP Stack		Choke & Kill Lines & Valves on both LMRP & Stack including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
			wells Type (I, P or M): M Testing is done in accordance with OEM to cover stem packing and bonnet gasket connections. Between wells, body/shell test. Type (I, P or M): M Wellbore testing Type (I, P or M): M					
				Wellbore fluid leakage to environment - Lower kill valve [Local Effects]	1	1	1	
				Wellbore fluid leakage to environment - 'Other' C&K valves [Local Effects]	1	1	1	
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
				Inability to Operate (an individual) C&K Valves as Needed - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.4)	7	3	2	42
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
				Failure to Close Pipe Ram on Demand - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.3)	9	1	6	63

2.3.5	Equipment:	Choke & Kill Lines & Valves - BOP Stack		Choke & Kill Lines & Valves on both LMRP & Stack including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Inability to Operate C&K Valves as Needed - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.4)	7	3	2	42
				Inability to Operate C&K Valves as needed - Failure to seal or partial seal on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.3.3)	7	3	2	42
				Inability to Operate C&K Valves as Needed - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.3)	9	3	2	54
				Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	8	2	4	48
				External Leak - Loss of containment - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.8.1)	9	5	3	135
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
				Failure to Close Annular / Blind-Shear Ram on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations	10	2	2	40

2.3.5	Equipment:	Choke & Kill Lines & Valves - BOP Stack		Choke & Kill Lines & Valves on both LMRP & Stack including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				on demand (linked to 1.2.1.3)				
				Inability to Operate C&K Valves as Needed - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.6)	9	2	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
				Failure to Close Hang-off Ram on Demand - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.3)	5	1	6	30
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	10	3	1	30
				External Leak - Loss of containment - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.6.1)	10	3	1	30
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36

2.3.5	Equipment:	Choke & Kill Lines & Valves - BOP Stack		Choke & Kill Lines & Valves on both LMRP & Stack including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				External Leak - Loss of containment - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.7.1)	10	2	3	60
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
				Inability to Operate C&K Valves as Needed - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.3)	7	4	2	56
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
				Inability to Operate C&K Valves as Needed - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.3)	7	4	2	56
				External Leak - Loss of containment - Circulate the well after drill pipe disconnect (linked to 1.9.5.1)	10	4	3	120
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure	10	1	2	20

2.3.5	Equipment:	Choke & Kill Lines & Valves - BOP Stack		Choke & Kill Lines & Valves on both LMRP & Stack including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)				
				Inability to Operate C&K Valves as Needed - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.3)	10	4	2	80
				External Leak - Loss of containment - Circulate across the BOP stack to remove trapped gas - (linked to 1.10.4.1)	10	3	3	90
2	Internal Leak	Dimensional wear - Operator failure Scoring - Operator Shuttle valve fails Rod piston seals - Operator fails Gate & seat leaks Shuttle valve fails (doesn't transition/move, stuck, leaks) Piston seal fails Seal seat fails due to defects Bleeding off choke & kill valves fails to safe close with loss of hydraulics	Control system fluid counts/flow meter Type (I, P or M): I Flow meter Type (I, P or M): I HPU pumps running Type (I, P or M): I Pressure loss in hydraulic system Type (I, P or M): I Chamber test completed at 3k and operated at 1500 psi Type (I, P or M): P Fail-safe close operation of valve due to spring closure Type (I, P or M): P Multiple entry points of C&K into Stack Type (I, P or M): P Redundant C&K valves Type (I, P or M): P Redundant pods Type (I, P or M): P Redundant annulars and rams Type (I, P or M): P Between wells - grease Type (I, P or M): M Five year rebuild on shuttle valves Type (I, P or M): M	Control fluid leakage to environment [Local Effects]	1	1	1	

2.3.5	Equipment:	Choke & Kill Lines & Valves - BOP Stack		Choke & Kill Lines & Valves on both LMRP & Stack including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
			Five year inspection of C&K valves Type (I, P or M): M Hydraulic system testing - Surface and subsea Type (I, P or M): M ROV inspection every 3 days Type (I, P or M): M Replace all seals/rubber goods Type (I, P or M): M Soak and stump tests between wells Type (I, P or M): M C&K valves are cycled & flushed 2x daily Type (I, P or M): M Testing is done in accordance with OEM to cover stem packing and bonnet gasket connections. Between wells, body/shell test. Type (I, P or M): M Routine function testing (Requirement is weekly) Type (I, P or M): M Test fail-safe closing spring - when BOP is pulled and during between well surface wellbore testing Type (I, P or M): M Test upstream and downstream seat to ensure redundancy within each valve - Between well & subsea Type (I, P or M): M					
				Leak of lower kill valves [Local Effects]	1	1	1	
				Leak of 'other' kill valves [Local Effects]	1	1	1	
				Loss of function of lower Kill valves [Local Effects]	1	1	1	
				Loss of function of 'other' kill	1	1	1	

2.3.5	Equipment:	Choke & Kill Lines & Valves - BOP Stack		Choke & Kill Lines & Valves on both LMRP & Stack including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				valves [Local Effects]				
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
				Inability to Operate (an individual) C&K Valves as Needed - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.4)	7	3	2	42
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	9	2	5	90
				Inability to Operate C&K Valves as Needed - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.4)	7	3	2	42
				Inability to Operate C&K Valves as needed - Failure to seal or partial seal on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.3.3)	7	3	2	42
				Inability to Operate C&K Valves as Needed - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.3)	9	3	2	54
				Unintentional Operation - Unintentional closing / opening -	8	2	4	48

2.3.5	Equipment:	Choke & Kill Lines & Valves - BOP Stack		Choke & Kill Lines & Valves on both LMRP & Stack including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)				
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
				Inability to Operate C&K Valves as Needed - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.6)	9	2	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
				Failure of Hydraulic Fluid to	9	1	3	27

2.3.5	Equipment:	Choke & Kill Lines & Valves - BOP Stack		Choke & Kill Lines & Valves on both LMRP & Stack including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)				
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
				Inability to Operate C&K Valves as Needed - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.3)	7	4	2	56
				Failure to Adequately Seal under Fail-safe Conditions - Failure to open / close fail-safe valves to seal - Circulate the well after drill pipe disconnect (linked to 1.9.3.2)	10	3	3	90
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
				Inability to Operate C&K Valves as Needed - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.3)	7	4	2	56
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
				Inability to Operate C&K Valves as Needed - Failure to circulate -	10	4	2	80

2.3.5	Equipment:	Choke & Kill Lines & Valves - BOP Stack		Choke & Kill Lines & Valves on both LMRP & Stack including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.3)				
				Failure to Adequately Seal under Fail-safe Condition - Failure to open / close fail-safe valves to seal - Circulate across the BOP stack to remove trapped gas (linked to 1.10.3.2)	10	3	3	90
				External Leak - Loss of containment - Circulate across the BOP stack to remove trapped gas - (linked to 1.10.4.1)	10	4	3	120
3	Plugged	Barite settling in lines Swarf & other contaminants in mud Contamination/filtering Clogged/plugged path (Includes filter, piping, tubing, etc.) Trash in the well (swarf, concrete, etc.) Restriction in system (filter, hose, ID of fitting) Bleeding off choke & kill valves fail to safe close with loss of hydraulics	Control system fluid counts/flow meter Type (I, P or M): I Increased pressure in C&K lines when drilling pumping fluid down the lines Type (I, P or M): I Multiple entry points of C&K into Stack Type (I, P or M): P C&K valves are cycled & flushed 2x daily Type (I, P or M): M Routine function testing (Requirement is weekly) Type (I, P or M): M	Loss of function of lower Kill valves [Local Effects]	1	1	1	
				Loss of function of 'other' kill valves [Local Effects]	1	1	1	
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure	8	2	3	48

2.3.5	Equipment:	Choke & Kill Lines & Valves - BOP Stack		Choke & Kill Lines & Valves on both LMRP & Stack including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)				
				Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	9	2	4	72
				Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	10	4	4	160
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
				Actuates Too Slowly on Demand - Closes too slowly - Controlled operation - Shear the drill pipe	8	3	2	48

2.3.5	Equipment:	Choke & Kill Lines & Valves - BOP Stack		Choke & Kill Lines & Valves on both LMRP & Stack including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				and seal the wellbore (linked to 1.5.5.1)				
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
				Actuates Too Slowly on Demand - Closes too slowly - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.6.1)	10	4	4	160
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	10	4	4	160
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	10	4	4	160

2.3.5	Equipment:	Choke & Kill Lines & Valves - BOP Stack		Choke & Kill Lines & Valves on both LMRP & Stack including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
4	Mechanical Failure	Interface between operator and gate (design change implemented) fails Springs break Contaminated fluid - swarf Galling Bonnet fails Contamination/filtering Springs fail Bonnet fails on doors Trash in the well (swarf, concrete, etc.) Bleeding off choke & kill valves fail to safe close with loss of hydraulics	Control system fluid counts/flow meter Type (I, P or M): I Pressure loss in hydraulic system Type (I, P or M): I HPU pumps running Type (I, P or M): I Mud loss Type (I, P or M): I Chamber test completed at 3k and operated at 1500 psi Type (I, P or M): P Redundant annulars and rams Type (I, P or M): P Redundant C&K valves Type (I, P or M): P Redundant pods Type (I, P or M): P Between wells - grease Type (I, P or M): M C&K valves are cycled & flushed 2x daily Type (I, P or M): M Five year inspection and maintenance of C&K valves	Loss of function of lower Kill valves [Local Effects]	1	1	1	

2.3.5	Equipment:	Choke & Kill Lines & Valves - BOP Stack		Choke & Kill Lines & Valves on both LMRP & Stack including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
			Type (I, P or M): M Hydraulic system testing - Surface and subsea Type (I, P or M): M Replace all seals/rubber goods Type (I, P or M): M Routine function testing (Requirement is weekly) Type (I, P or M): M Soak and stump tests between wells Type (I, P or M): M Wellbore testing Type (I, P or M): M Testing is done in accordance with OEM to cover stem packing and bonnet gasket connections. Between wells, body/shell test. Type (I, P or M): M					
				Loss of function of 'other' kill valves [Local Effects]	1	1	1	
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
				Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	9	2	4	72

2.3.5	Equipment:	Choke & Kill Lines & Valves - BOP Stack		Choke & Kill Lines & Valves on both LMRP & Stack including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Actuate Under Fail-safe Conditions - Failure to open / close fail-safe valves - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.6.1)	9	2	4	72
				Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54
				External Leak - Loss of containment - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.8.1)	9	5	3	135
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to	9	1	4	36

2.3.5	Equipment:	Choke & Kill Lines & Valves - BOP Stack		Choke & Kill Lines & Valves on both LMRP & Stack including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)				
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12

2.3.5	Equipment:	Choke & Kill Lines & Valves - BOP Stack		Choke & Kill Lines & Valves on both LMRP & Stack including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				External Leak - Loss of containment - Circulate the well after drill pipe disconnect (linked to 1.9.5.1)	10	4	3	120
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
				External Leak - Loss of containment - Circulate across the BOP stack to remove trapped gas - (linked to 1.10.4.1)	10	4	3	120
5	Wear	BX Gasket connections (top and bottom and side-outs) fail Operation/use of valve Dirty fluid Bonnet fails Interface between operator and gate (design change implemented) fails Springs break Shuttle valve leaks externally Piping connections fail Scoring Dimensional wear Bonnet seals fail Stem packing seals fail Operating cylinder seal leaks Grease fitting leaks Dimensional wear - Operator fails Scoring - Operator Shuttle valve leaks internally Rod piston seals - Operator fails Gate & seat leaks Barite settling in lines Swarf & other contaminants in	Control system fluid counts/flow meter Type (I, P or M): I HPU pumps running Type (I, P or M): I Mud loss Type (I, P or M): I Pressure loss in hydraulic system Type (I, P or M): I Chamber test completed at 3k and operated at 1500 psi Type (I, P or M): P Redundant pods Type (I, P or M): P Redundant C&K valves Type (I, P or M): P Redundant annulars and rams Type (I, P or M): P Between wells - grease Type (I, P or M): M C&K valves are cycled & flushed 2x daily Type (I, P or M): M Five year inspection and maintenance of C&K valves Type (I, P or M): M Hydraulic system testing - Surface	Leak of lower kill valves [Local Effects]	1	1	1	

2.3.5	Equipment:	Choke & Kill Lines & Valves - BOP Stack		Choke & Kill Lines & Valves on both LMRP & Stack including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
		mud Contaminated fluid - swarf Galling Shuttle valve fails (doesn't transition/move, stuck, leaks) Piston seal fails Stem packing fails Cylinder seal fails Springs fail Bonnet fails on doors Gasket fails between stack components (Wellhead to Stack to LMRP to Riser) Seal seat fails due to defects Trash in the well (swarf, concrete, etc.) Bleeding off choke & kill valves fail to safe close with loss of hydraulics	and subsea Type (I, P or M): M Replace all seals/rubber goods Type (I, P or M): M Routine function testing (Requirement is weekly) Type (I, P or M): M Soak and stump tests between wells Type (I, P or M): M Testing is done in accordance with OEM to cover stem packing and bonnet gasket connections. Between wells, body/shell test. Type (I, P or M): M Wellbore testing Type (I, P or M): M					
				Leak of 'other' kill valves [Local Effects]	1	1	1	
				Loss of function of lower Kill valves [Local Effects]	1	1	1	
				Loss of function of 'other' kill valves [Local Effects]	1	1	1	
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
				Inability to Operate (an individual) C&K Valves as Needed - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.4)	7	3	2	42

2.3.5	Equipment:	Choke & Kill Lines & Valves - BOP Stack		Choke & Kill Lines & Valves on both LMRP & Stack including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
				Failure to Close Pipe Ram on Demand - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.3)	9	1	6	63
				Inability to Operate C&K Valves as Needed - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.4)	7	3	2	42
				Inability to Operate C&K Valves as needed - Failure to seal or partial seal on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.3.3)	7	3	2	42
				Inability to Operate C&K Valves as Needed - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.3)	9	3	2	54
				Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	8	2	4	48
				Failure to Actuate Under Fail-safe Conditions - Failure to open / close fail-safe valves - Close and seal on the drill pipe and allow circulation on demand (linked to	9	2	4	72

2.3.5	Equipment:	Choke & Kill Lines & Valves - BOP Stack		Choke & Kill Lines & Valves on both LMRP & Stack including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				1.1.6.1)				
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
				Failure to Close Annular / Blind-Shear Ram on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.3)	10	2	2	40
				Inability to Operate C&K Valves as Needed - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.6)	9	2	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
				Failure to Close Hang-off Ram on Demand - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.3)	5	1	6	30
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to	6	1	4	24

2.3.5	Equipment:	Choke & Kill Lines & Valves - BOP Stack		Choke & Kill Lines & Valves on both LMRP & Stack including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)				
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
				Inability to Operate C&K Valves as Needed - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.3)	7	4	2	56
				Failure to Adequately Seal under Fail-safe Conditions - Failure to open / close fail-safe valves to seal - Circulate the well after drill pipe disconnect (linked to 1.9.3.2)	10	3	3	90
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
				Inability to Operate C&K Valves as	7	4	2	56

2.3.5	Equipment:	Choke & Kill Lines & Valves - BOP Stack		Choke & Kill Lines & Valves on both LMRP & Stack including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Needed - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.3)				
				External Leak - Loss of containment - Circulate the well after drill pipe disconnect (linked to 1.9.5.1)	10	4	3	120
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
				Inability to Operate C&K Valves as Needed - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.3)	10	4	2	80
				Failure to Adequately Seal under Fail-safe Condition - Failure to open / close fail-safe valves to seal - Circulate across the BOP stack to remove trapped gas (linked to 1.10.3.2)	10	3	3	90
				External Leak - Loss of containment - Circulate across the BOP stack to remove trapped gas - (linked to 1.10.4.1)	10	4	3	120
6	Corrosion/Erosion	Mud flow Bleeding off choke & kill valves fail to safe close with loss of hydraulics	Control system fluid counts/flow meter Type (I, P or M): I Pressure loss in hydraulic system Type (I, P or M): I HPU pumps running Type (I, P or M): I Mud loss Type (I, P or M): I Chamber test completed at 3k and operated at 1500 psi Type (I, P or M): P Redundant annulars and rams	Leak of lower kill valves [Local Effects]	1	1	1	

2.3.5	Equipment:	Choke & Kill Lines & Valves - BOP Stack		Choke & Kill Lines & Valves on both LMRP & Stack including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
			Type (I, P or M): P Redundant C&K valves Type (I, P or M): P Redundant pods Type (I, P or M): P Between wells - grease Type (I, P or M): M C&K valves are cycled & flushed 2x daily Type (I, P or M): M Five year inspection and maintenance of C&K valves Type (I, P or M): M Hydraulic system testing - Surface and subsea Type (I, P or M): M Replace all seals/rubber goods Type (I, P or M): M Routine function testing (Requirement is weekly) Type (I, P or M): M Soak and stump tests between wells Type (I, P or M): M Testing is done in accordance with OEM to cover stem packing and bonnet gasket connections. Between wells, body/shell test. Type (I, P or M): M Wellbore testing Type (I, P or M): M					
				Leak of 'other' kill valves [Local Effects]	1	1	1	
				Wellbore fluid leakage to environment - Lower kill valve [Local Effects]	1	1	1	
				Wellbore fluid leakage to environment - 'Other' C&K valves [Local Effects]	1	1	1	

2.3.5	Equipment:	Choke & Kill Lines & Valves - BOP Stack		Choke & Kill Lines & Valves on both LMRP & Stack including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	8	2	4	48
7	Loss of Function (general)	No additional causes identified beyond those reviewed in Choke & Kill Lines & Valves - BOP Stack - External Leak/Rupture - Bonnet seals failure (2.3.5.1-6)						

2.3.6	Equipment:	Connectors - BOP Stack		Connectors at Wellhead and LMRP/BOP Stack; and Hydraulic Stabs including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
1	External Leak/Rupture	BX connection to the BOP fails VX connection to well head fails AX connection on BOP mandrel fails - LMRP to BOP Hydraulic connections fails Pilot Operated check valves fails Shuttle valve fails Hydraulic piping fails Ball valve for POCV fails Shuttle valve fails (doesn't transition/move, stuck, leaks) Damaged LMRP connector face Leak of LMRP (set = LMRP failures)	Flow meter Type (I, P or M): I HPU pumps running Type (I, P or M): I Lock indicator Type (I, P or M): I Loss of mud volume in trip tank Type (I, P or M): I Key slots Type (I, P or M): I Pressure loss in hydraulic system Type (I, P or M): I POCV Type (I, P or M): I Chamber test completed at 3k and operated at 1500 psi Type (I, P or M): P For Asset/Personnel protection, leakage to environment as a protection Type (I, P or M): P Maintain latch-lock pressure 100% of time during operation Type (I, P or M): P Minimum differential pressure required on surface of transfer plate to unlock BOP Type (I, P or M): P ROV intervention Type (I, P or M): P Redundant pods Type (I, P or M): P Redundant unlock circuits Type (I, P or M): P VGX-2 gaskets with higher external pressure rating Type (I, P or M): P Hydraulic system testing - Surface and subsea Type (I, P or M): M Wellbore testing	Control fluid leakage to environment [Local Effects]	1	1	1	

2.3.6	Equipment:	Connectors - BOP Stack		Connectors at Wellhead and LMRP/BOP Stack; and Hydraulic Stabs including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
			Type (I, P or M): M Soak and stump tests between wells Type (I, P or M): M 5 year inspection and maintenance of BOP Type (I, P or M): M Overpull test on the BOP after landing Type (I, P or M): M Overpull on LMRP after each time it is reconnected Type (I, P or M): M New gaskets are used for each connection Type (I, P or M): M ROV cleans connectors directly prior to connection Type (I, P or M): M Between well - OEM recommendation, backdraft, unlock pressure testing... Type (I, P or M): M Test the BOP using a test plug in the wellhead to the maximum pressure the BOP will be tested Type (I, P or M): M Required ROV inspection every 3 day, however ROV is subsea more often Type (I, P or M): M Pressure test every 14 days (if no test ram, connector is tested) Type (I, P or M): M Between well clean, grease, inspect Type (I, P or M): M ROV inspection of connection & frame Type (I, P or M): M				
				Inability to latch/unlatch, on	1	1	1	

2.3.6	Equipment:	Connectors - BOP Stack		Connectors at Wellhead and LMRP/BOP Stack; and Hydraulic Stabs including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				demand [Local Effects]				
				Wellbore fluid leakage to environment [Local Effects]	1	1	1	
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
				Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the	8	1	2	16

2.3.6	Equipment:	Connectors - BOP Stack		Connectors at Wellhead and LMRP/BOP Stack; and Hydraulic Stabs including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				wellbore (linked to 1.4.2.1)				
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
				Failure LMRP / BOP to Connect or Disengage - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.2)	9	3	2	54
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
				Failure of LMRP / BOP Connector to Disengage - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.2)	8	3	2	48
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14

2.3.6	Equipment:	Connectors - BOP Stack		Connectors at Wellhead and LMRP/BOP Stack; and Hydraulic Stabs including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
				Failure of Wellhead Connector to Properly Lock and Seal - Inadequate BOP Connection - Connect BOP and LMRP at Landing (linked to 1.11.1.1)	2	5	3	30
				Failure of Connector Integrity - Inadequate BOP Connection - Connect BOP and LMRP at Landing (linked to 1.11.1.2)	6	2	2	24
				Failure of LMRP Connector to Properly Lock and Seal (auxiliary connections) - Inadequate LMRP Connection - Connect BOP and LMRP at Landing (linked to 1.11.2.1)	6	2	2	24
				Failure of Connector Integrity - Inadequate LMRP Connection - Connect BOP and LMRP at Landing (linked to 1.11.2.2)	6	2	2	24
2	Internal Leak	Shuttle valve fails Piston seal fails Check valve leaks Check valve fails Shuttle valve fails (doesn't	Control system fluid counts/flow meter Type (I, P or M): I HPU pumps running Type (I, P or M): I Lock indicator	Inability to latch/unlatch, on demand [Local Effects]	1	1	1	

2.3.6	Equipment:	Connectors - BOP Stack		Connectors at Wellhead and LMRP/BOP Stack; and Hydraulic Stabs including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
		transition/move, stuck, leaks) Cylinder seal fails Piston seal leaks	Type (I, P or M): I Key slots Type (I, P or M): I Loss of mud volume in trip tank Type (I, P or M): I Overpull (pull on BOP/wellhead to ensure connection) Type (I, P or M): I POCV Type (I, P or M): I Pressure loss in hydraulic system Type (I, P or M): I Alloy selection in corrosion prone areas Type (I, P or M): P Chamber test completed at 3k and operated at 1500 psi Type (I, P or M): P Minimum differential pressure required on surface of transfer plate to unlock BOP Type (I, P or M): P Place resilient (metal gasket with elastomeric component) seal on wellhead and/or BOP Type (I, P or M): P Redundant pods Type (I, P or M): P Between well clean, grease, inspect Type (I, P or M): M Clean wellhead mating surface with ROV prior to landing Type (I, P or M): M Five year inspection & rebuild of connectors Type (I, P or M): M Five year rebuild on shuttle valves Type (I, P or M): M Hydraulic system testing - Surface and subsea					

2.3.6	Equipment:	Connectors - BOP Stack		Connectors at Wellhead and LMRP/BOP Stack; and Hydraulic Stabs including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
			Type (I, P or M): M Pressure test every 14 days (if no test ram, connector is tested) Type (I, P or M): M Replace all gaskets/seals between each connection Type (I, P or M): M Required ROV inspection every 3 day, however ROV is subsea more often Type (I, P or M): M Routine function testing (Requirement is weekly) Type (I, P or M): M ROV inspection of connection & frame Type (I, P or M): M Soak and stump tests between wells Type (I, P or M): M Test the BOP using a test plug in the wellhead to the maximum pressure the BOP will be tested Type (I, P or M): M				
				Unable to maintain lock pressure in hydraulic system (assuming BSEE does not approve exception) [Local Effects]	1	1	1	
				Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on	8	2	3	48

2.3.6	Equipment:	Connectors - BOP Stack		Connectors at Wellhead and LMRP/BOP Stack; and Hydraulic Stabs including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				demand (linked to 1.1.2.2)				
				Failure to Close Pipe Ram on Demand - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.3)	9	1	6	63
				Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
				Failure to Close Annular / Blind-Shear Ram on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.3)	10	2	2	40
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
				Failure to Close Hang-off Ram on Demand - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.3)	5	1	6	30
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation -	6	1	4	24

2.3.6	Equipment:	Connectors - BOP Stack		Connectors at Wellhead and LMRP/BOP Stack; and Hydraulic Stabs including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)				
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
				Failure LMRP / BOP to Connect or Disengage - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.2)	9	3	2	54
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
				Failure of LMRP / BOP Connector to Disengage - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.2)	8	3	2	48
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12

2.3.6	Equipment:	Connectors - BOP Stack		Connectors at Wellhead and LMRP/BOP Stack; and Hydraulic Stabs including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
3	Plugged	No credible causes resulting in plugging of the Connectors - BOP Stack						
4	Mechanical Failure	Galling between piston and body Scoring or galling between piston and fingers Breakdown in everslick connection Debris in the piston Contaminated fluid Connector fails due to mechanical issues Debris in system	Flow meter Type (I, P or M): I Key slots Type (I, P or M): I Lock indicator Type (I, P or M): I Loss of mud volume in trip tank Type (I, P or M): I Overpull (pull on BOP/wellhead to ensure connection) Type (I, P or M): I POCV Type (I, P or M): I Alloy selection in corrosion prone areas Type (I, P or M): P Chamber test completed at 3k and operated at 1500 psi Type (I, P or M): P Minimum differential pressure required on surface of transfer plate to unlock BOP Type (I, P or M): P Place resilient (metal gasket with elastomeric component) seal on wellhead and/or BOP Type (I, P or M): P Between well clean, grease, inspect Type (I, P or M): M Between well connector maintenance	Inability to latch/unlatch, on demand [Local Effects]	1	1	6	

2.3.6	Equipment:	Connectors - BOP Stack		Connectors at Wellhead and LMRP/BOP Stack; and Hydraulic Stabs including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
			Type (I, P or M): M Control fluid management - Filtered, clean fluid Type (I, P or M): M Clean wellhead mating surface with ROV prior to landing Type (I, P or M): M Five year inspection & rebuild of connectors Type (I, P or M): M New metal gasket for each landing Type (I, P or M): M Pressure test every 14 days (if no test ram, connector is tested) Type (I, P or M): M Replace all gaskets/seals between each connection Type (I, P or M): M Required ROV inspection every 3 day, however ROV is subsea more often Type (I, P or M): M Soak and stump tests between wells Type (I, P or M): M Test the BOP using a test plug in the wellhead to the maximum pressure the BOP will be tested Type (I, P or M): M Tested on surface and subsea Type (I, P or M): M ROV inspection of connection & frame Type (I, P or M): M				
				Unable to maintain lock pressure in hydraulic system (assuming BSEE does not approve exception) [Local Effects]	1	1	1	
				Failure to Actuate Under Fail-safe Conditions - Failure to open / close fail-safe valves - Close and	9	2	7	126

2.3.6	Equipment:	Connectors - BOP Stack		Connectors at Wellhead and LMRP/BOP Stack; and Hydraulic Stabs including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				seal on the drill pipe and allow circulation on demand (linked to 1.1.6.1)				
				Failure LMRP / BOP to Connect or Disengage - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.2)	9	3	2	54
				Failure of LMRP / BOP Connector to Disengage - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.2)	8	3	2	48
				Failure of Wellhead Connector to Properly Lock and Seal - Inadequate BOP Connection - Connect BOP and LMRP at Landing (linked to 1.11.1.1)	2	5	3	30
				Failure of Connector Integrity - Inadequate BOP Connection - Connect BOP and LMRP at Landing (linked to 1.11.1.2)	6	2	2	24
				Failure of LMRP Connector to Properly Lock and Seal (auxiliary connections) - Inadequate LMRP Connection - Connect BOP and LMRP at Landing (linked to 1.11.2.1)	6	2	2	24
				Failure of Connector Integrity - Inadequate LMRP Connection - Connect BOP and LMRP at Landing (linked to 1.11.2.2)	6	2	2	24
5	Wear	Breakdown of everslick coating (surface treatments)	Control system fluid counts/flow meter Type (I, P or M): I Flow meter Type (I, P or M): I HPU pumps running Type (I, P or M): I	Inability to latch/unlatch, on demand [Local Effects]	1	1	1	

2.3.6	Equipment:	Connectors - BOP Stack		Connectors at Wellhead and LMRP/BOP Stack; and Hydraulic Stabs including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
			Key slots Type (I, P or M): I Lock indicator Type (I, P or M): I Loss of mud volume in trip tank Type (I, P or M): I POCV Type (I, P or M): I Pressure loss in hydraulic system Type (I, P or M): I Chamber test completed at 3k and operated at 1500 psi Type (I, P or M): P Minimum differential pressure required on surface of transfer plate to unlock BOP Type (I, P or M): P Pipe guides to assist pipe to center of rams Type (I, P or M): P Redundant annulars and rams Type (I, P or M): P Redundant pods Type (I, P or M): P VGX-2 gaskets with higher external pressure rating Type (I, P or M): P Five year inspection and maintenance of BOP Type (I, P or M): M Hydraulic system testing - Surface and subsea Type (I, P or M): M Overpull on LMRP after each time it is reconnected Type (I, P or M): M Overpull test on the BOP after landing to ensure connection Type (I, P or M): M Required ROV inspection every 3 day, however ROV is subsea more					

2.3.6	Equipment:	Connectors - BOP Stack		Connectors at Wellhead and LMRP/BOP Stack; and Hydraulic Stabs including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
			often Type (I, P or M): M ROV cleans connectors directly prior to connection Type (I, P or M): M Soak and stump tests between wells Type (I, P or M): M Test the BOP using a test plug in the wellhead to the maximum pressure the BOP will be tested Type (I, P or M): M Wellbore testing Type (I, P or M): M Between well - OEM recommendation, backdraft, unlock pressure testing... Type (I, P or M): M Pressure test every 14 days (if no test ram, connector is tested) Type (I, P or M): M Between well clean, grease, inspect Type (I, P or M): M ROV inspection of connection & frame Type (I, P or M): M 5 year rebuild on shuttle valves Type (I, P or M): M Replace all gaskets/seals between each connection Type (I, P or M): M Routine function testing (Requirement is weekly) Type (I, P or M): M 5 year inspection & rebuild of connectors Type (I, P or M): M Clean wellhead mating surface with ROV prior to landing Type (I, P or M): M				

2.3.6	Equipment:	Connectors - BOP Stack		Connectors at Wellhead and LMRP/BOP Stack; and Hydraulic Stabs including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
			Between well connector maintenance Type (I, P or M): M Control fluid management - Filtered, clean fluid Type (I, P or M): M New metal gasket for each landing Type (I, P or M): M Tested on surface and subsea Type (I, P or M): M Annual - Dimensional checks, chamber testing, MPL signature testing (predictive), MPL bearings replaced, NDT on ram blocks, connecting rods, and blades. Type (I, P or M): M Between Wells - Replace all seals/rubber goods on ram blocks Type (I, P or M): M Chamber test completed at 5k and operated at 1500 psi Type (I, P or M): M Clutch plate replaced every 3 years Type (I, P or M): M Five year inspection of BOP Type (I, P or M): M Hydraulic system testing - Surface and subsea Type (I, P or M): M Overhauling nuts replaced every 2 years Type (I, P or M): M Per PM, seals are replaced annually. However, typically replaced between wells. Type (I, P or M): M Routine function testing (Requirement is weekly however exception from BSEE requested if pipe is across shears at test time) Type (I, P or M): M				

2.3.6	Equipment:	Connectors - BOP Stack		Connectors at Wellhead and LMRP/BOP Stack; and Hydraulic Stabs including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
			ROV inspection every 3 days Type (I, P or M): M Soak and stump tests between wells Type (I, P or M): M Weekly function testing Type (I, P or M): M Wellbore testing Type (I, P or M): M					
				Failure LMRP / BOP to Connect or Disengage - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.2)	9	3	2	54
				Failure of LMRP / BOP Connector to Disengage - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.2)	8	3	2	48
6	Corrosion/Erosion	Corrosive/erosive environment	Control system fluid counts/flow meter Type (I, P or M): I Flow meter Type (I, P or M): I HPU pumps running Type (I, P or M): I Key slots Type (I, P or M): I Lock indicator Type (I, P or M): I Loss of mud volume in trip tank Type (I, P or M): I POCV Type (I, P or M): I Pressure loss in hydraulic system Type (I, P or M): I Cathodic protection (anodes) Type (I, P or M): P Material coatings (paint)	Control fluid leakage to environment [Local Effects]	1	1	1	

2.3.6	Equipment:	Connectors - BOP Stack		Connectors at Wellhead and LMRP/BOP Stack; and Hydraulic Stabs including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
			Type (I, P or M): P Material/Alloy selection in corrosion prone areas Type (I, P or M): P Minimum differential pressure required on surface of transfer plate to unlock BOP Type (I, P or M): P Redundant pods Type (I, P or M): P Chamber test completed at 3k and operated at 1500 psi Type (I, P or M): P VGX-2 gaskets with higher external pressure rating Type (I, P or M): P Wellbore testing Type (I, P or M): M Hydraulic system testing - Surface and subsea Type (I, P or M): M Soak and stump tests between wells Type (I, P or M): M 5 year inspection and maintenance of BOP Type (I, P or M): M Overpull test on the BOP after landing to ensure connection Type (I, P or M): M Overpull on LMRP after each time it is re-connected Type (I, P or M): M ROV cleans connectors directly prior to connection Type (I, P or M): M Between well - OEM recommendation, backdraft, unlock pressure testing... Type (I, P or M): M Test the BOP using a test plug in				

2.3.6	Equipment:	Connectors - BOP Stack		Connectors at Wellhead and LMRP/BOP Stack; and Hydraulic Stabs including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
			the wellhead to the maximum pressure the BOP will be tested Type (I, P or M): M Required ROV inspection every 3 day, however ROV is subsea more often Type (I, P or M): M Pressure test every 14 days (if no test ram, connector is tested) Type (I, P or M): M Between well clean, grease, inspect Type (I, P or M): M ROV inspection of connection & frame Type (I, P or M): M 5 year rebuild on shuttle valves Type (I, P or M): M Replace all gaskets/seals between each connection Type (I, P or M): M Routine function testing (Requirement is weekly) Type (I, P or M): M 5 year inspection & rebuild of connectors Type (I, P or M): M Clean wellhead mating surface with ROV prior to landing Type (I, P or M): M Between well connector maintenance Type (I, P or M): M Control fluid management - Filtered, clean fluid Type (I, P or M): M New metal gasket for each landing Type (I, P or M): M Tested on surface and subsea Type (I, P or M): M				
				Wellbore fluid leakage to	1	1	1	

2.3.6	Equipment:	Connectors - BOP Stack		Connectors at Wellhead and LMRP/BOP Stack; and Hydraulic Stabs including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				environment [Local Effects]				
				Failure LMRP / BOP to Connect or Disengage - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.2)	9	3	2	54
				Failure of LMRP / BOP Connector to Disengage - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.2)	8	3	2	48
7	Loss of Function (general)	Hydrates Connector fails due to mechanical issues	Glycol injection ports Type (I, P or M): P Hydrate seals Type (I, P or M): P ROV injects glycol on weekly basis Type (I, P or M): M ROV inspection every 3 days Type (I, P or M): M	Inability to latch/unlatch, on demand [Local Effects]	1	1	1	
				Failure LMRP / BOP to Connect or Disengage - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.2)	9	3	2	54
				Failure of Wellhead Connector to Properly Lock and Seal - Inadequate BOP Connection - Connect BOP and LMRP at Landing (linked to 1.11.1.1)	2	5	3	30
				Failure of Connector Integrity - Inadequate BOP Connection - Connect BOP and LMRP at Landing (linked to 1.11.1.2)	6	2	2	24
				Failure of LMRP Connector to Properly Lock and Seal (auxiliary connections) - Inadequate LMRP Connection - Connect BOP and LMRP at Landing (linked to 1.11.2.1)	6	2	2	24

2.3.6	Equipment:	Connectors - BOP Stack		Connectors at Wellhead and LMRP/BOP Stack; and Hydraulic Stabs including associated shuttle valves, and hydraulic supply to/from SPM valves including SPM valve connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure of Connector Integrity - Inadequate LMRP Connection - Connect BOP and LMRP at Landing (linked to 1.11.2.2)	6	2	2	24

2.3.7	Equipment:	Autoshear System - BOP Stack		Autoshear System including shear ram, autoshear arming, autoshear valve, and associated hydraulic connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
1	External Leak/Rupture	Piping connections fail SPM valve seals fail SPM - Pilot system leak past piston SPM - Spool/Seat damage Shuttle valve fails Trigger valve fails due to loss of pilot pressure Shuttle valve fails (doesn't transition/move, stuck, leaks) Autoshear trigger valve fails SPM (Autoshear will activate, as designed) fails due to loss of pilot signal to controls Trigger valve (SPM valve) fails to open Valve seat fails (assumed trigger valve)	Accumulator pressure monitoring/read-back Type (I, P or M): I HPU pumps running Type (I, P or M): I Initial latch up on wellhead Type (I, P or M): I Pressure loss in hydraulic system Type (I, P or M): I Mud loss Type (I, P or M): I Visual Type (I, P or M): I Annual rebuild Type (I, P or M): M Function test between well Type (I, P or M): M ROV inspection every 3 days Type (I, P or M): M	Fails to activate/shut-in well [Local Effects]	1	1	1	
				Unplanned activation [Local Effects]	1	1	1	
				Unintentional Closing - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.1)	9	3	3	54
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
				Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	10	3	1	30
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to	9	3	2	54

2.3.7	Equipment:	Autoshear System - BOP Stack		Autoshear System including shear ram, autoshear arming, autoshear valve, and associated hydraulic connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)				
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
2	Internal Leak	Trigger valve leaks (past spool/seat), when closed & armed would send pressure to ram POCV fails - would vent arm signal Autoshear trigger valve fails Trigger valve (SPM valve) fails to open	Accumulator pressure monitoring/read-back Type (I, P or M): I Drill string weight Type (I, P or M): I Flow meter Type (I, P or M): I HPU pumps running Type (I, P or M): I Initial latch up on wellhead Type (I, P or M): I Pressure loss in hydraulic system Type (I, P or M): I Annual valve rebuild Type (I, P or M): M Function test between well Type (I, P or M): M	Unplanned activation [Local Effects]	1	1	1	
				Unintentional Closing - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.1)	9	3	3	54
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation -	9	1	4	36

2.3.7	Equipment:	Autoshear System - BOP Stack		Autoshear System including shear ram, autoshear arming, autoshear valve, and associated hydraulic connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)				
				Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	10	3	1	30
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
				Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
3	Plugged	No credible causes resulting in plugging of the Autoshear System - BOP Stack						
4	Mechanical Failure	Particulate in hydraulic lines Accumulator bladders fail SPM seat or spring fails SPM springs fails due to hydrogen embrittlement (environmentally stressed corrosion) Shear seals (cups, scoring in metal-metal) - If failed, would affect the pilot signal for trigger valve...If system is armed and pilot lost, could activate. Pilot signal is sent from both pods simultaneously. Springs fail SPM (Autoshear will activate, as designed) fails due to loss of plot control signals	Accumulator pressure monitoring/read-back Type (I, P or M): I Drill string weight Type (I, P or M): I Initial latch up on wellhead Type (I, P or M): I Pilot signal to trigger & arm/disarm valve sent from both pods Type (I, P or M): I Function test between well Type (I, P or M): P Annual valve rebuild Type (I, P or M): M ROV intervention Type (I, P or M): M	Fails to activate/shut-in well [Local Effects]	1	1	1	

2.3.7	Equipment:	Autoshear System - BOP Stack		Autoshear System including shear ram, autoshear arming, autoshear valve, and associated hydraulic connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
		Autoshear trigger valve fails Trigger valve spring fails Valve seat fails (assumed trigger valve) Accumulator fails due to insufficient fluid/pressure to complete full/tight closure Accumulators fail due to insufficient charge						
				Unplanned activation [Local Effects]	1	1	1	
				Failure to Actuate Under Fail-safe Conditions - Failure to open / close fail-safe valves - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.6.1)	9	2	7	126
				Unintentional Closing - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.1)	9	3	3	54
				Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	10	3	1	30
				Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
				Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120

2.3.7	Equipment:	Autoshear System - BOP Stack		Autoshear System including shear ram, autoshear arming, autoshear valve, and associated hydraulic connections				
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
5	Wear	Friction		Change out components before wear occurs [Local Effects]	1	1	1	
6	Corrosion/Erosion	Corrosion/Erosion		Fails to activate/shut-in well [Local Effects]	1	1	1	
				Unplanned activation [Local Effects]	1	1	1	
				Unintentional Closing - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.1)	5	2	1	10
7	Loss of Function (general)	No additional causes identified beyond those reviewed in Autoshear System - BOP Stack - External Leak/Rupture - SPM - Spool/Seat damage (2.3.7.1-4) Autoshear arm valve fails so that it retains the arm signal but the electrical signal indicates the system is disarmed		Unintentional Closing - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.1)	5	2	1	10

2.3.8	Equipment:	ROV Intervention Interface - BOP Stack						
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
1	Internal Leak	Shuttle valve fails - ROV pressure applied elsewhere	Frequent cycling of pumps Type (I, P or M): I Low pressure alarms Type (I, P or M): I ROV will not be able to build pressure in system Type (I, P or M): I Visual indication by presence of fluid on rig Type (I, P or M): I Daily inspection/walkthrough of HPU room/system Type (I, P or M): M Pumps on OEM-based maintenance schedule Type (I, P or M): M ROV intervention system tested between wells, on surface Type (I, P or M): M ROV intervention system tested subsea on latch-up Type (I, P or M): M System pump-up capacity tested between wells (30 minutes for single pump, 15 minutes for complete system) Type (I, P or M): M Strainers checked on regular basis (weekly) Type (I, P or M): M Surface drawdown, before BOP deployment, after latch-up, every 6 months subsea Type (I, P or M): M	Unable to perform desired/designed function, where ROV is called upon as a backup measure. [Local Effects]	1	1	1	
2	External Leak	Shuttle valve fails - ROV pressure applied elsewhere Poor seal between receptacle and ROV hot stab Function connector (hard pipe, or hose depending on function) fails	Frequent cycling of pumps Type (I, P or M): I Low pressure alarms Type (I, P or M): I ROV unable to build pressure in system/function Type (I, P or M): I Seals located on ROV hot stab	Unable to perform desired/designed function, where ROV is called upon as a backup measure. [Local Effects]	1	1	1	

2.3.8	Equipment:	ROV Intervention Interface - BOP Stack						
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
			Type (I, P or M): I Visual indication by presence of fluid on rig Type (I, P or M): I Daily inspection/walkthrough of HPU room/system Type (I, P or M): M ROV intervention system tested between wells, on surface Type (I, P or M): M ROV intervention system tested subsea on latch-up Type (I, P or M): M System pump-up capacity tested between wells (30 minutes for single pump, 15 minutes for complete system) Type (I, P or M): M Surface drawdown, before BOP deployment, after latch-up, every 6 months subsea Type (I, P or M): M Strainers checked on regular basis (weekly) Type (I, P or M): M Pumps on OEM-based maintenance schedule Type (I, P or M): M					
3	Loss of Function	Shuttle valve fails to transition/move		Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	9	2	5	90

2.3.8	Equipment:	ROV Intervention Interface - BOP Stack						
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	2	36
				Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
				Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
				Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
				Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect	6	1	2	12

2.3.8	Equipment:	ROV Intervention Interface - BOP Stack						
Item	**Failure Mode**	**Causes**	**Indications/Protections/Maintenance**	**Effects**	**Severity Ratings**	**Occurrence Ratings**	**Detection Ratings**	**Risk Priority Numbers**
				(linked to 1.9.4.2)				
				Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20

APPENDIX C (sorted by RPN)

Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
11	2.1.1.1	HPU - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close and seal on the drill pipe and allow circulation on demand due to failure to close on drill pipe through annular(s) (1.1) (linked to 1.1.1.2)	8	3	2	48
12	2.1.1.1	HPU - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	48
13	2.1.1.1	HPU - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	3	2	48
14	2.1.1.1	HPU - Surface Control Systems	External Leak/ Rupture	Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
15	2.1.1.1	HPU - Surface Control Systems	External Leak/ Rupture	Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	3	2	54
16	2.1.1.1	HPU - Surface Control Systems	External Leak/ Rupture	Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54
17	2.1.1.1	HPU - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	3	2	54
18	2.1.1.1	HPU - Surface Control Systems	External Leak/ Rupture	Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	3	2	54
19	2.1.1.1	HPU - Surface Control Systems	External Leak/ Rupture	Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	3	2	54
20	2.1.1.1	HPU - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	2	48
21	2.1.1.1	HPU - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	3	2	48

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
22	2.1.1.1	HPU - Surface Control Systems	External Leak/ Rupture	Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	8	3	2	48
23	2.1.1.1	HPU - Surface Control Systems	External Leak/ Rupture	Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	3	2	36
24	2.1.1.1	HPU - Surface Control Systems	External Leak/ Rupture	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	3	2	36
25	2.1.1.1	HPU - Surface Control Systems	External Leak/ Rupture	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	3	2	36
26	2.1.1.1	HPU - Surface Control Systems	External Leak/ Rupture	Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	3	2	36
27	2.1.1.1	HPU - Surface Control Systems	External Leak/ Rupture	External Leak - Loss of containment - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.6.1)	10	3	1	30
28	2.1.1.1	HPU - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	3	2	54
29	2.1.1.1	HPU - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
30	2.1.1.1	HPU - Surface Control Systems	External Leak/ Rupture	Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	3	2	54
31	2.1.1.1	HPU - Surface Control Systems	External Leak/ Rupture	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	3	2	60
32	2.1.1.1	HPU - Surface Control Systems	External Leak/ Rupture	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	3	2	60
33	2.1.1.1	HPU - Surface Control Systems	External Leak/ Rupture	Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	3	2	60
34	2.1.1.1	HPU - Surface Control Systems	External Leak/ Rupture	External Leak - Loss of containment - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.7.1)	10	3	2	60
35	2.1.1.1	HPU - Surface Control Systems	External Leak/ Rupture	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	3	2	54

APPENDIX C (sorted by RPN)

Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
36	2.1.1.1	HPU - Surface Control Systems	External Leak/ Rupture	Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54
37	2.1.1.1	HPU - Surface Control Systems	External Leak/ Rupture	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	3	2	42
38	2.1.1.1	HPU - Surface Control Systems	External Leak/ Rupture	Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
39	2.1.1.1	HPU - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	3	2	36
40	2.1.1.1	HPU - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	3	2	36
41	2.1.1.1	HPU - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	3	2	60
42	2.1.1.1	HPU - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	10	3	2	60
44	2.1.1.2	HPU - Surface Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	3	72
45	2.1.1.2	HPU - Surface Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	3	3	72
46	2.1.1.2	HPU - Surface Control Systems	Internal Leak	Failure to Maintain Adequate Sealing Pressure on Annular - Failure to seal or partial seal on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.3.2)	9	3	3	81
47	2.1.1.2	HPU - Surface Control Systems	Internal Leak	Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	3	81
48	2.1.1.2	HPU - Surface Control Systems	Internal Leak	Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	3	3	81

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
49	2.1.1.2	HPU - Surface Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	3	3	81
50	2.1.1.2	HPU - Surface Control Systems	Internal Leak	Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	3	3	81
51	2.1.1.2	HPU - Surface Control Systems	Internal Leak	Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	3	3	81
52	2.1.1.2	HPU - Surface Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
53	2.1.1.2	HPU - Surface Control Systems	Internal Leak	Failure to Maintain Hydraulic Fluid & Pressure to Annulars - Failure to maintain stripping pressure - Strip the drill string using the annular BOP(s) (linked to 1.3.2.1)	9	3	3	81
54	2.1.1.2	HPU - Surface Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	3	3	81
55	2.1.1.2	HPU - Surface Control Systems	Internal Leak	Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	8	3	3	72
56	2.1.1.2	HPU - Surface Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	3	3	54
57	2.1.1.2	HPU - Surface Control Systems	Internal Leak	Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	3	3	54
58	2.1.1.2	HPU - Surface Control Systems	Internal Leak	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	3	3	54
59	2.1.1.2	HPU - Surface Control Systems	Internal Leak	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	3	3	54
60	2.1.1.2	HPU - Surface Control Systems	Internal Leak	Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	3	3	54

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
61	2.1.1.2	HPU - Surface Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	3	3	81
62	2.1.1.2	HPU - Surface Control Systems	Internal Leak	Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	10	3	3	90
63	2.1.1.2	HPU - Surface Control Systems	Internal Leak	Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	3	3	81
64	2.1.1.2	HPU - Surface Control Systems	Internal Leak	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	3	3	90
65	2.1.1.2	HPU - Surface Control Systems	Internal Leak	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	3	3	90
66	2.1.1.2	HPU - Surface Control Systems	Internal Leak	Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	3	3	90
67	2.1.1.2	HPU - Surface Control Systems	Internal Leak	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	3	3	90
68	2.1.1.2	HPU - Surface Control Systems	Internal Leak	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	3	3	63
69	2.1.1.2	HPU - Surface Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	3	3	54
70	2.1.1.2	HPU - Surface Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	3	3	54
71	2.1.1.2	HPU - Surface Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	3	3	90
74	2.1.1.3	HPU - Surface Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	3	72
75	2.1.1.3	HPU - Surface Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	3	3	72

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
76	2.1.1.3	HPU - Surface Control Systems	Plugged	Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	3	81
77	2.1.1.3	HPU - Surface Control Systems	Plugged	Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	3	3	81
78	2.1.1.3	HPU - Surface Control Systems	Plugged	Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	3	81
79	2.1.1.3	HPU - Surface Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	3	3	81
80	2.1.1.3	HPU - Surface Control Systems	Plugged	Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	3	3	81
81	2.1.1.3	HPU - Surface Control Systems	Plugged	Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	3	3	81
82	2.1.1.3	HPU - Surface Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
83	2.1.1.3	HPU - Surface Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	3	3	72
84	2.1.1.3	HPU - Surface Control Systems	Plugged	Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	8	3	3	72
85	2.1.1.3	HPU - Surface Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	3	3	72
86	2.1.1.3	HPU - Surface Control Systems	Plugged	Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	3	3	54
87	2.1.1.3	HPU - Surface Control Systems	Plugged	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	3	3	54

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
88	2.1.1.3	HPU - Surface Control Systems	Plugged	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	3	3	54
89	2.1.1.3	HPU - Surface Control Systems	Plugged	Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	3	3	54
90	2.1.1.3	HPU - Surface Control Systems	Plugged	Actuates Too Slowly on Demand - Closes too slowly - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.5.1)	8	3	3	72
91	2.1.1.3	HPU - Surface Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	3	3	81
92	2.1.1.3	HPU - Surface Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	3	81
93	2.1.1.3	HPU - Surface Control Systems	Plugged	Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	3	3	81
94	2.1.1.3	HPU - Surface Control Systems	Plugged	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	3	3	90
95	2.1.1.3	HPU - Surface Control Systems	Plugged	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	3	3	90
96	2.1.1.3	HPU - Surface Control Systems	Plugged	Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	3	3	90
97	2.1.1.3	HPU - Surface Control Systems	Plugged	Actuates Too Slowly on Demand - Closes too slowly - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.6.1)	9	3	3	81
98	2.1.1.3	HPU - Surface Control Systems	Plugged	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	3	3	81
99	2.1.1.3	HPU - Surface Control Systems	Plugged	Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	3	81
100	2.1.1.3	HPU - Surface Control Systems	Plugged	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	3	3	63
101	2.1.1.3	HPU - Surface Control Systems	Plugged	Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	3	81

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
102	2.1.1.3	HPU - Surface Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	3	3	54
103	2.1.1.3	HPU - Surface Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	3	3	54
104	2.1.1.3	HPU - Surface Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	3	3	90
107	2.1.1.4	HPU - Surface Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	4	2	64
108	2.1.1.4	HPU - Surface Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	4	2	64
109	2.1.1.4	HPU - Surface Control Systems	Mechanical Failure	Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	4	2	72
110	2.1.1.4	HPU - Surface Control Systems	Mechanical Failure	Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	4	2	72
111	2.1.1.4	HPU - Surface Control Systems	Mechanical Failure	Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	4	2	72
112	2.1.1.4	HPU - Surface Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	4	2	72
113	2.1.1.4	HPU - Surface Control Systems	Mechanical Failure	Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	4	2	72
114	2.1.1.4	HPU - Surface Control Systems	Mechanical Failure	Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	4	2	72
115	2.1.1.4	HPU - Surface Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	4	2	64

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
116	2.1.1.4	HPU - Surface Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	4	2	64
117	2.1.1.4	HPU - Surface Control Systems	Mechanical Failure	Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	8	4	2	64
118	2.1.1.4	HPU - Surface Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	4	2	48
119	2.1.1.4	HPU - Surface Control Systems	Mechanical Failure	Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	4	2	48
120	2.1.1.4	HPU - Surface Control Systems	Mechanical Failure	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	4	2	48
121	2.1.1.4	HPU - Surface Control Systems	Mechanical Failure	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	4	2	48
122	2.1.1.4	HPU - Surface Control Systems	Mechanical Failure	Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	4	2	48
123	2.1.1.4	HPU - Surface Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	4	2	72
124	2.1.1.4	HPU - Surface Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	4	2	72
125	2.1.1.4	HPU - Surface Control Systems	Mechanical Failure	Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	4	2	72
126	2.1.1.4	HPU - Surface Control Systems	Mechanical Failure	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	4	2	80
127	2.1.1.4	HPU - Surface Control Systems	Mechanical Failure	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	4	2	80
128	2.1.1.4	HPU - Surface Control Systems	Mechanical Failure	Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	4	2	80
129	2.1.1.4	HPU - Surface Control Systems	Mechanical Failure	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	4	2	72

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
130	2.1.1.4	HPU - Surface Control Systems	Mechanical Failure	Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	4	2	72
131	2.1.1.4	HPU - Surface Control Systems	Mechanical Failure	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	4	2	56
132	2.1.1.4	HPU - Surface Control Systems	Mechanical Failure	Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	4	2	72
133	2.1.1.4	HPU - Surface Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	4	2	48
134	2.1.1.4	HPU - Surface Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	4	2	48
135	2.1.1.4	HPU - Surface Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	4	2	80
146	2.1.1.7	HPU - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	48
147	2.1.1.7	HPU - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	3	2	48
148	2.1.1.7	HPU - Surface Control Systems	Loss of Function (general)	Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
149	2.1.1.7	HPU - Surface Control Systems	Loss of Function (general)	Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	3	2	54
150	2.1.1.7	HPU - Surface Control Systems	Loss of Function (general)	Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54
151	2.1.1.7	HPU - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	3	2	54

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
152	2.1.1.7	HPU - Surface Control Systems	Loss of Function (general)	Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	3	2	54
153	2.1.1.7	HPU - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	2	48
154	2.1.1.7	HPU - Surface Control Systems	Loss of Function (general)	Failure to Maintain Hydraulic Fluid & Pressure to Annulars - Failure to maintain stripping pressure - Strip the drill string using the annular BOP(s) (linked to 1.3.2.1)	8	3	2	48
155	2.1.1.7	HPU - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	3	2	48
156	2.1.1.7	HPU - Surface Control Systems	Loss of Function (general)	Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	8	3	2	48
157	2.1.1.7	HPU - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	3	2	36
158	2.1.1.7	HPU - Surface Control Systems	Loss of Function (general)	Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	3	2	36
159	2.1.1.7	HPU - Surface Control Systems	Loss of Function (general)	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	3	2	36
160	2.1.1.7	HPU - Surface Control Systems	Loss of Function (general)	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	3	2	36
161	2.1.1.7	HPU - Surface Control Systems	Loss of Function (general)	Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	3	2	36
162	2.1.1.7	HPU - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	3	2	54
163	2.1.1.7	HPU - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
164	2.1.1.7	HPU - Surface Control Systems	Loss of Function (general)	Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	3	2	54

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
165	2.1.1.7	HPU - Surface Control Systems	Loss of Function (general)	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	3	2	60
166	2.1.1.7	HPU - Surface Control Systems	Loss of Function (general)	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	3	2	60
167	2.1.1.7	HPU - Surface Control Systems	Loss of Function (general)	Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	3	2	60
168	2.1.1.7	HPU - Surface Control Systems	Loss of Function (general)	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	3	2	54
169	2.1.1.7	HPU - Surface Control Systems	Loss of Function (general)	Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54
170	2.1.1.7	HPU - Surface Control Systems	Loss of Function (general)	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	3	2	42
171	2.1.1.7	HPU - Surface Control Systems	Loss of Function (general)	Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
172	2.1.1.7	HPU - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	3	2	36
173	2.1.1.7	HPU - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	3	2	36
174	2.1.1.7	HPU - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	3	2	60
175	2.1.1.7	HPU - Surface Control Systems	Loss of Function (general)	Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	10	3	2	60
186	2.1.2.1	Power - Surface Control Systems	Loss of Power (UPS Shuts down with power degradation)	Failure to Provide Control Signal to Annular or C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.1)	9	2	1	18
187	2.1.2.1	Power - Surface Control Systems	Loss of Power (UPS Shuts down with power degradation)	Failure to Provide Control Signal to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.1)	9	2	4	72

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
188	2.1.2.1	Power - Surface Control Systems	Loss of Power (UPS Shuts down with power degradation)	Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
189	2.1.2.1	Power - Surface Control Systems	Loss of Power (UPS Shuts down with power degradation)	Failure to Provide Control Signal to Annular / Blind-Shear Ram or C&K Valves When Demanded - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.1)	9	2	1	18
190	2.1.2.1	Power - Surface Control Systems	Loss of Power (UPS Shuts down with power degradation)	Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
191	2.1.2.1	Power - Surface Control Systems	Loss of Power (UPS Shuts down with power degradation)	Failure to Provide Control Signal to Annulars When Demanded - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.1)	9	2	1	18
192	2.1.2.1	Power - Surface Control Systems	Loss of Power (UPS Shuts down with power degradation)	Failure to Provide Control Signal to Hang-off Ram When Demanded - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.1)	9	2	2	36
193	2.1.2.1	Power - Surface Control Systems	Loss of Power (UPS Shuts down with power degradation)	Failure to Provide Control Signal to Shear Ram When Demanded - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.1)	9	1	4	36
194	2.1.2.1	Power - Surface Control Systems	Loss of Power (UPS Shuts down with power degradation)	Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20
195	2.1.2.1	Power - Surface Control Systems	Loss of Power (UPS Shuts down with power degradation)	Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
196	2.1.2.1	Power - Surface Control Systems	Loss of Power (UPS Shuts down with power degradation)	Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
197	2.1.2.1	Power - Surface Control Systems	Loss of Power (UPS Shuts down with power degradation)	Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
198	2.1.2.1	Power - Surface Control Systems	Loss of Power (UPS Shuts down with power degradation)	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
199	2.1.2.1	Power - Surface Control Systems	Loss of Power (UPS Shuts down with power degradation)	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16
200	2.1.2.1	Power - Surface Control Systems	Loss of Power (UPS Shuts down with power degradation)	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10
209	2.1.2.2	Power - Surface Control Systems	Fails with no output	Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
210	2.1.2.2	Power - Surface Control Systems	Fails with no output	Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
213	2.1.2.3	Power - Surface Control Systems	Erratic output (Erratic, Intermittent)	Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	3	2	1	6
214	2.1.2.3	Power - Surface Control Systems	Erratic output (Erratic, Intermittent)	Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	3	2	1	6
224	2.1.2.5	Power - Surface Control Systems	Electrical Short	Failure to Provide Control Signal to Annular or C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.1)	9	2	1	18
225	2.1.2.5	Power - Surface Control Systems	Electrical Short	Failure to Provide Control Signal to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.1)	9	2	4	72
226	2.1.2.5	Power - Surface Control Systems	Electrical Short	Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
227	2.1.2.5	Power - Surface Control Systems	Electrical Short	Failure to Provide Control Signal to Annular / Blind-Shear Ram or C&K Valves When Demanded - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.1)	9	2	1	18
228	2.1.2.5	Power - Surface Control Systems	Electrical Short	Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
229	2.1.2.5	Power - Surface Control Systems	Electrical Short	Failure to Provide Control Signal to Annulars When Demanded - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.1)	9	2	1	18
230	2.1.2.5	Power - Surface Control Systems	Electrical Short	Failure to Provide Control Signal to Hang-off Ram When Demanded - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.1)	9	2	2	36
231	2.1.2.5	Power - Surface Control Systems	Electrical Short	Failure to Provide Control Signal to Shear Ram When Demanded - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.1)	9	1	4	36
232	2.1.2.5	Power - Surface Control Systems	Electrical Short	Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20
233	2.1.2.5	Power - Surface Control Systems	Electrical Short	Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
234	2.1.2.5	Power - Surface Control Systems	Electrical Short	Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
235	2.1.2.5	Power - Surface Control Systems	Electrical Short	Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
236	2.1.2.5	Power - Surface Control Systems	Electrical Short	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16
237	2.1.2.5	Power - Surface Control Systems	Electrical Short	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16
238	2.1.2.5	Power - Surface Control Systems	Electrical Short	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10
247	2.1.2.6	Power - Surface Control Systems	Loss of Function	Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
248	2.1.2.6	Power - Surface Control Systems	Loss of Function	Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
250	2.1.2.7	Power - Surface Control Systems	Ground Faults	Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
251	2.1.2.7	Power - Surface Control Systems	Ground Faults	Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
253	2.1.2.8	Power - Surface Control Systems	Loss of subsea transformer	Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
254	2.1.2.8	Power - Surface Control Systems	Loss of subsea transformer	Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
262	2.1.3.2	MUX System - Surface Control Systems	Fails with no output signal/ communication	Failure to Provide Control Signal to Annular or C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.1)	9	2	1	18
263	2.1.3.2	MUX System - Surface Control Systems	Fails with no output signal/ communication	Failure to Provide Control Signal to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.1)	9	2	4	72
264	2.1.3.2	MUX System - Surface Control Systems	Fails with no output signal/ communication	Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
265	2.1.3.2	MUX System - Surface Control Systems	Fails with no output signal/ communication	Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
266	2.1.3.2	MUX System - Surface Control Systems	Fails with no output signal/ communication	Failure to Provide Control Signal to Annular / Blind-Shear Ram or C&K Valves When Demanded - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.1)	9	2	1	18
267	2.1.3.2	MUX System - Surface Control Systems	Fails with no output signal/ communication	Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
268	2.1.3.2	MUX System - Surface Control Systems	Fails with no output signal/ communication	Failure to Provide Control Signal to Annulars When Demanded - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.1)	9	2	1	18
269	2.1.3.2	MUX System - Surface Control Systems	Fails with no output signal/ communication	Failure to Provide Control Signal to Hang-off Ram When Demanded - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.1)	9	2	2	36
270	2.1.3.2	MUX System - Surface Control Systems	Fails with no output signal/ communication	Failure to Provide Control Signal to Shear Ram When Demanded - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.1)	9	1	4	36
271	2.1.3.2	MUX System - Surface Control Systems	Fails with no output signal/ communication	Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20
272	2.1.3.2	MUX System - Surface Control Systems	Fails with no output signal/ communication	Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
273	2.1.3.2	MUX System - Surface Control Systems	Fails with no output signal/ communication	Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
274	2.1.3.2	MUX System - Surface Control Systems	Fails with no output signal/ communication	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16
275	2.1.3.2	MUX System - Surface Control Systems	Fails with no output signal/ communication	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16
276	2.1.3.2	MUX System - Surface Control Systems	Fails with no output signal/ communication	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10
280	2.1.3.4	MUX System - Surface Control Systems	Erratic output (Network)	Failure to Provide Control Signal to Annular or C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.1)	9	2	1	18
281	2.1.3.4	MUX System - Surface Control Systems	Erratic output (Network)	Failure to Provide Control Signal to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.1)	9	2	4	72

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
282	2.1.3.4	MUX System - Surface Control Systems	Erratic output (Network)	Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
283	2.1.3.4	MUX System - Surface Control Systems	Erratic output (Network)	Failure to Provide Control Signal to Annular / Blind-Shear Ram or C&K Valves When Demanded - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.1)	9	2	1	18
284	2.1.3.4	MUX System - Surface Control Systems	Erratic output (Network)	Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
285	2.1.3.4	MUX System - Surface Control Systems	Erratic output (Network)	Failure to Provide Control Signal to Annulars When Demanded - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.1)	9	2	1	18
286	2.1.3.4	MUX System - Surface Control Systems	Erratic output (Network)	Failure to Provide Control Signal to Hang-off Ram When Demanded - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.1)	9	2	2	36
287	2.1.3.4	MUX System - Surface Control Systems	Erratic output (Network)	Failure to Provide Control Signal to Shear Ram When Demanded - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.1)	9	1	4	36
288	2.1.3.4	MUX System - Surface Control Systems	Erratic output (Network)	Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20
289	2.1.3.4	MUX System - Surface Control Systems	Erratic output (Network)	Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
290	2.1.3.4	MUX System - Surface Control Systems	Erratic output (Network)	Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
291	2.1.3.4	MUX System - Surface Control Systems	Erratic output (Network)	Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
292	2.1.3.4	MUX System - Surface Control Systems	Erratic output (Network)	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
293	2.1.3.4	MUX System - Surface Control Systems	Erratic output (Network)	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16
294	2.1.3.4	MUX System - Surface Control Systems	Erratic output (Network)	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10
307	2.1.3.5	MUX System - Surface Control Systems	Fails to respond to input	Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
308	2.1.3.5	MUX System - Surface Control Systems	Fails to respond to input	Failure to Provide Control Signal to Annular or C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.1)	9	2	1	18
309	2.1.3.5	MUX System - Surface Control Systems	Fails to respond to input	Failure to Provide Control Signal to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.1)	9	2	4	72
310	2.1.3.5	MUX System - Surface Control Systems	Fails to respond to input	Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
311	2.1.3.5	MUX System - Surface Control Systems	Fails to respond to input	Failure to Provide Control Signal to Annular / Blind-Shear Ram or C&K Valves When Demanded - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.1)	9	2	1	18
312	2.1.3.5	MUX System - Surface Control Systems	Fails to respond to input	Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
313	2.1.3.5	MUX System - Surface Control Systems	Fails to respond to input	Failure to Provide Control Signal to Annulars When Demanded - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.1)	9	2	1	18
314	2.1.3.5	MUX System - Surface Control Systems	Fails to respond to input	Failure to Provide Control Signal to Hang-off Ram When Demanded - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.1)	9	2	2	36
315	2.1.3.5	MUX System - Surface Control Systems	Fails to respond to input	Failure to Provide Control Signal to Shear Ram When Demanded - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.1)	9	1	4	36

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
316	2.1.3.5	MUX System - Surface Control Systems	Fails to respond to input	Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20
317	2.1.3.5	MUX System - Surface Control Systems	Fails to respond to input	Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
318	2.1.3.5	MUX System - Surface Control Systems	Fails to respond to input	Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
319	2.1.3.5	MUX System - Surface Control Systems	Fails to respond to input	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16
320	2.1.3.5	MUX System - Surface Control Systems	Fails to respond to input	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16
321	2.1.3.5	MUX System - Surface Control Systems	Fails to respond to input	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10
326	2.1.3.7	MUX System - Surface Control Systems	Short	Failure to Provide Control Signal to Annular or C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.1)	9	2	1	18
327	2.1.3.7	MUX System - Surface Control Systems	Short	Failure to Provide Control Signal to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.1)	9	2	4	72
328	2.1.3.7	MUX System - Surface Control Systems	Short	Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
329	2.1.3.7	MUX System - Surface Control Systems	Short	Failure to Provide Control Signal to Annular / Blind-Shear Ram or C&K Valves When Demanded - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.1)	9	2	1	18
330	2.1.3.7	MUX System - Surface Control Systems	Short	Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
331	2.1.3.7	MUX System - Surface Control Systems	Short	Failure to Provide Control Signal to Annulars When Demanded - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.1)	9	2	1	18
332	2.1.3.7	MUX System - Surface Control Systems	Short	Failure to Provide Control Signal to Hang-off Ram When Demanded - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.1)	9	2	2	36
333	2.1.3.7	MUX System - Surface Control Systems	Short	Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20
334	2.1.3.7	MUX System - Surface Control Systems	Short	Failure to Provide Control Signal to Shear Ram When Demanded - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.1)	9	1	4	36
335	2.1.3.7	MUX System - Surface Control Systems	Short	Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
336	2.1.3.7	MUX System - Surface Control Systems	Short	Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
337	2.1.3.7	MUX System - Surface Control Systems	Short	Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
338	2.1.3.7	MUX System - Surface Control Systems	Short	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16
339	2.1.3.7	MUX System - Surface Control Systems	Short	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16
340	2.1.3.7	MUX System - Surface Control Systems	Short	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10
344	2.1.3.8	MUX System - Surface Control Systems	Loss of function (general)	Failure to Provide Control Signal to Annular or C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.1)	9	2	1	18

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
345	2.1.3.8	MUX System - Surface Control Systems	Loss of function (general)	Failure to Provide Control Signal to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.1)	9	2	4	72
346	2.1.3.8	MUX System - Surface Control Systems	Loss of function (general)	Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
347	2.1.3.8	MUX System - Surface Control Systems	Loss of function (general)	Failure to Provide Control Signal to Annular / Blind-Shear Ram or C&K Valves When Demanded - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.1)	9	2	1	18
348	2.1.3.8	MUX System - Surface Control Systems	Loss of function (general)	Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
349	2.1.3.8	MUX System - Surface Control Systems	Loss of function (general)	Failure to Provide Control Signal to Annulars When Demanded - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.1)	9	2	1	18
350	2.1.3.8	MUX System - Surface Control Systems	Loss of function (general)	Failure to Provide Control Signal to Hang-off Ram When Demanded - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.1)	9	2	2	36
351	2.1.3.8	MUX System - Surface Control Systems	Loss of function (general)	Failure to Provide Control Signal to Shear Ram When Demanded - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.1)	9	1	4	36
352	2.1.3.8	MUX System - Surface Control Systems	Loss of function (general)	Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20
353	2.1.3.8	MUX System - Surface Control Systems	Loss of function (general)	Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
354	2.1.3.8	MUX System - Surface Control Systems	Loss of function (general)	Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
355	2.1.3.8	MUX System - Surface Control Systems	Loss of function (general)	Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
356	2.1.3.8	MUX System - Surface Control Systems	Loss of function (general)	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16
357	2.1.3.8	MUX System - Surface Control Systems	Loss of function (general)	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16
358	2.1.3.8	MUX System - Surface Control Systems	Loss of function (general)	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10
362	2.1.3.9	MUX System - Surface Control Systems	Mechanical Failure	Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
363	2.1.3.9	MUX System - Surface Control Systems	Mechanical Failure	Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
370	2.1.4.1	Hydraulic Supply - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
371	2.1.4.1	Hydraulic Supply - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
372	2.1.4.1	Hydraulic Supply - Surface Control Systems	External Leak/ Rupture	Failure to Maintain Adequate Sealing Pressure on Annular - Failure to seal or partial seal on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.3.2)	9	2	3	54
373	2.1.4.1	Hydraulic Supply - Surface Control Systems	External Leak/ Rupture	Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
374	2.1.4.1	Hydraulic Supply - Surface Control Systems	External Leak/ Rupture	Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
375	2.1.4.1	Hydraulic Supply - Surface Control Systems	External Leak/ Rupture	Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54
376	2.1.4.1	Hydraulic Supply - Surface Control Systems	External Leak/ Rupture	External Leak - Loss of containment - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.8.1)	8	3	3	72
377	2.1.4.1	Hydraulic Supply - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
378	2.1.4.1	Hydraulic Supply - Surface Control Systems	External Leak/ Rupture	Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	1	2	18
379	2.1.4.1	Hydraulic Supply - Surface Control Systems	External Leak/ Rupture	Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
380	2.1.4.1	Hydraulic Supply - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
381	2.1.4.1	Hydraulic Supply - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
382	2.1.4.1	Hydraulic Supply - Surface Control Systems	External Leak/ Rupture	Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	8	1	2	16
383	2.1.4.1	Hydraulic Supply - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
384	2.1.4.1	Hydraulic Supply - Surface Control Systems	External Leak/ Rupture	Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
385	2.1.4.1	Hydraulic Supply - Surface Control Systems	External Leak/ Rupture	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
386	2.1.4.1	Hydraulic Supply - Surface Control Systems	External Leak/ Rupture	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12
387	2.1.4.1	Hydraulic Supply - Surface Control Systems	External Leak/ Rupture	Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	1	4	24
388	2.1.4.1	Hydraulic Supply - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
389	2.1.4.1	Hydraulic Supply - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
390	2.1.4.1	Hydraulic Supply - Surface Control Systems	External Leak/ Rupture	Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
391	2.1.4.1	Hydraulic Supply - Surface Control Systems	External Leak/ Rupture	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
392	2.1.4.1	Hydraulic Supply - Surface Control Systems	External Leak/ Rupture	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120

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393	2.1.4.1	Hydraulic Supply - Surface Control Systems	External Leak/ Rupture	Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	2	2	40
394	2.1.4.1	Hydraulic Supply - Surface Control Systems	External Leak/ Rupture	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
395	2.1.4.1	Hydraulic Supply - Surface Control Systems	External Leak/ Rupture	Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54
396	2.1.4.1	Hydraulic Supply - Surface Control Systems	External Leak/ Rupture	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
397	2.1.4.1	Hydraulic Supply - Surface Control Systems	External Leak/ Rupture	Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
398	2.1.4.1	Hydraulic Supply - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
399	2.1.4.1	Hydraulic Supply - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
400	2.1.4.1	Hydraulic Supply - Surface Control Systems	External Leak/ Rupture	External Leak - Loss of containment - Circulate the well after drill pipe disconnect (linked to 1.9.5.1)	8	3	3	72
401	2.1.4.1	Hydraulic Supply - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20

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402	2.1.4.1	Hydraulic Supply - Surface Control Systems	External Leak/ Rupture	External Leak - Loss of containment - Circulate across the BOP stack to remove trapped gas - (linked to 1.10.4.1)	8	3	3	72
411	2.1.4.7	Hydraulic Supply - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
412	2.1.4.7	Hydraulic Supply - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
413	2.1.4.7	Hydraulic Supply - Surface Control Systems	Loss of Function (general)	Failure to Maintain Adequate Sealing Pressure on Annular - Failure to seal or partial seal on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.3.2)	9	2	3	54
414	2.1.4.7	Hydraulic Supply - Surface Control Systems	Loss of Function (general)	Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
415	2.1.4.7	Hydraulic Supply - Surface Control Systems	Loss of Function (general)	Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
416	2.1.4.7	Hydraulic Supply - Surface Control Systems	Loss of Function (general)	Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54
417	2.1.4.7	Hydraulic Supply - Surface Control Systems	Loss of Function (general)	External Leak - Loss of containment - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.8.1)	8	3	3	72
418	2.1.4.7	Hydraulic Supply - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18

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419	2.1.4.7	Hydraulic Supply - Surface Control Systems	Loss of Function (general)	Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	1	2	18
420	2.1.4.7	Hydraulic Supply - Surface Control Systems	Loss of Function (general)	Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
421	2.1.4.7	Hydraulic Supply - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
422	2.1.4.7	Hydraulic Supply - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
423	2.1.4.7	Hydraulic Supply - Surface Control Systems	Loss of Function (general)	Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	8	1	2	16
424	2.1.4.7	Hydraulic Supply - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
425	2.1.4.7	Hydraulic Supply - Surface Control Systems	Loss of Function (general)	Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
426	2.1.4.7	Hydraulic Supply - Surface Control Systems	Loss of Function (general)	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
427	2.1.4.7	Hydraulic Supply - Surface Control Systems	Loss of Function (general)	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
428	2.1.4.7	Hydraulic Supply - Surface Control Systems	Loss of Function (general)	Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	1	4	24
429	2.1.4.7	Hydraulic Supply - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
430	2.1.4.7	Hydraulic Supply - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
431	2.1.4.7	Hydraulic Supply - Surface Control Systems	Loss of Function (general)	Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
432	2.1.4.7	Hydraulic Supply - Surface Control Systems	Loss of Function (general)	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
433	2.1.4.7	Hydraulic Supply - Surface Control Systems	Loss of Function (general)	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
434	2.1.4.7	Hydraulic Supply - Surface Control Systems	Loss of Function (general)	Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	2	2	40
435	2.1.4.7	Hydraulic Supply - Surface Control Systems	Loss of Function (general)	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
436	2.1.4.7	Hydraulic Supply - Surface Control Systems	Loss of Function (general)	Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
437	2.1.4.7	Hydraulic Supply - Surface Control Systems	Loss of Function (general)	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
438	2.1.4.7	Hydraulic Supply - Surface Control Systems	Loss of Function (general)	Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
439	2.1.4.7	Hydraulic Supply - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
440	2.1.4.7	Hydraulic Supply - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
441	2.1.4.7	Hydraulic Supply - Surface Control Systems	Loss of Function (general)	External Leak - Loss of containment - Circulate the well after drill pipe disconnect (linked to 1.9.5.1)	8	3	3	72
442	2.1.4.7	Hydraulic Supply - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
443	2.1.4.7	Hydraulic Supply - Surface Control Systems	Loss of Function (general)	External Leak - Loss of containment - Circulate across the BOP stack to remove trapped gas - (linked to 1.10.4.1)	8	3	3	72
450	2.1.5.1	Control Panels - Surface Control Systems	Loss of, or Degraded Power	Failure to Provide Control Signal to Annular or C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.1)	9	2	1	18
451	2.1.5.1	Control Panels - Surface Control Systems	Loss of, or Degraded Power	Failure to Provide Control Signal to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.1)	9	2	4	72
452	2.1.5.1	Control Panels - Surface Control Systems	Loss of, or Degraded Power	Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
453	2.1.5.1	Control Panels - Surface Control Systems	Loss of, or Degraded Power	Failure to Provide Control Signal to Annular / Blind-Shear Ram or C&K Valves When Demanded - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.1)	9	2	1	18
454	2.1.5.1	Control Panels - Surface Control Systems	Loss of, or Degraded Power	Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
455	2.1.5.1	Control Panels - Surface Control Systems	Loss of, or Degraded Power	Failure to Provide Control Signal to Annulars When Demanded - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.1)	9	2	1	18
456	2.1.5.1	Control Panels - Surface Control Systems	Loss of, or Degraded Power	Failure to Provide Control Signal to Hang-off Ram When Demanded - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.1)	9	2	2	36
457	2.1.5.1	Control Panels - Surface Control Systems	Loss of, or Degraded Power	Failure to Provide Control Signal to Shear Ram When Demanded - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.1)	9	1	4	36
458	2.1.5.1	Control Panels - Surface Control Systems	Loss of, or Degraded Power	Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20
459	2.1.5.1	Control Panels - Surface Control Systems	Loss of, or Degraded Power	Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
460	2.1.5.1	Control Panels - Surface Control Systems	Loss of, or Degraded Power	Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
461	2.1.5.1	Control Panels - Surface Control Systems	Loss of, or Degraded Power	Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
462	2.1.5.1	Control Panels - Surface Control Systems	Loss of, or Degraded Power	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16
463	2.1.5.1	Control Panels - Surface Control Systems	Loss of, or Degraded Power	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
464	2.1.5.1	Control Panels - Surface Control Systems	Loss of, or Degraded Power	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10
468	2.1.5.2	Control Panels - Surface Control Systems	Fails to respond (with no output signal/ communication or to input)	Failure to Provide Control Signal to Annular or C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.1)	9	2	1	18
469	2.1.5.2	Control Panels - Surface Control Systems	Fails to respond (with no output signal/ communication or to input)	Failure to Provide Control Signal to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.1)	9	2	4	72
470	2.1.5.2	Control Panels - Surface Control Systems	Fails to respond (with no output signal/ communication or to input)	Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
471	2.1.5.2	Control Panels - Surface Control Systems	Fails to respond (with no output signal/ communication or to input)	Failure to Provide Control Signal to Annular / Blind-Shear Ram or C&K Valves When Demanded - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.1)	9	2	1	18
472	2.1.5.2	Control Panels - Surface Control Systems	Fails to respond (with no output signal/ communication or to input)	Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
473	2.1.5.2	Control Panels - Surface Control Systems	Fails to respond (with no output signal/ communication or to input)	Failure to Provide Control Signal to Annulars When Demanded - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.1)	9	2	1	18
474	2.1.5.2	Control Panels - Surface Control Systems	Fails to respond (with no output signal/ communication or to input)	Failure to Provide Control Signal to Hang-off Ram When Demanded - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.1)	9	2	2	36
475	2.1.5.2	Control Panels - Surface Control Systems	Fails to respond (with no output signal/ communication or to input)	Failure to Provide Control Signal to Shear Ram When Demanded - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.1)	9	1	4	36
476	2.1.5.2	Control Panels - Surface Control Systems	Fails to respond (with no output signal/ communication or to input)	Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20
477	2.1.5.2	Control Panels - Surface Control Systems	Fails to respond (with no output signal/ communication or to input)	Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
478	2.1.5.2	Control Panels - Surface Control Systems	Fails to respond (with no output signal/ communication or to input)	Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
479	2.1.5.2	Control Panels - Surface Control Systems	Fails to respond (with no output signal/ communication or to input)	Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
480	2.1.5.2	Control Panels - Surface Control Systems	Fails to respond (with no output signal/ communication or to input)	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16
481	2.1.5.2	Control Panels - Surface Control Systems	Fails to respond (with no output signal/ communication or to input)	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16
482	2.1.5.2	Control Panels - Surface Control Systems	Fails to respond (with no output signal/ communication or to input)	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10
485	2.1.5.4	Control Panels - Surface Control Systems	Erratic output	Failure to Provide Control Signal to Annular or C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.1)	9	2	1	18
486	2.1.5.4	Control Panels - Surface Control Systems	Erratic output	Failure to Provide Control Signal to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.1)	9	2	4	72
487	2.1.5.4	Control Panels - Surface Control Systems	Erratic output	Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
488	2.1.5.4	Control Panels - Surface Control Systems	Erratic output	Failure to Provide Control Signal to Annular / Blind-Shear Ram or C&K Valves When Demanded - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.1)	9	2	1	18
489	2.1.5.4	Control Panels - Surface Control Systems	Erratic output	Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
490	2.1.5.4	Control Panels - Surface Control Systems	Erratic output	Failure to Provide Control Signal to Annulars When Demanded - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.1)	9	2	1	18

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491	2.1.5.4	Control Panels - Surface Control Systems	Erratic output	Failure to Provide Control Signal to Hang-off Ram When Demanded - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.1)	9	2	2	36
492	2.1.5.4	Control Panels - Surface Control Systems	Erratic output	Failure to Provide Control Signal to Shear Ram When Demanded - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.1)	9	1	4	36
493	2.1.5.4	Control Panels - Surface Control Systems	Erratic output	Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20
494	2.1.5.4	Control Panels - Surface Control Systems	Erratic output	Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
495	2.1.5.4	Control Panels - Surface Control Systems	Erratic output	Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
496	2.1.5.4	Control Panels - Surface Control Systems	Erratic output	Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
497	2.1.5.4	Control Panels - Surface Control Systems	Erratic output	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16
498	2.1.5.4	Control Panels - Surface Control Systems	Erratic output	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16
499	2.1.5.4	Control Panels - Surface Control Systems	Erratic output	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10
500	2.1.5.5	Control Panels - Surface Control Systems	Fails to respond to input	Failure to Provide Control Signal to Annular or C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.1)	9	2	1	18
501	2.1.5.5	Control Panels - Surface Control Systems	Fails to respond to input	Failure to Provide Control Signal to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.1)	9	2	4	72

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502	2.1.5.5	Control Panels - Surface Control Systems	Fails to respond to input	Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
503	2.1.5.5	Control Panels - Surface Control Systems	Fails to respond to input	Failure to Provide Control Signal to Annular / Blind-Shear Ram or C&K Valves When Demanded - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.1)	9	2	1	18
504	2.1.5.5	Control Panels - Surface Control Systems	Fails to respond to input	Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
505	2.1.5.5	Control Panels - Surface Control Systems	Fails to respond to input	Failure to Provide Control Signal to Annulars When Demanded - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.1)	9	2	1	18
506	2.1.5.5	Control Panels - Surface Control Systems	Fails to respond to input	Failure to Provide Control Signal to Hang-off Ram When Demanded - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.1)	9	2	2	36
507	2.1.5.5	Control Panels - Surface Control Systems	Fails to respond to input	Failure to Provide Control Signal to Shear Ram When Demanded - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.1)	9	1	4	36
508	2.1.5.5	Control Panels - Surface Control Systems	Fails to respond to input	Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20
509	2.1.5.5	Control Panels - Surface Control Systems	Fails to respond to input	Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
510	2.1.5.5	Control Panels - Surface Control Systems	Fails to respond to input	Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
511	2.1.5.5	Control Panels - Surface Control Systems	Fails to respond to input	Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
512	2.1.5.5	Control Panels - Surface Control Systems	Fails to respond to input	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16

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513	2.1.5.5	Control Panels - Surface Control Systems	Fails to respond to input	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16
514	2.1.5.5	Control Panels - Surface Control Systems	Fails to respond to input	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10
524	2.1.5.7	Control Panels - Surface Control Systems	Short	Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
525	2.1.5.7	Control Panels - Surface Control Systems	Short	Failure to Provide Control Signal to Annular or C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.1)	9	2	1	18
526	2.1.5.7	Control Panels - Surface Control Systems	Short	Failure to Provide Control Signal to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.1)	9	2	4	72
527	2.1.5.7	Control Panels - Surface Control Systems	Short	Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
528	2.1.5.7	Control Panels - Surface Control Systems	Short	Failure to Provide Control Signal to Annular / Blind-Shear Ram or C&K Valves When Demanded - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.1)	9	2	1	18
529	2.1.5.7	Control Panels - Surface Control Systems	Short	Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
530	2.1.5.7	Control Panels - Surface Control Systems	Short	Failure to Provide Control Signal to Annulars When Demanded - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.1)	9	2	1	18
531	2.1.5.7	Control Panels - Surface Control Systems	Short	Failure to Provide Control Signal to Hang-off Ram When Demanded - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.1)	9	2	2	36
532	2.1.5.7	Control Panels - Surface Control Systems	Short	Failure to Provide Control Signal to Shear Ram When Demanded - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.1)	9	1	4	36

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
533	2.1.5.7	Control Panels - Surface Control Systems	Short	Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20
534	2.1.5.7	Control Panels - Surface Control Systems	Short	Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
535	2.1.5.7	Control Panels - Surface Control Systems	Short	Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
536	2.1.5.7	Control Panels - Surface Control Systems	Short	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16
537	2.1.5.7	Control Panels - Surface Control Systems	Short	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16
538	2.1.5.7	Control Panels - Surface Control Systems	Short	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10
542	2.1.5.8	Control Panels - Surface Control Systems	Loss of function (general)	Failure to Provide Control Signal to Annular or C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.1)	9	2	1	18
543	2.1.5.8	Control Panels - Surface Control Systems	Loss of function (general)	Failure to Provide Control Signal to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.1)	9	2	4	72
544	2.1.5.8	Control Panels - Surface Control Systems	Loss of function (general)	Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
545	2.1.5.8	Control Panels - Surface Control Systems	Loss of function (general)	Failure to Provide Control Signal to Annular / Blind-Shear Ram or C&K Valves When Demanded - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.1)	9	2	1	18
546	2.1.5.8	Control Panels - Surface Control Systems	Loss of function (general)	Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36

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547	2.1.5.8	Control Panels - Surface Control Systems	Loss of function (general)	Failure to Provide Control Signal to Annulars When Demanded - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.1)	9	2	1	18
548	2.1.5.8	Control Panels - Surface Control Systems	Loss of function (general)	Failure to Provide Control Signal to Hang-off Ram When Demanded - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.1)	9	2	2	36
549	2.1.5.8	Control Panels - Surface Control Systems	Loss of function (general)	Failure to Provide Control Signal to Shear Ram When Demanded - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.1)	9	1	4	36
550	2.1.5.8	Control Panels - Surface Control Systems	Loss of function (general)	Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20
551	2.1.5.8	Control Panels - Surface Control Systems	Loss of function (general)	Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
552	2.1.5.8	Control Panels - Surface Control Systems	Loss of function (general)	Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
553	2.1.5.8	Control Panels - Surface Control Systems	Loss of function (general)	Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
554	2.1.5.8	Control Panels - Surface Control Systems	Loss of function (general)	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16
555	2.1.5.8	Control Panels - Surface Control Systems	Loss of function (general)	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16
556	2.1.5.8	Control Panels - Surface Control Systems	Loss of function (general)	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10
561	2.1.6.1	Accumulators - Surface - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
562	2.1.6.1	Accumulators - Surface - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
563	2.1.6.1	Accumulators - Surface - Surface Control Systems	External Leak/ Rupture	Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
564	2.1.6.1	Accumulators - Surface - Surface Control Systems	External Leak/ Rupture	Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
565	2.1.6.1	Accumulators - Surface - Surface Control Systems	External Leak/ Rupture	Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54
566	2.1.6.1	Accumulators - Surface - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
567	2.1.6.1	Accumulators - Surface - Surface Control Systems	External Leak/ Rupture	Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	1	2	18
568	2.1.6.1	Accumulators - Surface - Surface Control Systems	External Leak/ Rupture	Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
569	2.1.6.1	Accumulators - Surface - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
570	2.1.6.1	Accumulators - Surface - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
571	2.1.6.1	Accumulators - Surface - Surface Control Systems	External Leak/ Rupture	Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	8	1	2	16
572	2.1.6.1	Accumulators - Surface - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
573	2.1.6.1	Accumulators - Surface - Surface Control Systems	External Leak/ Rupture	Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
574	2.1.6.1	Accumulators - Surface - Surface Control Systems	External Leak/ Rupture	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
575	2.1.6.1	Accumulators - Surface - Surface Control Systems	External Leak/ Rupture	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12
576	2.1.6.1	Accumulators - Surface - Surface Control Systems	External Leak/ Rupture	Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	1	4	24
577	2.1.6.1	Accumulators - Surface - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
578	2.1.6.1	Accumulators - Surface - Surface Control Systems	External Leak/ Rupture	Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	10	4	4	160
579	2.1.6.1	Accumulators - Surface - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54

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580	2.1.6.1	Accumulators - Surface - Surface Control Systems	External Leak/ Rupture	Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
581	2.1.6.1	Accumulators - Surface - Surface Control Systems	External Leak/ Rupture	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
582	2.1.6.1	Accumulators - Surface - Surface Control Systems	External Leak/ Rupture	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
583	2.1.6.1	Accumulators - Surface - Surface Control Systems	External Leak/ Rupture	Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	2	2	40
584	2.1.6.1	Accumulators - Surface - Surface Control Systems	External Leak/ Rupture	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
585	2.1.6.1	Accumulators - Surface - Surface Control Systems	External Leak/ Rupture	Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54
586	2.1.6.1	Accumulators - Surface - Surface Control Systems	External Leak/ Rupture	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
587	2.1.6.1	Accumulators - Surface - Surface Control Systems	External Leak/ Rupture	Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
588	2.1.6.1	Accumulators - Surface - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
589	2.1.6.1	Accumulators - Surface - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
590	2.1.6.1	Accumulators - Surface - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
592	2.1.6.2	Accumulators - Surface - Surface Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
593	2.1.6.2	Accumulators - Surface - Surface Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
594	2.1.6.2	Accumulators - Surface - Surface Control Systems	Internal Leak	Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
595	2.1.6.2	Accumulators - Surface - Surface Control Systems	Internal Leak	Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
596	2.1.6.2	Accumulators - Surface - Surface Control Systems	Internal Leak	Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54
597	2.1.6.2	Accumulators - Surface - Surface Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
598	2.1.6.2	Accumulators - Surface - Surface Control Systems	Internal Leak	Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	1	2	18

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
599	2.1.6.2	Accumulators - Surface - Surface Control Systems	Internal Leak	Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
600	2.1.6.2	Accumulators - Surface - Surface Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
601	2.1.6.2	Accumulators - Surface - Surface Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
602	2.1.6.2	Accumulators - Surface - Surface Control Systems	Internal Leak	Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	8	1	2	16
603	2.1.6.2	Accumulators - Surface - Surface Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
604	2.1.6.2	Accumulators - Surface - Surface Control Systems	Internal Leak	Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
605	2.1.6.2	Accumulators - Surface - Surface Control Systems	Internal Leak	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
606	2.1.6.2	Accumulators - Surface - Surface Control Systems	Internal Leak	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12
607	2.1.6.2	Accumulators - Surface - Surface Control Systems	Internal Leak	Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	1	4	24

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
608	2.1.6.2	Accumulators - Surface - Surface Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
609	2.1.6.2	Accumulators - Surface - Surface Control Systems	Internal Leak	Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	10	4	4	160
610	2.1.6.2	Accumulators - Surface - Surface Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
611	2.1.6.2	Accumulators - Surface - Surface Control Systems	Internal Leak	Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
612	2.1.6.2	Accumulators - Surface - Surface Control Systems	Internal Leak	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
613	2.1.6.2	Accumulators - Surface - Surface Control Systems	Internal Leak	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
614	2.1.6.2	Accumulators - Surface - Surface Control Systems	Internal Leak	Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	2	2	40
615	2.1.6.2	Accumulators - Surface - Surface Control Systems	Internal Leak	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
616	2.1.6.2	Accumulators - Surface - Surface Control Systems	Internal Leak	Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54

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617	2.1.6.2	Accumulators - Surface - Surface Control Systems	Internal Leak	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
618	2.1.6.2	Accumulators - Surface - Surface Control Systems	Internal Leak	Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
619	2.1.6.2	Accumulators - Surface - Surface Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
620	2.1.6.2	Accumulators - Surface - Surface Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
621	2.1.6.2	Accumulators - Surface - Surface Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
622	2.1.6.3	Accumulators - Surface - Surface Control Systems	Plugged	Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	3	2	60
624	2.1.6.4	Accumulators - Surface - Surface Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
625	2.1.6.4	Accumulators - Surface - Surface Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
626	2.1.6.4	Accumulators - Surface - Surface Control Systems	Mechanical Failure	Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54

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627	2.1.6.4	Accumulators - Surface - Surface Control Systems	Mechanical Failure	Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
628	2.1.6.4	Accumulators - Surface - Surface Control Systems	Mechanical Failure	Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54
629	2.1.6.4	Accumulators - Surface - Surface Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
630	2.1.6.4	Accumulators - Surface - Surface Control Systems	Mechanical Failure	Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	1	2	18
631	2.1.6.4	Accumulators - Surface - Surface Control Systems	Mechanical Failure	Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
632	2.1.6.4	Accumulators - Surface - Surface Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
633	2.1.6.4	Accumulators - Surface - Surface Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
634	2.1.6.4	Accumulators - Surface - Surface Control Systems	Mechanical Failure	Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	8	1	2	16
635	2.1.6.4	Accumulators - Surface - Surface Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
636	2.1.6.4	Accumulators - Surface - Surface Control Systems	Mechanical Failure	Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
637	2.1.6.4	Accumulators - Surface - Surface Control Systems	Mechanical Failure	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
638	2.1.6.4	Accumulators - Surface - Surface Control Systems	Mechanical Failure	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12
639	2.1.6.4	Accumulators - Surface - Surface Control Systems	Mechanical Failure	Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	1	4	24
640	2.1.6.4	Accumulators - Surface - Surface Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
641	2.1.6.4	Accumulators - Surface - Surface Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
642	2.1.6.4	Accumulators - Surface - Surface Control Systems	Mechanical Failure	Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
643	2.1.6.4	Accumulators - Surface - Surface Control Systems	Mechanical Failure	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
644	2.1.6.4	Accumulators - Surface - Surface Control Systems	Mechanical Failure	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
645	2.1.6.4	Accumulators - Surface - Surface Control Systems	Mechanical Failure	Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	2	2	40
646	2.1.6.4	Accumulators - Surface - Surface Control Systems	Mechanical Failure	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
647	2.1.6.4	Accumulators - Surface - Surface Control Systems	Mechanical Failure	Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54
648	2.1.6.4	Accumulators - Surface - Surface Control Systems	Mechanical Failure	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
649	2.1.6.4	Accumulators - Surface - Surface Control Systems	Mechanical Failure	Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
650	2.1.6.4	Accumulators - Surface - Surface Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
651	2.1.6.4	Accumulators - Surface - Surface Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
652	2.1.6.4	Accumulators - Surface - Surface Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
654	2.1.6.5	Accumulators - Surface - Surface Control Systems	Wear	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
655	2.1.6.5	Accumulators - Surface - Surface Control Systems	Wear	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
656	2.1.6.5	Accumulators - Surface - Surface Control Systems	Wear	Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
657	2.1.6.5	Accumulators - Surface - Surface Control Systems	Wear	Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
658	2.1.6.5	Accumulators - Surface - Surface Control Systems	Wear	Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54
659	2.1.6.5	Accumulators - Surface - Surface Control Systems	Wear	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
660	2.1.6.5	Accumulators - Surface - Surface Control Systems	Wear	Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	1	2	18
661	2.1.6.5	Accumulators - Surface - Surface Control Systems	Wear	Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
662	2.1.6.5	Accumulators - Surface - Surface Control Systems	Wear	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
663	2.1.6.5	Accumulators - Surface - Surface Control Systems	Wear	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
664	2.1.6.5	Accumulators - Surface - Surface Control Systems	Wear	Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	8	1	2	16
665	2.1.6.5	Accumulators - Surface - Surface Control Systems	Wear	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
666	2.1.6.5	Accumulators - Surface - Surface Control Systems	Wear	Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
667	2.1.6.5	Accumulators - Surface - Surface Control Systems	Wear	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
668	2.1.6.5	Accumulators - Surface - Surface Control Systems	Wear	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12
669	2.1.6.5	Accumulators - Surface - Surface Control Systems	Wear	Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	1	4	24
670	2.1.6.5	Accumulators - Surface - Surface Control Systems	Wear	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
671	2.1.6.5	Accumulators - Surface - Surface Control Systems	Wear	Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	10	4	4	160
672	2.1.6.5	Accumulators - Surface - Surface Control Systems	Wear	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
673	2.1.6.5	Accumulators - Surface - Surface Control Systems	Wear	Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
674	2.1.6.5	Accumulators - Surface - Surface Control Systems	Wear	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
675	2.1.6.5	Accumulators - Surface - Surface Control Systems	Wear	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
676	2.1.6.5	Accumulators - Surface - Surface Control Systems	Wear	Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	2	2	40
677	2.1.6.5	Accumulators - Surface - Surface Control Systems	Wear	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
678	2.1.6.5	Accumulators - Surface - Surface Control Systems	Wear	Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54
679	2.1.6.5	Accumulators - Surface - Surface Control Systems	Wear	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
680	2.1.6.5	Accumulators - Surface - Surface Control Systems	Wear	Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
681	2.1.6.5	Accumulators - Surface - Surface Control Systems	Wear	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
682	2.1.6.5	Accumulators - Surface - Surface Control Systems	Wear	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
683	2.1.6.5	Accumulators - Surface - Surface Control Systems	Wear	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
688	2.1.6.7	Accumulators - Surface - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
689	2.1.6.7	Accumulators - Surface - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
690	2.1.6.7	Accumulators - Surface - Surface Control Systems	Loss of Function (general)	Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
691	2.1.6.7	Accumulators - Surface - Surface Control Systems	Loss of Function (general)	Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
692	2.1.6.7	Accumulators - Surface - Surface Control Systems	Loss of Function (general)	Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54
693	2.1.6.7	Accumulators - Surface - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
694	2.1.6.7	Accumulators - Surface - Surface Control Systems	Loss of Function (general)	Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	1	2	18

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
695	2.1.6.7	Accumulators - Surface - Surface Control Systems	Loss of Function (general)	Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
696	2.1.6.7	Accumulators - Surface - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
697	2.1.6.7	Accumulators - Surface - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
698	2.1.6.7	Accumulators - Surface - Surface Control Systems	Loss of Function (general)	Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	8	1	2	16
699	2.1.6.7	Accumulators - Surface - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
700	2.1.6.7	Accumulators - Surface - Surface Control Systems	Loss of Function (general)	Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
701	2.1.6.7	Accumulators - Surface - Surface Control Systems	Loss of Function (general)	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
702	2.1.6.7	Accumulators - Surface - Surface Control Systems	Loss of Function (general)	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12
703	2.1.6.7	Accumulators - Surface - Surface Control Systems	Loss of Function (general)	Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	1	4	24

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
704	2.1.6.7	Accumulators - Surface - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
705	2.1.6.7	Accumulators - Surface - Surface Control Systems	Loss of Function (general)	Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	10	4	4	160
706	2.1.6.7	Accumulators - Surface - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
707	2.1.6.7	Accumulators - Surface - Surface Control Systems	Loss of Function (general)	Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
708	2.1.6.7	Accumulators - Surface - Surface Control Systems	Loss of Function (general)	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
709	2.1.6.7	Accumulators - Surface - Surface Control Systems	Loss of Function (general)	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
710	2.1.6.7	Accumulators - Surface - Surface Control Systems	Loss of Function (general)	Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	2	2	40
711	2.1.6.7	Accumulators - Surface - Surface Control Systems	Loss of Function (general)	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
712	2.1.6.7	Accumulators - Surface - Surface Control Systems	Loss of Function (general)	Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
713	2.1.6.7	Accumulators - Surface - Surface Control Systems	Loss of Function (general)	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
714	2.1.6.7	Accumulators - Surface - Surface Control Systems	Loss of Function (general)	Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
715	2.1.6.7	Accumulators - Surface - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
716	2.1.6.7	Accumulators - Surface - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
717	2.1.6.7	Accumulators - Surface - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
723	2.1.7.1	Fluid Reservoir Unit - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
724	2.1.7.1	Fluid Reservoir Unit - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
725	2.1.7.1	Fluid Reservoir Unit - Surface Control Systems	External Leak/ Rupture	Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54
726	2.1.7.1	Fluid Reservoir Unit - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
727	2.1.7.1	Fluid Reservoir Unit - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
728	2.1.7.1	Fluid Reservoir Unit - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
729	2.1.7.1	Fluid Reservoir Unit - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
730	2.1.7.1	Fluid Reservoir Unit - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
731	2.1.7.1	Fluid Reservoir Unit - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
732	2.1.7.1	Fluid Reservoir Unit - Surface Control Systems	External Leak/ Rupture	Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
733	2.1.7.1	Fluid Reservoir Unit - Surface Control Systems	External Leak/ Rupture	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
734	2.1.7.1	Fluid Reservoir Unit - Surface Control Systems	External Leak/ Rupture	Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54
735	2.1.7.1	Fluid Reservoir Unit - Surface Control Systems	External Leak/ Rupture	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
736	2.1.7.1	Fluid Reservoir Unit - Surface Control Systems	External Leak/ Rupture	Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
737	2.1.7.1	Fluid Reservoir Unit - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
738	2.1.7.1	Fluid Reservoir Unit - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
739	2.1.7.1	Fluid Reservoir Unit - Surface Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
741	2.1.7.2	Fluid Reservoir Unit - Surface Control Systems	Internal Leak	Failure to Maintain Adequate Sealing Pressure on Annular - Failure to seal or partial seal on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.3.2)	9	2	3	54
742	2.1.7.2	Fluid Reservoir Unit - Surface Control Systems	Internal Leak	Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
743	2.1.7.2	Fluid Reservoir Unit - Surface Control Systems	Internal Leak	Failure to Maintain Hydraulic Fluid & Pressure to Annulars - Failure to maintain stripping pressure - Strip the drill string using the annular BOP(s) (linked to 1.3.2.1)	9	2	2	36
746	2.1.7.3	Fluid Reservoir Unit - Surface Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
747	2.1.7.3	Fluid Reservoir Unit - Surface Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
748	2.1.7.3	Fluid Reservoir Unit - Surface Control Systems	Plugged	Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54
749	2.1.7.3	Fluid Reservoir Unit - Surface Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
750	2.1.7.3	Fluid Reservoir Unit - Surface Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
751	2.1.7.3	Fluid Reservoir Unit - Surface Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
752	2.1.7.3	Fluid Reservoir Unit - Surface Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
753	2.1.7.3	Fluid Reservoir Unit - Surface Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
754	2.1.7.3	Fluid Reservoir Unit - Surface Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
755	2.1.7.3	Fluid Reservoir Unit - Surface Control Systems	Plugged	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
756	2.1.7.3	Fluid Reservoir Unit - Surface Control Systems	Plugged	Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
757	2.1.7.3	Fluid Reservoir Unit - Surface Control Systems	Plugged	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
758	2.1.7.3	Fluid Reservoir Unit - Surface Control Systems	Plugged	Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
759	2.1.7.3	Fluid Reservoir Unit - Surface Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
760	2.1.7.3	Fluid Reservoir Unit - Surface Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
761	2.1.7.3	Fluid Reservoir Unit - Surface Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
763	2.1.7.4	Fluid Reservoir Unit - Surface Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
764	2.1.7.4	Fluid Reservoir Unit - Surface Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
765	2.1.7.4	Fluid Reservoir Unit - Surface Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
766	2.1.7.4	Fluid Reservoir Unit - Surface Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
767	2.1.7.4	Fluid Reservoir Unit - Surface Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
768	2.1.7.4	Fluid Reservoir Unit - Surface Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
769	2.1.7.4	Fluid Reservoir Unit - Surface Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
770	2.1.7.4	Fluid Reservoir Unit - Surface Control Systems	Mechanical Failure	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
771	2.1.7.4	Fluid Reservoir Unit - Surface Control Systems	Mechanical Failure	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
772	2.1.7.4	Fluid Reservoir Unit - Surface Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
773	2.1.7.4	Fluid Reservoir Unit - Surface Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
774	2.1.7.4	Fluid Reservoir Unit - Surface Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
776	2.1.7.5	Fluid Reservoir Unit - Surface Control Systems	Wear	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	2	1	3	6

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
782	2.1.7.7	Fluid Reservoir Unit - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
783	2.1.7.7	Fluid Reservoir Unit - Surface Control Systems	Loss of Function (general)	Failure to Maintain Adequate Sealing Pressure on Annular - Failure to seal or partial seal on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.3.2)	9	2	3	54
784	2.1.7.7	Fluid Reservoir Unit - Surface Control Systems	Loss of Function (general)	Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
785	2.1.7.7	Fluid Reservoir Unit - Surface Control Systems	Loss of Function (general)	Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54
786	2.1.7.7	Fluid Reservoir Unit - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
787	2.1.7.7	Fluid Reservoir Unit - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
788	2.1.7.7	Fluid Reservoir Unit - Surface Control Systems	Loss of Function (general)	Failure to Maintain Hydraulic Fluid & Pressure to Annulars - Failure to maintain stripping pressure - Strip the drill string using the annular BOP(s) (linked to 1.3.2.1)	9	2	2	36
789	2.1.7.7	Fluid Reservoir Unit - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
790	2.1.7.7	Fluid Reservoir Unit - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
791	2.1.7.7	Fluid Reservoir Unit - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
792	2.1.7.7	Fluid Reservoir Unit - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
793	2.1.7.7	Fluid Reservoir Unit - Surface Control Systems	Loss of Function (general)	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
794	2.1.7.7	Fluid Reservoir Unit - Surface Control Systems	Loss of Function (general)	Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54
795	2.1.7.7	Fluid Reservoir Unit - Surface Control Systems	Loss of Function (general)	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
796	2.1.7.7	Fluid Reservoir Unit - Surface Control Systems	Loss of Function (general)	Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
797	2.1.7.7	Fluid Reservoir Unit - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
798	2.1.7.7	Fluid Reservoir Unit - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
799	2.1.7.7	Fluid Reservoir Unit - Surface Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
804	2.1.8.1	Secondary & Emergency Control Systems - Surface Control Systems	Loss of, or Degraded Power	Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20
805	2.1.8.1	Secondary & Emergency Control Systems - Surface Control Systems	Loss of, or Degraded Power	Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
806	2.1.8.1	Secondary & Emergency Control Systems - Surface Control Systems	Loss of, or Degraded Power	Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
807	2.1.8.1	Secondary & Emergency Control Systems - Surface Control Systems	Loss of, or Degraded Power	Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
808	2.1.8.1	Secondary & Emergency Control Systems - Surface Control Systems	Loss of, or Degraded Power	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16
809	2.1.8.1	Secondary & Emergency Control Systems - Surface Control Systems	Loss of, or Degraded Power	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
810	2.1.8.1	Secondary & Emergency Control Systems - Surface Control Systems	Loss of, or Degraded Power	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10
812	2.1.8.2	Secondary & Emergency Control Systems - Surface Control Systems	Fails with no output signal/ communication (Includes Short)	Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20
813	2.1.8.2	Secondary & Emergency Control Systems - Surface Control Systems	Fails with no output signal/ communication (Includes Short)	Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
814	2.1.8.2	Secondary & Emergency Control Systems - Surface Control Systems	Fails with no output signal/ communication (Includes Short)	Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
815	2.1.8.2	Secondary & Emergency Control Systems - Surface Control Systems	Fails with no output signal/ communication (Includes Short)	Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
816	2.1.8.2	Secondary & Emergency Control Systems - Surface Control Systems	Fails with no output signal/ communication (Includes Short)	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
817	2.1.8.2	Secondary & Emergency Control Systems - Surface Control Systems	Fails with no output signal/ communication (Includes Short)	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16
818	2.1.8.2	Secondary & Emergency Control Systems - Surface Control Systems	Fails with no output signal/ communication (Includes Short)	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10
820	2.1.8.3	Secondary & Emergency Control Systems - Surface Control Systems	Loss of function (general)	Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20
821	2.1.8.3	Secondary & Emergency Control Systems - Surface Control Systems	Loss of function (general)	Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
822	2.1.8.3	Secondary & Emergency Control Systems - Surface Control Systems	Loss of function (general)	Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
823	2.1.8.3	Secondary & Emergency Control Systems - Surface Control Systems	Loss of function (general)	Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
824	2.1.8.3	Secondary & Emergency Control Systems - Surface Control Systems	Loss of function (general)	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16
825	2.1.8.3	Secondary & Emergency Control Systems - Surface Control Systems	Loss of function (general)	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16
826	2.1.8.3	Secondary & Emergency Control Systems - Surface Control Systems	Loss of function (general)	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10
834	2.2.1.1	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Loss of, or Degraded Power	Failure to Provide Control Signal to Annular or C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.1)	9	2	4	72
835	2.2.1.1	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Loss of, or Degraded Power	Failure to Provide Control Signal to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.1)	9	2	4	72
836	2.2.1.1	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Loss of, or Degraded Power	Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
837	2.2.1.1	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Loss of, or Degraded Power	Failure to Provide Control Signal to Annular / Blind-Shear Ram or C&K Valves When Demanded - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.1)	9	2	1	18
838	2.2.1.1	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Loss of, or Degraded Power	Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
839	2.2.1.1	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Loss of, or Degraded Power	Failure to Provide Control Signal to Annulars When Demanded - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.1)	9	2	1	18
840	2.2.1.1	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Loss of, or Degraded Power	Failure to Provide Control Signal to Hang-off Ram When Demanded - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.1)	9	2	2	36
841	2.2.1.1	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Loss of, or Degraded Power	Failure to Provide Control Signal to Shear Ram When Demanded - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.1)	9	1	4	36
842	2.2.1.1	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Loss of, or Degraded Power	Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
843	2.2.1.1	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Loss of, or Degraded Power	Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
844	2.2.1.1	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Loss of, or Degraded Power	Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
845	2.2.1.1	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Loss of, or Degraded Power	Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
846	2.2.1.1	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Loss of, or Degraded Power	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16
847	2.2.1.1	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Loss of, or Degraded Power	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16
848	2.2.1.1	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Loss of, or Degraded Power	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
851	2.2.1.2	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Fails with no output signal/ communication	Failure to Provide Control Signal to Annular or C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.1)	9	2	1	18
852	2.2.1.2	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Fails with no output signal/ communication	Failure to Provide Control Signal to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.1)	9	2	4	72
853	2.2.1.2	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Fails with no output signal/ communication	Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
854	2.2.1.2	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Fails with no output signal/ communication	Failure to Provide Control Signal to Annular / Blind-Shear Ram or C&K Valves When Demanded - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.1)	9	2	1	18
855	2.2.1.2	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Fails with no output signal/ communication	Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
856	2.2.1.2	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Fails with no output signal/ communication	Failure to Provide Control Signal to Annulars When Demanded - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.1)	9	2	1	18

APPENDIX C (sorted by RPN)

Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
857	2.2.1.2	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Fails with no output signal/ communication	Failure to Provide Control Signal to Hang-off Ram When Demanded - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.1)	9	2	2	36
858	2.2.1.2	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Fails with no output signal/ communication	Failure to Provide Control Signal to Shear Ram When Demanded - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.1)	9	1	4	36
859	2.2.1.2	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Fails with no output signal/ communication	Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20
860	2.2.1.2	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Fails with no output signal/ communication	Failure to provide control signal, when demanded - Failure to receive EDS signal - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.1.1)	10	2	1	20
861	2.2.1.2	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Fails with no output signal/ communication	Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
862	2.2.1.2	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Fails with no output signal/ communication	Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18

APPENDIX C (sorted by RPN)

Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
863	2.2.1.2	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Fails with no output signal/ communication	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16
864	2.2.1.2	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Fails with no output signal/ communication	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16
865	2.2.1.2	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Fails with no output signal/ communication	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10
867	2.2.1.3	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Erratic output	Failure to Provide Control Signal to Annular or C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.1)	9	2	1	18
868	2.2.1.3	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Erratic output	Failure to Provide Control Signal to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.1)	9	2	4	72
869	2.2.1.3	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Erratic output	Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
870	2.2.1.3	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Erratic output	Failure to Provide Control Signal to Annular / Blind-Shear Ram or C&K Valves When Demanded - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.1)	9	2	1	18
871	2.2.1.3	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Erratic output	Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
872	2.2.1.3	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Erratic output	Failure to Provide Control Signal to Annulars When Demanded - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.1)	9	2	1	18
873	2.2.1.3	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Erratic output	Failure to Provide Control Signal to Hang-off Ram When Demanded - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.1)	9	2	2	36
874	2.2.1.3	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Erratic output	Failure to Provide Control Signal to Shear Ram When Demanded - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.1)	9	1	4	36
875	2.2.1.3	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Erratic output	Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
876	2.2.1.3	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Erratic output	Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
877	2.2.1.3	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Erratic output	Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
878	2.2.1.3	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Erratic output	Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
879	2.2.1.3	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Erratic output	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16
880	2.2.1.3	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Erratic output	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16
881	2.2.1.3	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Erratic output	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
884	2.2.1.4	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Fails to respond to input - Electrical	Failure to Provide Control Signal to Annular or C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.1)	9	2	1	18
885	2.2.1.4	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Fails to respond to input - Electrical	Failure to Provide Control Signal to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.1)	9	2	4	72
886	2.2.1.4	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Fails to respond to input - Electrical	Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
887	2.2.1.4	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Fails to respond to input - Electrical	Failure to Provide Control Signal to Annular / Blind-Shear Ram or C&K Valves When Demanded - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.1)	9	2	1	18
888	2.2.1.4	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Fails to respond to input - Electrical	Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
889	2.2.1.4	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Fails to respond to input - Electrical	Failure to Provide Control Signal to Annulars When Demanded - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.1)	9	2	1	18

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
890	2.2.1.4	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Fails to respond to input - Electrical	Failure to Provide Control Signal to Hang-off Ram When Demanded - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.1)	9	2	2	36
891	2.2.1.4	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Fails to respond to input - Electrical	Failure to Provide Control Signal to Shear Ram When Demanded - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.1)	9	1	4	36
892	2.2.1.4	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Fails to respond to input - Electrical	Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20
893	2.2.1.4	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Fails to respond to input - Electrical	Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
894	2.2.1.4	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Fails to respond to input - Electrical	Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
895	2.2.1.4	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Fails to respond to input - Electrical	Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
896	2.2.1.4	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Fails to respond to input - Electrical	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16
897	2.2.1.4	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Fails to respond to input - Electrical	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16
898	2.2.1.4	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Fails to respond to input - Electrical	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10
900	2.2.1.5	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Processing error	Failure to provide control signal, when demanded - Failure to receive EDS signal - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.1.1)	10	2	1	20
902	2.2.1.6	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Ground Fault	Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
903	2.2.1.6	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Ground Fault	Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
909	2.2.1.7	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Loss of function (general)	Failure to Provide Control Signal to Annular or C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.1)	9	2	1	18
910	2.2.1.7	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Loss of function (general)	Failure to Provide Control Signal to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.1)	9	2	4	72
911	2.2.1.7	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Loss of function (general)	Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	6	2	4	48
912	2.2.1.7	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Loss of function (general)	Failure to Provide Control Signal to Annular / Blind-Shear Ram or C&K Valves When Demanded - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.1)	9	2	1	18
913	2.2.1.7	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Loss of function (general)	Unintentional Closing - Unintentional closing / opening - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.2.1)	6	2	3	36
914	2.2.1.7	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Loss of function (general)	Failure to Provide Control Signal to Annulars When Demanded - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.1)	9	2	1	18

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
915	2.2.1.7	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Loss of function (general)	Failure to Provide Control Signal to Hang-off Ram When Demanded - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.1)	9	2	2	36
916	2.2.1.7	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Loss of function (general)	Failure to Provide Control Signal to Shear Ram When Demanded - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.1)	9	1	4	36
917	2.2.1.7	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Loss of function (general)	Failure to Provide Control Signal - Failure to Arm - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.1.1)	10	2	1	20
918	2.2.1.7	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Loss of function (general)	Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
919	2.2.1.7	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Loss of function (general)	Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
920	2.2.1.7	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Loss of function (general)	Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
921	2.2.1.7	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Loss of function (general)	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.1)	8	2	1	16
922	2.2.1.7	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Loss of function (general)	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.1)	8	2	1	16
923	2.2.1.7	Blue & Yellow Control Systems - Electrical - Subsea Control Systems	Loss of function (general)	Failure to Provide Control Signal to C&K Valves when Demanded - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.1)	10	1	1	10
931	2.2.2.1	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak / Rupture	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
932	2.2.2.1	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak / Rupture	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
933	2.2.2.1	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak / Rupture	Failure to Maintain Adequate Sealing Pressure on Annular - Failure to seal or partial seal on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.3.2)	9	2	3	54

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
934	2.2.2.1	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak / Rupture	Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
935	2.2.2.1	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak / Rupture	Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
936	2.2.2.1	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak / Rupture	Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54
937	2.2.2.1	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak / Rupture	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
938	2.2.2.1	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak / Rupture	Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	1	2	18
939	2.2.2.1	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak / Rupture	Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
940	2.2.2.1	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak / Rupture	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
941	2.2.2.1	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak / Rupture	Failure to Maintain Hydraulic Fluid & Pressure to Annulars - Failure to maintain stripping pressure - Strip the drill string using the annular BOP(s) (linked to 1.3.2.1)	9	2	2	36
942	2.2.2.1	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak / Rupture	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
943	2.2.2.1	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak / Rupture	Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	8	1	2	16
944	2.2.2.1	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak / Rupture	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
945	2.2.2.1	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak / Rupture	Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
946	2.2.2.1	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak / Rupture	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
947	2.2.2.1	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak / Rupture	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12
948	2.2.2.1	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak / Rupture	Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	1	4	24
949	2.2.2.1	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak / Rupture	External Leak - Loss of containment - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.6.1)	10	3	1	30
950	2.2.2.1	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak / Rupture	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
951	2.2.2.1	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak / Rupture	Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	10	2	1	20

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
952	2.2.2.1	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak / Rupture	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
953	2.2.2.1	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak / Rupture	Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
954	2.2.2.1	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak / Rupture	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
955	2.2.2.1	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak / Rupture	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
956	2.2.2.1	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak / Rupture	Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	2	2	40
957	2.2.2.1	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak / Rupture	External Leak - Loss of containment - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.7.1)	10	2	2	40

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
958	2.2.2.1	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak / Rupture	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
959	2.2.2.1	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak / Rupture	Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54
960	2.2.2.1	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak / Rupture	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
961	2.2.2.1	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak / Rupture	Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
962	2.2.2.1	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak / Rupture	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
963	2.2.2.1	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak / Rupture	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
964	2.2.2.1	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	External Leak / Rupture	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
968	2.2.2.2	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	48
969	2.2.2.2	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Internal Leak	Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
970	2.2.2.2	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Internal Leak	Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
971	2.2.2.2	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
972	2.2.2.2	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Internal Leak	Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	1	2	18

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
973	2.2.2.2	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Internal Leak	Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
974	2.2.2.2	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
975	2.2.2.2	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Internal Leak	Failure to Maintain Hydraulic Fluid & Pressure to Annulars - Failure to maintain stripping pressure - Strip the drill string using the annular BOP(s) (linked to 1.3.2.1)	9	2	2	36
976	2.2.2.2	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
977	2.2.2.2	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Internal Leak	Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	8	1	2	16
978	2.2.2.2	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
979	2.2.2.2	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Internal Leak	Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
980	2.2.2.2	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Internal Leak	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
981	2.2.2.2	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Internal Leak	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12
982	2.2.2.2	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Internal Leak	Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	1	4	24
983	2.2.2.2	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
984	2.2.2.2	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Internal Leak	Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	10	2	1	20

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
985	2.2.2.2	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Internal Leak	Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
986	2.2.2.2	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Internal Leak	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
987	2.2.2.2	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Internal Leak	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
988	2.2.2.2	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Internal Leak	Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	2	2	40
989	2.2.2.2	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Internal Leak	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
990	2.2.2.2	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Internal Leak	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
991	2.2.2.2	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
992	2.2.2.2	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
993	2.2.2.2	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
998	2.2.2.3	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	48
999	2.2.2.3	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
1000	2.2.2.3	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Plugged	Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1001	2.2.2.3	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Plugged	Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
1002	2.2.2.3	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Plugged	Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	4	108
1003	2.2.2.3	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
1004	2.2.2.3	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Plugged	Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	1	2	18
1005	2.2.2.3	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Plugged	Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
1006	2.2.2.3	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1007	2.2.2.3	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
1008	2.2.2.3	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Plugged	Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	8	1	2	16
1009	2.2.2.3	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
1010	2.2.2.3	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Plugged	Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
1011	2.2.2.3	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Plugged	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
1012	2.2.2.3	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Plugged	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1013	2.2.2.3	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Plugged	Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	1	4	24
1014	2.2.2.3	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Plugged	Actuates Too Slowly on Demand - Closes too slowly - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.5.1)	8	3	2	48
1015	2.2.2.3	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
1016	2.2.2.3	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
1017	2.2.2.3	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Plugged	Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
1018	2.2.2.3	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Plugged	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1019	2.2.2.3	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Plugged	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
1020	2.2.2.3	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Plugged	Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	2	2	40
1021	2.2.2.3	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Plugged	Actuates Too Slowly on Demand - Closes too slowly - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.6.1)	9	3	4	108
1022	2.2.2.3	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Plugged	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
1023	2.2.2.3	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Plugged	Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	4	108
1024	2.2.2.3	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Plugged	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1025	2.2.2.3	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Plugged	Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	4	108
1026	2.2.2.3	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
1027	2.2.2.3	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
1028	2.2.2.3	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
1032	2.2.2.4	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
1033	2.2.2.4	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1034	2.2.2.4	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	Failure to Maintain Adequate Sealing Pressure on Annular - Failure to seal or partial seal on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.3.2)	9	2	3	54
1035	2.2.2.4	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
1036	2.2.2.4	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
1037	2.2.2.4	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	Failure to Actuate Under Fail-safe Conditions - Failure to open / close fail-safe valves - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.6.1)	9	2	7	126
1038	2.2.2.4	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
1039	2.2.2.4	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	1	2	18

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1040	2.2.2.4	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
1041	2.2.2.4	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
1042	2.2.2.4	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
1043	2.2.2.4	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	8	1	2	16
1044	2.2.2.4	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
1045	2.2.2.4	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1046	2.2.2.4	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
1047	2.2.2.4	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12
1048	2.2.2.4	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	1	4	24
1049	2.2.2.4	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
1050	2.2.2.4	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	10	2	1	20
1051	2.2.2.4	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1052	2.2.2.4	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
1053	2.2.2.4	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
1054	2.2.2.4	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	2	2	40
1055	2.2.2.4	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
1056	2.2.2.4	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
1057	2.2.2.4	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1058	2.2.2.4	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
1059	2.2.2.4	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
1064	2.2.2.6	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Corrosion/ Erosion	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	48
1065	2.2.2.6	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Corrosion/ Erosion	Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
1066	2.2.2.6	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Corrosion/ Erosion	Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
1067	2.2.2.6	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Corrosion/ Erosion	Failure to Actuate Under Fail-safe Conditions - Failure to open / close fail-safe valves - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.6.1)	9	2	7	126

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1068	2.2.2.6	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Corrosion/ Erosion	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
1069	2.2.2.6	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Corrosion/ Erosion	Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	1	2	18
1070	2.2.2.6	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Corrosion/ Erosion	Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
1071	2.2.2.6	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Corrosion/ Erosion	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
1072	2.2.2.6	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Corrosion/ Erosion	Failure to Maintain Hydraulic Fluid & Pressure to Annulars - Failure to maintain stripping pressure - Strip the drill string using the annular BOP(s) (linked to 1.3.2.1)	9	2	2	36
1073	2.2.2.6	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Corrosion/ Erosion	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32

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1074	2.2.2.6	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Corrosion/ Erosion	Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	8	1	2	16
1075	2.2.2.6	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Corrosion/ Erosion	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
1076	2.2.2.6	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Corrosion/ Erosion	Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
1077	2.2.2.6	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Corrosion/ Erosion	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
1078	2.2.2.6	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Corrosion/ Erosion	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12
1079	2.2.2.6	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Corrosion/ Erosion	Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	1	4	24

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1080	2.2.2.6	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Corrosion/ Erosion	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
1081	2.2.2.6	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Corrosion/ Erosion	Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	10	2	1	20
1082	2.2.2.6	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Corrosion/ Erosion	Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
1083	2.2.2.6	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Corrosion/ Erosion	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
1084	2.2.2.6	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Corrosion/ Erosion	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
1085	2.2.2.6	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Corrosion/ Erosion	Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	2	2	40

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1086	2.2.2.6	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Corrosion/ Erosion	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
1087	2.2.2.6	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Corrosion/ Erosion	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
1088	2.2.2.6	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Corrosion/ Erosion	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
1089	2.2.2.6	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Corrosion/ Erosion	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
1090	2.2.2.6	Blue & Yellow Control Systems - Hydraulics - Subsea Control Systems	Corrosion/ Erosion	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
1096	2.2.3.1	Accumulators - Subsea Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
1097	2.2.3.1	Accumulators - Subsea Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
1098	2.2.3.1	Accumulators - Subsea Control Systems	External Leak/ Rupture	Failure to Maintain Adequate Sealing Pressure on Annular - Failure to seal or partial seal on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.3.2)	9	2	3	54

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1099	2.2.3.1	Accumulators - Subsea Control Systems	External Leak/ Rupture	Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
1100	2.2.3.1	Accumulators - Subsea Control Systems	External Leak/ Rupture	Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
1101	2.2.3.1	Accumulators - Subsea Control Systems	External Leak/ Rupture	Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54
1102	2.2.3.1	Accumulators - Subsea Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
1103	2.2.3.1	Accumulators - Subsea Control Systems	External Leak/ Rupture	Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	1	2	18
1104	2.2.3.1	Accumulators - Subsea Control Systems	External Leak/ Rupture	Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
1105	2.2.3.1	Accumulators - Subsea Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
1106	2.2.3.1	Accumulators - Subsea Control Systems	External Leak/ Rupture	Failure to Maintain Hydraulic Fluid & Pressure to Annulars - Failure to maintain stripping pressure - Strip the drill string using the annular BOP(s) (linked to 1.3.2.1)	9	2	2	36
1107	2.2.3.1	Accumulators - Subsea Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
1108	2.2.3.1	Accumulators - Subsea Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
1109	2.2.3.1	Accumulators - Subsea Control Systems	External Leak/ Rupture	Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6

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1110	2.2.3.1	Accumulators - Subsea Control Systems	External Leak/ Rupture	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
1111	2.2.3.1	Accumulators - Subsea Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
1112	2.2.3.1	Accumulators - Subsea Control Systems	External Leak/ Rupture	Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	10	2	1	20
1113	2.2.3.1	Accumulators - Subsea Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
1114	2.2.3.1	Accumulators - Subsea Control Systems	External Leak/ Rupture	Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
1115	2.2.3.1	Accumulators - Subsea Control Systems	External Leak/ Rupture	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
1116	2.2.3.1	Accumulators - Subsea Control Systems	External Leak/ Rupture	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
1117	2.2.3.1	Accumulators - Subsea Control Systems	External Leak/ Rupture	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
1118	2.2.3.1	Accumulators - Subsea Control Systems	External Leak/ Rupture	Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54
1119	2.2.3.1	Accumulators - Subsea Control Systems	External Leak/ Rupture	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
1120	2.2.3.1	Accumulators - Subsea Control Systems	External Leak/ Rupture	Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
1121	2.2.3.1	Accumulators - Subsea Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12

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1122	2.2.3.1	Accumulators - Subsea Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
1123	2.2.3.1	Accumulators - Subsea Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
1125	2.2.3.2	Accumulators - Subsea Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
1126	2.2.3.2	Accumulators - Subsea Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
1127	2.2.3.2	Accumulators - Subsea Control Systems	Internal Leak	Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
1128	2.2.3.2	Accumulators - Subsea Control Systems	Internal Leak	Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
1129	2.2.3.2	Accumulators - Subsea Control Systems	Internal Leak	Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54
1130	2.2.3.2	Accumulators - Subsea Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
1131	2.2.3.2	Accumulators - Subsea Control Systems	Internal Leak	Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	1	2	18
1132	2.2.3.2	Accumulators - Subsea Control Systems	Internal Leak	Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
1133	2.2.3.2	Accumulators - Subsea Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72

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1134	2.2.3.2	Accumulators - Subsea Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
1135	2.2.3.2	Accumulators - Subsea Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
1136	2.2.3.2	Accumulators - Subsea Control Systems	Internal Leak	Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
1137	2.2.3.2	Accumulators - Subsea Control Systems	Internal Leak	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
1138	2.2.3.2	Accumulators - Subsea Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
1139	2.2.3.2	Accumulators - Subsea Control Systems	Internal Leak	Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	10	2	1	20
1140	2.2.3.2	Accumulators - Subsea Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
1141	2.2.3.2	Accumulators - Subsea Control Systems	Internal Leak	Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
1142	2.2.3.2	Accumulators - Subsea Control Systems	Internal Leak	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
1143	2.2.3.2	Accumulators - Subsea Control Systems	Internal Leak	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
1144	2.2.3.2	Accumulators - Subsea Control Systems	Internal Leak	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
1145	2.2.3.2	Accumulators - Subsea Control Systems	Internal Leak	Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1146	2.2.3.2	Accumulators - Subsea Control Systems	Internal Leak	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
1147	2.2.3.2	Accumulators - Subsea Control Systems	Internal Leak	Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
1148	2.2.3.2	Accumulators - Subsea Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
1149	2.2.3.2	Accumulators - Subsea Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
1150	2.2.3.2	Accumulators - Subsea Control Systems	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
1153	2.2.3.4	Accumulators - Subsea Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
1154	2.2.3.4	Accumulators - Subsea Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
1155	2.2.3.4	Accumulators - Subsea Control Systems	Mechanical Failure	Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
1156	2.2.3.4	Accumulators - Subsea Control Systems	Mechanical Failure	Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
1157	2.2.3.4	Accumulators - Subsea Control Systems	Mechanical Failure	Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54
1158	2.2.3.4	Accumulators - Subsea Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1159	2.2.3.4	Accumulators - Subsea Control Systems	Mechanical Failure	Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	1	2	18
1160	2.2.3.4	Accumulators - Subsea Control Systems	Mechanical Failure	Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
1161	2.2.3.4	Accumulators - Subsea Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
1162	2.2.3.4	Accumulators - Subsea Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
1163	2.2.3.4	Accumulators - Subsea Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
1164	2.2.3.4	Accumulators - Subsea Control Systems	Mechanical Failure	Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
1165	2.2.3.4	Accumulators - Subsea Control Systems	Mechanical Failure	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
1166	2.2.3.4	Accumulators - Subsea Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
1167	2.2.3.4	Accumulators - Subsea Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
1168	2.2.3.4	Accumulators - Subsea Control Systems	Mechanical Failure	Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
1169	2.2.3.4	Accumulators - Subsea Control Systems	Mechanical Failure	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1170	2.2.3.4	Accumulators - Subsea Control Systems	Mechanical Failure	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
1171	2.2.3.4	Accumulators - Subsea Control Systems	Mechanical Failure	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
1172	2.2.3.4	Accumulators - Subsea Control Systems	Mechanical Failure	Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54
1173	2.2.3.4	Accumulators - Subsea Control Systems	Mechanical Failure	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
1174	2.2.3.4	Accumulators - Subsea Control Systems	Mechanical Failure	Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
1175	2.2.3.4	Accumulators - Subsea Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
1176	2.2.3.4	Accumulators - Subsea Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
1177	2.2.3.4	Accumulators - Subsea Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
1179	2.2.3.5	Accumulators - Subsea Control Systems	Wear	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
1180	2.2.3.5	Accumulators - Subsea Control Systems	Wear	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
1181	2.2.3.5	Accumulators - Subsea Control Systems	Wear	Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1182	2.2.3.5	Accumulators - Subsea Control Systems	Wear	Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
1183	2.2.3.5	Accumulators - Subsea Control Systems	Wear	Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54
1184	2.2.3.5	Accumulators - Subsea Control Systems	Wear	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
1185	2.2.3.5	Accumulators - Subsea Control Systems	Wear	Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	1	2	18
1186	2.2.3.5	Accumulators - Subsea Control Systems	Wear	Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
1187	2.2.3.5	Accumulators - Subsea Control Systems	Wear	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
1188	2.2.3.5	Accumulators - Subsea Control Systems	Wear	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
1189	2.2.3.5	Accumulators - Subsea Control Systems	Wear	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
1190	2.2.3.5	Accumulators - Subsea Control Systems	Wear	Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
1191	2.2.3.5	Accumulators - Subsea Control Systems	Wear	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
1192	2.2.3.5	Accumulators - Subsea Control Systems	Wear	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1193	2.2.3.5	Accumulators - Subsea Control Systems	Wear	Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	10	2	1	20
1194	2.2.3.5	Accumulators - Subsea Control Systems	Wear	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
1195	2.2.3.5	Accumulators - Subsea Control Systems	Wear	Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
1196	2.2.3.5	Accumulators - Subsea Control Systems	Wear	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
1197	2.2.3.5	Accumulators - Subsea Control Systems	Wear	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
1198	2.2.3.5	Accumulators - Subsea Control Systems	Wear	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
1199	2.2.3.5	Accumulators - Subsea Control Systems	Wear	Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54
1200	2.2.3.5	Accumulators - Subsea Control Systems	Wear	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
1201	2.2.3.5	Accumulators - Subsea Control Systems	Wear	Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
1202	2.2.3.5	Accumulators - Subsea Control Systems	Wear	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
1203	2.2.3.5	Accumulators - Subsea Control Systems	Wear	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
1204	2.2.3.5	Accumulators - Subsea Control Systems	Wear	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1209	2.2.3.7	Accumulators - Subsea Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
1210	2.2.3.7	Accumulators - Subsea Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
1211	2.2.3.7	Accumulators - Subsea Control Systems	Loss of Function (general)	Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
1212	2.2.3.7	Accumulators - Subsea Control Systems	Loss of Function (general)	Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
1213	2.2.3.7	Accumulators - Subsea Control Systems	Loss of Function (general)	Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54
1214	2.2.3.7	Accumulators - Subsea Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
1215	2.2.3.7	Accumulators - Subsea Control Systems	Loss of Function (general)	Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	1	2	18
1216	2.2.3.7	Accumulators - Subsea Control Systems	Loss of Function (general)	Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
1217	2.2.3.7	Accumulators - Subsea Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
1218	2.2.3.7	Accumulators - Subsea Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
1219	2.2.3.7	Accumulators - Subsea Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1220	2.2.3.7	Accumulators - Subsea Control Systems	Loss of Function (general)	Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
1221	2.2.3.7	Accumulators - Subsea Control Systems	Loss of Function (general)	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
1222	2.2.3.7	Accumulators - Subsea Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
1223	2.2.3.7	Accumulators - Subsea Control Systems	Loss of Function (general)	Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	10	2	1	20
1224	2.2.3.7	Accumulators - Subsea Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
1225	2.2.3.7	Accumulators - Subsea Control Systems	Loss of Function (general)	Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
1226	2.2.3.7	Accumulators - Subsea Control Systems	Loss of Function (general)	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
1227	2.2.3.7	Accumulators - Subsea Control Systems	Loss of Function (general)	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
1228	2.2.3.7	Accumulators - Subsea Control Systems	Loss of Function (general)	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
1229	2.2.3.7	Accumulators - Subsea Control Systems	Loss of Function (general)	Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54
1230	2.2.3.7	Accumulators - Subsea Control Systems	Loss of Function (general)	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
1231	2.2.3.7	Accumulators - Subsea Control Systems	Loss of Function (general)	Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1232	2.2.3.7	Accumulators - Subsea Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
1233	2.2.3.7	Accumulators - Subsea Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
1234	2.2.3.7	Accumulators - Subsea Control Systems	Loss of Function (general)	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
1241	2.2.4.1	EDS - Subsea Control Systems	Loss of, or Degraded Power	Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
1242	2.2.4.1	EDS - Subsea Control Systems	Loss of, or Degraded Power	Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
1243	2.2.4.1	EDS - Subsea Control Systems	Loss of, or Degraded Power	Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
1246	2.2.4.2	EDS - Subsea Control Systems	Fails with no output signal/ communication	Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
1247	2.2.4.2	EDS - Subsea Control Systems	Fails with no output signal/ communication	Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
1248	2.2.4.2	EDS - Subsea Control Systems	Fails with no output signal/ communication	Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
1253	2.2.4.3	EDS - Subsea Control Systems	Erratic output	Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
1254	2.2.4.3	EDS - Subsea Control Systems	Erratic output	Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
1255	2.2.4.3	EDS - Subsea Control Systems	Erratic output	Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1259	2.2.4.4	EDS - Subsea Control Systems	Fails to respond to input	Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
1260	2.2.4.4	EDS - Subsea Control Systems	Fails to respond to input	Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
1261	2.2.4.4	EDS - Subsea Control Systems	Fails to respond to input	Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
1265	2.2.4.5	EDS - Subsea Control Systems	Processing error	Failure to provide control signal, when demanded - Failure to receive EDS signal - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.1.1)	10	2	1	20
1267	2.2.4.6	EDS - Subsea Control Systems	Ground Fault	Failure to provide control signal, when demanded - Failure to receive EDS signal - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.1.1)	2	7	1	14
1271	2.2.4.7	EDS - Subsea Control Systems	Loss of function (general)	Failure to provide control signal, when demanded - Failure to receive EDS signal prevents disconnecting from stack during emergency operation when using the EDS (1.7) (linked to 1.7.1.1)	10	2	1	20
1272	2.2.4.7	EDS - Subsea Control Systems	Loss of function (general)	Failure to Provide Disconnect Signal (automatically) - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.1)	10	2	1	20
1273	2.2.4.7	EDS - Subsea Control Systems	Loss of function (general)	Failure to Provide Disconnect Signal (automatically or manually) - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.1)	9	2	1	18
1279	2.2.5.1	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
1280	2.2.5.1	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1281	2.2.5.1	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External Leak/ Rupture	Failure to Maintain Adequate Sealing Pressure on Annular - Failure to seal or partial seal on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.3.2)	9	2	3	54
1282	2.2.5.1	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External Leak/ Rupture	Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
1283	2.2.5.1	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External Leak/ Rupture	Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
1284	2.2.5.1	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External Leak/ Rupture	Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54
1285	2.2.5.1	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External Leak/ Rupture	External Leak - Loss of containment - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.8.1)	8	3	3	72
1286	2.2.5.1	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18

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1287	2.2.5.1	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External Leak/ Rupture	Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	1	2	18
1288	2.2.5.1	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External Leak/ Rupture	Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
1289	2.2.5.1	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
1290	2.2.5.1	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External Leak/ Rupture	Failure to Maintain Hydraulic Fluid & Pressure to Annulars - Failure to maintain stripping pressure - Strip the drill string using the annular BOP(s) (linked to 1.3.2.1)	8	2	2	32
1291	2.2.5.1	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
1292	2.2.5.1	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External Leak/ Rupture	Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	8	1	2	16

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1293	2.2.5.1	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
1294	2.2.5.1	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External Leak/ Rupture	Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
1295	2.2.5.1	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External Leak/ Rupture	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
1296	2.2.5.1	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External Leak/ Rupture	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12
1297	2.2.5.1	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External Leak/ Rupture	External Leak - Loss of containment - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.6.1)	10	3	1	30
1298	2.2.5.1	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36

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1299	2.2.5.1	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External Leak/ Rupture	Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	10	2	1	20
1300	2.2.5.1	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
1301	2.2.5.1	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External Leak/ Rupture	Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
1302	2.2.5.1	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External Leak/ Rupture	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
1303	2.2.5.1	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External Leak/ Rupture	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
1304	2.2.5.1	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External Leak/ Rupture	External Leak - Loss of containment - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.7.1)	10	3	1	30

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1305	2.2.5.1	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External Leak/ Rupture	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
1306	2.2.5.1	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External Leak/ Rupture	Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54
1307	2.2.5.1	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External Leak/ Rupture	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
1308	2.2.5.1	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External Leak/ Rupture	Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
1309	2.2.5.1	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
1310	2.2.5.1	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12

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1311	2.2.5.1	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External Leak/ Rupture	External Leak - Loss of containment - Circulate the well after drill pipe disconnect (linked to 1.9.5.1)	8	3	3	72
1312	2.2.5.1	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
1315	2.2.5.2	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Internal leak	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	48
1316	2.2.5.2	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Internal leak	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
1317	2.2.5.2	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Internal leak	Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
1318	2.2.5.2	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Internal leak	Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54

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1319	2.2.5.2	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Internal leak	Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	1	2	18
1320	2.2.5.2	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Internal leak	Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
1321	2.2.5.2	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Internal leak	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
1322	2.2.5.2	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Internal leak	Failure to Maintain Hydraulic Fluid & Pressure to Annulars - Failure to maintain stripping pressure - Strip the drill string using the annular BOP(s) (linked to 1.3.2.1)	9	2	2	36
1323	2.2.5.2	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Internal leak	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
1324	2.2.5.2	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Internal leak	Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	8	1	2	16

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1325	2.2.5.2	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Internal leak	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
1326	2.2.5.2	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Internal leak	Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
1327	2.2.5.2	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Internal leak	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
1328	2.2.5.2	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Internal leak	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12
1329	2.2.5.2	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Internal leak	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
1330	2.2.5.2	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Internal leak	Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	10	2	1	20

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1331	2.2.5.2	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Internal leak	Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
1332	2.2.5.2	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Internal leak	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
1333	2.2.5.2	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Internal leak	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
1334	2.2.5.2	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Internal leak	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
1335	2.2.5.2	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Internal leak	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
1336	2.2.5.2	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Internal leak	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12

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1337	2.2.5.2	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Internal leak	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
1338	2.2.5.2	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Internal leak	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
1343	2.2.5.3	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
1344	2.2.5.3	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
1345	2.2.5.3	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Plugged	Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
1346	2.2.5.3	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Plugged	Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54

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1347	2.2.5.3	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Plugged	Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	4	108
1348	2.2.5.3	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
1349	2.2.5.3	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Plugged	Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	1	2	18
1350	2.2.5.3	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Plugged	Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
1351	2.2.5.3	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
1352	2.2.5.3	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Plugged	Failure to Maintain Hydraulic Fluid & Pressure to Annulars - Failure to maintain stripping pressure - Strip the drill string using the annular BOP(s) (linked to 1.3.2.1)	8	2	2	32

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1353	2.2.5.3	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
1354	2.2.5.3	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
1355	2.2.5.3	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Plugged	Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
1356	2.2.5.3	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Plugged	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
1357	2.2.5.3	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Plugged	Actuates Too Slowly on Demand - Closes too slowly - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.5.1)	8	3	2	48
1358	2.2.5.3	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1359	2.2.5.3	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Plugged	Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	10	2	1	20
1360	2.2.5.3	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
1361	2.2.5.3	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Plugged	Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
1362	2.2.5.3	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Plugged	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
1363	2.2.5.3	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Plugged	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
1364	2.2.5.3	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Plugged	Actuates Too Slowly on Demand - Closes too slowly - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.6.1)	9	3	4	108

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1365	2.2.5.3	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Plugged	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
1366	2.2.5.3	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Plugged	Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	4	108
1367	2.2.5.3	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Plugged	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
1368	2.2.5.3	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Plugged	Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	4	108
1369	2.2.5.3	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
1370	2.2.5.3	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1371	2.2.5.3	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Plugged	External Leak - Loss of containment - Circulate the well after drill pipe disconnect (linked to 1.9.5.1)	8	3	3	72
1372	2.2.5.3	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Plugged	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
1376	2.2.5.4	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
1377	2.2.5.4	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
1378	2.2.5.4	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Mechanical Failure	Failure to Maintain Adequate Sealing Pressure on Annular - Failure to seal or partial seal on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.3.2)	9	2	3	54
1379	2.2.5.4	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Mechanical Failure	Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54

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1380	2.2.5.4	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Mechanical Failure	Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
1381	2.2.5.4	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Mechanical Failure	Failure to Actuate Under Fail-safe Conditions - Failure to open / close fail-safe valves - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.6.1)	9	2	7	126
1382	2.2.5.4	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
1383	2.2.5.4	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Mechanical Failure	Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	1	2	18
1384	2.2.5.4	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Mechanical Failure	Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
1385	2.2.5.4	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1386	2.2.5.4	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Mechanical Failure	Failure to Maintain Hydraulic Fluid & Pressure to Annulars - Failure to maintain stripping pressure - Strip the drill string using the annular BOP(s) (linked to 1.3.2.1)	8	2	2	32
1387	2.2.5.4	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
1388	2.2.5.4	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
1389	2.2.5.4	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Mechanical Failure	Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
1390	2.2.5.4	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Mechanical Failure	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
1391	2.2.5.4	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1392	2.2.5.4	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Mechanical Failure	Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	10	2	1	20
1393	2.2.5.4	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Mechanical Failure	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
1394	2.2.5.4	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Mechanical Failure	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
1395	2.2.5.4	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Mechanical Failure	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
1396	2.2.5.4	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Mechanical Failure	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
1397	2.2.5.4	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1398	2.2.5.4	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
1399	2.2.5.4	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
1404	2.2.5.6	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Corrosion/ Erosion	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
1405	2.2.5.6	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Corrosion/ Erosion	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
1406	2.2.5.6	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Corrosion/ Erosion	Failure to Maintain Adequate Sealing Pressure on Annular - Failure to seal or partial seal on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.3.2)	9	2	3	54
1407	2.2.5.6	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Corrosion/ Erosion	Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54

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1408	2.2.5.6	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Corrosion/ Erosion	Failure to Maintain Adequate Sealing Pressure on Pipe Ram - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.2)	9	2	3	54
1409	2.2.5.6	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Corrosion/ Erosion	Failure to Actuate Under Fail-safe Conditions - Failure to open / close fail-safe valves - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.6.1)	9	2	7	126
1410	2.2.5.6	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Corrosion/ Erosion	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
1411	2.2.5.6	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Corrosion/ Erosion	Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	1	2	18
1412	2.2.5.6	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Corrosion/ Erosion	Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
1413	2.2.5.6	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Corrosion/ Erosion	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1414	2.2.5.6	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Corrosion/ Erosion	Failure to Maintain Hydraulic Fluid & Pressure to Annulars - Failure to maintain stripping pressure - Strip the drill string using the annular BOP(s) (linked to 1.3.2.1)	8	2	2	32
1415	2.2.5.6	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Corrosion/ Erosion	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
1416	2.2.5.6	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Corrosion/ Erosion	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
1417	2.2.5.6	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Corrosion/ Erosion	Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
1418	2.2.5.6	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Corrosion/ Erosion	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
1419	2.2.5.6	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Corrosion/ Erosion	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1420	2.2.5.6	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Corrosion/ Erosion	Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	10	2	1	20
1421	2.2.5.6	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Corrosion/ Erosion	Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
1422	2.2.5.6	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Corrosion/ Erosion	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
1423	2.2.5.6	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Corrosion/ Erosion	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
1424	2.2.5.6	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Corrosion/ Erosion	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
1425	2.2.5.6	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Corrosion/ Erosion	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14

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1426	2.2.5.6	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Corrosion/ Erosion	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
1427	2.2.5.6	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Corrosion/ Erosion	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
1428	2.2.5.6	Hydraulic Supply: Rigid Conduit and Manifold - Subsea Control Systems	Corrosion/ Erosion	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
1439	2.3.1.1	Annulars - BOP Stack	External Leak/ Rupture	Failure to Close Annular / Blind-Shear Ram on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.3)	10	2	2	40
1440	2.3.1.1	Annulars - BOP Stack	External Leak/ Rupture	Failure to Close Annulars on Drill String on Demand - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.3)	8	2	2	32
1441	2.3.1.1	Annulars - BOP Stack	External Leak/ Rupture	Failure of Annulars to Seal on Demand - Failure to seal - Strip the drill string using the annular BOP(s) (linked to 1.3.3.1)	8	2	2	32
1442	2.3.1.1	Annulars - BOP Stack	External Leak/ Rupture	Failure to Maintain Sealing Pressure on Annulars - Failure to seal - Strip the drill string using the annular BOP(s) (linked to 1.3.3.2)	9	2	2	36
1443	2.3.1.1	Annulars - BOP Stack	External Leak/ Rupture	Failure to Close Annular on Demand - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.3)	10	2	2	40
1444	2.3.1.1	Annulars - BOP Stack	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	10	2	2	40
1445	2.3.1.1	Annulars - BOP Stack	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	10	2	2	40

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1446	2.3.1.1	Annulars - BOP Stack	External Leak/ Rupture	Failure to Close Pipe Ram on Demand - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.3)	10	2	2	40
1447	2.3.1.1	Annulars - BOP Stack	External Leak/ Rupture	External Leak - Loss of containment - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.8.1)	10	2	2	40
1448	2.3.1.1	Annulars - BOP Stack	External Leak/ Rupture	Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	2	2	36
1449	2.3.1.1	Annulars - BOP Stack	External Leak/ Rupture	Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	2	2	36
1450	2.3.1.1	Annulars - BOP Stack	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	10	2	2	40
1451	2.3.1.1	Annulars - BOP Stack	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	10	2	2	40
1452	2.3.1.1	Annulars - BOP Stack	External Leak/ Rupture	Failure to Close Hang-off Ram on Demand - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.3)	10	2	2	40
1453	2.3.1.1	Annulars - BOP Stack	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	9	2	2	36
1454	2.3.1.1	Annulars - BOP Stack	External Leak/ Rupture	Failure to Adequately Seal under Fail-safe Conditions - Failure to open / close fail-safe valves to seal - Circulate the well after drill pipe disconnect (linked to 1.9.3.2)	10	2	2	40
1455	2.3.1.1	Annulars - BOP Stack	External Leak/ Rupture	Failure to Adequately Seal under Fail-safe Condition - Failure to open / close fail-safe valves to seal - Circulate across the BOP stack to remove trapped gas (linked to 1.10.3.2)	9	2	2	40
1456	2.3.1.1	Annulars - BOP Stack	External Leak/ Rupture	External Leak - Loss of containment - Circulate across the BOP stack to remove trapped gas - (linked to 1.10.4.1)	10	2	2	40
1459	2.3.1.2	Annulars - BOP Stack	Internal Leak	Failure to Close Annular / Blind-Shear Ram on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.3)	10	2	2	40
1460	2.3.1.2	Annulars - BOP Stack	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	2	1	16

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1461	2.3.1.2	Annulars - BOP Stack	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	1	16
1462	2.3.1.2	Annulars - BOP Stack	Internal Leak	Failure to Close Pipe Ram on Demand - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.3)	9	2	1	18
1463	2.3.1.2	Annulars - BOP Stack	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	10	2	1	20
1464	2.3.1.2	Annulars - BOP Stack	Internal Leak	Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	10	2	1	20
1465	2.3.1.2	Annulars - BOP Stack	Internal Leak	Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	10	2	1	20
1466	2.3.1.2	Annulars - BOP Stack	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	10	2	1	20
1467	2.3.1.2	Annulars - BOP Stack	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	10	2	1	20
1468	2.3.1.2	Annulars - BOP Stack	Internal Leak	Failure to Close Hang-off Ram on Demand - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.3)	9	2	1	18
1469	2.3.1.2	Annulars - BOP Stack	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	9	2	1	18
1470	2.3.1.2	Annulars - BOP Stack	Internal Leak	Failure to Adequately Seal under Fail-safe Conditions - Failure to open / close fail-safe valves to seal - Circulate the well after drill pipe disconnect (linked to 1.9.3.2)	10	2	1	20
1471	2.3.1.2	Annulars - BOP Stack	Internal Leak	Failure to Adequately Seal under Fail-safe Condition - Failure to open / close fail-safe valves to seal - Circulate across the BOP stack to remove trapped gas (linked to 1.10.3.2)	10	2	1	20
1472	2.3.1.3	Annulars - BOP Stack	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1473	2.3.1.3	Annulars - BOP Stack	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
1474	2.3.1.3	Annulars - BOP Stack	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
1475	2.3.1.3	Annulars - BOP Stack	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
1476	2.3.1.3	Annulars - BOP Stack	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
1477	2.3.1.3	Annulars - BOP Stack	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
1479	2.3.1.4	Annulars - BOP Stack	Mechanical Failure	Failure of Annular to Seal on Demand - Failure to seal or partial seal on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.3.1)	9	2	2	36
1480	2.3.1.4	Annulars - BOP Stack	Mechanical Failure	Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	10	2	2	40
1481	2.3.1.4	Annulars - BOP Stack	Mechanical Failure	Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
1482	2.3.1.4	Annulars - BOP Stack	Mechanical Failure	Failure of Annulars to Seal on Demand - Failure to seal - Strip the drill string using the annular BOP(s) (linked to 1.3.3.1)	8	2	2	32
1483	2.3.1.4	Annulars - BOP Stack	Mechanical Failure	Failure to Maintain Sealing Pressure on Annulars - Failure to seal - Strip the drill string using the annular BOP(s) (linked to 1.3.3.2)	9	2	2	36
1486	2.3.1.5	Annulars - BOP Stack	Wear	Failure to Maintain Sealing Pressure on Annulars - Failure to seal - Strip the drill string using the annular BOP(s) (linked to 1.3.3.2)	9	2	2	36
1487	2.3.1.5	Annulars - BOP Stack	Wear	Failure of Annular to Seal on Demand - Failure to seal or partial seal on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.3.1)	9	2	1	36
1488	2.3.1.5	Annulars - BOP Stack	Wear	Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	9	2	1	36

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1489	2.3.1.5	Annulars - BOP Stack	Wear	Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	2	1	36
1490	2.3.1.5	Annulars - BOP Stack	Wear	Failure of Annulars to Seal on Demand - Failure to seal - Strip the drill string using the annular BOP(s) (linked to 1.3.3.1)	9	2	1	36
1499	2.3.2.1	Blind Shear Ram - BOP Stack	External Leak/ Rupture	External Leak - Loss of containment - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.8.1)	9	5	3	135
1500	2.3.2.1	Blind Shear Ram - BOP Stack	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
1501	2.3.2.1	Blind Shear Ram - BOP Stack	External Leak/ Rupture	Failure to Close Annular / Blind-Shear Ram on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.3)	10	2	2	40
1502	2.3.2.1	Blind Shear Ram - BOP Stack	External Leak/ Rupture	Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	10	2	2	40
1503	2.3.2.1	Blind Shear Ram - BOP Stack	External Leak/ Rupture	Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
1504	2.3.2.1	Blind Shear Ram - BOP Stack	External Leak/ Rupture	Failure to Engage Lock on Hang-off Ram - Failure to maintain locking - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.3.1)	8	5	2	80
1505	2.3.2.1	Blind Shear Ram - BOP Stack	External Leak/ Rupture	Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
1506	2.3.2.1	Blind Shear Ram - BOP Stack	External Leak/ Rupture	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
1507	2.3.2.1	Blind Shear Ram - BOP Stack	External Leak/ Rupture	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12
1508	2.3.2.1	Blind Shear Ram - BOP Stack	External Leak/ Rupture	Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	1	4	24

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1509	2.3.2.1	Blind Shear Ram - BOP Stack	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
1510	2.3.2.1	Blind Shear Ram - BOP Stack	External Leak/ Rupture	Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
1511	2.3.2.1	Blind Shear Ram - BOP Stack	External Leak/ Rupture	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
1512	2.3.2.1	Blind Shear Ram - BOP Stack	External Leak/ Rupture	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
1513	2.3.2.1	Blind Shear Ram - BOP Stack	External Leak/ Rupture	Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	2	2	40
1514	2.3.2.1	Blind Shear Ram - BOP Stack	External Leak/ Rupture	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
1515	2.3.2.1	Blind Shear Ram - BOP Stack	External Leak/ Rupture	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
1516	2.3.2.1	Blind Shear Ram - BOP Stack	External Leak/ Rupture	External Leak - Loss of containment - Circulate the well after drill pipe disconnect (linked to 1.9.5.1)	10	4	3	120
1517	2.3.2.1	Blind Shear Ram - BOP Stack	External Leak/ Rupture	External Leak - Loss of containment - Circulate across the BOP stack to remove trapped gas - (linked to 1.10.4.1)	10	4	3	120
1521	2.3.2.2	Blind Shear Ram - BOP Stack	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
1522	2.3.2.2	Blind Shear Ram - BOP Stack	Internal Leak	Failure to Close Annular / Blind-Shear Ram on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.3)	10	2	2	40
1523	2.3.2.2	Blind Shear Ram - BOP Stack	Internal Leak	Failure to Engage Lock on Hang-off Ram - Failure to maintain locking - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.3.1)	8	5	2	80
1524	2.3.2.2	Blind Shear Ram - BOP Stack	Internal Leak	Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6

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1525	2.3.2.2	Blind Shear Ram - BOP Stack	Internal Leak	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
1526	2.3.2.2	Blind Shear Ram - BOP Stack	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
1527	2.3.2.2	Blind Shear Ram - BOP Stack	Internal Leak	Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
1528	2.3.2.2	Blind Shear Ram - BOP Stack	Internal Leak	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
1529	2.3.2.2	Blind Shear Ram - BOP Stack	Internal Leak	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
1530	2.3.2.2	Blind Shear Ram - BOP Stack	Internal Leak	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
1531	2.3.2.2	Blind Shear Ram - BOP Stack	Internal Leak	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
1534	2.3.2.4	Blind Shear Ram - BOP Stack	Mechanical Failure	External Leak - Loss of containment - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.8.1)	9	5	3	135
1535	2.3.2.4	Blind Shear Ram - BOP Stack	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
1536	2.3.2.4	Blind Shear Ram - BOP Stack	Mechanical Failure	Failure to Close Annular / Blind-Shear Ram on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.3)	10	2	2	40
1537	2.3.2.4	Blind Shear Ram - BOP Stack	Mechanical Failure	Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	10	2	2	40
1538	2.3.2.4	Blind Shear Ram - BOP Stack	Mechanical Failure	Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18

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1539	2.3.2.4	Blind Shear Ram - BOP Stack	Mechanical Failure	Failure to Engage Lock on Hang-off Ram - Failure to maintain locking - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.3.1)	8	5	2	80
1540	2.3.2.4	Blind Shear Ram - BOP Stack	Mechanical Failure	Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
1541	2.3.2.4	Blind Shear Ram - BOP Stack	Mechanical Failure	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
1542	2.3.2.4	Blind Shear Ram - BOP Stack	Mechanical Failure	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12
1543	2.3.2.4	Blind Shear Ram - BOP Stack	Mechanical Failure	Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	1	4	24
1544	2.3.2.4	Blind Shear Ram - BOP Stack	Mechanical Failure	Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
1545	2.3.2.4	Blind Shear Ram - BOP Stack	Mechanical Failure	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
1546	2.3.2.4	Blind Shear Ram - BOP Stack	Mechanical Failure	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
1547	2.3.2.4	Blind Shear Ram - BOP Stack	Mechanical Failure	Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	2	2	40
1548	2.3.2.4	Blind Shear Ram - BOP Stack	Mechanical Failure	External Leak - Loss of containment - Circulate the well after drill pipe disconnect (linked to 1.9.5.1)	10	4	3	120
1553	2.3.2.5	Blind Shear Ram - BOP Stack	Wear	External Leak - Loss of containment - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.8.1)	9	5	3	135
1554	2.3.2.5	Blind Shear Ram - BOP Stack	Wear	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
1555	2.3.2.5	Blind Shear Ram - BOP Stack	Wear	Failure to Close Annular / Blind-Shear Ram on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.3)	10	2	2	40

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1556	2.3.2.5	Blind Shear Ram - BOP Stack	Wear	Failure of Annular / Blind-Shear Ram to Seal on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.4)	10	2	2	40
1557	2.3.2.5	Blind Shear Ram - BOP Stack	Wear	Failure to Maintain Adequate Sealing Pressure on Annular / Blind-Shear Ram - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.5)	9	1	2	18
1558	2.3.2.5	Blind Shear Ram - BOP Stack	Wear	Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	9	2	1	18
1559	2.3.2.5	Blind Shear Ram - BOP Stack	Wear	Failure to Engage Lock on Hang-off Ram - Failure to maintain locking - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.3.1)	8	5	2	80
1560	2.3.2.5	Blind Shear Ram - BOP Stack	Wear	Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
1561	2.3.2.5	Blind Shear Ram - BOP Stack	Wear	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
1562	2.3.2.5	Blind Shear Ram - BOP Stack	Wear	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12
1563	2.3.2.5	Blind Shear Ram - BOP Stack	Wear	Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	1	4	24
1564	2.3.2.5	Blind Shear Ram - BOP Stack	Wear	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
1565	2.3.2.5	Blind Shear Ram - BOP Stack	Wear	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
1566	2.3.2.5	Blind Shear Ram - BOP Stack	Wear	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
1567	2.3.2.5	Blind Shear Ram - BOP Stack	Wear	Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	2	2	40
1568	2.3.2.5	Blind Shear Ram - BOP Stack	Wear	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1569	2.3.2.5	Blind Shear Ram - BOP Stack	Wear	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
1570	2.3.2.5	Blind Shear Ram - BOP Stack	Wear	External Leak - Loss of containment - Circulate the well after drill pipe disconnect (linked to 1.9.5.1)	10	4	3	120
1571	2.3.2.5	Blind Shear Ram - BOP Stack	Wear	External Leak - Loss of containment - Circulate across the BOP stack to remove trapped gas - (linked to 1.10.4.1)	10	4	3	120
1576	2.3.2.6	Blind Shear Ram - BOP Stack	Corrosion/ Erosion	Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
1577	2.3.2.6	Blind Shear Ram - BOP Stack	Corrosion/ Erosion	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
1578	2.3.2.6	Blind Shear Ram - BOP Stack	Corrosion/ Erosion	Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
1579	2.3.2.6	Blind Shear Ram - BOP Stack	Corrosion/ Erosion	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
1580	2.3.2.6	Blind Shear Ram - BOP Stack	Corrosion/ Erosion	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
1588	2.3.3.1	Casing Shear Ram - BOP Stack	External Leak/ Rupture	External Leak - Loss of containment - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.8.1)	9	5	3	135
1589	2.3.3.1	Casing Shear Ram - BOP Stack	External Leak/ Rupture	Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
1590	2.3.3.1	Casing Shear Ram - BOP Stack	External Leak/ Rupture	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
1591	2.3.3.1	Casing Shear Ram - BOP Stack	External Leak/ Rupture	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12
1592	2.3.3.1	Casing Shear Ram - BOP Stack	External Leak/ Rupture	Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	1	4	24
1593	2.3.3.1	Casing Shear Ram - BOP Stack	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1594	2.3.3.1	Casing Shear Ram - BOP Stack	External Leak/ Rupture	Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
1595	2.3.3.1	Casing Shear Ram - BOP Stack	External Leak/ Rupture	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
1596	2.3.3.1	Casing Shear Ram - BOP Stack	External Leak/ Rupture	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
1597	2.3.3.1	Casing Shear Ram - BOP Stack	External Leak/ Rupture	Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	2	2	40
1598	2.3.3.1	Casing Shear Ram - BOP Stack	External Leak/ Rupture	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
1599	2.3.3.1	Casing Shear Ram - BOP Stack	External Leak/ Rupture	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
1600	2.3.3.1	Casing Shear Ram - BOP Stack	External Leak/ Rupture	External Leak - Loss of containment - Circulate the well after drill pipe disconnect (linked to 1.9.5.1)	10	4	3	120
1601	2.3.3.1	Casing Shear Ram - BOP Stack	External Leak/ Rupture	External Leak - Loss of containment - Circulate across the BOP stack to remove trapped gas - (linked to 1.10.4.1)	10	4	3	120
1605	2.3.3.2	Casing Shear Ram - BOP Stack	Internal Leak	Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
1606	2.3.3.2	Casing Shear Ram - BOP Stack	Internal Leak	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
1607	2.3.3.2	Casing Shear Ram - BOP Stack	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
1608	2.3.3.2	Casing Shear Ram - BOP Stack	Internal Leak	Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
1609	2.3.3.2	Casing Shear Ram - BOP Stack	Internal Leak	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
1610	2.3.3.2	Casing Shear Ram - BOP Stack	Internal Leak	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120

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1611	2.3.3.2	Casing Shear Ram - BOP Stack	Internal Leak	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
1612	2.3.3.2	Casing Shear Ram - BOP Stack	Internal Leak	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
1616	2.3.3.4	Casing Shear Ram - BOP Stack	Mechanical Failure	External Leak - Loss of containment - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.8.1)	9	5	3	135
1617	2.3.3.4	Casing Shear Ram - BOP Stack	Mechanical Failure	Failure to Engage Lock on Hang-off Ram - Failure to maintain locking - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.3.1)	8	5	2	80
1618	2.3.3.4	Casing Shear Ram - BOP Stack	Mechanical Failure	Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
1619	2.3.3.4	Casing Shear Ram - BOP Stack	Mechanical Failure	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
1620	2.3.3.4	Casing Shear Ram - BOP Stack	Mechanical Failure	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12
1621	2.3.3.4	Casing Shear Ram - BOP Stack	Mechanical Failure	Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	1	4	24
1622	2.3.3.4	Casing Shear Ram - BOP Stack	Mechanical Failure	Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
1623	2.3.3.4	Casing Shear Ram - BOP Stack	Mechanical Failure	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
1624	2.3.3.4	Casing Shear Ram - BOP Stack	Mechanical Failure	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
1625	2.3.3.4	Casing Shear Ram - BOP Stack	Mechanical Failure	Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	2	2	40
1626	2.3.3.4	Casing Shear Ram - BOP Stack	Mechanical Failure	External Leak - Loss of containment - Circulate the well after drill pipe disconnect (linked to 1.9.5.1)	10	4	3	120
1627	2.3.3.4	Casing Shear Ram - BOP Stack	Mechanical Failure	External Leak - Loss of containment - Circulate across the BOP stack to remove trapped gas - (linked to 1.10.4.1)	10	4	3	120

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1632	2.3.3.5	Casing Shear Ram - BOP Stack	Wear	External Leak - Loss of containment - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.8.1)	9	5	3	135
1633	2.3.3.5	Casing Shear Ram - BOP Stack	Wear	Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	9	2	1	18
1634	2.3.3.5	Casing Shear Ram - BOP Stack	Wear	Failure to Engage Lock on Hang-off Ram - Failure to maintain locking - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.3.1)	8	5	2	80
1635	2.3.3.5	Casing Shear Ram - BOP Stack	Wear	Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
1636	2.3.3.5	Casing Shear Ram - BOP Stack	Wear	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
1637	2.3.3.5	Casing Shear Ram - BOP Stack	Wear	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12
1638	2.3.3.5	Casing Shear Ram - BOP Stack	Wear	Unintentional Opening - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.2)	6	1	4	24
1639	2.3.3.5	Casing Shear Ram - BOP Stack	Wear	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
1640	2.3.3.5	Casing Shear Ram - BOP Stack	Wear	Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
1641	2.3.3.5	Casing Shear Ram - BOP Stack	Wear	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
1642	2.3.3.5	Casing Shear Ram - BOP Stack	Wear	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
1643	2.3.3.5	Casing Shear Ram - BOP Stack	Wear	Unintentional Opening - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.2)	10	2	2	40
1644	2.3.3.5	Casing Shear Ram - BOP Stack	Wear	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
1645	2.3.3.5	Casing Shear Ram - BOP Stack	Wear	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14

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1646	2.3.3.5	Casing Shear Ram - BOP Stack	Wear	External Leak - Loss of containment - Circulate the well after drill pipe disconnect (linked to 1.9.5.1)	10	4	3	120
1647	2.3.3.5	Casing Shear Ram - BOP Stack	Wear	External Leak - Loss of containment - Circulate across the BOP stack to remove trapped gas - (linked to 1.10.4.1)	10	4	3	120
1652	2.3.3.6	Casing Shear Ram - BOP Stack	Corrosion/ Erosion	Failure to Shear Pipe - Failure to shear the drill pipe - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.2.1)	6	1	1	6
1653	2.3.3.6	Casing Shear Ram - BOP Stack	Corrosion/ Erosion	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.1)	6	1	1	6
1654	2.3.3.6	Casing Shear Ram - BOP Stack	Corrosion/ Erosion	Failure to Shear Pipe - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.2)	9	1	2	18
1655	2.3.3.6	Casing Shear Ram - BOP Stack	Corrosion/ Erosion	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
1656	2.3.3.6	Casing Shear Ram - BOP Stack	Corrosion/ Erosion	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
1665	2.3.4.1	Pipe & Test Rams - BOP Stack	External Leak/ Rupture	Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
1666	2.3.4.1	Pipe & Test Rams - BOP Stack	External Leak/ Rupture	External Leak - Loss of containment - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.8.1)	9	5	3	135
1667	2.3.4.1	Pipe & Test Rams - BOP Stack	External Leak/ Rupture	External Leak - Loss of containment - Circulate across the BOP stack to remove trapped gas - (linked to 1.10.4.1)	9	3	3	54
1671	2.3.4.2	Pipe & Test Rams - BOP Stack	Internal Leak	Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
1674	2.3.4.4	Pipe & Test Rams - BOP Stack	Mechanical Failure	External Leak - Loss of containment - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.8.1)	9	5	3	135
1679	2.3.4.5	Pipe & Test Rams - BOP Stack	Wear	Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
1680	2.3.4.5	Pipe & Test Rams - BOP Stack	Wear	Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	9	2	1	18

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1685	2.3.4.6	Pipe & Test Rams - BOP Stack	Corrosion/ Erosion	Failure of Pipe Ram to Seal on Demand - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.1)	9	3	2	54
1693	2.3.5.1	Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
1694	2.3.5.1	Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	Inability to Operate (an individual) C&K Valves as Needed - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.4)	7	3	2	42
1695	2.3.5.1	Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
1696	2.3.5.1	Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	Failure to Close Pipe Ram on Demand - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.3)	9	1	6	63
1697	2.3.5.1	Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	Inability to Operate C&K Valves as Needed - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.4)	7	3	2	42
1698	2.3.5.1	Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	Inability to Operate C&K Valves as needed - Failure to seal or partial seal on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.3.3)	7	3	2	42
1699	2.3.5.1	Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	Inability to Operate C&K Valves as Needed - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.3)	9	3	2	54
1700	2.3.5.1	Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	8	2	4	48
1701	2.3.5.1	Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	External Leak - Loss of containment - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.8.1)	9	5	3	135
1702	2.3.5.1	Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18

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1703	2.3.5.1	Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	Failure to Close Annular / Blind-Shear Ram on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.3)	10	2	2	40
1704	2.3.5.1	Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	Inability to Operate C&K Valves as Needed - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.6)	9	2	2	36
1705	2.3.5.1	Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	2	36
1706	2.3.5.1	Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
1707	2.3.5.1	Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	Failure to Close Hang-off Ram on Demand - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.3)	5	1	6	30
1708	2.3.5.1	Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	10	3	1	30
1709	2.3.5.1	Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	External Leak - Loss of containment - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.6.1)	10	3	1	30
1710	2.3.5.1	Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
1711	2.3.5.1	Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	External Leak - Loss of containment - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.7.1)	10	2	3	60
1712	2.3.5.1	Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
1713	2.3.5.1	Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1714	2.3.5.1	Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
1715	2.3.5.1	Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	Inability to Operate C&K Valves as Needed - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.3)	7	4	2	56
1716	2.3.5.1	Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
1717	2.3.5.1	Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	Inability to Operate C&K Valves as Needed - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.3)	7	4	2	56
1718	2.3.5.1	Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	External Leak - Loss of containment - Circulate the well after drill pipe disconnect (linked to 1.9.5.1)	10	4	3	120
1719	2.3.5.1	Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
1720	2.3.5.1	Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	Inability to Operate C&K Valves as Needed - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.3)	10	4	2	80
1721	2.3.5.1	Choke & Kill Lines & Valves - BOP Stack	External Leak/ Rupture	External Leak - Loss of containment - Circulate across the BOP stack to remove trapped gas - (linked to 1.10.4.1)	10	3	3	90
1727	2.3.5.2	Choke & Kill Lines & Valves - BOP Stack	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
1728	2.3.5.2	Choke & Kill Lines & Valves - BOP Stack	Internal Leak	Inability to Operate (an individual) C&K Valves as Needed - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.4)	7	3	2	42
1729	2.3.5.2	Choke & Kill Lines & Valves - BOP Stack	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	9	2	5	90

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1730	2.3.5.2	Choke & Kill Lines & Valves - BOP Stack	Internal Leak	Inability to Operate C&K Valves as Needed - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.4)	7	3	2	42
1731	2.3.5.2	Choke & Kill Lines & Valves - BOP Stack	Internal Leak	Inability to Operate C&K Valves as needed - Failure to seal or partial seal on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.3.3)	7	3	2	42
1732	2.3.5.2	Choke & Kill Lines & Valves - BOP Stack	Internal Leak	Inability to Operate C&K Valves as Needed - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.3)	9	3	2	54
1733	2.3.5.2	Choke & Kill Lines & Valves - BOP Stack	Internal Leak	Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	8	2	4	48
1734	2.3.5.2	Choke & Kill Lines & Valves - BOP Stack	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
1735	2.3.5.2	Choke & Kill Lines & Valves - BOP Stack	Internal Leak	Inability to Operate C&K Valves as Needed - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.6)	9	2	2	36
1736	2.3.5.2	Choke & Kill Lines & Valves - BOP Stack	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	2	36
1737	2.3.5.2	Choke & Kill Lines & Valves - BOP Stack	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
1738	2.3.5.2	Choke & Kill Lines & Valves - BOP Stack	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
1739	2.3.5.2	Choke & Kill Lines & Valves - BOP Stack	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
1740	2.3.5.2	Choke & Kill Lines & Valves - BOP Stack	Internal Leak	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1741	2.3.5.2	Choke & Kill Lines & Valves - BOP Stack	Internal Leak	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
1742	2.3.5.2	Choke & Kill Lines & Valves - BOP Stack	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
1743	2.3.5.2	Choke & Kill Lines & Valves - BOP Stack	Internal Leak	Inability to Operate C&K Valves as Needed - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.3)	7	4	2	56
1744	2.3.5.2	Choke & Kill Lines & Valves - BOP Stack	Internal Leak	Failure to Adequately Seal under Fail-safe Conditions - Failure to open / close fail-safe valves to seal - Circulate the well after drill pipe disconnect (linked to 1.9.3.2)	10	3	3	90
1745	2.3.5.2	Choke & Kill Lines & Valves - BOP Stack	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
1746	2.3.5.2	Choke & Kill Lines & Valves - BOP Stack	Internal Leak	Inability to Operate C&K Valves as Needed - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.3)	7	4	2	56
1747	2.3.5.2	Choke & Kill Lines & Valves - BOP Stack	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
1748	2.3.5.2	Choke & Kill Lines & Valves - BOP Stack	Internal Leak	Inability to Operate C&K Valves as Needed - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.3)	10	4	2	80
1749	2.3.5.2	Choke & Kill Lines & Valves - BOP Stack	Internal Leak	Failure to Adequately Seal under Fail-safe Condition - Failure to open / close fail-safe valves to seal - Circulate across the BOP stack to remove trapped gas (linked to 1.10.3.2)	10	3	3	90
1750	2.3.5.2	Choke & Kill Lines & Valves - BOP Stack	Internal Leak	External Leak - Loss of containment - Circulate across the BOP stack to remove trapped gas - (linked to 1.10.4.1)	10	4	3	120
1753	2.3.5.3	Choke & Kill Lines & Valves - BOP Stack	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1754	2.3.5.3	Choke & Kill Lines & Valves - BOP Stack	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
1755	2.3.5.3	Choke & Kill Lines & Valves - BOP Stack	Plugged	Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	9	2	4	72
1756	2.3.5.3	Choke & Kill Lines & Valves - BOP Stack	Plugged	Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	10	4	4	160
1757	2.3.5.3	Choke & Kill Lines & Valves - BOP Stack	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
1758	2.3.5.3	Choke & Kill Lines & Valves - BOP Stack	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	2	36
1759	2.3.5.3	Choke & Kill Lines & Valves - BOP Stack	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
1760	2.3.5.3	Choke & Kill Lines & Valves - BOP Stack	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
1761	2.3.5.3	Choke & Kill Lines & Valves - BOP Stack	Plugged	Actuates Too Slowly on Demand - Closes too slowly - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.5.1)	8	3	2	48
1762	2.3.5.3	Choke & Kill Lines & Valves - BOP Stack	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
1763	2.3.5.3	Choke & Kill Lines & Valves - BOP Stack	Plugged	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
1764	2.3.5.3	Choke & Kill Lines & Valves - BOP Stack	Plugged	Actuates Too Slowly on Demand - Closes too slowly - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.6.1)	10	4	4	160

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1765	2.3.5.3	Choke & Kill Lines & Valves - BOP Stack	Plugged	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
1766	2.3.5.3	Choke & Kill Lines & Valves - BOP Stack	Plugged	Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	10	4	4	160
1767	2.3.5.3	Choke & Kill Lines & Valves - BOP Stack	Plugged	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
1768	2.3.5.3	Choke & Kill Lines & Valves - BOP Stack	Plugged	Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	10	4	4	160
1769	2.3.5.3	Choke & Kill Lines & Valves - BOP Stack	Plugged	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
1770	2.3.5.3	Choke & Kill Lines & Valves - BOP Stack	Plugged	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
1771	2.3.5.3	Choke & Kill Lines & Valves - BOP Stack	Plugged	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
1774	2.3.5.4	Choke & Kill Lines & Valves - BOP Stack	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
1775	2.3.5.4	Choke & Kill Lines & Valves - BOP Stack	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
1776	2.3.5.4	Choke & Kill Lines & Valves - BOP Stack	Mechanical Failure	Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	9	2	4	72
1777	2.3.5.4	Choke & Kill Lines & Valves - BOP Stack	Mechanical Failure	Failure to Actuate Under Fail-safe Conditions - Failure to open / close fail-safe valves - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.6.1)	9	2	4	72

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1778	2.3.5.4	Choke & Kill Lines & Valves - BOP Stack	Mechanical Failure	Actuates Too Slowly on Demand - Closes too slowly - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.7.1)	9	3	2	54
1779	2.3.5.4	Choke & Kill Lines & Valves - BOP Stack	Mechanical Failure	External Leak - Loss of containment - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.8.1)	9	5	3	135
1780	2.3.5.4	Choke & Kill Lines & Valves - BOP Stack	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
1781	2.3.5.4	Choke & Kill Lines & Valves - BOP Stack	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	2	36
1782	2.3.5.4	Choke & Kill Lines & Valves - BOP Stack	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
1783	2.3.5.4	Choke & Kill Lines & Valves - BOP Stack	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
1784	2.3.5.4	Choke & Kill Lines & Valves - BOP Stack	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
1785	2.3.5.4	Choke & Kill Lines & Valves - BOP Stack	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
1786	2.3.5.4	Choke & Kill Lines & Valves - BOP Stack	Mechanical Failure	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
1787	2.3.5.4	Choke & Kill Lines & Valves - BOP Stack	Mechanical Failure	Moves too slowly to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.4)	9	3	2	54
1788	2.3.5.4	Choke & Kill Lines & Valves - BOP Stack	Mechanical Failure	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1789	2.3.5.4	Choke & Kill Lines & Valves - BOP Stack	Mechanical Failure	Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
1790	2.3.5.4	Choke & Kill Lines & Valves - BOP Stack	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
1791	2.3.5.4	Choke & Kill Lines & Valves - BOP Stack	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
1792	2.3.5.4	Choke & Kill Lines & Valves - BOP Stack	Mechanical Failure	External Leak - Loss of containment - Circulate the well after drill pipe disconnect (linked to 1.9.5.1)	10	4	3	120
1793	2.3.5.4	Choke & Kill Lines & Valves - BOP Stack	Mechanical Failure	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
1794	2.3.5.4	Choke & Kill Lines & Valves - BOP Stack	Mechanical Failure	External Leak - Loss of containment - Circulate across the BOP stack to remove trapped gas - (linked to 1.10.4.1)	10	4	3	120
1799	2.3.5.5	Choke & Kill Lines & Valves - BOP Stack	Wear	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
1800	2.3.5.5	Choke & Kill Lines & Valves - BOP Stack	Wear	Inability to Operate (an individual) C&K Valves as Needed - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.4)	7	3	2	42
1801	2.3.5.5	Choke & Kill Lines & Valves - BOP Stack	Wear	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
1802	2.3.5.5	Choke & Kill Lines & Valves - BOP Stack	Wear	Failure to Close Pipe Ram on Demand - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.3)	9	1	6	63
1803	2.3.5.5	Choke & Kill Lines & Valves - BOP Stack	Wear	Inability to Operate C&K Valves as Needed - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.4)	7	3	2	42

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1804	2.3.5.5	Choke & Kill Lines & Valves - BOP Stack	Wear	Inability to Operate C&K Valves as needed - Failure to seal or partial seal on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.3.3)	7	3	2	42
1805	2.3.5.5	Choke & Kill Lines & Valves - BOP Stack	Wear	Inability to Operate C&K Valves as Needed - Failure to seal or partial seal on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.4.3)	9	3	2	54
1806	2.3.5.5	Choke & Kill Lines & Valves - BOP Stack	Wear	Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	8	2	4	48
1807	2.3.5.5	Choke & Kill Lines & Valves - BOP Stack	Wear	Failure to Actuate Under Fail-safe Conditions - Failure to open / close fail-safe valves - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.6.1)	9	2	4	72
1808	2.3.5.5	Choke & Kill Lines & Valves - BOP Stack	Wear	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
1809	2.3.5.5	Choke & Kill Lines & Valves - BOP Stack	Wear	Failure to Close Annular / Blind-Shear Ram on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.3)	10	2	2	40
1810	2.3.5.5	Choke & Kill Lines & Valves - BOP Stack	Wear	Inability to Operate C&K Valves as Needed - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.6)	9	2	2	36
1811	2.3.5.5	Choke & Kill Lines & Valves - BOP Stack	Wear	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	2	36
1812	2.3.5.5	Choke & Kill Lines & Valves - BOP Stack	Wear	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
1813	2.3.5.5	Choke & Kill Lines & Valves - BOP Stack	Wear	Failure to Close Hang-off Ram on Demand - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.3)	5	1	6	30
1814	2.3.5.5	Choke & Kill Lines & Valves - BOP Stack	Wear	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1815	2.3.5.5	Choke & Kill Lines & Valves - BOP Stack	Wear	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
1816	2.3.5.5	Choke & Kill Lines & Valves - BOP Stack	Wear	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
1817	2.3.5.5	Choke & Kill Lines & Valves - BOP Stack	Wear	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
1818	2.3.5.5	Choke & Kill Lines & Valves - BOP Stack	Wear	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
1819	2.3.5.5	Choke & Kill Lines & Valves - BOP Stack	Wear	Inability to Operate C&K Valves as Needed - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.3)	7	4	2	56
1820	2.3.5.5	Choke & Kill Lines & Valves - BOP Stack	Wear	Failure to Adequately Seal under Fail-safe Conditions - Failure to open / close fail-safe valves to seal - Circulate the well after drill pipe disconnect (linked to 1.9.3.2)	10	3	3	90
1821	2.3.5.5	Choke & Kill Lines & Valves - BOP Stack	Wear	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
1822	2.3.5.5	Choke & Kill Lines & Valves - BOP Stack	Wear	Inability to Operate C&K Valves as Needed - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.3)	7	4	2	56
1823	2.3.5.5	Choke & Kill Lines & Valves - BOP Stack	Wear	External Leak - Loss of containment - Circulate the well after drill pipe disconnect (linked to 1.9.5.1)	10	4	3	120
1824	2.3.5.5	Choke & Kill Lines & Valves - BOP Stack	Wear	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
1825	2.3.5.5	Choke & Kill Lines & Valves - BOP Stack	Wear	Inability to Operate C&K Valves as Needed - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.3)	10	4	2	80
1826	2.3.5.5	Choke & Kill Lines & Valves - BOP Stack	Wear	Failure to Adequately Seal under Fail-safe Condition - Failure to open / close fail-safe valves to seal - Circulate across the BOP stack to remove trapped gas (linked to 1.10.3.2)	10	3	3	90

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1827	2.3.5.5	Choke & Kill Lines & Valves - BOP Stack	Wear	External Leak - Loss of containment - Circulate across the BOP stack to remove trapped gas - (linked to 1.10.4.1)	10	4	3	120
1832	2.3.5.6	Choke & Kill Lines & Valves - BOP Stack	Corrosion/ Erosion	Unintentional Operation - Unintentional closing / opening - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.5.1)	8	2	4	48
1840	2.3.6.1	Connectors - BOP Stack	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
1841	2.3.6.1	Connectors - BOP Stack	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
1842	2.3.6.1	Connectors - BOP Stack	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
1843	2.3.6.1	Connectors - BOP Stack	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
1844	2.3.6.1	Connectors - BOP Stack	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
1845	2.3.6.1	Connectors - BOP Stack	External Leak/ Rupture	Failure to Maintain Closing Pressure on Hang-off Ram - Failure to maintain closing pressure - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.2.1)	8	1	2	16
1846	2.3.6.1	Connectors - BOP Stack	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
1847	2.3.6.1	Connectors - BOP Stack	External Leak/ Rupture	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.3.2)	6	1	2	12
1848	2.3.6.1	Connectors - BOP Stack	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
1849	2.3.6.1	Connectors - BOP Stack	External Leak/ Rupture	Failure LMRP / BOP to Connect or Disengage - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.2)	9	3	2	54

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1850	2.3.6.1	Connectors - BOP Stack	External Leak/ Rupture	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
1851	2.3.6.1	Connectors - BOP Stack	External Leak/ Rupture	Failure of LMRP / BOP Connector to Disengage - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.2)	8	3	2	48
1852	2.3.6.1	Connectors - BOP Stack	External Leak/ Rupture	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
1853	2.3.6.1	Connectors - BOP Stack	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
1854	2.3.6.1	Connectors - BOP Stack	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
1855	2.3.6.1	Connectors - BOP Stack	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
1856	2.3.6.1	Connectors - BOP Stack	External Leak/ Rupture	Failure of Wellhead Connector to Properly Lock and Seal - Inadequate BOP Connection - Connect BOP and LMRP at Landing (linked to 1.11.1.1)	2	5	3	30
1857	2.3.6.1	Connectors - BOP Stack	External Leak/ Rupture	Failure of Connector Integrity - Inadequate BOP Connection - Connect BOP and LMRP at Landing (linked to 1.11.1.2)	6	2	2	24
1858	2.3.6.1	Connectors - BOP Stack	External Leak/ Rupture	Failure of LMRP Connector to Properly Lock and Seal (auxiliary connections) - Inadequate LMRP Connection - Connect BOP and LMRP at Landing (linked to 1.11.2.1)	6	2	2	24
1859	2.3.6.1	Connectors - BOP Stack	External Leak/ Rupture	Failure of Connector Integrity - Inadequate LMRP Connection - Connect BOP and LMRP at Landing (linked to 1.11.2.2)	6	2	2	24
1862	2.3.6.2	Connectors - BOP Stack	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
1863	2.3.6.2	Connectors - BOP Stack	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	8	2	3	48
1864	2.3.6.2	Connectors - BOP Stack	Internal Leak	Failure to Close Pipe Ram on Demand - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.3)	9	1	6	63

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1865	2.3.6.2	Connectors - BOP Stack	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Annular / Blind-Shear Ram or C&K Valves - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.2)	9	1	2	18
1866	2.3.6.2	Connectors - BOP Stack	Internal Leak	Failure to Close Annular / Blind-Shear Ram on Demand - Failure to close on open hole through blind-shear rams or annular - Close and seal on open hole and allow volumetric well control operations on demand (linked to 1.2.1.3)	10	2	2	40
1867	2.3.6.2	Connectors - BOP Stack	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	3	72
1868	2.3.6.2	Connectors - BOP Stack	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
1869	2.3.6.2	Connectors - BOP Stack	Internal Leak	Failure to Close Hang-off Ram on Demand - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.3)	5	1	6	30
1870	2.3.6.2	Connectors - BOP Stack	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24
1871	2.3.6.2	Connectors - BOP Stack	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
1872	2.3.6.2	Connectors - BOP Stack	Internal Leak	Failure LMRP / BOP to Connect or Disengage - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.2)	9	3	2	54
1873	2.3.6.2	Connectors - BOP Stack	Internal Leak	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
1874	2.3.6.2	Connectors - BOP Stack	Internal Leak	Failure of LMRP / BOP Connector to Disengage - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.2)	8	3	2	48
1875	2.3.6.2	Connectors - BOP Stack	Internal Leak	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
1876	2.3.6.2	Connectors - BOP Stack	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
1877	2.3.6.2	Connectors - BOP Stack	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1878	2.3.6.2	Connectors - BOP Stack	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20
1882	2.3.6.4	Connectors - BOP Stack	Mechanical Failure	Failure to Actuate Under Fail-safe Conditions - Failure to open / close fail-safe valves - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.6.1)	9	2	7	126
1883	2.3.6.4	Connectors - BOP Stack	Mechanical Failure	Failure LMRP / BOP to Connect or Disengage - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.2)	9	3	2	54
1884	2.3.6.4	Connectors - BOP Stack	Mechanical Failure	Failure of LMRP / BOP Connector to Disengage - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.2)	8	3	2	48
1885	2.3.6.4	Connectors - BOP Stack	Mechanical Failure	Failure of Wellhead Connector to Properly Lock and Seal - Inadequate BOP Connection - Connect BOP and LMRP at Landing (linked to 1.11.1.1)	2	5	3	30
1886	2.3.6.4	Connectors - BOP Stack	Mechanical Failure	Failure of Connector Integrity - Inadequate BOP Connection - Connect BOP and LMRP at Landing (linked to 1.11.1.2)	6	2	2	24
1887	2.3.6.4	Connectors - BOP Stack	Mechanical Failure	Failure of LMRP Connector to Properly Lock and Seal (auxiliary connections) - Inadequate LMRP Connection - Connect BOP and LMRP at Landing (linked to 1.11.2.1)	6	2	2	24
1888	2.3.6.4	Connectors - BOP Stack	Mechanical Failure	Failure of Connector Integrity - Inadequate LMRP Connection - Connect BOP and LMRP at Landing (linked to 1.11.2.2)	6	2	2	24
1890	2.3.6.5	Connectors - BOP Stack	Wear	Failure LMRP / BOP to Connect or Disengage - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.2)	9	3	2	54
1891	2.3.6.5	Connectors - BOP Stack	Wear	Failure of LMRP / BOP Connector to Disengage - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.2)	8	3	2	48
1894	2.3.6.6	Connectors - BOP Stack	Corrosion/ Erosion	Failure LMRP / BOP to Connect or Disengage - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.2)	9	3	2	54
1895	2.3.6.6	Connectors - BOP Stack	Corrosion/ Erosion	Failure of LMRP / BOP Connector to Disengage - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.2)	8	3	2	48
1897	2.3.6.7	Connectors - BOP Stack	Loss of Function (general)	Failure LMRP / BOP to Connect or Disengage - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.2)	9	3	2	54
1898	2.3.6.7	Connectors - BOP Stack	Loss of Function (general)	Failure of Wellhead Connector to Properly Lock and Seal - Inadequate BOP Connection - Connect BOP and LMRP at Landing (linked to 1.11.1.1)	2	5	3	30

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1899	2.3.6.7	Connectors - BOP Stack	Loss of Function (general)	Failure of Connector Integrity - Inadequate BOP Connection - Connect BOP and LMRP at Landing (linked to 1.11.1.2)	6	2	2	24
1900	2.3.6.7	Connectors - BOP Stack	Loss of Function (general)	Failure of LMRP Connector to Properly Lock and Seal (auxiliary connections) - Inadequate LMRP Connection - Connect BOP and LMRP at Landing (linked to 1.11.2.1)	6	2	2	24
1901	2.3.6.7	Connectors - BOP Stack	Loss of Function (general)	Failure of Connector Integrity - Inadequate LMRP Connection - Connect BOP and LMRP at Landing (linked to 1.11.2.2)	6	2	2	24
1907	2.3.7.1	Autoshear System - BOP Stack	External Leak/ Rupture	Unintentional Closing - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.1)	9	3	3	54
1908	2.3.7.1	Autoshear System - BOP Stack	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
1909	2.3.7.1	Autoshear System - BOP Stack	External Leak/ Rupture	Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	10	3	1	30
1910	2.3.7.1	Autoshear System - BOP Stack	External Leak/ Rupture	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
1911	2.3.7.1	Autoshear System - BOP Stack	External Leak/ Rupture	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
1912	2.3.7.1	Autoshear System - BOP Stack	External Leak/ Rupture	Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54
1914	2.3.7.2	Autoshear System - BOP Stack	Internal Leak	Unintentional Closing - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.1)	9	3	3	54
1915	2.3.7.2	Autoshear System - BOP Stack	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
1916	2.3.7.2	Autoshear System - BOP Stack	Internal Leak	Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	10	3	1	30
1917	2.3.7.2	Autoshear System - BOP Stack	Internal Leak	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to shear the drill pipe - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.3.1)	9	3	2	54
1918	2.3.7.2	Autoshear System - BOP Stack	Internal Leak	Moves too slowly to disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.4)	9	3	2	54

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Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1922	2.3.7.4	Autoshear System - BOP Stack	Mechanical Failure	Failure to Actuate Under Fail-safe Conditions - Failure to open / close fail-safe valves - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.6.1)	9	2	7	126
1923	2.3.7.4	Autoshear System - BOP Stack	Mechanical Failure	Unintentional Closing - Unintentional closing / opening - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.4.1)	9	3	3	54
1924	2.3.7.4	Autoshear System - BOP Stack	Mechanical Failure	Failure to initiate autoshear sequence - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.2)	10	3	1	30
1925	2.3.7.4	Autoshear System - BOP Stack	Mechanical Failure	Failure of Shear Ram to Seal On Demand - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.1)	10	2	6	120
1926	2.3.7.4	Autoshear System - BOP Stack	Mechanical Failure	Failure to Maintain Sealing Pressure on Shear Ram - Failure to seal the wellbore - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.4.2)	10	2	6	120
1930	2.3.7.6	Autoshear System - BOP Stack	Corrosion/ Erosion	Unintentional Closing - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.1)	5	2	1	10
1931	2.3.7.7	Autoshear System - BOP Stack	Loss of Function (general)	Unintentional Closing - Unintentional closing / opening - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.5.1)	5	2	1	10
1937	2.3.8.3	ROV Intervention Interface - BOP Stack	Loss of Function	Failure to Supply Hydraulic Fluid & Pressure to Annular & C&K Valves When Demanded - Failure to close on drill pipe through annular(s) - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.1.2)	8	3	2	36
1938	2.3.8.3	ROV Intervention Interface - BOP Stack	Loss of Function	Failure to Supply Hydraulic Fluid & Pressure to Pipe Ram or C&K Valves When Demanded - Failure to close on drill pipe through pipe rams - Close and seal on the drill pipe and allow circulation on demand (linked to 1.1.2.2)	9	2	5	90
1939	2.3.8.3	ROV Intervention Interface - BOP Stack	Loss of Function	Failure to Supply Hydraulic Fluid & Pressure to Annulars - Failure to close annulars - Strip the drill string using the annular BOP(s) (linked to 1.3.1.2)	8	3	2	36
1940	2.3.8.3	ROV Intervention Interface - BOP Stack	Loss of Function	Failure to Supply Hydraulic Fluid & Pressure to Hang-off Ram - Failure of hang-off ram to close - Hang-off the drill pipe on a ram BOP and control the wellbore (linked to 1.4.1.2)	8	1	4	32
1941	2.3.8.3	ROV Intervention Interface - BOP Stack	Loss of Function	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Controlled operation - Shear the drill pipe and seal the wellbore (linked to 1.5.1.2)	6	1	4	24

APPENDIX C (sorted by RPN)

Sorting Index	Item Index	EXF2	Failure Mode	Effects	Severity Ratings	Occurrence Ratings	Detection Ratings	Risk Priority Numbers
1942	2.3.8.3	ROV Intervention Interface - BOP Stack	Loss of Function	Failure to Supply Hydraulic Fluid & Pressure to Shear Ram - Failure to close - Emergency Operation - Auto-Shear - Shear the drill pipe and seal the wellbore (linked to 1.6.2.1)	9	1	4	36
1943	2.3.8.3	ROV Intervention Interface - BOP Stack	Loss of Function	Failure of Hydraulic Fluid to disconnect - Failure to disconnect the LMRP - Emergency Operation: EDS - Disconnect from the stack (linked to 1.7.2.3)	9	1	3	27
1944	2.3.8.3	ROV Intervention Interface - BOP Stack	Loss of Function	Failure of Hydraulic Fluid to Disconnect - Failure to disconnect the LMRP - Controlled Operation - Disconnect the LMRP from the Lower BOP stack (linked to 1.8.1.3)	7	1	2	14
1945	2.3.8.3	ROV Intervention Interface - BOP Stack	Loss of Function	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate the well after drill pipe disconnect (linked to 1.9.1.2)	6	1	2	12
1946	2.3.8.3	ROV Intervention Interface - BOP Stack	Loss of Function	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to seal wellbore - Circulate the well after drill pipe disconnect (linked to 1.9.4.2)	6	1	2	12
1947	mmix	ROV Intervention Interface - BOP Stack	Loss of Function	Failure to Supply Hydraulic Fluid & Pressure to C&K Valves - Failure to circulate - Circulate across the BOP stack to remove trapped gas (linked to 1.10.1.2)	10	1	2	20