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Supplement
Estimated WCE System Component Counts

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Supplement: Estimated Well Control Equipment System Component Counts

Abstract

This supplement provides a listing of the types of components that could comprise a typical offshore well control equipment (WCE) system configuration and estimates of the count of each type. These estimates are used to provide context for WCE failures reported to SafeOCS, and they may provide insight into how often events occur relative to the number of similar components in use.

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Table of Contents

List of Tables

Introduction

This supplement provides a listing of the types of components that could comprise a typical offshore well control equipment (WCE) system configuration and estimates of the count of each type. These estimates are used to provide context for reported WCE failures, and they may provide insight into how often events occur relative to the number of similar components in use. The major topics discussed in this supplement include the following:

- Component population analysis
- Subsea WCE system component counts
- Surface WCE system component counts

This supplement has been revised to reflect to the SafeOCS equipment component schema.

1. Component Population Analysis

1.1. TOTAL ESTIMATES BY WCE SYSTEM TYPE

Component counts vary by WCE system configuration; still, it is useful to formulate estimates for a generic WCE system that is likely to reflect many existing configurations. SafeOCS uses these estimates to develop exposure measures that quantify the population of WCE equipment that could be called upon to perform its functional specification. SafeOCS developed the component population estimates described in this document, which included considerations of previous estimations by the Bureau of Safety and Environmental Enforcement (BSEE) and the IOGP/IADC Blowout Preventer (BOP) Reliability JIP.[1]

SafeOCS developed estimates of the number of components for the following generic WCE systems:

- A 15,000-psi subsea WCE system with one or two subsea BOP stacks, equating to Class 8-A2-R6 BOP stacks with two annular preventers and six ram-type preventers
- A 10,000-psi surface WCE system with a Class 4-A1-R3 BOP stack with one annular preventer and three ram-type preventers[2]

Table 1 shows the estimated number of components for these systems, broken down by subunit. Complete listings of the components considered in developing the estimates are provided in Table 2 for subsea WCE systems and Table 3 for surface WCE systems.

Table 1. Estimated Number of Components per Rig

Subunit	Subsea system with 1 stack	Subsea system with 2 stacks	Surface system
BOP Controls	135	270	0
BOP Emergency Controls	107	214	39
BOP Secondary Controls	124	241	0
BOP Stack System	1,004	1,789	110
Choke Manifold System	109	109	111
Diverter System	88	88	86
Riser System	85	85	2
Total	**1,652**	**2,796**	**348**
1-Stack:2-Stack Ratio	**1**	**1.69**	

BOP = blowout preventer.
Source: U.S. Department of Transportation, Bureau of Transportation Statistics, SafeOCS.

1.2. REVISIONS TO ESTIMATES

This section summarizes changes to the estimated component counts since this document was first published in 2021.

[1] Int'l Assoc. of Oil & Gas Producers (IOGP) / Int'l Assoc. of Drilling Contractors (IADC) BOP Reliability Joint Industry Project (JIP). The JIP developed and manages RAPID-53, the Reliability and Performance Information Database for Well Control Equipment covered under API Standard 53.
[2] BOP stack classifications are described in sections 6.1.2 and 7.1.2 of API Standard 53, Blowout Prevention Equipment Systems for Drilling Wells, Fourth Edition.

1.2.1. Recategorization of Some Components as Parts

In the SafeOCS component failure database, a component is generally defined as the smallest element with an established maintenance routine within the relevant WCE system, with exceptions for certain elastomeric seals and other non-repairable devices to aid in tracking such failures. Many previously listed components, such as fasteners, have been reduced to parts in keeping with this definition. The following subsections describe examples of this change within each WCE subunit.

Parts are excluded from the component count estimates. Previously, piping and tubing were listed as a single component; throughout the database, the component name has been expanded to include piping, tubing, hoses, and all related fittings, while at the same time reducing the individual elements to parts. Hoses, except API Spec. 16C choke and kill hoses, as well as piping and tubing runs, are generally not quantified in the estimates due to wide variance across WCE systems.

1.2.2. BOP Controls Systems

Several terms that were used on older generation control systems, such as RBQ plates, have been removed. The fluid recovery unit was removed due to obsolescence, and fluid was removed as it is not an equipment component.

The following components have been reduced to parts: gas valve, metering needle valve, pod packer, pod hose, primary gripper, secondary gripper, transformer, variable pilot valve, variable pilot valve, HP (high pressure) swivel, junction box, slip ring, battery, cylinder, piping / tubing, and hose.

In the previous estimates, solenoid valves were categorized as three separate types: solenoid valve (hydraulic), solenoid valve (electric), and solenoid valve. The first two types reflect the failure mode, and either could have been categorized accurately in the third type. The revised estimates consolidate the three types into one solenoid valve, titled electrically piloted directional control valve.

Review of reported failure events showed frequent confusion among directional control valves, as shear-seal fluid ends can be used in both electrically and hydraulically piloted valves. To reduce such confusion, remote-controlled valves have been categorized into two groups to reflect how the remote-controlled valve is piloted:

- Hydraulically piloted directional control valve, for all SPM (subplate mounted) valves, DRG valves, and slide valves
- Electrically piloted directional control valve, for all forms of solenoid valve

The catch-all term “instruments” was previously included in the component count alongside pressure gauges, pressure / temperature sensors, transducers, and switches. To prevent any potential duplication in the estimates, the catch-all term has been removed. Although some included instruments may not have a maintenance routine and may be non-repairable, they are included to aid in tracking such failures.

All types of accumulators are now categorized simply as accumulator, including piston type, bladder type, and depth compensated type. Similarly, pulsation dampener has been renamed accumulator in the revised estimates.

Interconnect cables and PBOF (pressure balanced, oil-filled) cables have been combined under a single component name: interconnect cable. Cable connectors are now included with the cables to which they are attached, instead of as separate components.

1.2.3. BOP Stack System

The ram-type BOP body, which is a single forging, was previously included in the count estimates as two end connections, four side outlets, and four ram cavities. The revised estimate counts the ram body as one component, whether a single, a double or a triple body. A similar philosophy was followed when considering the annular BOPs, stack choke and kill valves, and drill-through connectors. For the typical subsea stack, the estimated BOP body count considers three double ram bodies. This philosophy has been followed throughout.

The following components have been reduced to parts: ring gasket, studs and nuts, kick-out sub, hub clamp, locking dog, flange, buoyancy module, choke and kill line, conduit line, flange bolt, lift tool, main tube, mud boost line, other line, riser coupling, riser protection, shuttle tool, inner barrel, inner barrel lock, and bearing, riser coupling, choke and kill valve operator seal, and other similar parts.

In the revised estimates, hardware generally refers to metal parts, such as the body, piston, cylinder, etc., while operating system seals comprise the elastomeric parts of a component.

1.2.4. Choke Manifold System

Rig-mounted mud boost components have been removed, as this equipment is less relevant to well control.

The choke and kill drape hoses (choke hose and kill hose), which are identical, have been combined into a single component: drape hose. The choke and kill piping components have been merged from five components into three by combining the buffer manifold with the manifold blocks, and the spools with the vessel piping. The manifold gate valves have been reduced to only the valve assembly and the valve actuator assembly (for the hydraulically controlled valves). The auto-choke is renamed for accuracy to remote choke and now includes only two components: choke actuator and choke hardware. The manual choke is now simply a choke assembly.

1.2.5. Diverter System

The diverter control system was originally populated with similar components to the BOP control system, as they usually share much of the BOP control system. To prevent potential duplication in the estimates, these 24 components have been reduced to 14.

Some component types within the diverter housing, diverter piping, and upper flex joint were consolidated. Component types within the diverter valve were also consolidated, mainly by combining the various diverter valve types. Several component types within the diverter assembly were reduced to parts, including the ring gaskets, studs and nuts, and hoses.

1.2.6. Riser System

Marine drilling riser joints for subsea BOP stacks are typically 75 feet long and 5 feet in diameter, comprise a main pipe with five smaller pipes (i.e., lines) permanently attached around the periphery, and are typically encapsulated in syntactic foam buoyancy modules. In previous estimates, the main tube, the welded coupling on the end of the main tube, the five individual lines (choke, kill, mud boost, hydraulic conduit A, and hydraulic conduit B, and other), and the pairs of buoyancy modules were counted separately. In the revised estimates, each riser joint is now considered a single component, because the entire joint must be replaced in the event of damage. These joints are too big to disassemble on the rig. If a riser joint suffers any damage while running or retrieving, then the entire joint is replaced, and the damaged joint is sent off the rig to a facility for repair.

The following components have been reduced to parts: flange, buoyancy module, choke and kill line, conduit line, flange bolt, lift tool, main tube, mud boost line, other line, riser coupling, riser protection, shuttle tool, inner barrel, inner barrel lock, and bearing, riser coupling, and other similar parts.

Facilities with surface WCE systems, such as some platforms, tension-leg platforms (TLPs), spars, or semi-submersibles, typically use risers only for workover or well intervention activities. These risers are also referred to as overshot spools. Thus, the component estimates for the riser system for surface WCE systems include only the spool for the typical surface BOP stack configuration.

1.2.7. Auxiliary Equipment

The auxiliary equipment subunit, which comprised the drill string valves, gas separation equipment, test equipment, and top drive equipment, has been removed as this equipment is less relevant to well control. The subunit comprised relatively few components, including approximately 1.3 percent of components in a generic 1-stack subsea system, 0.9 percent in a 2-stack subsea system, and 4.2 percent in a surface system, in the prior component count estimates.

2. Subsea WCE System Component Estimates

Table 2 shows the estimated count of components in a generic subsea WCE system with one or two Class 8-A2-R6 BOP stacks. The estimates include the riser components required for a subsea well of average water depth (5,200 ft) in the Gulf of Mexico Outer Continental Shelf (GOM OCS). Based on these estimates, a rig with two subsea BOP stacks has approximately 1.69 times the number of components as a rig with one subsea BOP stack.

Table 2. Listing of Subsea WCE System Component Count Estimates

Subunit	Item	Component	Estimate for 1-stack system	Estimate for 2-stack system
BOP controls	BOP control panel	Central control console	1	1
BOP controls	BOP control panel	Control panel (auxiliary, driller's, rig manager's, subsea, toolpusher's)	3	3
BOP controls	BOP control panel	Software	1	1
BOP controls	BOP control panel	Uninterruptible power supply (UPS)	2	2
BOP controls	BOP control pod	Accumulator	10	20
BOP controls	BOP control pod	Check valve	4	8
BOP controls	BOP control pod	Compensated chamber	2	4
BOP controls	BOP control pod	Electrically piloted directional control valve	258	516
BOP controls	BOP control pod	Filter	8	16
BOP controls	BOP control pod	Flowmeter	2	4
BOP controls	BOP control pod	Hydraulically piloted directional control valve	230	460
BOP controls	BOP control pod	Inclinometer	2	4
BOP controls	BOP control pod	Pod receptacle	4	8
BOP controls	BOP control pod	Pod stab/stinger	4	8
BOP controls	BOP control pod	Pressure gauge	30	60
BOP controls	BOP control pod	Pressure transducer	30	60
BOP controls	BOP control pod	Regulator	14	28
BOP controls	BOP control pod	Relief valve	5	10
BOP controls	BOP control pod	SEA/SEM	4	8
BOP controls	BOP control pod	Shuttle valve	10	20
BOP controls	BOP control pod	Software	2	4
BOP controls	BOP control pod	Subsea compensator	1	2
BOP controls	BOP stack mounted controls	Accumulator	2	4
BOP controls	BOP stack mounted controls	Check valve	4	8
BOP controls	BOP stack mounted controls	Conduit manifold	1	2
BOP controls	BOP stack mounted controls	Flowmeter	2	4
BOP controls	BOP stack mounted controls	Hot line manifold	1	2
BOP controls	BOP stack mounted controls	Hydraulic stab	2	4
BOP controls	BOP stack mounted controls	Hydraulically piloted directional control valve	12	24
BOP controls	BOP stack mounted controls	Inclinometer	1	2
BOP controls	BOP stack mounted controls	Interconnect cable	8	16
BOP controls	BOP stack mounted controls	Pilot operated check valve	2	4
BOP controls	BOP stack mounted controls	Pressure gauge	1	2
BOP controls	BOP stack mounted controls	Pressure temperature sensor	2	4
BOP controls	BOP stack mounted controls	Quick dump valve	4	8

Subunit	Item	Component	Estimate for 1-stack system	Estimate for 2-stack system
BOP controls	BOP stack mounted controls	Regulator	2	4
BOP controls	BOP stack mounted controls	Relief valve	1	2
BOP controls	BOP stack mounted controls	Riser control box (RCB)	2	4
BOP controls	BOP stack mounted controls	Shuttle valve	117	234
BOP controls	BOP stack mounted controls	Wet mate connector	1	2
BOP controls	HPU and mix systems	Accumulator	82	82
BOP controls	HPU and mix systems	Ball valve	38	38
BOP controls	HPU and mix systems	Check valve	14	14
BOP controls	HPU and mix systems	Electrically piloted directional control valve	11	11
BOP controls	HPU and mix systems	Filter	4	4
BOP controls	HPU and mix systems	Flowmeter	2	2
BOP controls	HPU and mix systems	HPU control panel	1	1
BOP controls	HPU and mix systems	Pressure gauge	20	20
BOP controls	HPU and mix systems	Pressure switch	12	12
BOP controls	HPU and mix systems	Pump	6	6
BOP controls	HPU and mix systems	Regulator	5	5
BOP controls	HPU and mix systems	Relief valve	5	5
BOP controls	Reels hoses cables	Hot line hose	1	1
BOP controls	Reels hoses cables	MUX cable/connector	2	2
BOP controls	Reels hoses cables	Reel	3	3
BOP controls	Reels hoses cables	Sheave	6	6
BOP emergency controls	Autoshear/deadman/EHBS	Accumulator	71	142
BOP emergency controls	Autoshear/deadman/EHBS	Check valve	5	10
BOP emergency controls	Autoshear/deadman/EHBS	Deadman autoshear control pod	1	2
BOP emergency controls	Autoshear/deadman/EHBS	Electrically piloted directional control valve	10	20
BOP emergency controls	Autoshear/deadman/EHBS	Hydraulic stab	1	2
BOP emergency controls	Autoshear/deadman/EHBS	Hydraulically piloted directional control valve	15	30
BOP emergency controls	Autoshear/deadman/EHBS	Pilot operated check valve	11	22
BOP emergency controls	Autoshear/deadman/EHBS	Pressure gauge	1	2
BOP emergency controls	Autoshear/deadman/EHBS	Pressure transducer	8	16
BOP emergency controls	Autoshear/deadman/EHBS	Regulator	1	2
BOP emergency controls	Autoshear/deadman/EHBS	Relief valve	4	8
BOP emergency controls	Autoshear/deadman/EHBS	Shuttle valve	5	10
BOP emergency controls	Autoshear/deadman/EHBS	Trigger valve	1	2
BOP emergency controls	Emergency disconnect sequence	Software	1	2
BOP secondary controls	Acoustic system	Accumulator	22	44
BOP secondary controls	Acoustic system	Acoustic command unit (ACU)	1	1
BOP secondary controls	Acoustic system	Check valve	3	6
BOP secondary controls	Acoustic system	Compensated chamber	1	2
BOP secondary controls	Acoustic system	Electrically piloted directional control valve	9	18
BOP secondary controls	Acoustic system	Filter	4	8
BOP secondary controls	Acoustic system	Hydraulic stab	1	2
BOP secondary controls	Acoustic system	Hydraulically piloted directional control valve	9	18
BOP secondary controls	Acoustic system	Pilot operated check valve	8	16
BOP secondary controls	Acoustic system	Pressure gauge	2	4
BOP secondary controls	Acoustic system	Pressure transducer	9	18

Subunit	Item	Component	Estimate for 1-stack system	Estimate for 2-stack system
BOP secondary controls	Acoustic system	Regulator	1	2
BOP secondary controls	Acoustic system	Relief valve	2	4
BOP secondary controls	Acoustic system	Shuttle valve	12	24
BOP secondary controls	Acoustic system	Software	1	2
BOP secondary controls	Acoustic system	Subsea compensator	1	2
BOP secondary controls	Acoustic system	Subsea control unit (SCU)	1	1
BOP secondary controls	Acoustic system	Transducer	2	4
BOP secondary controls	Acoustic system	Transducer deployment arm	2	4
BOP secondary controls	Acoustic system	Transponder	5	5
BOP secondary controls	Acoustic system	Trigger valve	1	2
BOP secondary controls	ROV intervention	Pressure gauge	3	6
BOP secondary controls	ROV intervention	Regulator	1	2
BOP secondary controls	ROV intervention	ROV receptacle	11	22
BOP secondary controls	ROV intervention	ROV stinger/hot stab	2	4
BOP secondary controls	ROV intervention	ROV valve	10	20
BOP stack system	Annular preventer	Annular BOP hardware	2	4
BOP stack system	Annular preventer	Operating system seal	2	4
BOP stack system	Annular preventer	Packing element	2	4
BOP stack system	Lower flex joint assembly	Lower flex joint	1	2
BOP stack system	Pipe ram preventer	Bonnet face seal	8	16
BOP stack system	Pipe ram preventer	Bonnet hardware	8	16
BOP stack system	Pipe ram preventer	Operating system seal (set)	8	16
BOP stack system	Pipe ram preventer	Pipe ram block hardware (set)	4	8
BOP stack system	Pipe ram preventer	Pipe ram block seal (set)	4	8
BOP stack system	Pipe ram preventer	Ram body hardware	2	4
BOP stack system	Riser adaptor assembly	Mud boost valve	1	2
BOP stack system	Riser adaptor assembly	Mud boost valve operator	1	2
BOP stack system	Riser adaptor assembly	Riser adaptor	1	2
BOP stack system	Riser connector	Hardware	1	2
BOP stack system	Riser connector	Operating system seal	1	2
BOP stack system	Riser mandrel	Hardware	1	2
BOP stack system	Shear ram preventer	Bonnet face seal	4	8
BOP stack system	Shear ram preventer	Bonnet hardware	4	8
BOP stack system	Shear ram preventer	Operating system seal (set)	4	8
BOP stack system	Shear ram preventer	Ram body hardware	1	2
BOP stack system	Shear ram preventer	Shear ram block hardware (set)	2	4
BOP stack system	Shear ram preventer	Shear ram block seal (set)	1	2
BOP stack system	Stack choke and kill system	Connector receptacle	2	4
BOP stack system	Stack choke and kill system	Connector stab	2	4
BOP stack system	Stack choke and kill system	Flex loop or hose	2	4
BOP stack system	Stack choke and kill system	Spool	8	16
BOP stack system	Stack choke and kill system	Valve assembly	14	28
BOP stack system	Stack choke and kill system	Valve operator assembly	14	28
BOP stack system	Wellhead connector	Hardware	1	2
BOP stack system	Wellhead connector	Operating system seal	1	2
Choke manifold system	Choke and kill drape hose	Drape hose	2	2
Choke manifold system	Choke and kill piping components	Fluid cushion	8	8

Subunit	Item	Component	Estimate for 1-stack system	Estimate for 2-stack system
Choke manifold system	Choke and kill piping components	Manifold block	15	15
Choke manifold system	Choke and kill piping components	Piping	2	2
Choke manifold system	Choke and kill piping components	Valve actuator assembly	6	6
Choke manifold system	Choke and kill piping components	Valve assembly	52	52
Choke manifold system	Choke manifold controls	Accumulator	1	1
Choke manifold system	Choke manifold controls	HPU	1	1
Choke manifold system	Choke manifold controls	Selector or manipulator 4-way valve	6	6
Choke manifold system	Instruments	Pressure gauge	6	6
Choke manifold system	Instruments	Pressure transducer	4	4
Choke manifold system	Manual choke	Choke assembly	2	2
Choke manifold system	Remote choke	Choke actuator	2	2
Choke manifold system	Remote choke	Choke assembly	2	2
Diverter system	Diverter assembly	Flowline seal	2	2
Diverter system	Diverter assembly	Hardware	1	1
Diverter system	Diverter assembly	Hydraulic control interface	1	1
Diverter system	Diverter assembly	Operating system seal	1	1
Diverter system	Diverter assembly	Packing element or insert packer	1	1
Diverter system	Diverter control system	Accumulator	10	10
Diverter system	Diverter control system	Ball valve	13	13
Diverter system	Diverter control system	Check valve	2	2
Diverter system	Diverter control system	Electrically piloted directional control valve	13	13
Diverter system	Diverter control system	Filter	1	1
Diverter system	Diverter control system	Flowmeter	1	1
Diverter system	Diverter control system	Hydraulically piloted directional control valve	1	1
Diverter system	Diverter control system	Pressure gauge	6	6
Diverter system	Diverter control system	Pressure switch	6	6
Diverter system	Diverter control system	Pump	1	1
Diverter system	Diverter control system	Regulator	5	5
Diverter system	Diverter control system	Relief valve	1	1
Diverter system	Diverter control system	Selector or manipulator 4-way valve	6	6
Diverter system	Diverter housing assembly	Hardware	1	1
Diverter system	Diverter piping components	Actuator	5	5
Diverter system	Diverter piping components	Flow diverter	1	1
Diverter system	Diverter piping components	Piping	3	3
Diverter system	Diverter piping components	Valve	5	5
Diverter system	Upper flex joint assembly	Upper flex joint	1	1
Riser system	Riser	Riser joint	69	69
Riser system	Riser gas handling equipment	Ball valve	1	1
Riser system	Riser gas handling equipment	Gooseneck	2	2
Riser system	Riser gas handling equipment	Packing element	1	1
Riser system	Riser gas handling equipment	Riser gas handler	1	1
Riser system	Telescopic joint assembly	Gooseneck	5	5
Riser system	Telescopic joint assembly	Hands free gooseneck system (HFGS)	1	1
Riser system	Telescopic joint assembly	Hydraulic stab	2	2
Riser system	Telescopic joint assembly	Packer	2	2

Subunit	Item	Component	Estimate for 1-stack system	Estimate for 2-stack system
Riser system	Telescopic joint assembly	Telescopic joint	1	1
Total			**1,652**	**2,796**

BOP = blowout preventer; SEA/SEM = subsea electronic assembly/subsea electronic module; HPU = hydraulic power unit; MUX = multiplex; EHBS = emergency hydraulic backup system; ROV = remotely operated vehicle.
Source: U.S. Department of Transportation, Bureau of Transportation Statistics, SafeOCS.

3. Surface WCE System Component Estimates

Table 3 shows the estimated count of components in a typical Class 4-A1-R3 surface BOP stack arrangement as used on the GOM jack-up fleet.

Table 3. Listing of Surface WCE System Component Count Estimates

Subunit	Item	Component	Estimate
BOP controls	BOP control panel	Driller's control panel	1
BOP controls	BOP control panel	Toolpusher's control panel	1
BOP controls	BOP control panel	Uninterruptible power supply (UPS)	2
BOP controls	BOP stack mounted controls	Pressure temperature sensor	2
BOP controls	Surface BOP stack control system	Accumulator	40
BOP controls	Surface BOP stack control system	Ball valve	19
BOP controls	Surface BOP stack control system	Check valve	2
BOP controls	Surface BOP stack control system	Filter	2
BOP controls	Surface BOP stack control system	Flowmeter	1
BOP controls	Surface BOP stack control system	Pressure gauge	10
BOP controls	Surface BOP stack control system	Pressure switch	12
BOP controls	Surface BOP stack control system	Pressure transducer	4
BOP controls	Surface BOP stack control system	Pump	2
BOP controls	Surface BOP stack control system	Regulator	3
BOP controls	Surface BOP stack control system	Relief valve	3
BOP controls	Surface BOP stack control system	Selector or manipulator 4-way valve	6
BOP stack system	Annular preventer	Annular BOP hardware	1
BOP stack system	Annular preventer	Operating system seal	1
BOP stack system	Annular preventer	Packing element	1
BOP stack system	Pipe ram preventer	Bonnet face seal	4
BOP stack system	Pipe ram preventer	Bonnet hardware	4
BOP stack system	Pipe ram preventer	Operating system seal (set)	4
BOP stack system	Pipe ram preventer	Pipe ram block hardware (set)	2
BOP stack system	Pipe ram preventer	Pipe ram block seal (set)	2
BOP stack system	Pipe ram preventer	Ram body hardware	1
BOP stack system	Shear ram preventer	Bonnet face seal	2
BOP stack system	Shear ram preventer	Bonnet hardware	2
BOP stack system	Shear ram preventer	Operating system seal (set)	2
BOP stack system	Shear ram preventer	Ram body hardware	1
BOP stack system	Shear ram preventer	Shear ram block hardware (set)	1
BOP stack system	Shear ram preventer	Shear ram block seal (set)	1
BOP stack system	Stack choke and kill system	Spool	4
BOP stack system	Stack choke and kill system	Valve assembly	4
BOP stack system	Stack choke and kill system	Valve operator assembly	2
Choke manifold system	Choke and kill drape hose	Drape hose	2
Choke manifold system	Choke and kill piping components	Fluid cushion	8
Choke manifold system	Choke and kill piping components	Manifold block	15
Choke manifold system	Choke and kill piping components	Piping	2
Choke manifold system	Choke and kill piping components	Valve actuator assembly	6
Choke manifold system	Choke and kill piping components	Valve assembly	52
Choke manifold system	Choke manifold controls	Accumulator	1
Choke manifold system	Choke manifold controls	HPU	1
Choke manifold system	Choke manifold controls	Selector or manipulator 4-way valve	5

Choke manifold system	Instruments	Pressure gauge	6
Choke manifold system	Instruments	Pressure transducer	8
Choke manifold system	Manual choke	Choke assembly	1
Choke manifold system	Remote choke	Choke actuator	2
Choke manifold system	Remote choke	Choke assembly	2
Diverter system	Diverter assembly	Flowline seal	2
Diverter system	Diverter assembly	Hardware	1
Diverter system	Diverter assembly	Hydraulic control interface	1
Diverter system	Diverter assembly	Operating system seal	1
Diverter system	Diverter assembly	Packing element or insert packer	1
Diverter system	Diverter control system	Accumulator	10
Diverter system	Diverter control system	Ball valve	13
Diverter system	Diverter control system	Check valve	2
Diverter system	Diverter control system	Electrically piloted directional control valve	13
Diverter system	Diverter control system	Filter	1
Diverter system	Diverter control system	Flowmeter	1
Diverter system	Diverter control system	Hydraulically piloted directional control valve	1
Diverter system	Diverter control system	Pressure gauge	6
Diverter system	Diverter control system	Pressure switch	6
Diverter system	Diverter control system	Pump	1
Diverter system	Diverter control system	Regulator	5
Diverter system	Diverter control system	Relief valve	1
Diverter system	Diverter control system	Selector or manipulator 4-way valve	6
Diverter system	Diverter housing assembly	Hardware	1
Diverter system	Diverter piping components	Actuator	5
Diverter system	Diverter piping components	Piping	3
Diverter system	Diverter piping components	Valve	5
Riser system	Riser	Spool	2
Total			**348**

BOP = blowout preventer; HPU = hydraulic power unit.
Source: U.S. Department of Transportation, Bureau of Transportation Statistics, SafeOCS.

List of Abbreviations, Acronyms, and Initialisms

API	American Petroleum Institute
BOP	blowout preventer
BSEE	Bureau of Safety and Environmental Enforcement
BTS	Bureau of Transportation Statistics
EHBS	emergency hydraulic backup system
GOM	Gulf of Mexico
HP	high pressure
HPU	hydraulic power unit
IADC	International Association of Drilling Contractors
IOGP	International Association of Oil & Gas Producers
JIP	joint industry project
MUX	multiplex
OCS	Outer Continental Shelf
PBOF	pressure balanced, oil-filled
ROV	remotely operated vehicle
SEA	subsea electronic assembly
SEM	subsea electronic module
SPM	subplate mounted
WCE	well control equipment