

RISK

ESD in a DP Vessel – For Safety, not for Blackout

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Dynamic Positioning Safety Program



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1. Introduction
2. ESD – Definition
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MODU Code - 4.12 Dynamic positioning systems

- **DP as a sole means of position keeping**
- **level of safety equivalent for anchoring arrangements.**



- ✓ prevents or minimizes the consequences of emergency situations

- ✓ helps to avoid
 - ✓ loss of human life,
 - ✓ damage to the environment,
 - ✓ and/or loss of equipment.



- .Prevent escalation of events
 - .Shutdown part of systems and equipment
- .Isolate electrical equipment
 - .Stop hydrocarbon flow
- .Emergency ventilation control
 - .Close watertight doors and fire doors



MODU Code - Chapter 6, “*Machinery and electrical installations in hazardous areas **for all types of units***”, divides the hazardous areas into zones as follows:

- Zone 0: explosive gas/air mixture is continuously present.
- Zone 1: explosive gas/air mixture is likely to occur.
- Zone 2: explosive gas/air mixture is not likely to occur.



- ✓ **6.5.1** (...) special arrangements should be provided to facilitate the selective disconnection or shutdown of:
- .1 ventilation systems (...);
 - .2 main generator prime movers (...);
 - .3 emergency generator prime movers.



- ✓ **6.5.2** Disconnection or shutdown should be possible from at least two strategic locations, (...).
- ✓ **6.5.3** (...) should be so designed that the risk of unintentional stoppages (...) and the risk of inadvertent operation of a shutdown are **minimized**.



- 6.5.4** (...) At least the following facilities should be operable after an emergency shutdown:
- emergency lighting required by 5.3.6.1.1 to 5.3.6.1.4 for half an hour;
 - blow-out preventer control system;
 - general alarm system;
 - public address system; and
 - battery-supplied radiocommunication installations.



● IMCA M 196

- requirements demand to shut down the UPSs for abandoning the vessel.
- the UPSs must allow the vessel to be ‘black started’ without the main power supply.
- they shall be supplied with a means to disconnect the batteries remotely.
- no specific tests as part of the annual trials program.



- **DNV** (*Section 5 Emergency Shutdown (ESD) Principles*)
 - **A201** (...) applied to all offshore units or installations having direct operational contact with hydrocarbons.
 - **A401** (...) the risk of unintentional shutdown caused by malfunction or inadvertent operation is minimized.
 - **E101** Shutdowns shall normally be automatically initiated, (...) manually initiated where detrimental to safety (drilling and DP).
 - Abandon Platform Pushbuttons:
 - Main and emergency control rooms
 - Muster stations, lifeboat stations and helicopter deck
 - Bridge connections between platforms



- **ABS** (*7. Systems Associated with Drilling Operations*)
 - As per MODU requirements
 - disconnection or shutdown, either selectively or simultaneously, of all electrical equipment and devices
 - Initiating may vary according to the nature of the emergency.
 - A sequence to be provided in the unit's operating manual.



- **LR** (*Section 7 Emergency shutdown (ESD) systems*)
 - When any process could affect the safety of personnel, the safety of the unit or pollution.
 - The operation to be initiated manually.
 - Drilling shutdown is only to be initiated manually.
 - Manual actuation points for complete shutdown at the main control station and others, e.g. at the helicopter deck and the emergency evacuation stations.
 - High level ESD is to be provided with local reset of each final element.



• **Semi-submersible – RIG ‘A’**

- ESD Level 2 Service Shutdown
- ESD Level 1 Topside Shutdown (Preparation for Abandon)
- ESD Level 0 Abandon Vessel Shutdown (AVS)

- **ESD Level 0 trips:**
 - Radio communications
 - ESD and Fire/Gas panels
 - Public Address and Public warning systems and integrated talkback system
 - The following UPS:
 - F&G/ESD Workstations UPS
 - Blow Out Preventer UPS
 - Driller Equipment UPS



• **Semi-submersible – RIG ‘B’**

- Manually and automatic. Manual activation from the ESD & F&G matrix and from manual pushbuttons
 - AVS Lifeboat Stations, Helideck Entrance
 - ESD 0 Nav Bridge, ECR
 - ESD 1 Nav Bridge, ECR
 - ESD 2 Nav Bridge, ECR, DCR
 - ESD 3 Nav Bridge, ECR, DCR
 - ESD 4 Nav Bridge, ECR

- Manual ESD pushbuttons in AVS stations, each AVS station with 2 pushbuttons. Both pushbuttons to activate AVS.



● Drillship 'A'

- Five pushbuttons for AVS : one on the bridge, two at the helideck and two on each lifeboat.
- After a total shutdown, an extra key shall be used for reset.
- ESD 1
 - All main engines stop
 - All main engine HV breakers open
 - Engine room fans trip
 - Engine room quick closing valves close
 - All engine PLC ACU's trip
- ESD 3 (Prepare for Emergency Response) on the Pilot House, Engine Control Room, Drillers Control Cabin, Forward Stbd Escape Way, Midships Stbd Escape Way, Aft Escape Way and shall be activated by nominated persons.



Drillship 'B'

ESD No	Description	Availability of ESD				
		Fwd Em HQ	Aft Em HQ	Bridge	DWS	ECR
1	Accommodation and non-DP related ventilation shutdown and damper closure	•	•	•	•	•
2	Automatic ventilation shutdown by fire or gas alarm					
3	Forward machinery space and forward thruster room ventilation shutdown, damper closure and QCV closure.	•	•	•	•	•
4	Shutdown forward and aft FO, LO and BO transfer pumps and valves	•	•	•		•
5	Topsides hazardous area ventilation shutdown and damper closure	•	•	•	•	•
6	Port engine room fans shutdown	•	•	•	•	•
7	Centre engine room fans shutdown	•	•	•	•	•
8	Starboard engine room fans shutdown	•	•	•	•	•
9	Aft thruster rooms, boiler room and IG plant ventilation shutdown and damper closure	•	•	•	•	•
10	Cargo pump shutdown and suction valve closure	•	•	•		•
11	Emergency generator shutdown and damper closure	•	•	•		
13	Port engines only shutdown	•	•			
14	Centre engines only shutdown	•	•			
15	Starboard engines only shutdown	•	•			
16	Port engine room total shutdown	•	•			
17	Centre engine room total shutdown	•	•			
18	Starboard engine room total shutdown	•	•			
19	Port engine room dampers and fans shutdown	•	•	•	•	•
20	Centre engine room dampers and fans shutdown	•	•	•	•	•
21	Starboard engine room dampers and fans shutdown	•	•	•	•	•



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Potential Risks

● Rules --> Risks

- total blackout
- loss of position
- termination of well control efforts
- vessel drifts uncontrolled

● ESD pushbuttons-helideck-lifeboats-->Risks

- opportunity for unintentional activation
- susceptibility to mechanical damage and/or water ingress in open locations
- human error



- **Human Error as Root Cause of DP Incidents**
 - NO specific PROCEDURES
 - MORE ACTIVITIES and responsibilities
 - LESS EXPERIENCED operators
 - HIGH TURNOVER among companies
 - NOT enough time to be FAMILIAR with systems
 - FEW opportunities for PRACTICING
 - INEFFECTIVE on-job-TRAINING
 - LACK of participation during COMMISSIONING
 - POOR quality/Absence of MANUALS especially after upgrades
 - Experienced people TOO MUCH CONFIDENT
 - People RELYING ON higher level of AUTOMATION



Concerns

- MODU Code 6.5.2. refers to *'at least two strategic locations'*.
- On MODU Code 6.5.3, it says that *'the system's design should minimize the risk of inadvertent operation'*.
- No guiding to operate ESD pushbuttons on the Rigs Operating Manuals.
- Supply faults including voltage fluctuations should not generate any ESD tripping action



- ABS +A1(E), “Drilling Unit”, +AMS, +ACCU, +DPS-3, NBLES, DLA, New Built (2009) 6th.Generation Deepwater Drillship: someone operated a ESD switch near a lifeboat and blacked the rig out.
- LR +100A1, +LMC, UMS, DP (AAA), PC, DRILL, OIWS: while waiting on the commencement of the contract, someone intentionally operated a ESD switch near the helideck and blacked the rig out.
- DNV 1A1 COLUMN STABILIZED UNIT DRILLING VESSEL, HELDK, DYNPOS AUTR, EO, DRILL: while performing a DNV test on one of the F & G emergency stations the operator made a mistake and pushed the wrong button blacking the rig out.



- LR +100A1, +LMC, UMS, DP (AAA), PC, DRILL, OIWS: during acceptance trials a voltage drop caused the ESD system to activate blacking the rig out.
 - By following the procedure to restore power, almost one hour was spent. Uncontrolled drift and lack of communication was noticed.

- Engine Shutdown X Emergency Stop



- **Isolation of the highest levels and shutdowns**

- protective covers and other barriers to prevent accidental activation should be fit to avoid that.

- **Technical Specification**

- *“If the unit has ESD (Emergency Shutdown) devices installed, they shall be permanently deactivated prior to the commencement of the Contract with Petrobras. That action shall be proven by tests and a certificate shall be issued by an IMO-recognized company to ensure that.”*



MODU Code

- ✓ guidance note to raise awareness that current ESD rules may be unsafe for DP MODUs
- ✓ accept *centralized* RESET to minimize drift time without power if ESD was applied
- ✓ a possible new redaction for item 6.5, as below:
“In the case of units using dynamic positioning systems as a sole means of position keeping, special consideration may be given to the selective disconnection or shutdown of machinery and equipment associated with maintaining the operability of the dynamic positioning system in order to preserve the integrity of the well.”



MODU – Code (cont.)

- 6.5.2 – “In the case of units using dynamic positioning systems (...) in order to preserve the integrity of the well **and the maneuverability of the vessel.**”
 - **Reason:** quick restoration of power to maintain the control of the vessel.
- 6.5.4 – “Shutdown systems that are provided to comply with paragraph 6.5.1 (...) and the risk of inadvertent operation of a shutdown are (**minimized**) **eliminated.**”
 - **Reason:** a single action should cause no effects on the system.



Petrobrás/DPPS Technical Specification (4.2.2)

- ✓ “Emergency Shutdown (ESD): the system shall be hierarchically integrated in such a way that the high levels are comprised of lower levels.
- ✓ Every actuator shall have clear identification of the equipments to shut down.
- ✓ It shall be protected against inadvertent activation by a mechanical protection.
- ✓ The highest level (usually Abandon Vessel Shutdown) shall not be activated by a single device, even if mechanically protected or activated by two independent actions, unless special features such as a password are implemented.
- ✓ Any activation of the ESD system shall be followed by visual and audible alarms.”



- **Shahin Oil & Gas – SS Amazonia (Kongsberg)**
 - Level 3 ESD3 (APS) Abandon vessel
 - Level 2 ESD2 Rig Emergency Equipment Shutdown
 - Level 1 ESD1 Fire & Gas Shutdown

 - Manual pushbuttons located at:
 - CCR
 - ECR

 - APS shall only be initiated by the Captain.



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- IMO – MODU Code, the Classification Societies rules and DPPS Class II and Class III Technical Specifications.
- ESD devices.
- History of inadvertent acts.
- Problems to restore power after ESD.
- It should be considered a single point failure.
- Join efforts.
- Improve reliability.



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Thank You !



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Questions?

You can also send your questions or comments to:

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