

STATOIL ASA

*BASIC ENGINEERING
BLAFRO SLIP-JOINT
MUD SPILL PREVENTER*

Document Title:

**FUNCTIONAL DESCRIPTION
BLAFRO SLIP-JOINT MUD SPILL PREVENTER**

Rev.	Date	Reason for Issue	Prepared	Checked	Approved
02	24.08.2007	Issued for Information	BHL		
01	20.07.2007	Issued for IDC	MOH		



GRENLAND GROUP TECHNOLOGY

Client Doc No.:

Document No.:


Revision:

Discipline:

10112908-0011-FDS

02

I (Instrumentation/metering)

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REVISION RECORD

The revisions are denoted as follows:

- i) By the symbol | with the revision number adjacent, located in left-hand column.

REV.	DESCRIPTION OF CHANGES
01	First Issue
02	Issued for Information



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1 INTRODUCTION

The purpose of this document is to clearly define the functions and all parts that will be used for manufacture of the Blafro Slip-Joint Mud Spill Preventer.

All information necessary to select correct materials and components for the system and service will be included in this document.

It is manufacturers responsibility to assume full responsibility for detailed design and compliance with applicable codes and standards. Buyer should be notified without any undue delay if further clarifications are required.

Documentation shall comply with requirements as laid down in NS.5820.

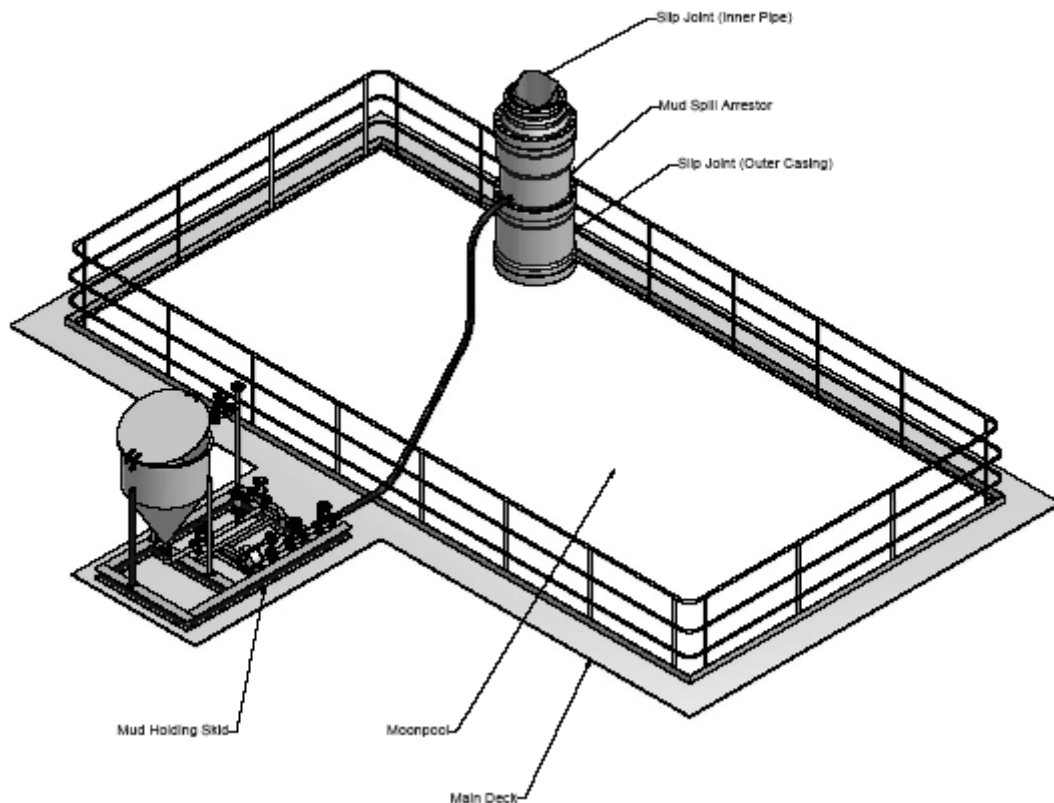




Figure 1 – Proposed assembly of complete system

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2 LIST OF APPLICABLE STANDARDS

The following standards shall be adhered to with regard to design and calculations:

- DNV-OS-E101 - Drilling Plant
- DNC-OS-F201 - Dynamic Risers
- API RP 16Q - Drilling Riser Recommended Practice
- ANSI B16.5 - Standards of Pipes and Fittings
- NORSOK M-501 Surface preparation and protective coating Rev.5

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3 SYSTEM DESCRIPTION

3.1 PURPOSE OF SYSTEM

The purpose of the Blafro Slip-Joint Mud Spill Preventer is to ensure that the level of drilling mud within the slip ring is controlled, in case the lower and upper packer both start leaking.

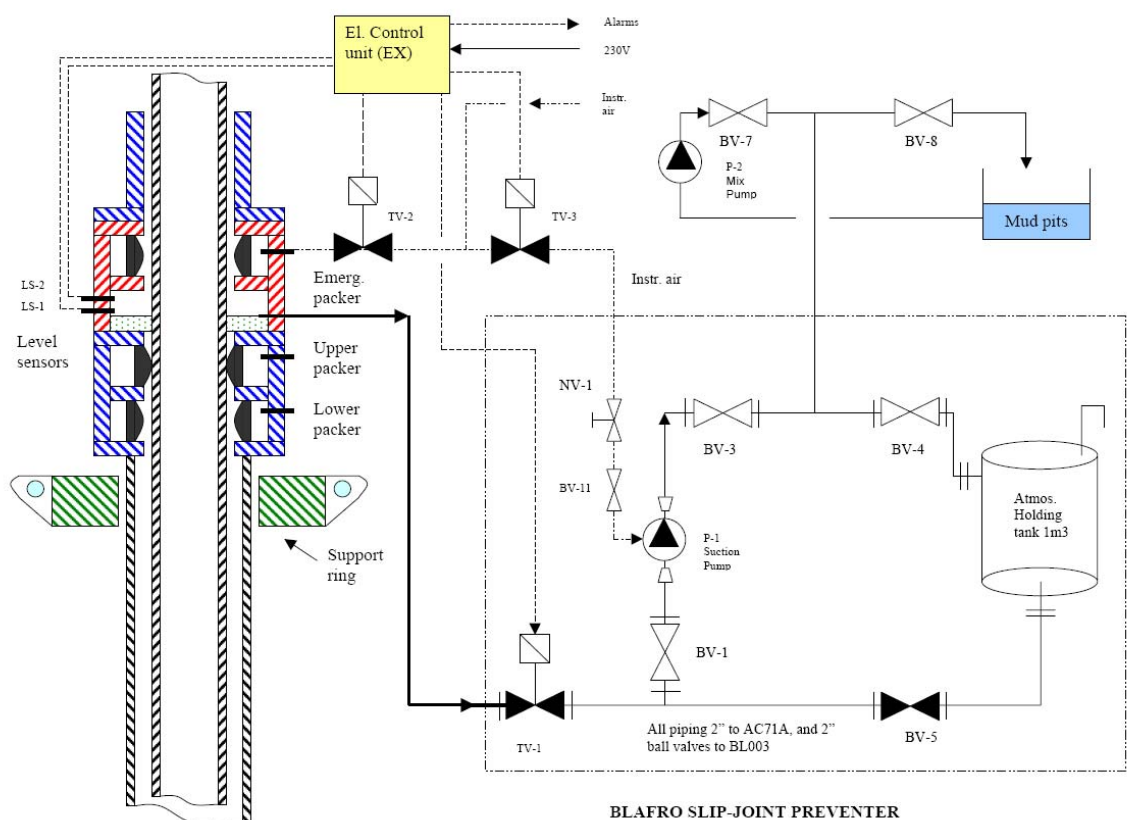



Figure 2 – System in standby mode

The Upper Packer is normally in operation. When this packer is subject to leakage, the Lower Packer will also be activated.

If the Lower Packer is also subject to leakage, the leakage into the Slip-Joint should be controllable.

To achieve this, a new spool piece will be installed – namely the Blafro Slip-Joint Mud Spill Preventer.

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This unit constitutes the following components:

1. 1 each “housing”/spool piece (slip-joint) with a Rig Air Emergency Packer
2. 1 each solenoid valve for actuation of the Rig Air Emergency Packer
3. Two each level switches for mud level inside the slip-joint
4. A local Control Unit (PLC system suitable for Zone 1 operation)
5. A skid mounted mud-collection system

Note: All electrical and instrument equipment used will be suitable for Zone 1 operation.

The skid mounted mud-collection system constitutes the following components:

1. One each pump (pneumatic operated) suitable for mud, and controlled by the self contained Control Unit (PLC).
2. Lot 2” piping and 2” isolation valves to piping class AC71A
3. One ach 2” electrical operated isolation valve for mud from Slip-Joint
4. Solenoid valve for start/stop of pump (air operated)
5. An atmospheric holding tank (0.5-1.0 m³)
6. A 2” flexible hose for connection to the spool piece
7. A manual start/stop control unit for the pneumatic operated pump (used during wash/drain service)

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3.2 OPERATION OF SYSTEM

The following is a short description of the function of the system.

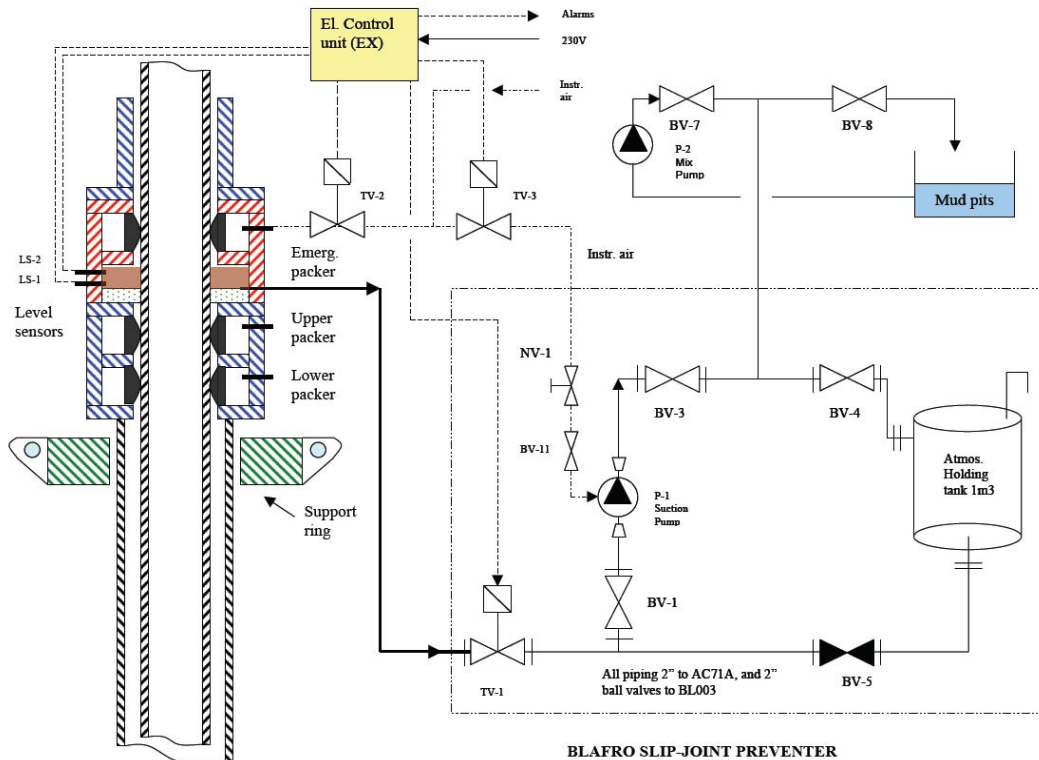


Figure 3 – System is operational

3.2.1 Leakage into the Blafro Slip-Joint


In case the upper and lower packer leaks, the Blafro Slip-Joint (spool piece coloured red) will be filled with mud (coloured brown).

When level sensor LS-1 gets activated (high level):

1. PLC will open solenoid valve TV-2 to activate the Rig Emergency Packer.

When mud level increases further, level sensor LS-2 gets activated (high level):

1. Isolation valve TV-1 against mud collection system is opened.
2. System is assumed to be in standby-mode (Manual isolation valves BV-1, BV-3, and BV-4 are open, whereas isolation valve BV-5 is closed).
3. Pump P-1 will be started when PLC actuate solenoid valve TV-3. (The speed and thereby the capacity of the pump will be adjusted and pre-set using needle valve NV-1. Isolation valve BV-11 is intended for use during maintenance).

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4. Pump P-1 will run until Level sensor LS-1 is de-activated (low level), and will then be stopped by closing solenoid valve TV-3.
5. When pump is stopped, inlet isolation valve TV-1 will close.

3.2.2 Mud collection system

The mud collection system will be delivered on a skid for easy installation and hook-up.

The figure below shows the general proposed design. Supports will be added, and control unit and solenoid valves will be located during detail design.

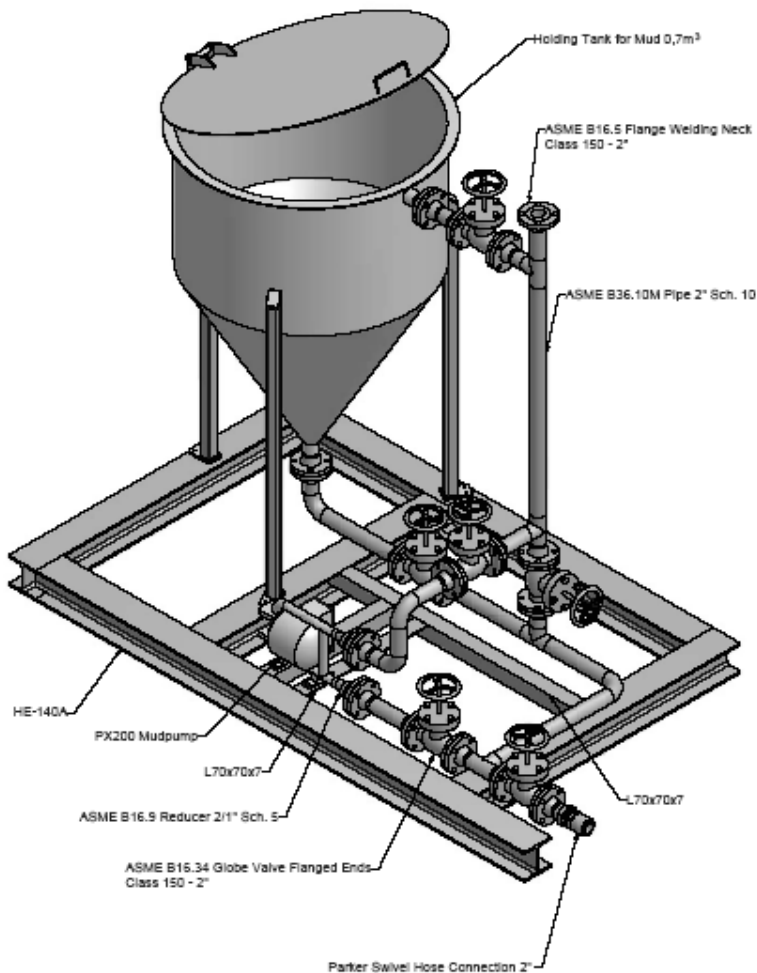

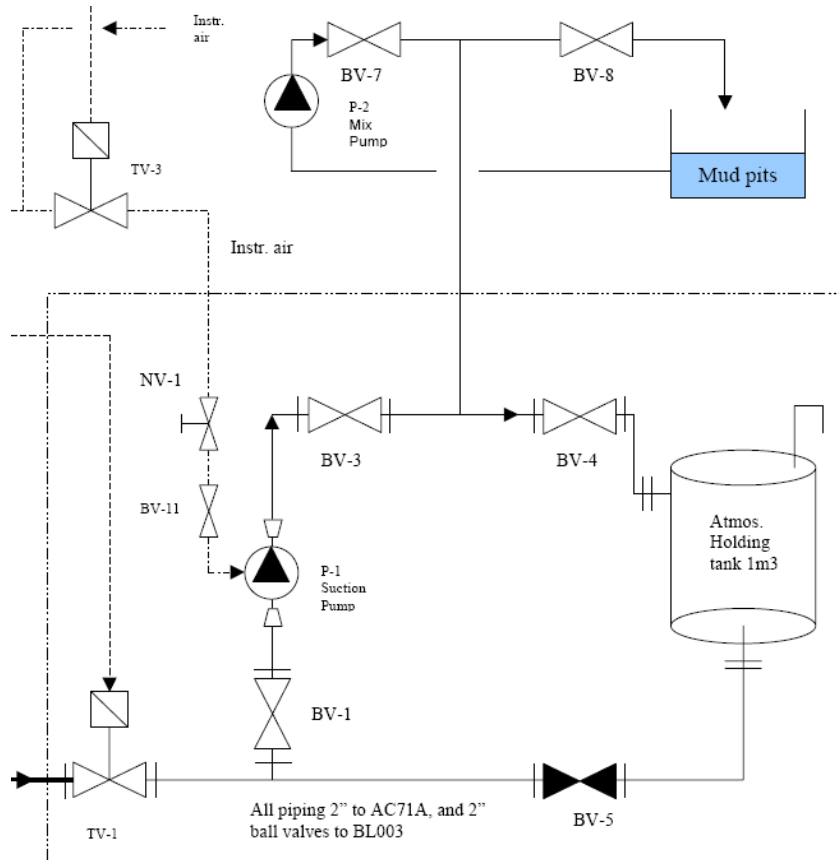


Figure 4 – Skid Mounted mud collection system

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Normal operation


In normal operation (and standby-mode), isolation valves BV-1, BV-3 and BV-4 are left open, and isolation valve BV-5 is closed.

Pump P-1 will therefore pump the mud from the Blafro Slip-Joint the easiest way – to the atmospheric holding tank.

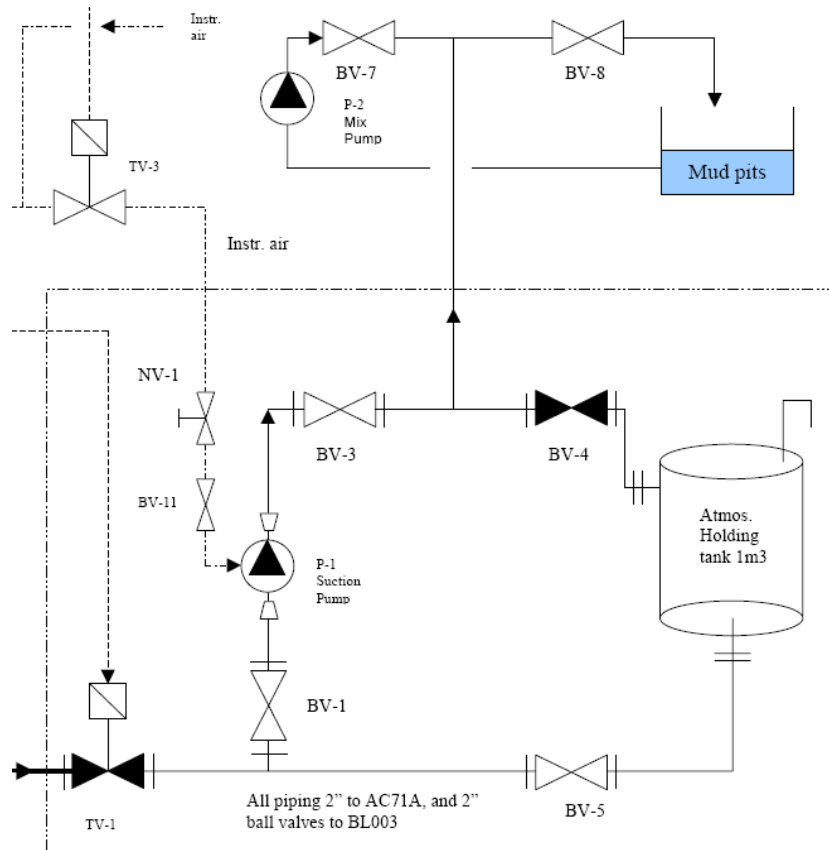
(Note: Elevations of physical installation of the different parts must be verified).

On above figure, inlet valve TV-1 from Blafro Slip-Joint is activated based on high level read inside the Slip-Joint, and pump is started. Pump will be running until low level inside the Slip-Joint is activated.

Currently, no level indicators/transmitters are fitted to the holding tank, as we assume that operators will inspect the tank at regular intervals.

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Draining holding tank




When the atmospheric holding tank is near full, isolation valve BV-4 is closed, and isolation valve BV-5 is opened.

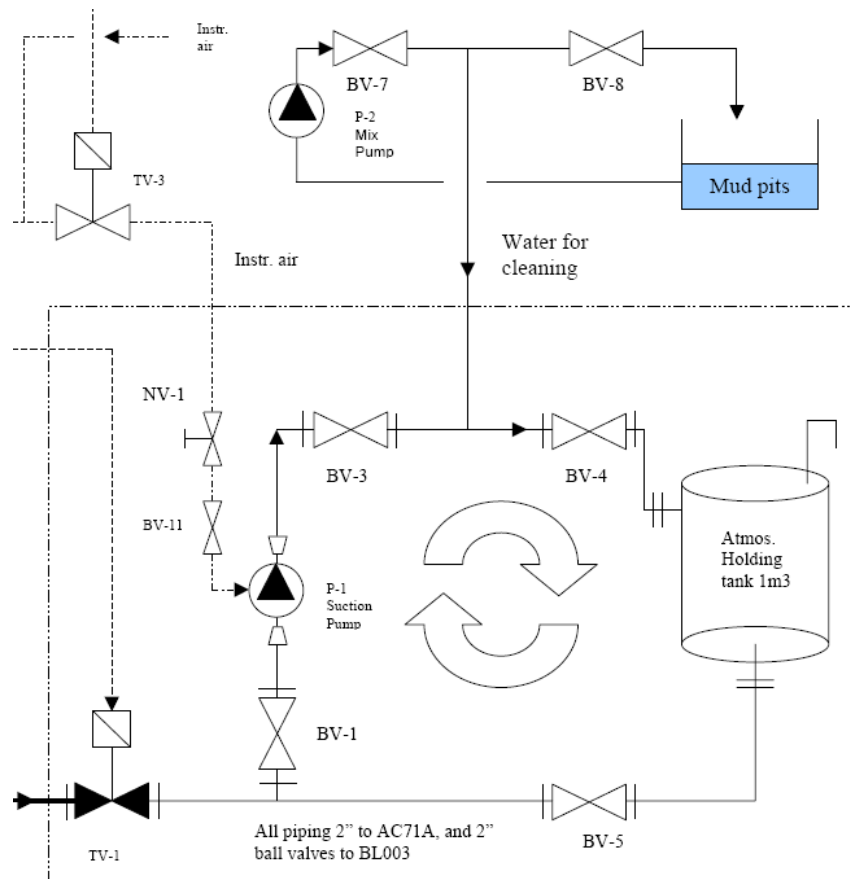
Operation of a local control button (located at the atmospheric holding tank) interfaced to the PLC, will close inlet isolation valve TV-1, and thereafter start suction pump P-1.

Suction pump P-1 will drain the holding tank to mud pits, until the control button is switched off again (manual control assumed).

When the control button is switched off, pump P-1 will stop, and isolation valve TV-1 is also default set to closed, ready for automatic operation.

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Cleaning holding tank




When flushing/cleaning of system is required, water is filled into the system from mud pits manifold system.

Valves BV-1, BV-3, BV-4 and BV-5 are all left open, and water will fill the system onto suction side of pump P-1 and into the atmospheric holding tank.

When the atmospheric holding tank is half-full, operation of the control button located at the atmospheric holding tank will start suction pump P-1. Water will now circulate inside the system.

When flushing/cleaning is considered complete, the system shall be drained as explained in previous section.

When the control button is switched off, pump P-1 will stop, and isolation valve TV-1 is also default set to closed, ready for automatic operation.

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Valves BV-1, BV-3, BV-4 and BV-5 shall now be set to standby positions.

3.3 CONTROL SYSTEM (PLC)

The Control System mounted on the skid will be an EExd enclosure, which again will be mounted into an EExe junction box.

This design is selected to minimise maintenance of the flame paths of the EExd enclosure.

The following will be mounted inside the EExd enclosure:

- The PLC itself
- The combined Namur amplifier/barriers for the level switches
- Power supply (if required)

All client connections for incoming cables will be terminated onto rails in the EExe compartment.

Solenoids used will be EExm, and will be powered from the PLC.

The inlet isolation valve TV-1 will be electrically or pneumatic actuated (part of detail design).

3.4 MATERIALS OF CONSTRUCTION


All piping equipment shall be selected according to piping class AC71A, and painting of piping components shall be to NORSOK Coating System no. 1.

Instrument bulk valves and solenoid valves shall have wetted parts in 316SS.

The skid itself will be delivered in hot-dip galvanized in accordance with ISO 1461. Minimum coating thickness for structural items and outfitting steel shall be 125 µm and 900 g/m². Structural items shall be blast cleaned before hot-dip galvanizing.

The skid will be delivered with certified lifting lugs for easy handling onshore-supply boat-platform.

Regarding coating, NORSOK standard M-501 shall be adhered to.

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4 BLAFRO SLIP-JOINT

4.1 INTRODUCTION

The design of the Blafro mud spill preventer is based on material lists received from client, and from physical measurements, which took place in Kristiansund.

All drawings must therefore carefully be reviewed and approved by client until any manufacture of components will take place. This to ensure that GGT have a correct understanding of client technical requirements, as well as client's expectations to the function and operation of the complete system.

4.2 MATERIALS OF CONSTRUCTION

We find from existing drawings of the slip joint and material certificates that similar parts to the mud spill preventer body, have earlier been manufactured in the AISI 4130 material. The mud spill preventer body will therefore also be made from AISI 4130.

For parts such as packers, o-rings and bolts, there will be used standard parts that are used in the slip-joints today.

4.3 NON DESTRUCTIVE EXAMINATION


To ensure good quality the mud spill preventer body will be subject to 100% X-Ray.

4.4 FORCES TO CONSTRUCTION

In operation condition the mud spill preventer will only be subjected to atmospheric pressure. Furthermore the bending forces in this condition are considered negligible. The governing condition for the equipment will therefore be during installation of the riser/slip-joint system. The mud spill preventer will then be subjected to an axial load of 450 tons. We will use FEM analysis to verify the strength of the mud spill preventer.

4.5 INSTALLATION

To be discussed.

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5 REFERENCES

5.1 DRAWINGS

/1/	10112908-0010-ARD	Main arrangement
/2/	10112908-0009-ARD.....	Mud holding skid arrangement
/3/	10112908-0008-ARD.....	Mud holding tank arrangement
/4/	10112908-0012-ASD.....	Mud spill arrestor arrangement
/5/	10112908-0014-DED.....	Mud spill arrestor body details