	TECHNICAL SPECIFICATION		Nº: I-ET-3010.1Y-1350-200-P4X-001
	CLIENT:	BÚZIOS	SHEET: 1 OF 20
	JOB:	HIGH CAPACITY FPSO DESIGN	
	AREA:	BÚZIOS	
SRGE	TITLE:	HULL PIPING PRACTICE	INTERNAL
			ESUP

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INDEX OF REVISIONS

REV.	DESCRIPTION AND/OR REVISED SHEETS
0	ORIGINAL
A	WHERE INDICATED

	REV. 0	REV. A	REV. B	REV. C	REV. D	REV. E	REV. F	REV. G	REV. H
DATE	15/01/2021	16/04/21							
DESIGN	ESUP	ESUP							
EXECUTION	U4T1	BNNX							
CHECK	CXZ0	BYA6							
APPROVAL	CYEL	CYEL							

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THIS FORM IS PART OF PETROBRAS N-381 REV.J ANNEX A – FIGURE A.1.



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1. INTRODUCTION

1.1. OBJECTIVE

This Technical Specification contains Technical Requirements and Recommended Practices.

This Technical Specification also complements the applicable codes, defining supplemental requirements and OWNER definitions.

In case of conflicting requirements between this technical specification and other cited references, the most stringent shall prevail. If necessary, the hull supplier may revert to OWNER for clarification.

1.2. DEFINITIONS

All definitions are found on I-ET-3010.00-1200-940-P4X-002 – GENERAL TECHNICAL TERMS

2. REFERENCE DOCUMENTS

Ref Doc Number	Ref Doc Name
I-DE-3010.1Y-1350-944-P4X-001	CLOSED VENTING SYSTEM
I-DE-3010.1Y-1350-944-P4X-002	LOADING SYSTEM
I-DE-3010.1Y-1350-944-P4X-003	CARGO SYSTEM
I-DE-3010.1Y-1350-944-P4X-005	TANK LEVEL, PRESSURE, TEMPERATURE AND FLOODING INDICATION SYSTEM
I-DE-3010.1Y-5111-944-P4X-004	ENGINE ROOM SEAWATER COOLING SYSTEM
I-DE-3010.1Y-5115-944-P4X-002	FRESH, HOT AND POTABLE WATER SYSTEM
I-DE-3010.1Y-5115-944-P4X-003	FRESH, HOT AND POTABLE WATER SYSTEM DISTRIBUTION



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I-DE-3010.1Y-5120-944-P4X-001	ENGINE ROOM CENTRAL FRESH WATER COOLING SYSTEM
I-DE-3010.1Y-5133-944-P4X-003	DIESEL OIL PURIFIER AND SERVICE SYSTEM
I-DE-3010.1Y-5133-944-P4X-004	DIESEL OIL STORAGE SYSTEM
I-DE-3010.1Y-5138-944-P4X-001	AUXILIARY AND EMERGENCY GENERATORS START-UP AIR SYSTEM
I-DE-3010.1Y-5139-944-P4X-001	HYDRAULIC SYSTEM FOR HYDRAULIC SUBMERGED PUMPS
I-DE-3010.1Y-5139-944-P4X-002	HYDRAULIC SYSTEM FOR RISER PULL-IN SYSTEM
I-DE-3010.1Y-5139-944-P4X-003	HYDRAULIC VALVES REMOCON (HULL SYSTEMS)
I-DE-3010.1Y-5139-944-P4X-004	MOORING HYDRAULIC SYSTEM
I-DE-3010.1Y-5139-944-P4X-005	OFFLOADING HYDRAULIC SYSTEM
I-DE-3010.1Y-5241-944-P4X-002	INERT GAS SEAWATER SYSTEM
I-DE-3010.1Y-5241-944-P4X-003	INERT GAS SYSTEM
I-DE-3010.1Y-5241-944-P4X-004	INERT GAS DISTRIBUTION SYSTEM
I-DE-3010.1Y-5241-944-P4X-005	PURGING AND STRIPPING SYSTEM FOR SUBMERGED PUMPS PIPE STACKS
I-DE-3010.1Y-5260-944-P4X-001	EMERGENCY AND AUXILIARY GENERATORS
I-DE-3010.1Y-5262-944-P4X-001	HULL GENERATOR



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I-DE-3010.1Y-5271-944-P4X-001	TANKS CLEANING AND RECIRCULATION SYSTEM
I-DE-3010.1Y-5300-944-P4X-001	DIRTY OIL DRAIN SYSTEM
I-DE-3010.1Y-5310-944-P4X-001	BLACK AND GREY WATER SYSTEM
I-DE-3010.1Y-5310-944-P4X-002	BLACK AND GREY WATER SYSTEM COLLECTION
I-DE-3010.1Y-5320-944-P4X-001	UPPER RISER BALCONY DRAINAGE SYSTEM
I-DE-3010.1Y-5330-944-P4X-001	BILGE, SLUDGE, BALLAST (AFT) AND GENERAL SERVICE SEAWATER SYSTEM
I-DE-3010.1Y-5330-944-P4X-002	HULL EXPOSED AREAS DRAINING SYSTEM
I-DE-3010.1Y-5330-944-P4X-003	COFFERDAM, VOID SPACES AND STORES DRAINING SYSTEM
I-DE-3010.1Y-5330-944-P4X-004	SCUPPERS AND COAMINGS DRAINS IN ENGINE ROOM
I-DE-3010.1Y-5335-944-P4X-001	BALLAST SYSTEM (FWD)
I-DE-3010.1Y-5336-944-P4X-005	SLOP DISCHARGE SYSTEM
I-DE-3010.1Y-5415-944-P4X-003	HULL EXHAUST GAS DISCHARGE SYSTEM
I-DE-3010.1Y-5415-944-P4X-004	VENTING AND SOUNDING SYSTEM
I-DE-3010.1Y-5520-944-P4X-001	GAS SAMPLING SYSTEM
I-DE-3010.1Y-6124-944-P4X-001	HULL SERVICE AND INSTRUMENT AIR DISTRIBUTION SYSTEM



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I-DE-3010.1Y-6650-944-P4X-001	DRAUGHT, TRIM AND HEEL INDICATION SYSTEM
I-DE-3010.1Y-5423-944-P4X-001	PIPING AND INSTRUMENT DIAGRAM-FIRE WATER PUMP SET (DIESEL HYDRAULIC UNIT "A")
I-DE-3010.1Y-5423-944-P4X-002	PIPING AND INSTRUMENT DIAGRAM-FIRE WATER PUMP SET (DIESEL HYDRAULIC UNIT "B")
I-DE-3010.1Y-5423-944-P4X-003	PIPING AND INSTRUMENT DIAGRAM-FIRE WATER PUMP SET (DIESEL HYDRAULIC UNIT "C")
I-DE-3010.1Y-5423-944-P4X-004	PIPING AND INSTRUMENT DIAGRAM-FIRE WATER PUMP SET (DIESEL HYDRAULIC UNIT "D")
I-DE-3010.1Y-5423-944-P4X-005	PIPING AND INSTRUMENT DIAGRAM - FIRE WATER DISTRIBUTION - FIRE WATER RING MAIN
I-DE-3010.1Y-5423-944-P4X-006	PIPING AND INSTRUMENT DIAGRAM - FIRE WATER DISTRIBUTION - PRODUCTION PLANT
I-DE-3010.1Y-5423-944-P4X-007	PIPING AND INSTRUMENT DIAGRAM - FIRE WATER DISTRIBUTION - ACCOMMODATION, ENGINE ROOM, MAIN DECK, FORECASTLE AND HELIDECK
I-DE-3010.1Y-5424-944-P4X-001	PIPING AND INSTRUMENT DIAGRAM - FOAM SUPPLY SYSTEM
I-DE-3010.1Y-5424-944-P4X-002	PIPING AND INSTRUMENT DIAGRAM - FOAM DISTRIBUTION
I-DE-3010.1Y-5424-944-P4X-003	PIPING AND INSTRUMENT DIAGRAM - FOAM DISTRIBUTION - COAMING AREAS



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I-DE-3010.1Y-5424-944-P4X-004	PIPING AND INSTRUMENT DIAGRAM - FOAM SUPPLY SYSTEM - HELIDECK
I-DE-3010.1Y-5400-94A-P4X-001	AREA CLASSIFICATION - GENERAL
I-DE-3010.1Y-5331-943-P4X-001	PRODUCED WATER SYSTEM
I-DE-3010.1Y-5331-944-P4X-001	PRODUCED WATER COOLER AND FLASH DRUM
I-DE-3010.1Y-5331-944-P4X-002	HYDROCYCLONES
I-DE-3010.1Y-5331-944-P4X-003	GAS FLOTATION UNIT "A"
I-DE-3010.1Y-5331-944-P4X-004	GAS FLOTATION UNIT "B"
I-DE-3010.1Y-5331-944-P4X-005	PRODUCED WATER TANK "P"
I-DE-3010.1Y-5331-944-P4X-006	PRODUCED WATER TANK "S"
I-DE-3010.1Y-5331-944-P4X-007	PRODUCED WATER BOOSTER PUMP AND FILTER
I-DE-3010.1Y-1223-944-P4X-015	OFF-SPEC OIL TANK
I-DE-3010.1Y-5252-944-P4X-001	CHILLED WATER GENERATION
I-DE-3010.1Y-5252-944-P4X-002	CHILLED WATER DISTRIBUTION - ACCOMMODATIONS
I-DE-3010.1Y-5252-944-P4X-003	CHILLED WATER DISTRIBUTION - TOPSIDES AND SHIPSERVICE
I-ET-3010.1Y-1200-200-P4X-001	PIPING SPECIFICATION FOR TOPSIDES



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I-ET-3010.1Y-1200-200-P4X-002	PIPING SPECIFICATION FOR HULL
I-ET-3010.1Y-1200-200-P4X-004	REQUIREMENTS FOR PIPING SUPPORT
I-ET-3010.1Y-1200-200-P4X-005	MINIMUM REQUIREMENTS FOR PIPING MECHANICAL DESIGN AND LAYOUT
I-ET-3010.1Y-1200-200-P4X-006	REQUIREMENTS FOR PIPING STRESS ANALYSIS
I-ET-3010.00-1200-200-P4X-003	DESIGN, CONSTRUCTION AND ASSEMBLY OF FRP PIPING
I-ET-3010.00-1200-956-P4X-002	GENERAL PAINTING
I-ET-3010.00-1200-940-P4X-002	GENERAL TECHNICAL TERMS

3. DOUBLE PLATES

For suction and discharge pipes in structural tanks, there shall be plates welded to the structure, aligned with the suction(s) and discharge(s) in each structural tank, in order to prevent wear of the main structure.

The area of the plate shall be sufficient to ensure that a jet from the end of the discharge / suction pipe at an angle of 45° to the flow will collide with the tanks plate and not with the unprotected structure, in order to guarantee that the entire area of contact with the jet will be properly protected against corrosion and abrasion. The area of the double plate shall be at least four times the projection area of the discharge or suction piping. The plate area will be limited to the distances between the reinforcements.

3.1. GENERAL REQUIREMENTS

The thickness and material of the plate shall be the same as the structure in which the plate will be welded.

An anti-abrasion coating shall be applied at double plates of tanks. The anti-abrasion coating is an epoxy Novolac based coating with high resistance to erosion-corrosion, according to I-ET-3010.00-1200-956-P4X-002 GENERAL PAINTING.

For double/wear plates for suction and discharge of submerge pumps located inside tanks, the dimensions and distance to the equipment must be in accordance with the vendor's recommendations

3.2. DOUBLE PLATES FOR SUCTION PIPES IN TANKS

The height (H) shown in Figure 1, between the suction face of the pipe and wear plate face, unless it is defined in the P&ID or it is required by the classification society shall have the dimensions defined in Table 1:

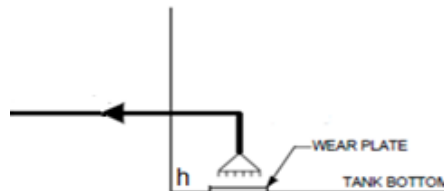


Figure 1: Double plate for suction pipes

Pipeline Dn (in)	H (mm)
1" - 2 1/2"	15
3" - 6"	35
8"-12"	80
14"-18"	120
20"- 24"	170
26" - 30"	210
>= 32"	250

Table 1: distance between pipe and double plate

3.3. DOUBLE PLATES FOR DISCHARGE PIPES IN TANKS

The distance (H) shown in Figure 2, between the discharge face of the pipe and double plate face, unless it is defined in the P&ID or it is required by the classification society shall have the dimensions defined in Table 2.

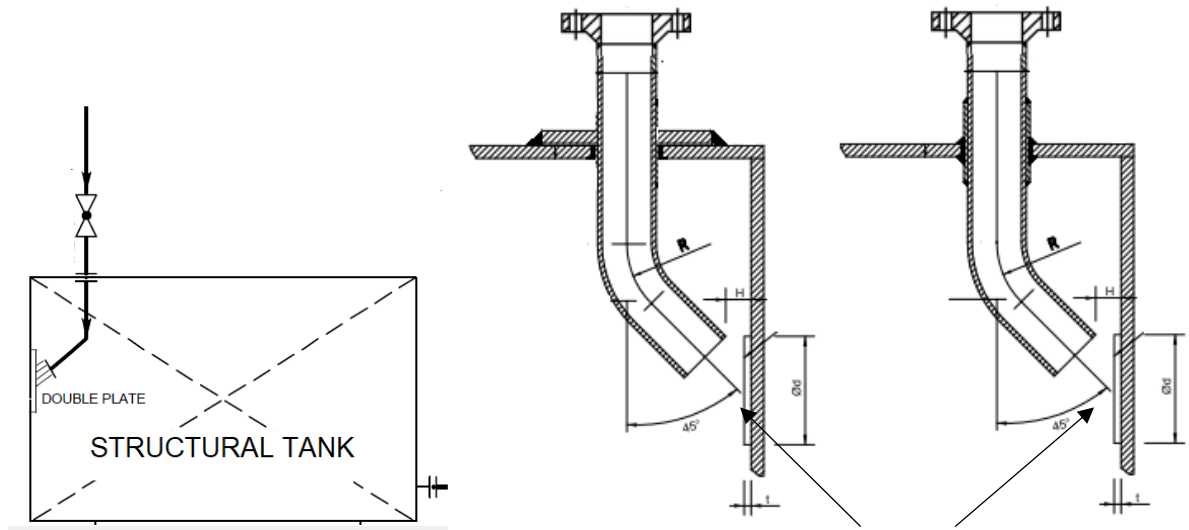


Figure 2: Double plate for discharge pipes

Dn (in)	H (mm)
1" - 2 1/2"	50
3" - 6"	80
8" - 12"	120
14" - 18"	170
20" - 24"	220
26" - 30"	300
>= 32"	350

Table 2: distance between pipe and wear plate

3.4. DOUBLE PLATES FOR DROPLINES

The Loading and Transference systems droplines are vertical pipes fitted inside the cargo tanks from main deck up to a height of 500 mm from the bottom plating, as shown in Figure 3 and Figure 4.

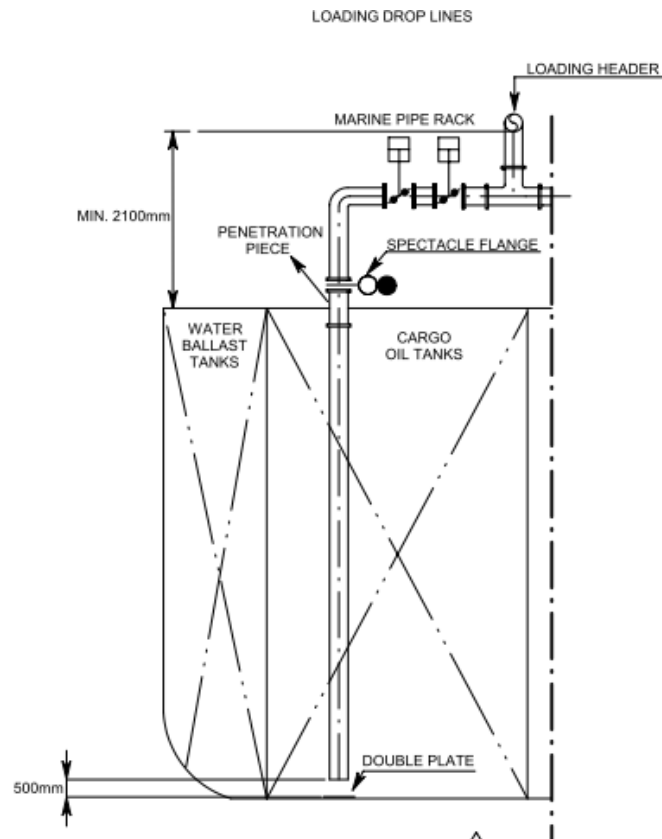


Figure 3: Double plate for droplines of the Loading System

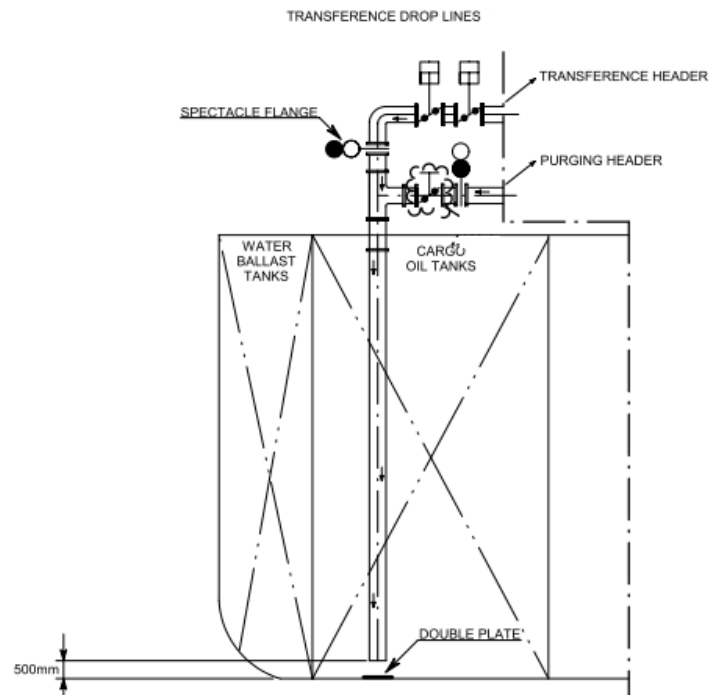


Figure 4: Double plate for droplines of the Transference System

3.5. DOUBLE PLATES FOR BELL MOUTHS

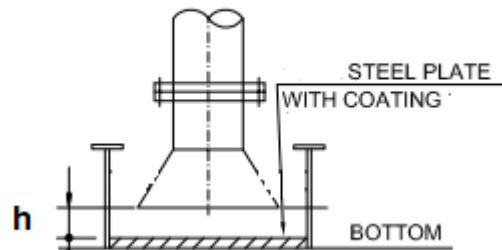


Figure 5: bell mouth

Bell mouths shall have a double plate in alignment with its suction / discharge in order to prevent wear of the main structure, with the same requirements of 3.1. The distance from the bell mouth to the bottom of the tank shall be calculated according to the following formula.

$$h = 1,3 \cdot \frac{d^2}{4 \cdot D}$$

Where: d = pipe internal diameter (mm); D = bell mouth internal diameter (mm) and h = distance from the bell mouth to the bottom of the tank (mm)

3.6. DISCHARGE LINES IN SLOP TANKS

For lines that discharge into Slop tanks (TQ-5336506P / S), the height of the double plate shall be 3 m above the bottom of the tank, as shown in Figure 6.

The discharge lines in slop tanks should preferably be fitted in bulkheads without reinforcements.

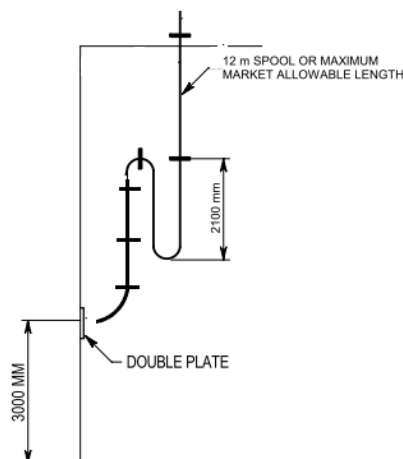


Figure 6: Double plate of the slop tanks discharge pipes

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4. PENETRATION PIECES

4.1. GENERAL REQUIREMENTS

This item presents the types of penetration pieces to be applied where de pipes are passed through side/bottoms, watertight bulkhead or deck. The types to be used are not limited to those described below. Other types that are not represented below, such as for penetrations pieces for fire integrity bulkhead, penetrations pieces for hydraulic piping, for example, shall be developed during the detailing phase.

The dimensions referenced here for the components of the penetration pieces may change during the detailing phase or by recommendations of the classification society

Where pipes pass through side/bottoms, bulkheads, decks or tanks tops the penetrations are to be made by methods, which will maintain the required tightness (watertight, firetight or smoketight) integrity and do not cause damage to the inside lining of these penetrations.

Penetration pieces shall be made of the same or compatible material of the plates in which it penetrates. Galvanic corrosion between materials is not allowed.

Two (2) types of penetration pieces such as sleeve and middle flange type shall be generally applied on pipe which is passed through side shell, bottom, watertight bulkhead or deck. The types of penetration pieces to be developed during detailing phase shall be submitted to OWNER approval.

The dimensions and materials used in the penetration parts also shall comply with Classification Society requirements.

Only weld neck type flanges shall be used.

4.2. MIDDLE FLANGE TYPE

This type shall be preferably be used in carbon steel piping system.

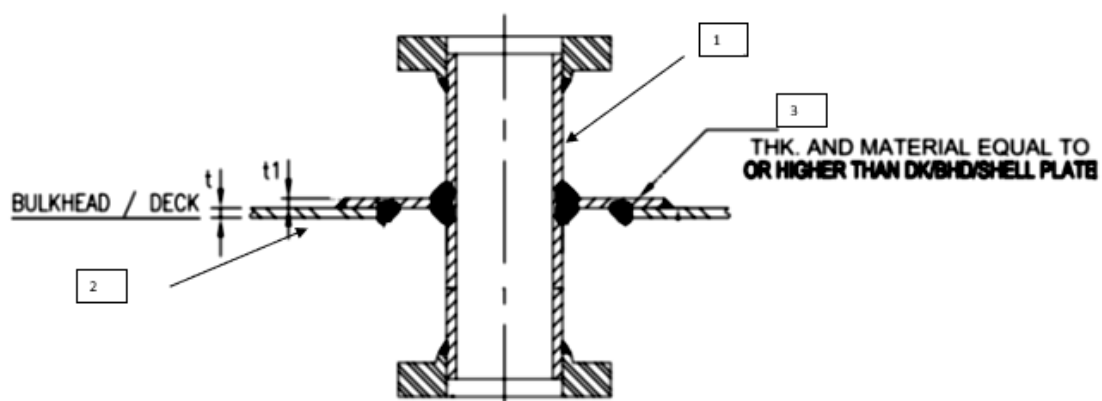


Figure 7: Middle flange type

1- Pipe

- Thickness: according to I-ET-3010.1Y-1200-200-P4X-002 – PIPING SPECIFICATION FOR HULL, if there is no requirement of the Classification Society.

- Material: same as pipeline material. If the pipeline is made of a non metallic material, the pipe shall follow the system's P&ID.

2- Bulkhead or deck

3- Middle flange

- Thickness (t_1) and material: equal to or higher than deck's, bulkhead's shell plate.

Note 1: The area of the middle flange shall be calculated in order to compensate the strength of the structure, recomposing the area where the opening will be made and to guarantee that no damage will be made to the pipes internal lining due to the welding on deck/bulkhead.

Note 2: The middle flange of coated lines shall be welded and adjusted before pipe coating.

The thickness of piping shall also comply with Classification Society requirements.

Note 3: If necessary, to guarantee the strength, structural brackets may be applied. These brackets shall be welded and adjusted on pipe (1) before pipe coating.

4.3. SLEEVE TYPE

This type shall be preferably be used in stainless steel, duplex piping system.

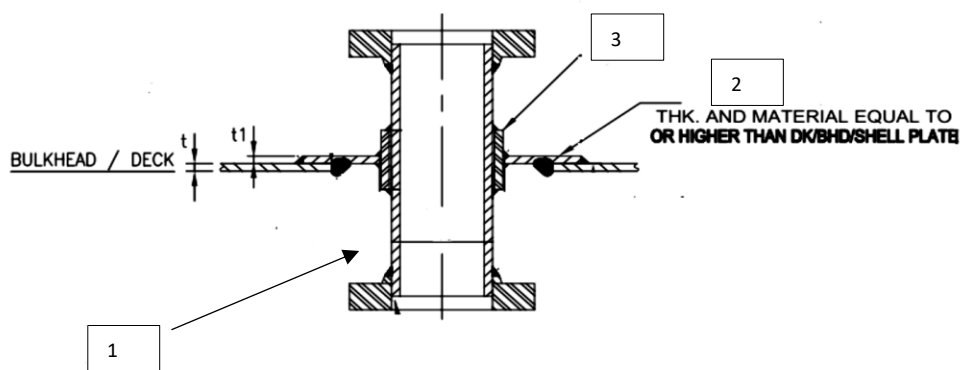


Figure 8: Sleeve type

1- Pipe

- Thickness: According to I-ET-3010.1Y-1200-200-P4X-002 – PIPING SPECIFICATION FOR HULL if there is no requirement of the Classification Society.

- Material: Same as pipeline material.



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2- Middle flange

Thickness (t1) and material: equal to or higher than deck's, bulkhead's shell plate.

3- Sleeve

- Material: API 5L Gr B or the same of pipeline; to be defined

Thickness: Shall be the same as the pipeline.

Note 1: The area of the middle flange shall be calculated in order to compensate the strength of the structure, recomposing the area where the opening will be made.

4.4. ADDITIONAL REQUIREMENTS FOR SHIP SIDE AND SEA CHEST PENETRATION PIECES

Pipe connections fitted between shell and valves are to be at least extra strong, in accordance with Classification Society. Shall be used SPEC B18H, according to I-ET-3010.1Y-1200-200-P4X-002 – PIPING SPECIFICATION FOR HULL.

4.5 ADDITIONAL REQUIREMENTS FOR VENTS E SOUNDING PIPES PENETRATION PIECES

The penetrating pieces of the carbon steel Venting and sounding lines, specs B8H and B10H, shall have minimum thickness as shown in Table 3.

Dn <= 8"	SCH 80
Dn >= 10"	SCH XS

Table 3: minimum thickness

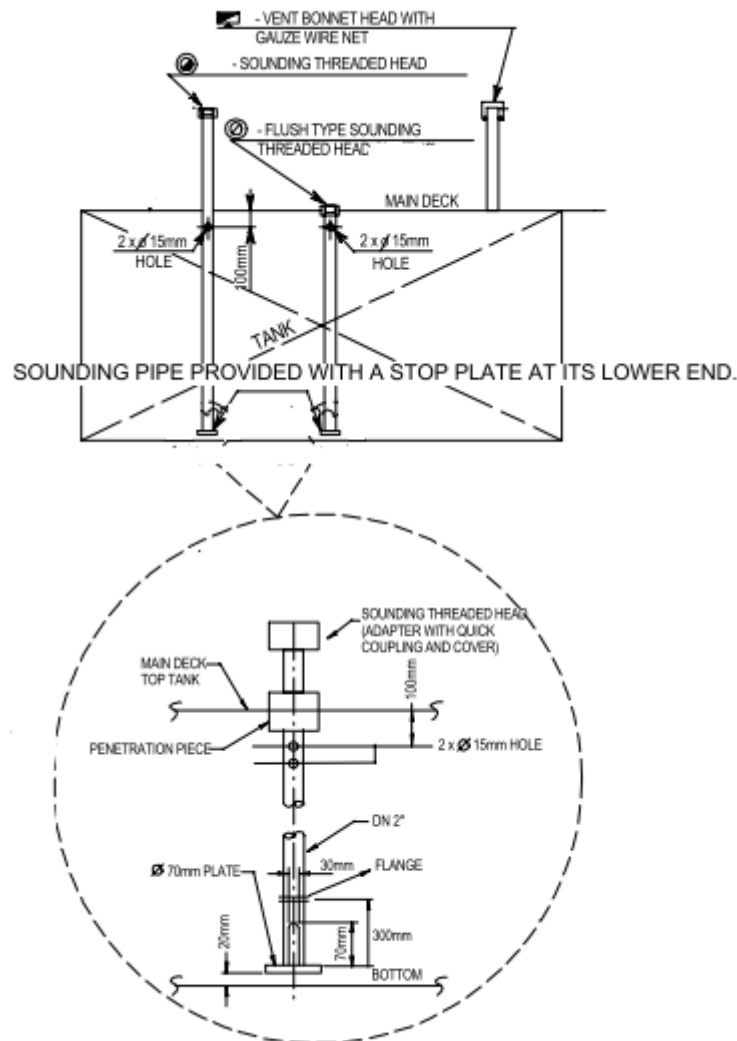


Figure 10: venting and sounding penetration piece

4.5. TUBING PENETRATION PIECES OF REMOCON SYSTEM

The penetration pieces for tubing shall be according the following requirements

- The penetration pieces shall be composed, whenever possible, of the grouping of the tubing arranged on a plate, as shown in Figure 11;
- Plate- material: Same as Bulkhead or deck. Thickness shall be equal to or greater than the thickness of the deck or bulkhead.
- The distances "A", "B" and "D" in Figure 11, shall be calculated according to the diameter of the tubing.
- Pipe 1, Figure 11: Material: API 5L GR B PSL 1, size according OD tubing, SCH 80.
- Pipe 2 Figure 11: Material ASTM A312 GR TP 316, size according OD tubing, SCH 40.

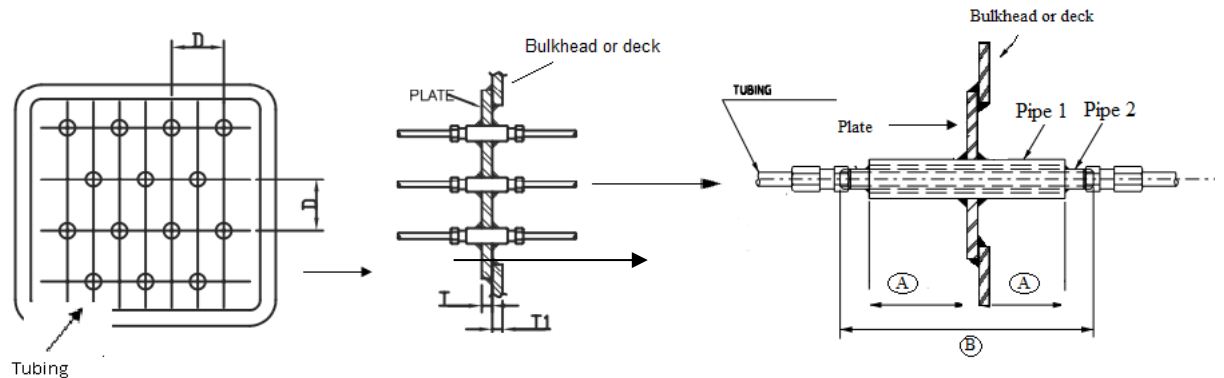


Figure 11: Typical detail of tubing penetration

5. SIPHON

5.1. WATER SEALS

Any connections between hazardous and non-hazardous systems shall be designed to eliminate or control the risk of ingress of hazardous material from one system to the other due to incorrect operation or leaks. In the case of piping system connecting hazardous and non-hazardous areas the lines shall have a siphon to avoid gas back flow.

The siphon shall comply with the following requirements:

- Shall be installed with a purge valve and blind flange.
- Shall be installed at hazardous area as close as possible to non-hazardous area entrance, according to Figure 12. Example: main deck and engine room.
- Shall have a minimum height as indicated in the P&IDs. If not indicated in the P&ID, the height of the siphon shall be 750 mm.
- Shall have a block valve for filling operation;
- Valve type according to I-ET-3010.1Y-1200-200-P4X-002 – PIPING SPECIFICATION FOR HULL.

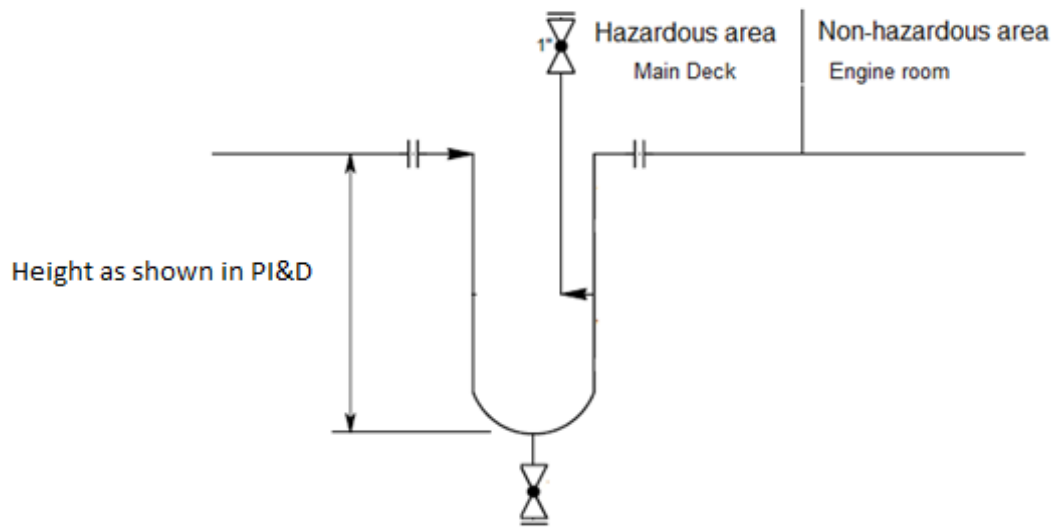


Figure 12: Typical siphon

5.2. SLOP TANK DISCHARGE LINES

All discharge lines inside the slop tanks (TQ-5336506S/P) shall have one siphon with height according Figure 13. Height as shown in PI&D

The line above main deck shall have a block valve and blind flange to filling operation. And shall be fitted between spectacle blind and block valve, as shown in Figure 13.

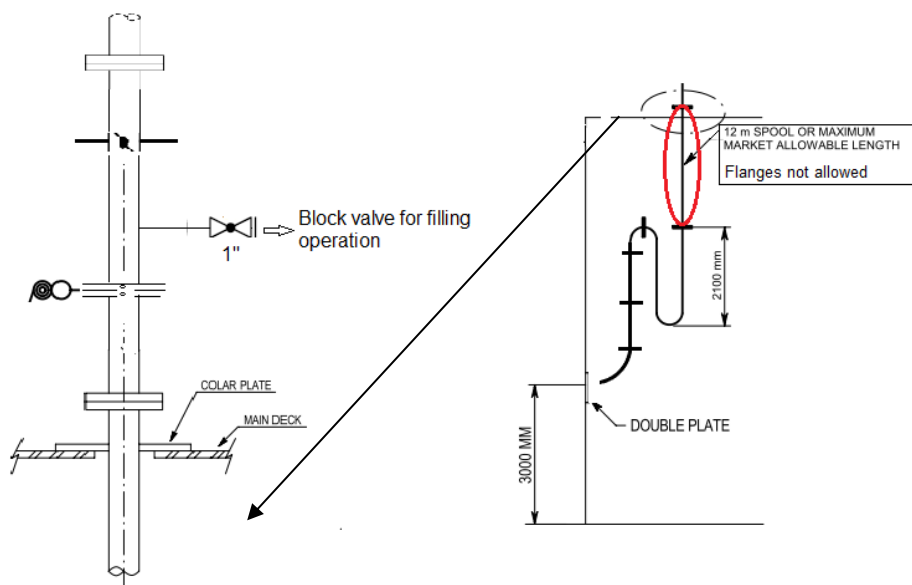


Figure 13: Slop discharge line

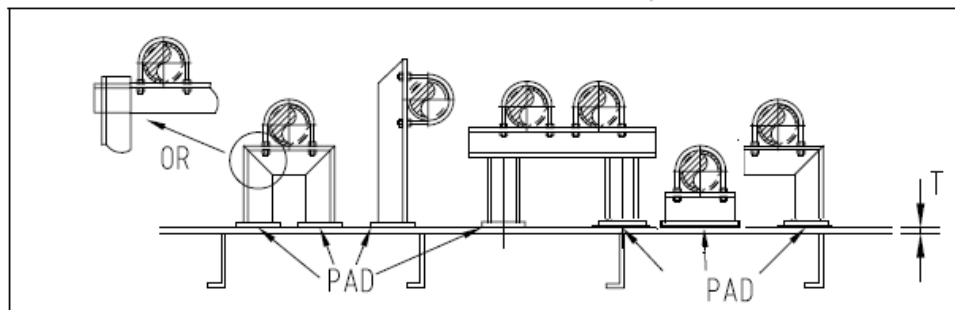
6. SUPPORTS

6.1. ANTI-FRICTION PADS

The horizontal piping systems on main deck, ballast tanks, void spaces and cofferdams shall have anti-friction PTFE pads on horizontal supports to avoid piping wearing. The sheet from PTFE shall be grip or fastened by support

6.2. PAD PLATE FOR SUPPORTS

Pad plate for supports shall be fitted in tanks, Main Deck, bulkheads.



Tank Wall constructed into hull, tank top, upper deck bulkhead

Figure 14: Pad plate for supports

Notes:

Main supports for heavy pipes to be fitted on the longitudinal member structure.

Pad plate dimensions shall be calculated on detailed design phase.

Pad plates shall be fully welded to avoid crevice corrosion.

7. VENTS AND DRAINS

The installation of vents at all high points and drains at all low points is mandatory for any piping, if those showed on the P&IDs are not sufficient/suitable.

Drains and vents connections shall be according Annex C of I-ET-3010.1Y-1200-200-P4X-002.

8. INERT GAS INJECTION NOZZLE

The penetration pieces of the inert gas system of each cargo tank shall be fitted with the inert gas nozzles, supplied by vendor, and shall be assembled according to Figure 15 and Figure 16.

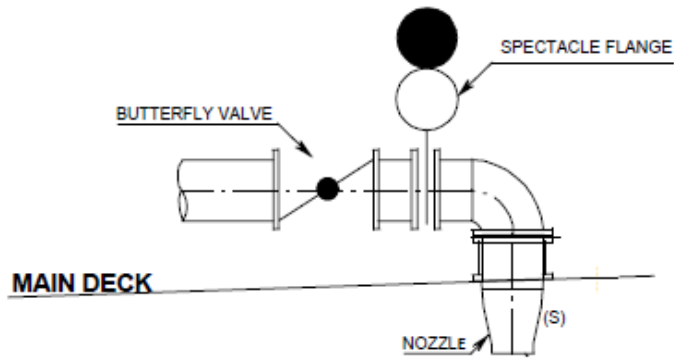


Figure 15: Typical detail inert gas nozzle

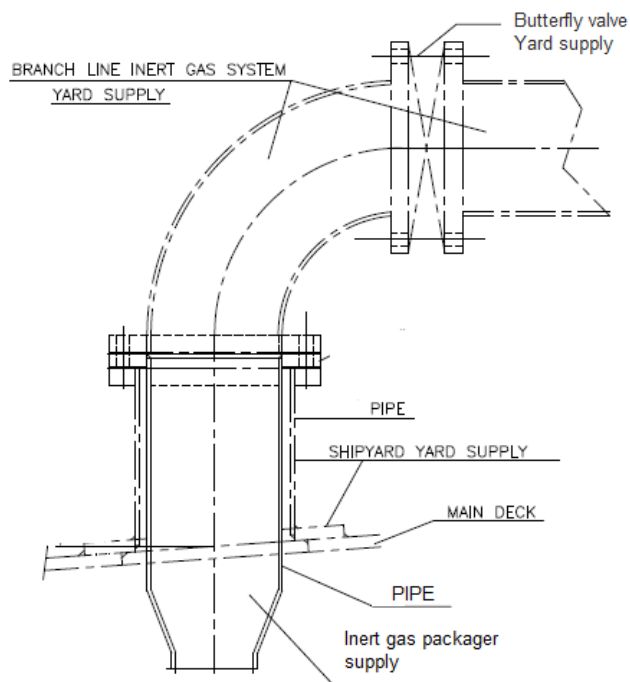


Figure 16: Inert gas nozzle