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1. SCOPE

1.1 This Specification defines the minimum requirements and recommended practices for design, fabrication and assembly of pipe supporting of production and utility piping systems for HULL, TOPSIDE, packages and modules of offshore projects.

1.2 The requirements herein listed are applicable to all players performing such related activities within the scope of this unit, including manufacturers, packagers, suppliers, sub suppliers, integrators, constructors, and all technical personnel involved. Within the scope of this document, they are all referred to as being a SELLER.

1.3 In addition to the requirements of this technical specification, SELLER shall follow all the requirements of the Exhibit I (SCOPE OF SUPPLY), as well as Exhibit III (DIRECTIVES FOR ENGINEERING EXECUTION), Exhibit IV (DIRECTIVES FOR CONSTRUCTION AND ASSEMBLY), Exhibit V (DIRECTIVES FOR PROCUREMENT), Exhibit VI (DIRECTIVES FOR PLANNING AND CONTROL), Exhibit VII (DIRECTIVES FOR QUALITY MANAGEMENT SYSTEM) and Exhibit VIII (DIRECTIVES FOR COMMISSIONING PROCESS).

2. ABBREVIATIONS

In addition to general definitions set in reference \1\, the following abbreviations are used in this specification.

- CS Classification Society
- DNV Det Norske Veritas

3. DEFINITIONS AND TERMS

For the purposes of this document, the following definitions and terms are applicable.

All definitions are found on \1\.

4. NORMATIVE REFERENCES


The following standards and documents include provisions, which, through reference in this text or not, constitute requirements of this technical specification. Latest issue of the references shall be used unless otherwise agreed. Other recognized standards may be used provided it can be shown that they meet or exceed the requirements of the standards referenced below.

4.1. Classification Rules

4.1.1. SELLER shall perform the work in accordance with the requirements of the Classification Society.

4.1.2. SELLER is responsible to submit to the Classification Society the documentation in compliance with stated Rules. SELLER's responsibilities include documents submission to the certifying authority as described in the latest edition of their rules for equipment on offshore facilities.

4.1.3. Classification Society rules may only be waived upon the formal approval from the Classification

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Society itself and from BUYER.

4.2. Codes, Standards and Regulations

In addition to rules and regulations set forth in reference 4.1 and 4.4, the following codes and standards are applicable. The latest issue of the references shall be used unless otherwise agreed.

ASME B31.3 - Process Piping

4.3. Governmental Regulation

4.3.1. Brazilian Government regulations are mandatory and shall prevail, if more stringent, over the requirements of this specification and other references herein.

4.4. Design Specifications

The following documents are cited or not within this technical specification and therefore constitute requirements for items presented in this technical specification.

Ref. #	Doc. No.	Doc. Title
\1\	I-ET-3010.00-1200-940-P4X-002	General Technical Terms
\2\	I-MD-3010.2Q-1200-940-P4X-009	Descriptive Memorandum – Piping
\3\	I-ET-3010.2Q-1200-200-P4X-002	Piping Specification for Hull
\4\	I-ET-3010.2Q-1200-200-P4X-004	Requirements for Piping Support
\5\	I-ET-3010.2Q-1200-200-P4X-005	Requirements for Piping Design and Layout
\6\	I-ET-3010.2Q-1200-200-P4X-006	Requirements for Piping Stress Analysis
\7\	I-ET-3010.00-1200-956-P4X-002	General Painting
\8\	I-MD-3010.2Q-1200-940-P4X-027	Descriptive Memorandum - Hull Systems
\9\	I-ET-3010.2Q-1200-200-P4X-001	Piping Specification for Topside

4.5. Conflicting Requirements

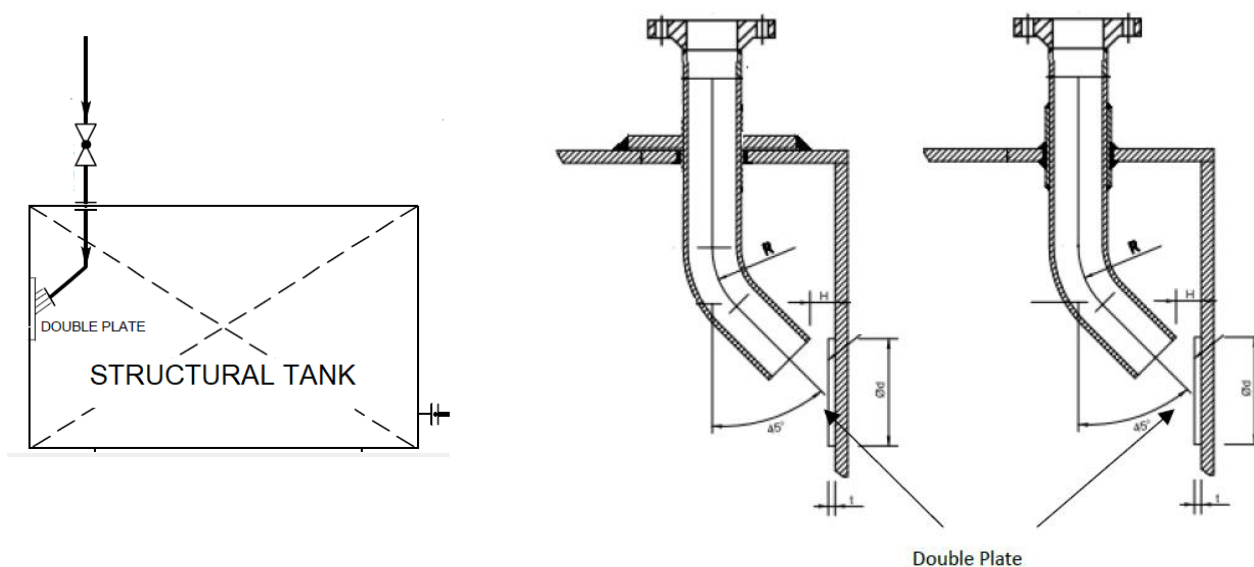
4.5.1. In case of conflicting requirements between this technical specification and other cited references, the most stringent shall prevail. If necessary, the SELLER may revert to BUYER for clarification.

Table 1: distance between pipe and double plate

PIPING NPS (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

5.3. Double Plates for Discharge Pipes Inside 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
Table 2: distance between pipe and wear plate

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

5.4. Double Plates for Droplines

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

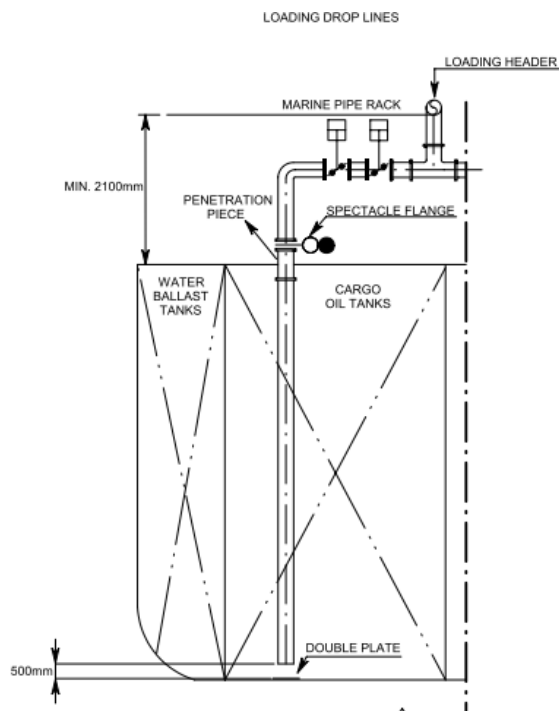


Figure 3: Double plate for droplines of the Loading System

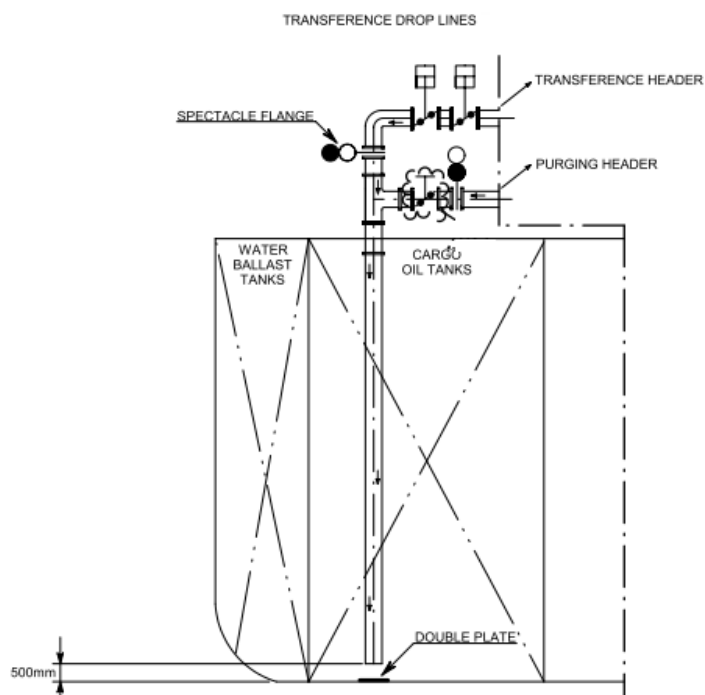



Figure 4: Double plate for droplines of the Transference System

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5.5. Double Plates for Bell Mouths

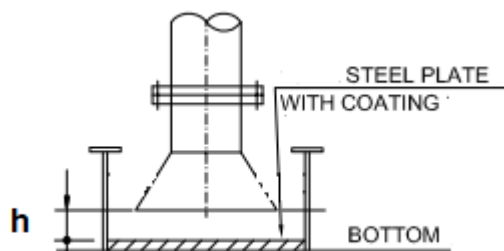


Figure 5: bell mouth

Bell mouths, Figure 5, shall have a double plate in alignment with its suction / discharge to prevent wear of the main structure, with the same requirements of 5.1. 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).

5.6. Discharge Lines Inside Slop Tanks

5.6.1. 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.

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

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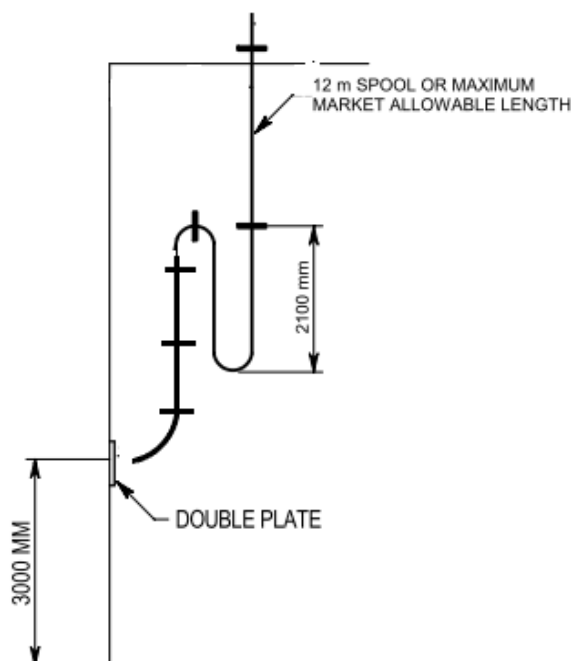


Figure 6: Double plate of the slop tanks discharge pipes

6. PENETRATION PIECES

6.1. General Requirements

6.1.1. Here is presented some types of penetration pieces to be applied where de pipes passes through side/bottoms, watertight bulkhead or deck.

6.1.2. 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, shall be developed during the detailing phase.

6.1.3. The dimensions referenced here for the components of the penetration pieces may change during the detailing phase or by recommendations of the classification society. Those changes shall be submitted to BUYER approval.

6.1.4. 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.

6.1.5. Penetration pieces shall be made of the same or compatible material of the plates in which it penetrates. Dissimilar connection between materials is not allowed, due to possibility of galvanic corrosion.

6.1.6. Two 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.

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

6.1.8. Only weld neck type flanges shall be used.

6.2. Middle Flange Type

Penetration peace middle flange type without sleeve shall not be used.

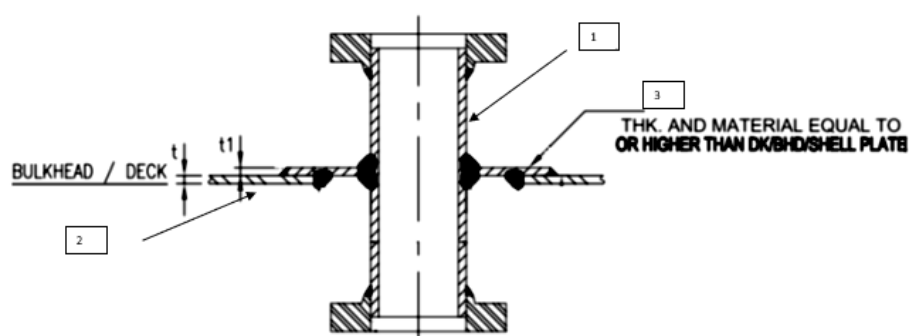


Figure 7: Middle flange type – shall not be used

6.3. Sleeve Type

The sleeve type chosen shall be used in all materials especially other than carbon steel such as stainless steel, duplex and super duplex, CuNi and inconel piping system.

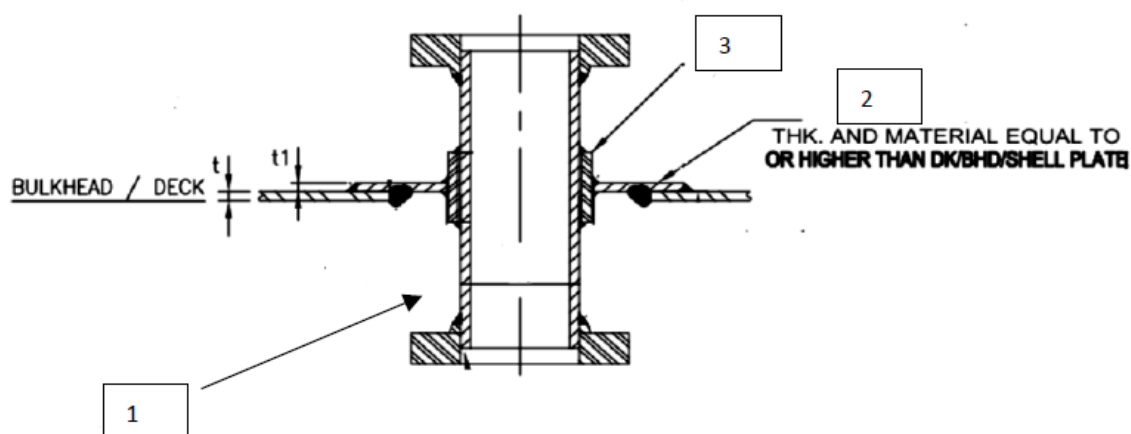



Figure 8: Sleeve type

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1- Pipe

- Thickness: shall be according to reference /3/ but shall also comply with requirements of the Classification Society.
- Material: Same as pipeline material. If the pipeline is made of a nonmetallic material, the pipe shall follow the system's P&ID and confirmed with Naval System BUYER's discipline.

2- Middle flange Sleeve Type

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

3- Sleeve

- Material and thickness: same criteria as wear pad, according to reference /4/.

Note 1: The area of the middle flange shall be calculated 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 Sleeve Type 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, if applicable.

6.4. 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 reference \3\.

6.5. Tubing Penetration Pieces of Remocon System

6.5.1. The penetration pieces for tubing shall be according to the following requirements.

6.5.2. The penetration pieces shall be composed, whenever possible, of the grouping of the tubing arranged on a plate, as shown in Figure 9.

6.5.3. Plate- material: Same as Bulkhead or deck. Thickness shall be equal to or greater than the thickness of the deck or bulkhead.

6.5.4. The distances "A", "B" and "D", shall be calculated according to the diameter of the tubing.

6.5.5. Pipe 1, Material: API 5L GR B PSL 1, size according OD tubing, SCH 80.

6.5.6. Pipe 2, Material ASTM A312 GR TP 316, size according OD tubing, SCH 40.

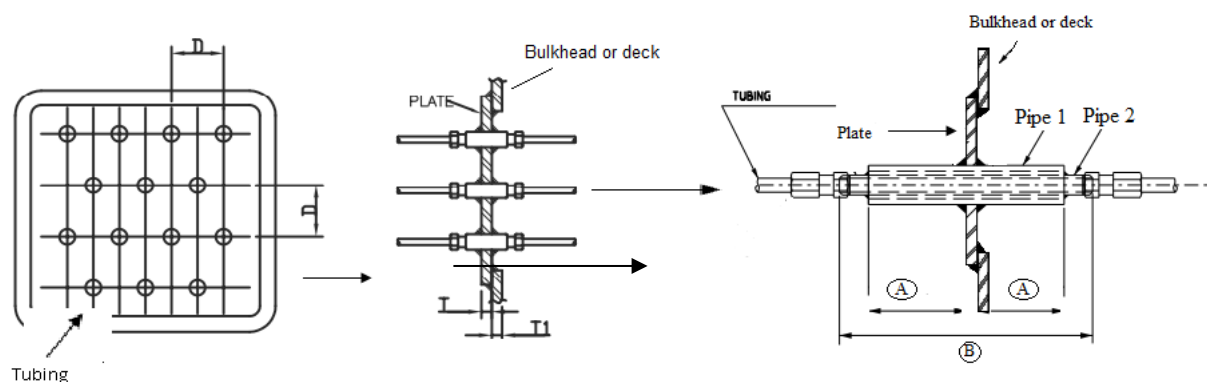


Figure 9 : Typical detail of tubing penetration

6.6. Penetration Pieces for Deck, Bulkhead and Modules

6.6.1. This section presents some types of penetration pieces to be applied where pipes pass through bulkheads or modules decks of topside.

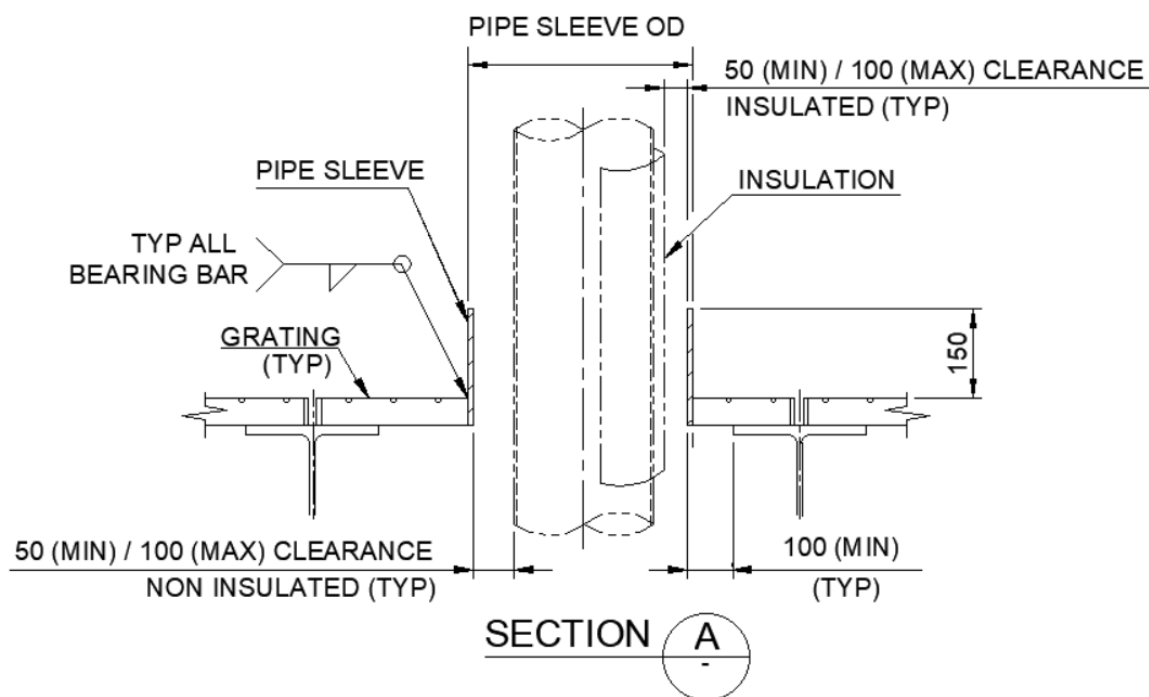
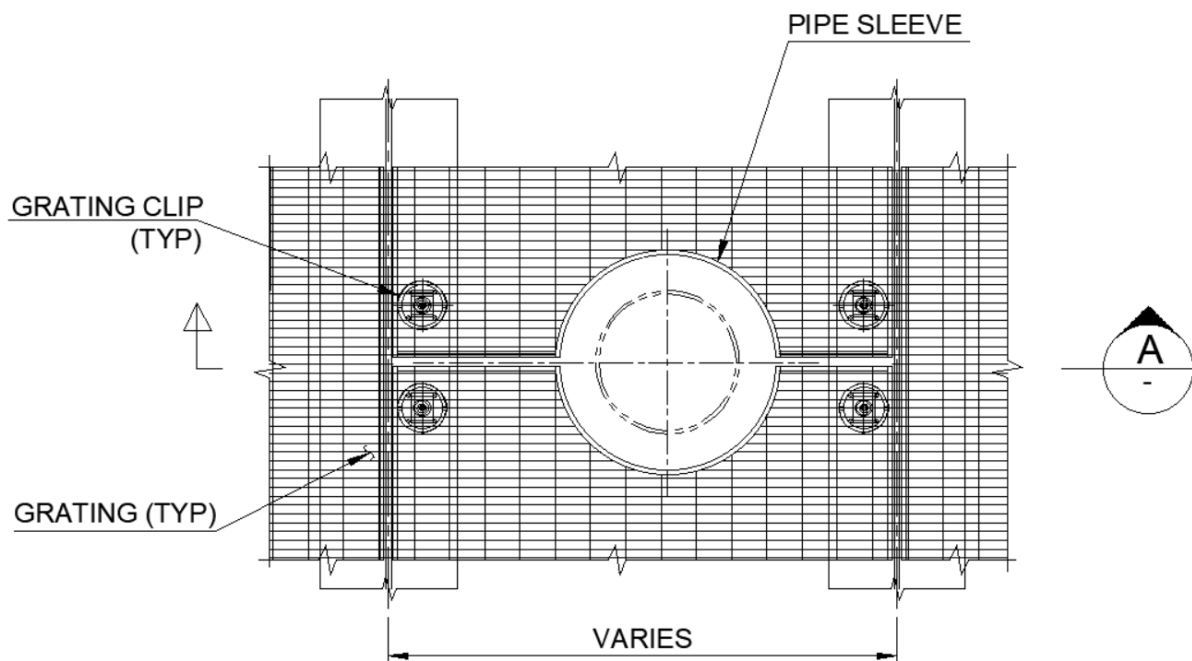
6.6.2. The types to be used are not limited to those described below. Other types that are not represented below shall be developed during the detailing phase.

6.6.3. The dimensions referenced here for the components of the penetration pieces may change during the detailing phase or by recommendations of the classification society. Those changes shall be submitted to BUYER approval.

6.6.4. Thickness and material of penetration pieces shall be equal to or higher than deck's or bulkhead's plates.

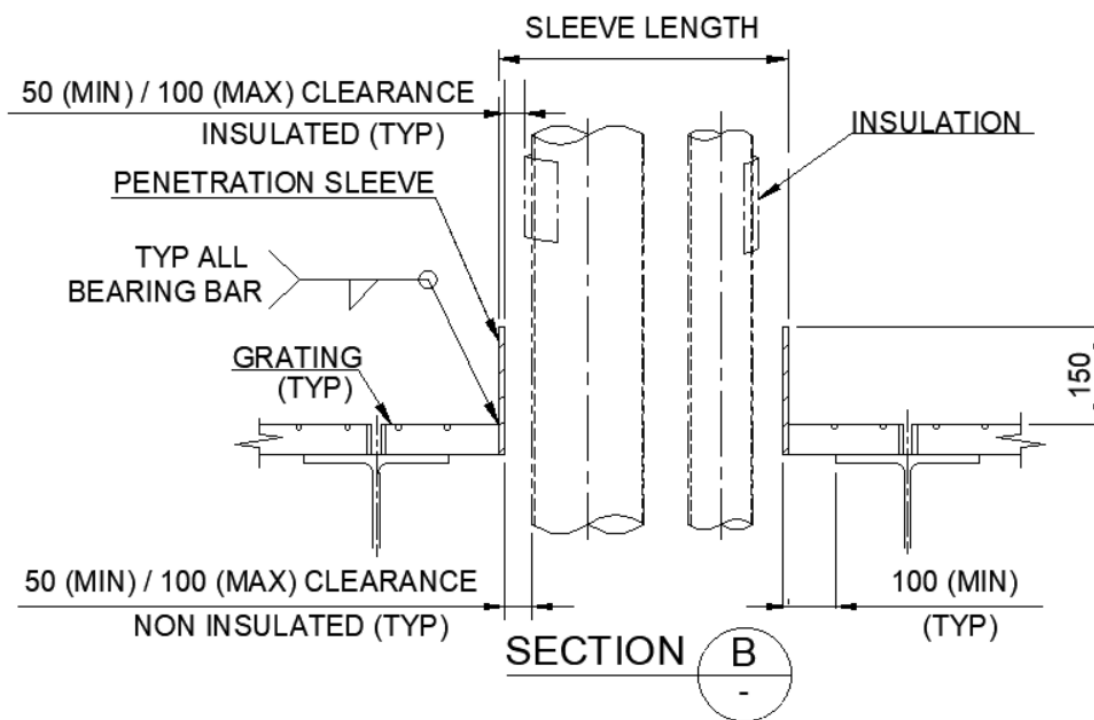
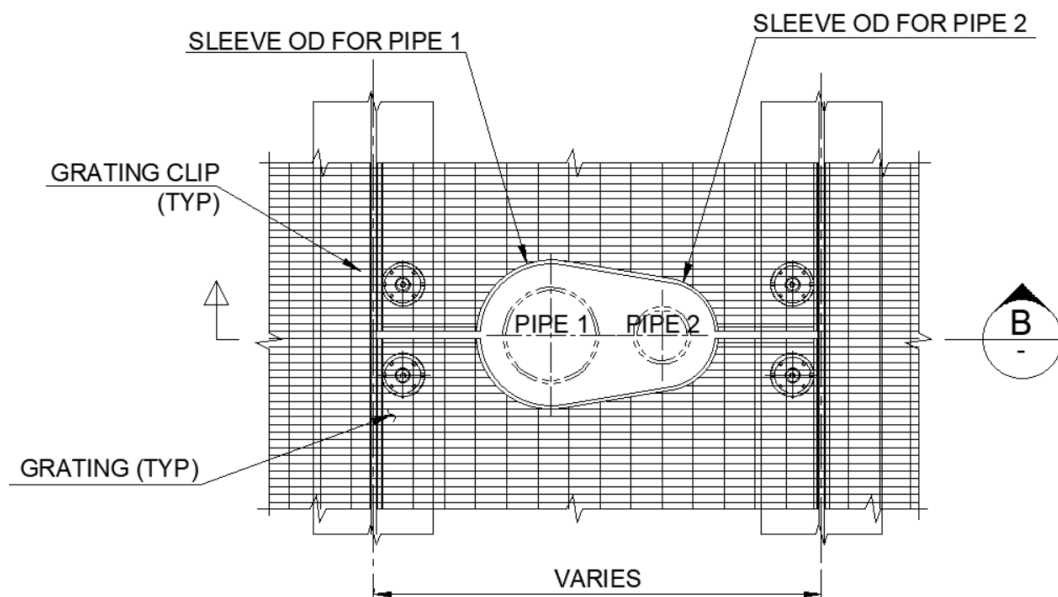
6.6.5. Pipe sleeve length shall comply with fire rated sealant specification requirements. To comply with this item, SELLER shall take the penetration piece catalogue and check if the pipe sleeve length is at least the minimum required for the selected vendor. This requirement to be in accordance with fire certification of the vendor aims to avoid using a small sleeve length that could not prevent fire protection.

6.6.6. Single Pipe Penetration – Steel Grating



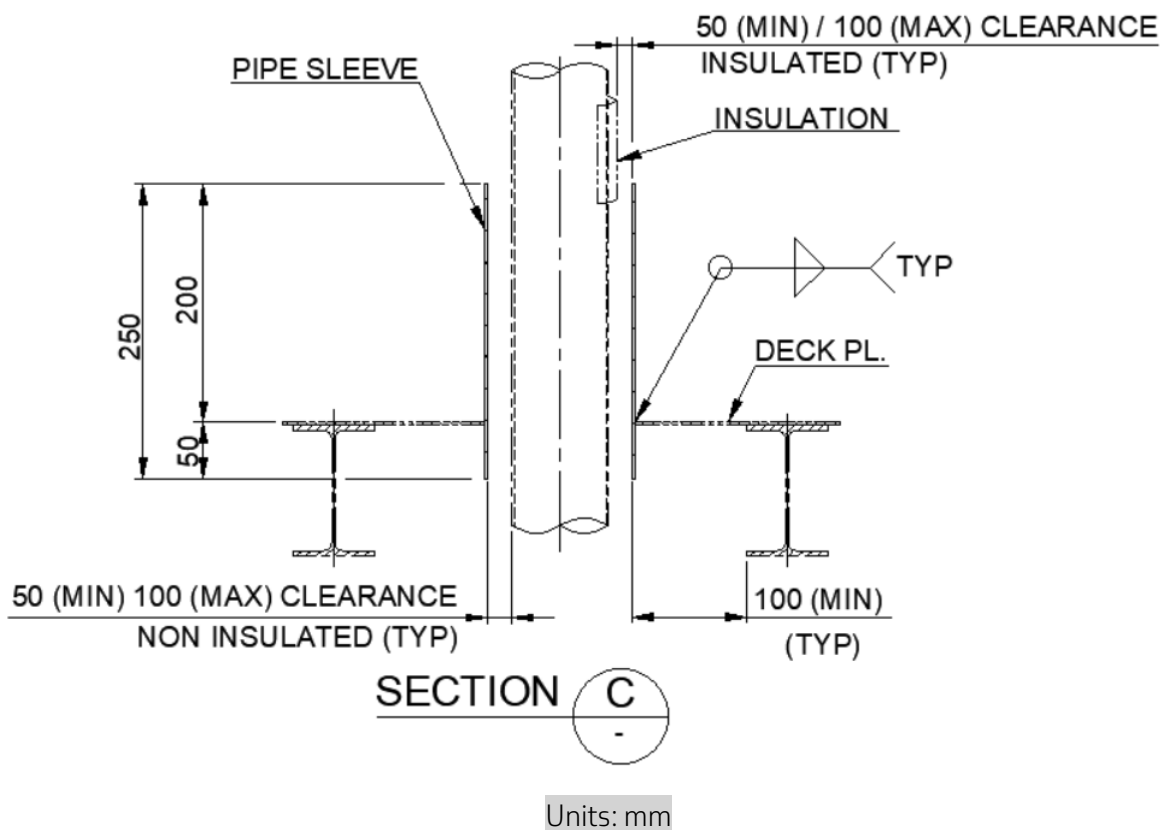
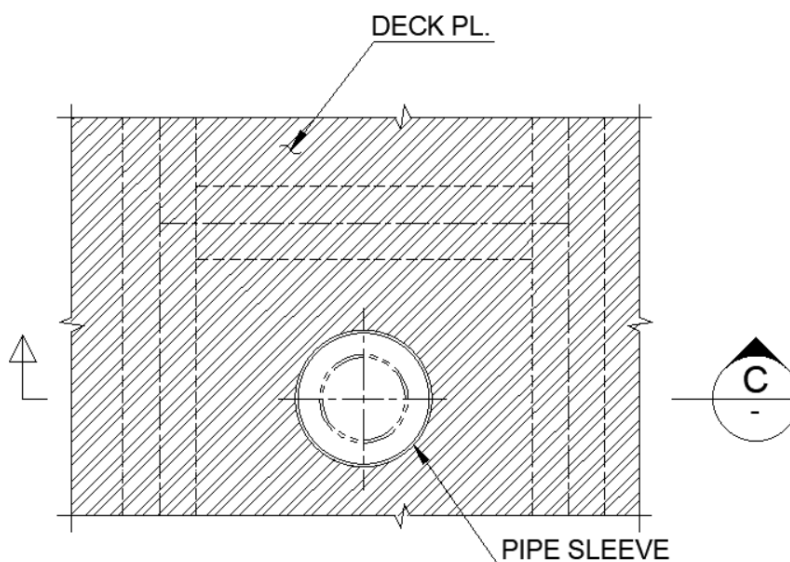
Units: mm

6.6.7. Multiple Pipe Penetration – Steel Grating

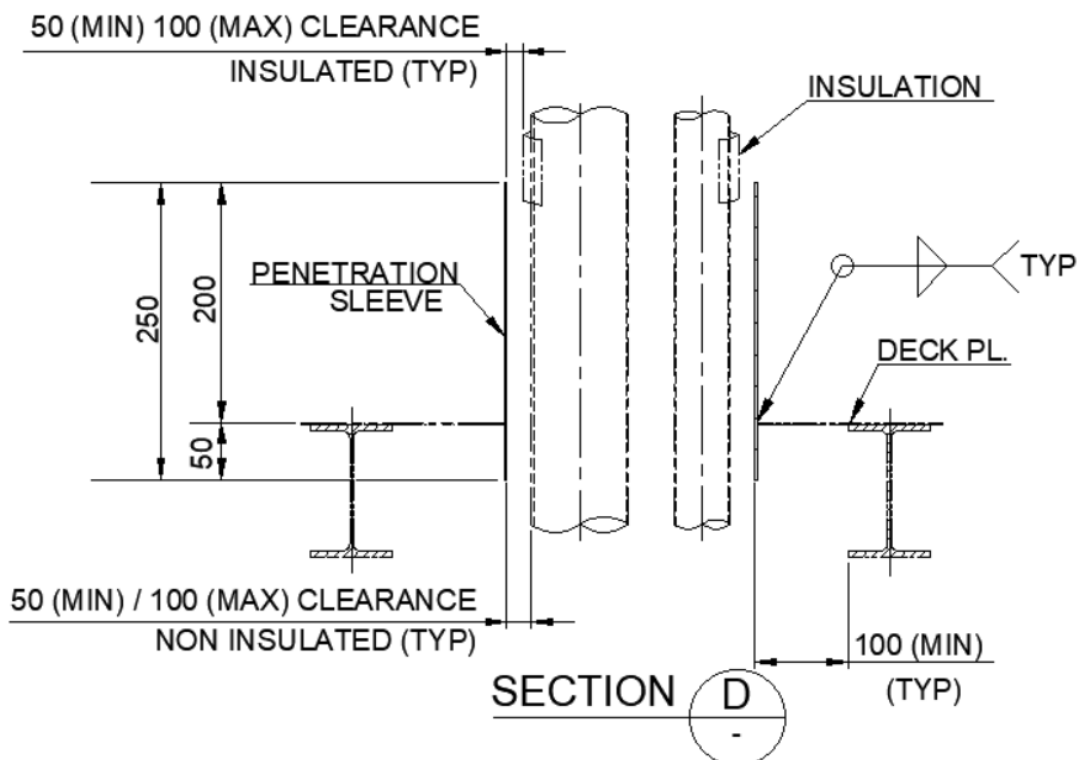
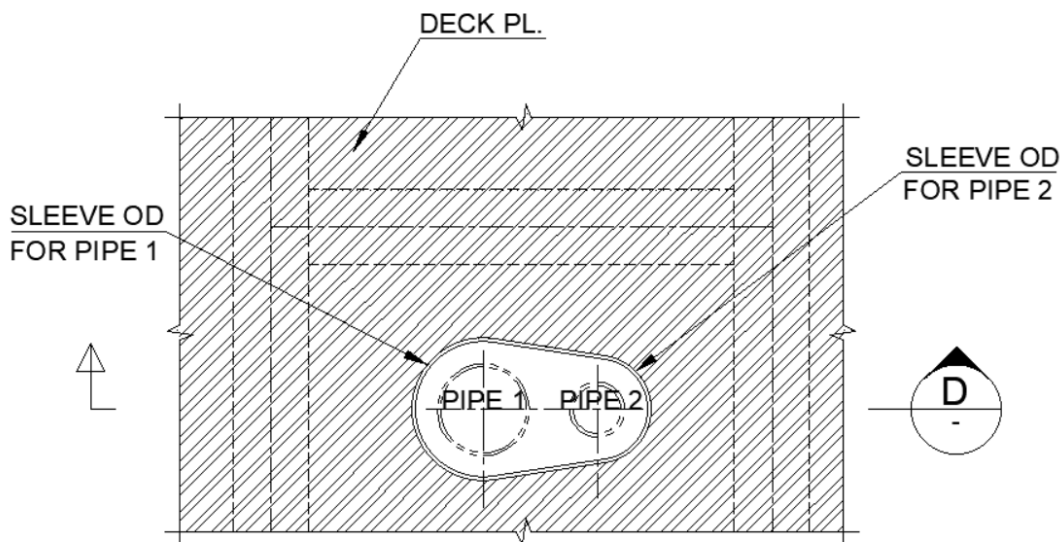


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6.6.8. Single Pipe Penetration – Steel Plating

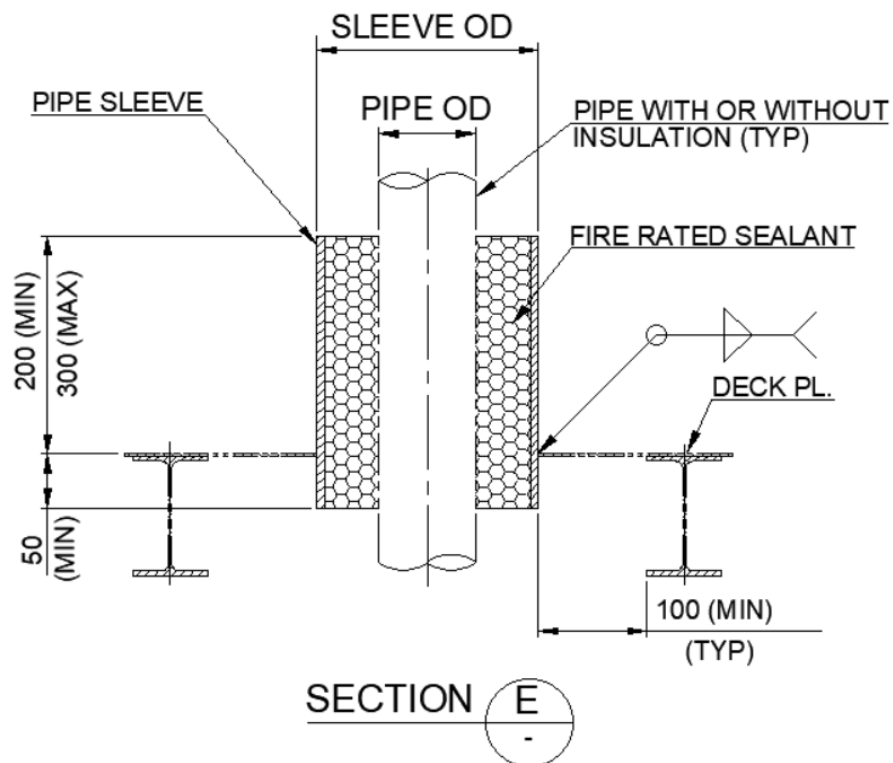
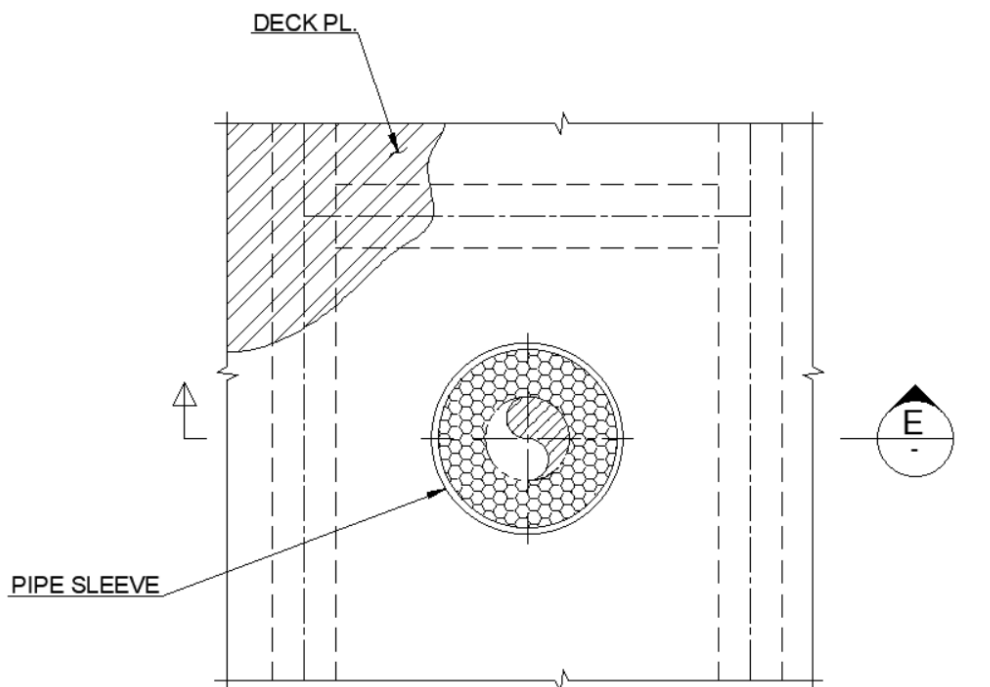


6.6.9. Multiple Pipe Penetration – Steel Plating



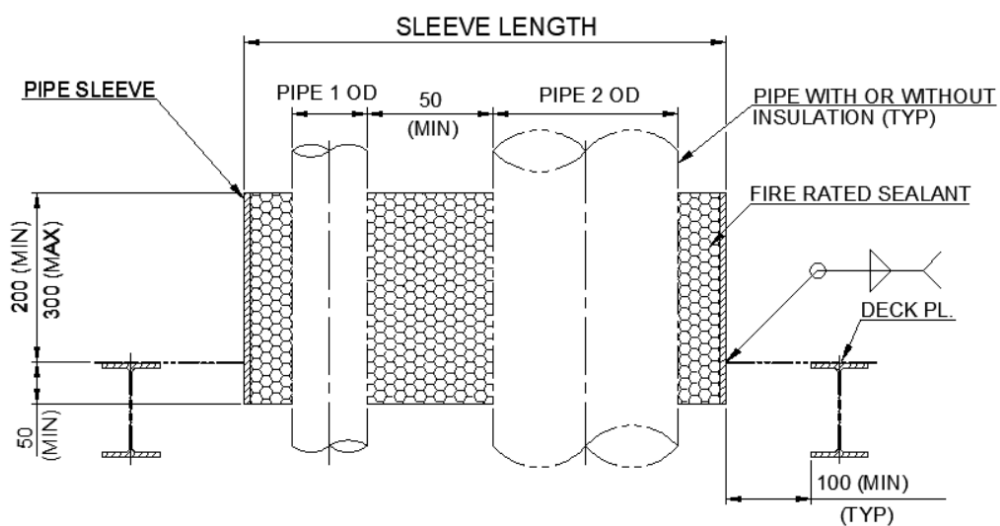
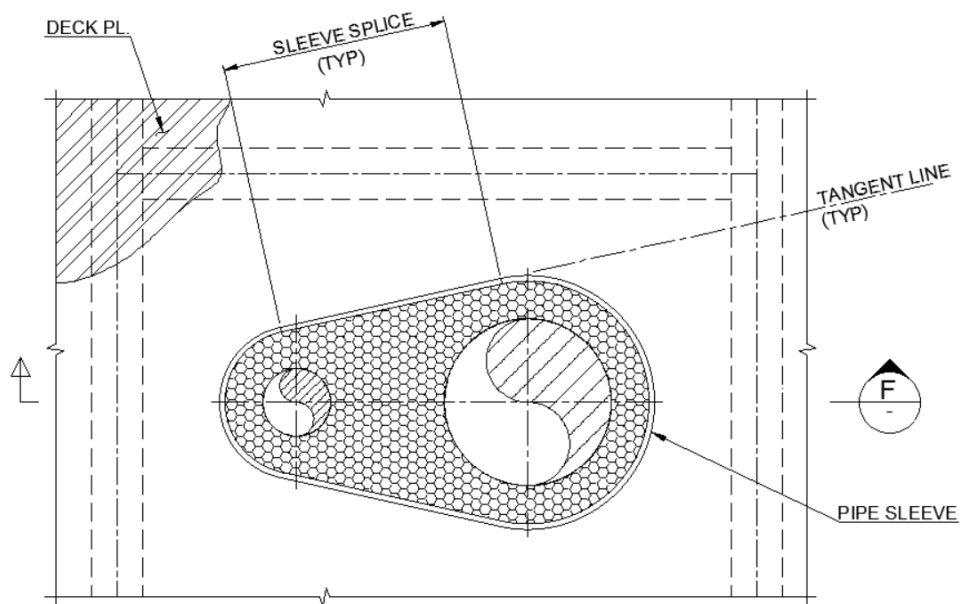
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6.6.10. Single Watertight/Firetight/Smoketight Pipe Penetration – Steel Plating



Units: mm

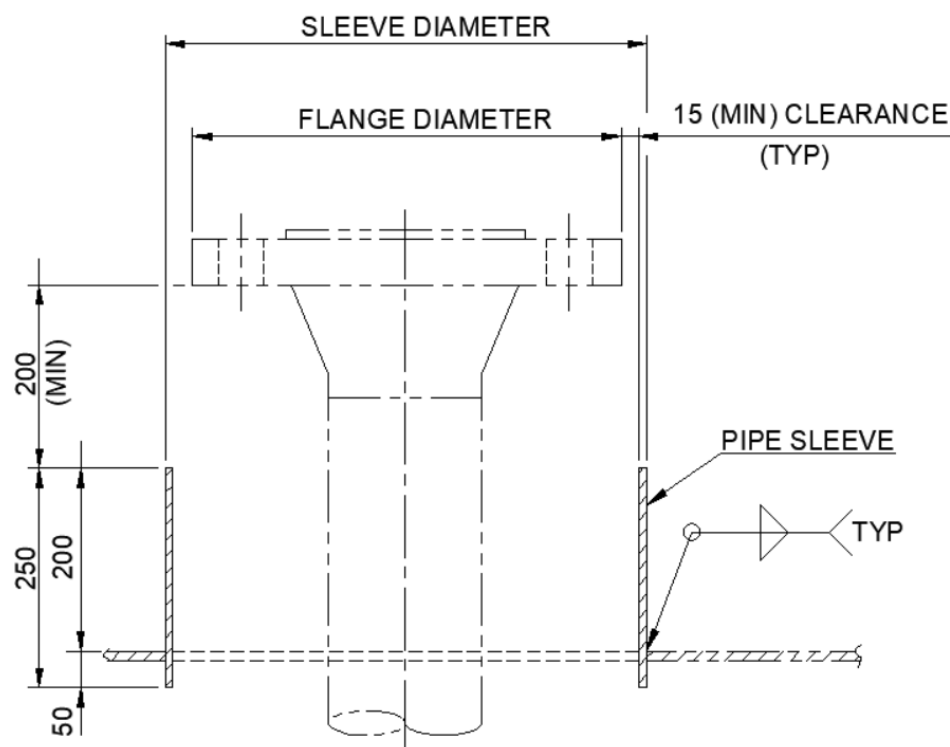
6.6.11. Multiple Watertight/Firetight/Smoketight Pipe Penetration – Steel Plating



SECTION **F**

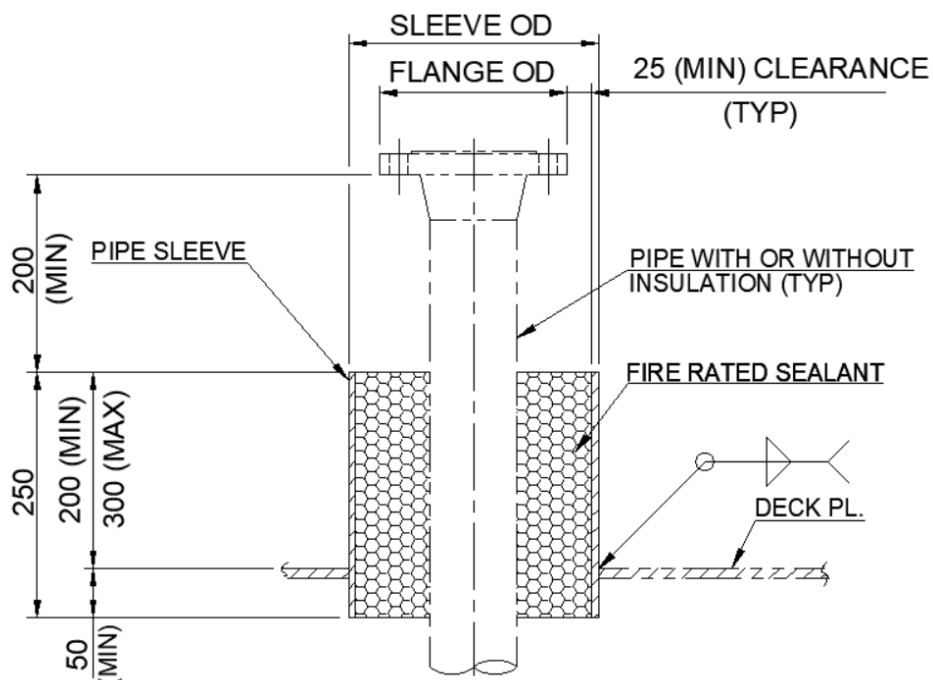
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6.6.12. Simple Pipe Penetration with Flange - Steel Plating



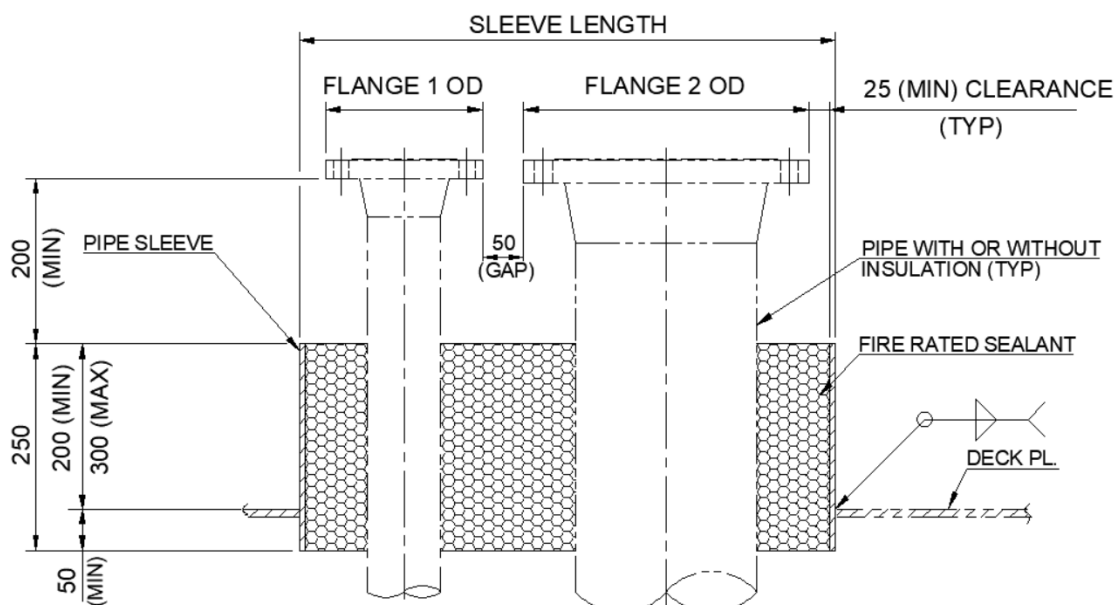
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6.6.13. Simple Watertight/Firetight/Smoketight Pipe Penetration with Flange - Steel Plating



Units: mm

6.6.14. Multiple Watertight/Firetight/Smoketight Pipe Penetration with Flange - Steel Plating



Units: mm

7. SIPHON

7.1. 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:

- 7.1.1. Shall be installed with a purge valve and blind flange.
- 7.1.2. Shall be installed at hazardous area as close as possible to non-hazardous area entrance, according to Figure 10. Example: main deck and engine room.
- 7.1.3. 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.
- 7.1.4. Shall have a block valve for filling operation.
- 7.1.5. Valve type according to reference \3\.

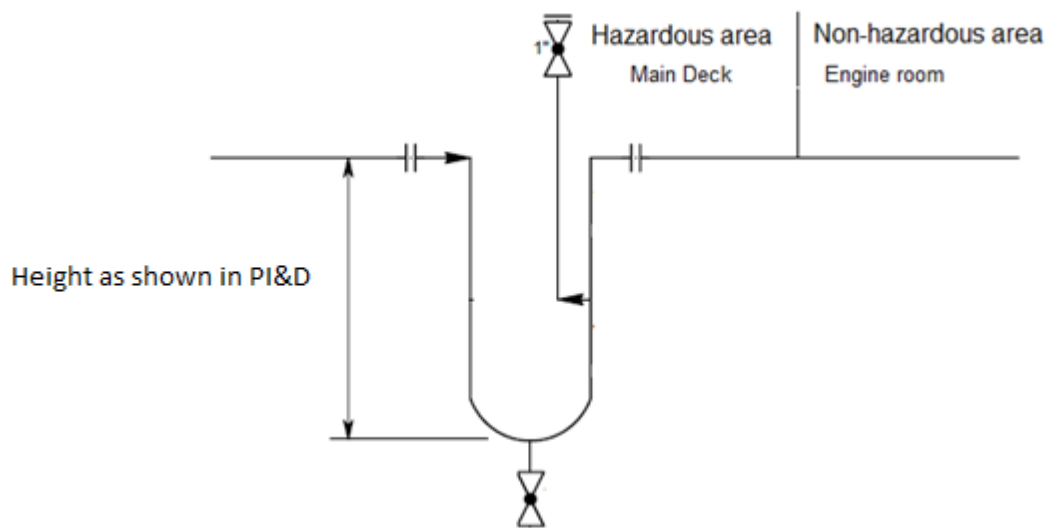


Figure 10: Typical siphon

7.2. Slop Tank Discharge Lines

7.2.1. All discharge lines inside the slop tanks (TQ-5336506S/P) shall have one siphon with height according Figure 11. Height as shown in P&ID

7.2.2. 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 11.

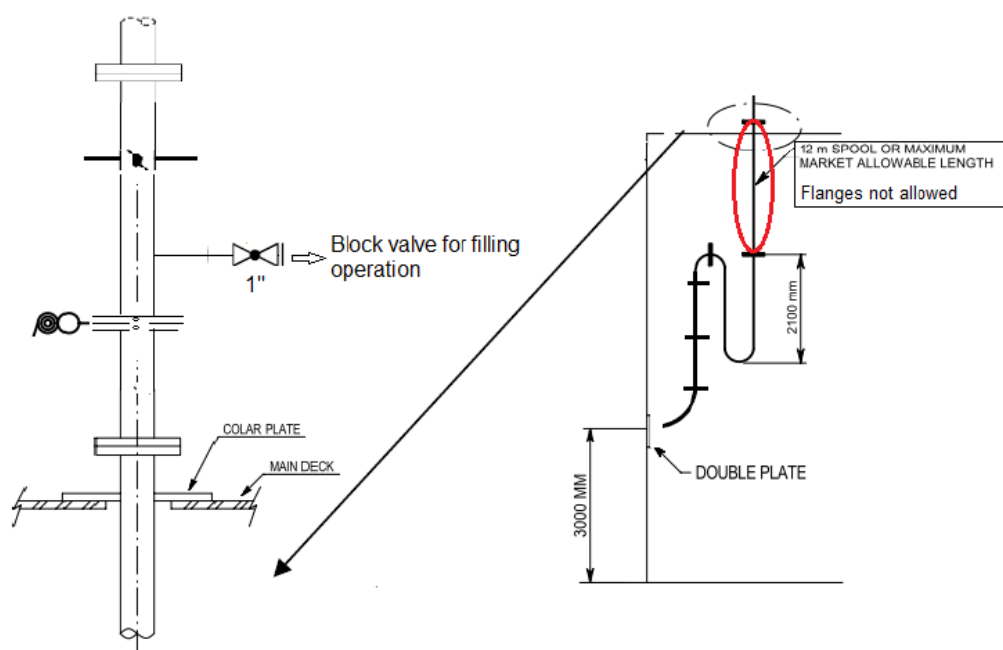



Figure 11: Slop discharge line

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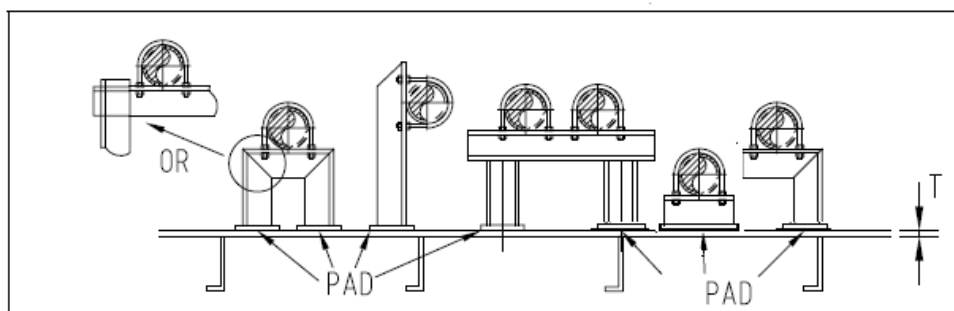
8. SUPPORTS

8.1. Anti-Friction Pads

Besides the requirements of use of nonmetallic material on supports presented on reference \4\, the horizontal piping systems on main deck, ballast tanks, void spaces and cofferdams shall have anti-friction nonmetallic pads on rest supports to avoid piping wearing. The half round bar from nonmetallic material shall be gripped or fastened to the support and shall comply with requirements presented on reference \4\.

8.2. 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 12: Pad plate for supports

Notes:

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


Pad dimensions shall be calculated on detailed design phase.

Pad plates shall be fully welded to avoid crevice corrosion.

9. VENTS AND DRAINS

9.1. 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 for pressure test.

9.2. Drains and vents connections shall be according to Annex C of reference \3\. Drains and vents used for pressure pressure test shall be removed and replaced by blind flanges after test according to reference \3\.

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10. HULL SYSTEMS' EXPANSION LOOPS

10.1. The headers that shall have the expansion and piping movement flexibility performed by loops are indicated in Marine Systems and Safety P&IDs.

10.2. The expansion loop quantity and location to be spaced shall be defined in the detailed engineering design according to piping stress analysis.

11. BIRD SCREEN FOR VENTS

11.1. Vents open to atmosphere shall be equipped with bird screen vent and rain hood or goose neck type.

11.2. For vent hood the material shall be AISI 316 or AISI 316L. Goose neck may follow piping material.

11.3. Pressure drop across vent hood with bird screen or goose neck shall not cause any damage to tanks or systems.

11.4. The free area of flame screen shall be at least 1.5 times the area of the pipe passage or shall be calculated for pressure loss.

11.5. It is necessary to issue detail drawings for vent hoods with screen, with part numbers for replacements. For fabrication in shipyard, fabrication drawing with parts shall be issued.

11.6. The vent and rain hood and goose neck may be flanged type.

11.7. The rules of Classification Society shall be followed, and type approved certification is required for flame screen.

11.8. Norsok L-003 may be used as reference.