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SRGE	CHEMICAL INJECTION POINTS	INTERNAL
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DATE	27/02/21	APR/16/21	OCT/30/22	DEC/08/22					
DESIGN	EEA	EEA	EEA	EEA					
EXECUTION	CJH4	CJH4	HXG3	HXG3					
CHECK	U4T1	UPTP	CJH4	CJH4					
APPROVAL	U32N	U32N	U32N	U32N					

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FORM OWNED TO BUYER N-0381 REV.L.



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1 SCOPE

This Technical Specification covers the minimum requirements for design, engineering, materials, fabrication, and commissioning of CHEMICAL INJECTION POINTS to be supplied to BUYER. This specification also includes chemical injection lines to well.

2 NORMATIVE REFERENCES

2.1 GENERAL REQUIREMENTS

- 2.1.1 The chemical injection points shall comply with the requirements of this technical specification and references herein.
- 2.1.2 As a general guideline, 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.

2.2 CLASSIFICATION SOCIETY

- 2.2.1 SELLER shall perform the work in accordance with the requirements of Classification Society.
- 2.2.2 SELLER is responsible for submitting to the Classification Society all documentation in compliance with stated Rules.

2.3 CODES AND STANDARDS

The latest editions of the following codes and standards are shown in Table 1 and shall be used as design guidelines.

Table 1: Codes and Standards

API RP 14C	Analysis, Design, Installation, and Testing of Safety Systems for Offshore Production Facilities
API RP-505	Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Zone 0, Zone I and Zone 2
API RP 578	Guidelines for a Material Verification Program (MVP) for New and Existing Assets
API SPEC 6D	Specification for Valves
ASME B16.11	Forged Fittings, Socket-Welding and Threaded
ASME B16.5	Pipe Flanges and Flanged Fittings NPS ½ Through NPS 24 Metric/Inch Standard
ASME B31.3	Process Piping
ASME PTC 19.3 TW	Thermowells Performance Test Codes



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ISO 15156	Materials for use in H ₂ S-containing environments in oil and gas production
ISO 12944	Paints and Varnishes - Corrosion Protection of Steel Structures by Protective Paint Systems - Part 2: Classification of Environments.

2.4 GOVERNMENT REGULATION

The following Brazilian Regulatory Standards (Table 2) are mandatory and shall prevail, if more stringent, over the requirements of this specification and other references herein.

Table 2: Brazilian Regulatory Standards


NR-10 - Brazilian Regulatory Standard - Safety in Electrical Facilities and Services
NR-13 - Brazilian Regulatory Standard - Boilers, Pressure Vessels, Piping and Metallic Storage Tanks
NR-26 - Brazilian Regulatory Standard - Safety Signaling
NR-37 - Brazilian Regulatory Standard – Safety and Health in Petroleum Platforms

2.5 DESIGN SPECIFICATIONS

The latest revision of following Design Specifications (Table 3) shall be used.

Table 3: Design Specifications

DR-ENGP-M-I-1.3	SAFETY ENGINEERING
DR-ENGP-I-1.15	COLOR CODING
I-ET-3010.00-1200-940-P4X-002	GENERAL TECHNICAL TERMS.
I-ET-3000.00-1200-940-P4X-001	TAGGING PROCEDURE FOR PRODUCTION UNITS DESIGN.
I-ET-3010.00-1200-955-P4X-001	WELDING
I-ET-3010.00-1200-200-P4X-115	REQUIREMENTS FOR PIPING FABRICATION, INSPECTION, ASSEMBLY AND COMMISSIONING
I-ET-3010.00-1200-956-P4X-002	GENERAL PAINTING
I-ET-3010.00-1200-251-P4X-001	REQUIREMENTS FOR BOLTING MATERIALS
I-ET-3010.00-1200-200-P4X-001	MINIMUM REQUIREMENTS FOR PIPING MECHANICAL DESIGN AND LAYOUT
I-ET-3010.00-1200-431-P4X-001	THERMAL INSULATION FOR MARITIME INSTALLATIONS
I-ET-3010.00-1200-970-P4X-004	NON-DESTRUCTIVE TESTING REQUIREMENTS FOR METALLIC AND NON-METALLIC MATERIALS

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2.6 PROJECT SPECIFICATION

All requirements of the latest revision of Project Specifications [Document supplied by BUYER] shall be met in full.

[PIPING SPECIFICATION FOR TOPSIDE]

[PIPING SPECIFICATION FOR HULL]

[METOCEAN DATA]

[MOTION ANALYSIS]

[CHEMICAL INJECTION UNITS]

[CHEMICAL INJECTION POINTS]

2.7 Conflicting Requirements

2.7.1 In case of conflicting information between this Specification and other specific BUYER's document (data sheet) the specific BUYER's document shall prevail.

2.7.2 In all cases of conflict between this specification and applicable documents listed herein, the more stringent requirements shall prevail. In such cases, SELLER shall inform BUYER of the conflict and seek clarification.

3 DEFINITIONS AND ABBREVIATIONS

3.1 DEFINITIONS

3.1.1 In addition to terms and definitions established in I-ET-3010.00-1200-940-P4X-002 - GENERAL TECHNICAL TERMS, the following are applicable:

HTM (Hot Tap Machine): a tool used for making a hole in the pipe or vessel by the cutting action of a drill, even during operation.

CHEMICAL INJECTION POINT: specific region in the pipe (location) or vessel where the access fitting is installed for chemical injection products purposes.

RETRIEVAL TOOL (KIT): A device which includes a double block service valve, a hydraulic pump (hand pump) and a retriever tool device which acts inserting or removing the plug. The retrieval tool function is to insert or remove the plug without disturbing the full process conditions.

CHEMICAL INJECTION DEVICE: A device, the attachment of which to tubing or equipment is by means of a welded or flanged connection, through which chemicals are injected into the fluid stream flowing through the tubing or equipment. This device is a retractable system (the part in contact with the fluid can be inserted and removed in operation) that is connected to the tubing that carries the chemical to be injected.

3.2 ABBREVIATIONS

[1] CS – Carbon Steel


[2] CA – Corrosion Allowance

[3] CRA – Corrosion Resistant Alloys

[4] FRP – Fiber Reinforced Polymers

[5] DSS - Duplex Stainless Steel

[6] SDSS - Super Duplex Stainless Steel

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- [7] SS - Stainless Steel
- [8] Alloy 625 – Inconel UNS N06625
- [9] NDT – Non Destructive Testing
- [10] PMI – Positive Material Identification

4 DESIGN REQUIREMENTS

4.1 GENERAL DESIGN REQUIREMENTS

- 4.1.1 The chemical injection points design shall be submitted to Classification Society, when required, for comments and its approval.
- 4.1.2 The chemical injection points shall be suitable for marine environment according to class CX of ISO 12944 Part 2.
- 4.1.3 The chemical injection points are fixed or retrievable as required at Data Sheet CHEMICAL INJECTION POINTS [Document supplied by BUYER].
- 4.1.4 Design pressures equal to or higher than 600# shall be considered as high-pressure service.
- 4.1.5 Fasteners (Studs, bolts, tightening bolts and nuts) shall follow the requirements of I-ET-3010.00-1200-251-P4X-001 – REQUIREMENTS FOR BOLTING MATERIALS.
- 4.1.6 The thermal insulation shall be according to latest revision of I-ET-3010.00-1200-431-P4X-001 – THERMAL INSULATION FOR MARITIME INSTALLATIONS.

4.2 OPERATION ENVIRONMENT

- 4.2.1 The equipment supplied shall be suitable for the environment and range of ambient condition defined in METOCEAN DATA [Document supplied by BUYER].

4.3 MOTION REQUIREMENTS

- 4.3.1 The necessary design data and information on motion requirements are given in MOTION ANALYSIS [Document supplied by BUYER].

4.4 INJECTION ASSEMBLY

- 4.4.1 A typical injection assembly is shown in Figure 1 and consists of:
 - 4.4.1.1 An access fitting body with a side Tee through which the fluid transfer takes place.
 - 4.4.1.2 A Solid Plug Assembly inside the fitting body is used to carry an injection nut that has the injection tube/nozzle assembly screwed into its base.
 - 4.4.1.3 An Injection Nut is a multiple use device that replaces the nut on the end of the solid plug. It is used to direct the injected product to the injection tube or atomization device.
 - 4.4.1.4 The Injection nut may be of the following types:
 - **Open tube:** The tube end is cut at a 90° angle. The natural turbulence within the pipeline is used to insure even distribution. There is no pressure differential experienced at the orifice, so it is necessary to control the injection rate at the injection pump or the shut-off valve
 - **Quill tube:** Quill tube is an open-ended tube cut at a 45° angle with a slot. It utilizes the turbulence created by its unique design to achieve distribution of the injected chemical into the product flow. As with the Open Tube, injection rate must be

controlled at the injection pump or shut-off valve.

- **Spray tube (NPT with nozzle):** The tube end as a spray nozzle that directs the chemical product parallel to the flow with the use of a right angle nozzle. Permit atomization of the fluid as it is injected into the product line or vessel.
- **Head with Caps, Cores, and Strainers:** with various devices that, when attached to the dispersion end of the Injection Tube, permit atomization of the fluid as it is injected into the product line or vessel.

4.4.2 The injection tube nut type shall follow the requirements of Data Sheet CHEMICAL INJECTION POINTS [Document supplied by BUYER]. In case not specified otherwise in the project Table 4 shall be followed.

4.4.3 For hydrate inhibitor, a secondary access point shall be installed with an open type injection tube. The spray injection tube shall be used as the main chemical injection point.

4.4.3.1 The spray injection tube access point shall be retrievable, and the secondary access point shall be fixed type.

4.4.3.2 In case of more than one access point for hydrate inhibitor, the secondary access may be waived. The project datasheet shall be followed.

4.4.4 Unless otherwise stated, the chemical products injection direction shall be centralized to the pipe, and parallel to the flow.

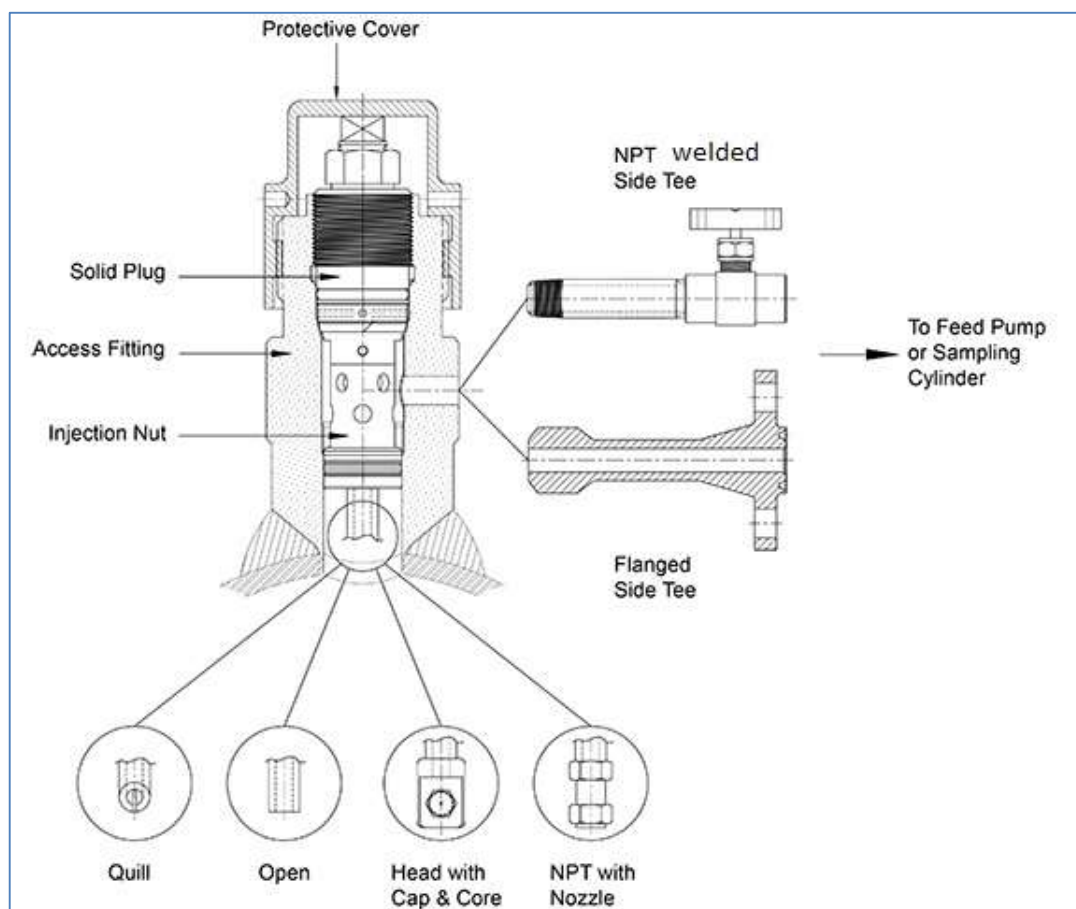


Figure 1: Example of Chemical injection Device



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Table 4: Injection Tube Nut Type

Chemical product	Injection tube nut type
Acidifying agent	Quill
Asphaltene Inhibitor	Quill
Biocide /Biostatic	Quill
Bio coagulant	Quill
Corrosion inhibitor water systems and biphasic systems	Quill
Defoamer	Quill
Demulsifier / Biodisperser	Quill
Gas Corrosion inhibitor	Spray
H ₂ S scavenger	Quill
Hydrate inhibitor	Spray / Open ¹
Hypochlorite	Quill
Oil scale inhibitor	Quill
Oxygen scavenger	Quill
Polyelectrolyte (inverted emulsion inhibitor)	Quill
Produced Water scale inhibitor	Quill
Water Scale Inhibitor	Quill
Sodium Hydroxide Solution	Quill
Wax Inhibitor	Quill

1 The injection tube type shall be as defined in the specific document [Document Supplied by BUYER].

4.5 ACCESS FITTING

- 4.5.1 The access fitting shall be designed according to ASME B31.3. The fittings shall be as per ASME B16.11 and ASME B16.5. The access fitting material shall follow the pipe specification (SPEC) where it is welded.
- 4.5.2 All access fittings shall be specified for welded connection, unless for the specified cases bellow.
 - 4.5.2.1 All chemical injection access point in pipes with internal coating.
 - 4.5.2.2 Chemical injection related to downhole shall be connected to tutu plate by specific connection as defined by subsea. This shall be confirmed at detailed engineering

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phase.

- 4.5.3 For non-operational point, the access points shall be supplied and installed. A blind flange shall be used after the block valve at chemical injection line.
- 4.5.4 The connection between the access fitting and the main piping shall be according to the derivation table of the piping spec used.
- 4.5.5 The connection for access fitting to chemical injection tubing (Figure 1) shall be welded and may be of two types:
- Flanged type: The connection to chemical injection tubing is by a flanged connection.
 - Nipple type (NPT): The connection to chemical injection tubing is by a nipple (welded) connection.
- 4.5.6 All access fitting of sodium hypochlorite shall be flanged to tubing.
- 4.5.7 Screwed nipple connections shall not be used due the risk of fatigue cracking.
- 4.5.8 The requirements regarding electric isolation of PIPING SPECIFICATION FOR TOPSIDE and PIPING SPECIFICATION FOR HULL [Document supplied by BUYER] shall be followed as applicable, to avoid galvanic corrosion between the fittings and pipe.
- 4.5.9 The retrievable access fitting shall be hydraulic type. Mechanical access fittings may be acceptable provided previous BUYER approval.
- 4.5.10 The chemical injection points in the vacuum deaeration column shall be flanged type to tubing (flange with 1") to use the column flange.
- 4.5.11 The injection point at pressure vessels shall be designed to assure:
- Proper mixing of the corrosion inhibitor / oxygen scavenger.
 - Selected material shall be suitable for corrosion inhibitor / oxygen scavenger.
 - Injection on the liquid phase, avoiding impingement on the pressure vessel's shell.

4.6 SHUT-OFF VALVES

- 4.6.1 The shut-off valves shall be scope of supply of the chemical injection device supplier. The exceptions are:
- The chemical injection connections on topside umbilical connectors.
 - The non-operational chemical injection points.
 - Chemical injection connections on Vacuum deaerator column.
 - Chemical injection connections on top of vessels: V-5124001 and V-5125001
- 4.6.2 The access fitting and the shut-off valves shall be from only one supplier.
- 4.6.3 The shut-off valves shall be suitable for connecting the chemical product tubing.
- 4.6.4 The shut-off valves shall be double block.
- 4.6.5 Every shut-off valve shall be supported on the piping where the chemical will be injected to avoid vibration fatigue problems due to the mass of the rocking valve.
- 4.6.6 A verification of the vortex-induced vibration nozzle fatigue strength shall be made following the analysis line in ASME PTC 19.3 TW for vortex-induced vibration in the flow direction and in the transverse direction in the direction of flow.
- 4.6.7 The supplier of the chemical injection system shall provide the natural frequency of the chemical injection point (set of access fitting and shut-off valve).



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- 4.6.8 When using double block, the two shut-off valves shall be supported on the piping to avoid vibration fatigue problems due to the large mass (see supporting details recommended in Figure 2 and Figure 3).
- 4.6.9 SELLER shall assure that there is a block valve installed at the chemical injection unit for each chemical injection line and that check valve is present upstream access point (with or without shut-off valve).

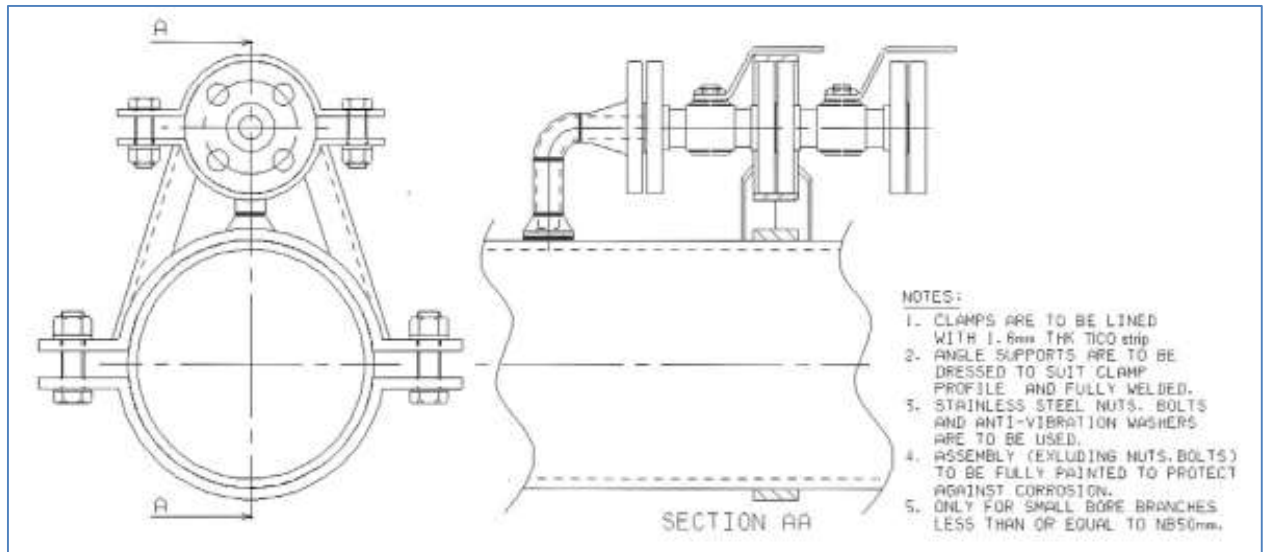


Figure 2 - Preferential support scheme

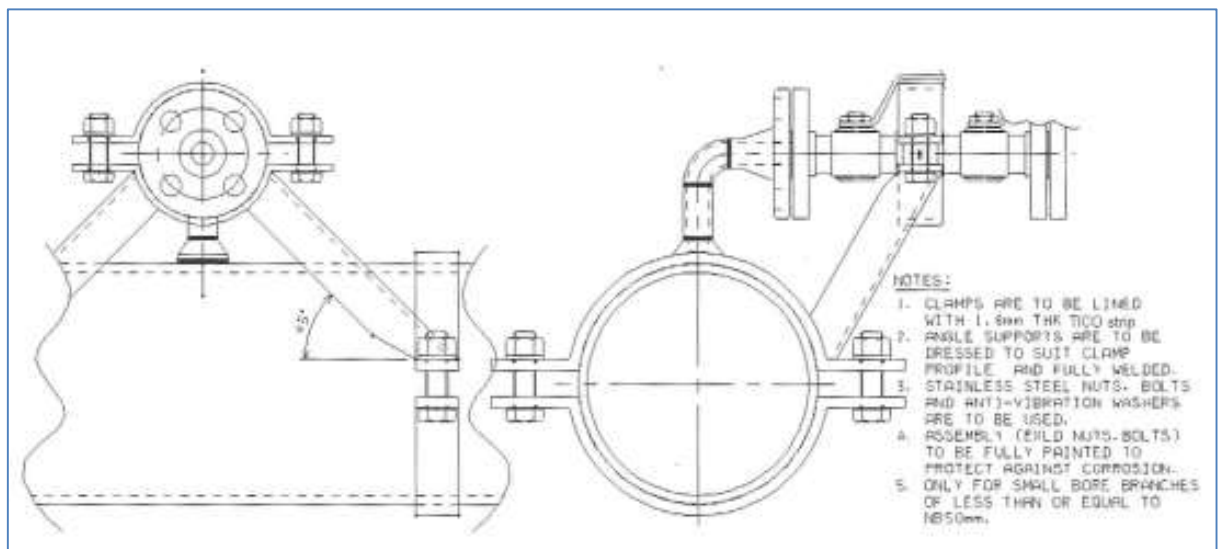


Figure 3 - Secondary support scheme

4.7 TUBING

- 4.7.1 The design of tubing transporting chemical shall consider adequate flexibility to prevent differential movement and / or vibration of the line where the product will be injected to cause damage to the tubing transporting the chemical.
- 4.7.2 Supporting systems that may create crevice corrosion points shall not be used, like tubing



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strips or clamp supports. Tubing supporting systems shall be designed to reduce the points of contact between tubing and the support system to avoid crevice corrosion points.

- 4.7.3 When necessary to run more than one tubing in parallel an appropriate insulation shall be designed to avoid contact between them.
- 4.7.4 If it is necessary to install the tubing in the same route of the pipes, the U type setting support shall be used. The U type support with its half and all round bars configurations avoid the crevice at the pipe and tubing and allows no water accumulation. The use of rods (metallic or non-metallic) between tubing allows the correct separation and also avoid crevice. The metal-to-metal contact is eliminated by using insulation material for half and all round bars and by using an insulated U Bolt and insulated metallic rods.
- 4.7.5 In case of installation of tubing on cable trays, water shield and water drainage shall be used to avoid water ingress and accumulation.
- 4.7.6 Tubing shall be electrically isolated from carbon steel supports and materials to avoid galvanic corrosion.
- 4.7.7 Tubing fittings shall not be used to support instruments, which shall be independently mounted.

5 FABRICATION AND ASSEMBLY REQUIREMENTS

5.1 MATERIALS SPECIFICATION:


5.1.1 When not specified, the materials selection shall be according Table 5.

Table 5: Materials Selection

Equipment or component	Material specification
Access fitting (body)	Stainless steel 316L or according to pipe specification, when the pipe material is not carbon steel. ¹
Injection tube Plug	Stainless steel 316L (up to 50°C) ² or 625 alloy ⁷ .
Shut-off valve	Stainless steel 316L (up to 50°C) ^{2, 6} or 625 alloy ⁷ .
Access fitting (body) and injection tube Plug for hypochlorite injection	Hastelloy C 276 ³ or Titanium Grade 2 ^{4,5,6}

NOTES:


- 1- Since scale inhibitors may have low pH, more corrosion resistant materials (AISI 316, for example) shall be selected. The risk of stress corrosion cracking of austenitic stainless steels over 60°C shall be considered during the selection stage.
- 2- The risk of stress corrosion cracking shall be considered during the selection. For operational temperatures from 50°C to 90°C, consider the use of UNS 32750 or 32760.
- 3- For design temperature up to 26°C.
- 4- For design temperatures higher than 26°C.
- 5-Titanium SHALL NOT BE USED FOR DRY CHLORINE. Titanium is ideal for wet chlorine but catches fire on contact with dry chlorine (Burning in this case means rapid combination with chlorine, not oxygen).
- 6- Other materials may be accepted if in accordance with chemical injection line pipe spec.
- 7- For carbon steel coated internally with 625 alloy piping.

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- 5.1.2 The access fitting cannot limit the piping system pressure, so its material and design temperature and pressure shall be compatible with the piping being welded at.
- 5.1.3 The tubing specification shall be in accordance with of [PIPING SPECIFICATION FOR TOPSIDE] and [PIPING SPECIFICATION FOR HULL] [Document supplied by BUYER].
 - 5.1.3.1 During the installation process, the contamination by iron oxide (Fe_2O_3 / Fe_3O_4) caused by welding or grinding shall be avoided.
 - 5.1.3.2 Any weld splatter on stainless steel tubing shall be removed. In severe cases, the tubing shall be replaced.
- 5.1.4 All lot size shall be analyzed by Positive Material Identification (PMI) according to API RP 578.
- 5.1.5 Only seamless stainless steel tubing shall be used. Coiled tubing requires prior approval of BUYER.
- 5.1.6 Connections shall use double ferrule technology. Connections materials shall be chosen so as not to generate potential difference high enough to cause galvanic corrosion due to surface contact with tubing.
- 5.1.7 Tubing rods shall be provided with a standard 6 meter length. Coiled tubing is not acceptable. For tubing straight lengths longer than 15 meters, tubing rods longer than 6 meters can be used to reduce the required number of connections.
- 5.1.8 When connections are implemented using unions, project shall forecast room for connection changes in the intermediate tubing with angles between 30 and 45 degrees.

5.2 WELDING

- 5.2.1 The welding shall be in accordance with I-ET-3010.00-1200-955-P4X-001- WELDING.
- 5.2.2 Welding shall be carried out with procedures and welders qualified in accordance with Design Code and additional requirements stated in contractual technical specifications. Welding shall not be performed before qualified welding procedures specification have been approved.
- 5.2.3 Welding inspection shall be according to the Design Code and additional requirements stated in the contractual technical specification I-ET-3010.00-1200-200-P4X-115- REQUIREMENTS FOR PIPING FABRICATION, INSPECTION, ASSEMBLY AND COMMISSIONING.
- 5.2.4 Buttwelded end access fittings shall be welded to a reducing Tee or a Weldolet as defined by run pipe to branch size table according to piping specification of the project [document supplied by BUYER].
- 5.2.5 Run pipes above or equal NPS 6 shall have flareweld end access fitting directly welded to run pipe.
- 5.2.6 Run pipes below NPS 6 shall have buttwelded end access fittings welded to a reducing Tee at the run pipe.
- 5.2.7 Socket welded, intermittent fillet welds, flanged or threaded connections to run pipe are not permitted.
- 5.2.8 All welds of access fitting to piping/equipment shall be full strength weld.
- 5.2.9 Fillet welds shall not be used to weld the access fitting body to pipe or equipment. Fillet welds in other parts of access fitting may be acceptable, provided that receive Toe gridding or TIG dressing to avoid fatigue cracks.
- 5.2.10 To avoid the possibility of Liquid Metal Embrittlement, tubing and tubing connections shall

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not be in direct contact or located directly under Zinc coated or galvanized components.

5.2.11 Any circumferential weld in coiled tubing shall be fully radiographed as a minimum.

5.2.12 Access Fitting shall be welded during pipe spool fabrication at pipe shop facilities.

5.2.13 Preparation and installation of access fitting shall follow Manufacturer's procedure.

5.2.14 It is recommended to cut a small hole before welding and make a final cutting hole sized to the internals after the welding of access fitting assuring the removal of excess weld and burrs.

5.2.15 Final cut can be done with a reamer or with drill of a hot tap machine, care shall be taken no to damage internal threads of the access fitting.

5.2.16 NDT shall be according to the Design Code and I-ET-3010.00-1200-970-P4X-004 - NON-DESTRUCTIVE TESTING REQUIREMENTS FOR METALLIC AND NON-METALLIC MATERIALS.

5.2.17 Final NDTs, for acceptance purposes shall be performed after completion of any post weld heat treatment (when applicable) and prior to paint application, hydrostatic testing, etc.

5.3 PAINTING

5.3.1 Paint system for external coating shall be according to I-ET-3010.00-1200-956-P4X-002 – GENERAL PAINTING.

5.3.2 Color code shall comply with DR-ENGP-I-1.15 – COLOR CODING.

5.4 LOCATION OF CHEMICAL INJECTION POINTS:

5.4.1 The access fitting shall be installed in the 12 o'clock position on horizontal pipes as shown in Figure 5.

5.4.2 The injection tube plug length shall be enough to inject the chemical products at the center of the pipe. When installed on vessels or tanks nozzles, the injection tube plug length shall direct the flow to the liquid phase, avoiding direct impingement on the walls.

5.4.3 The chemical injection point shall be located at a minimum distance of 5 times the piping diameter from any piping stagnation area as shown in Figure 5.

5.4.4 Retrievable chemical injection point location shall have enough clearance for installation of retrieval kit with service valve. For pipes under NPS 16 at least a clearance of 350 mm radius and 2000 mm length shall be set up around the chemical injection point location as shown in Figure 4 and Figure 5. For NPS 16 above the manufacturer shall be consulted for proper installation requirements.

5.4.5 Retrievable chemical injection points shall have access by ladders and platforms. For installations heights up to 3,5 m it may be acceptable temporary ladders and scaffolding arrangement when permanent access installation is not feasible.

5.4.6 No chemical injection point shall be positioned over the sea.



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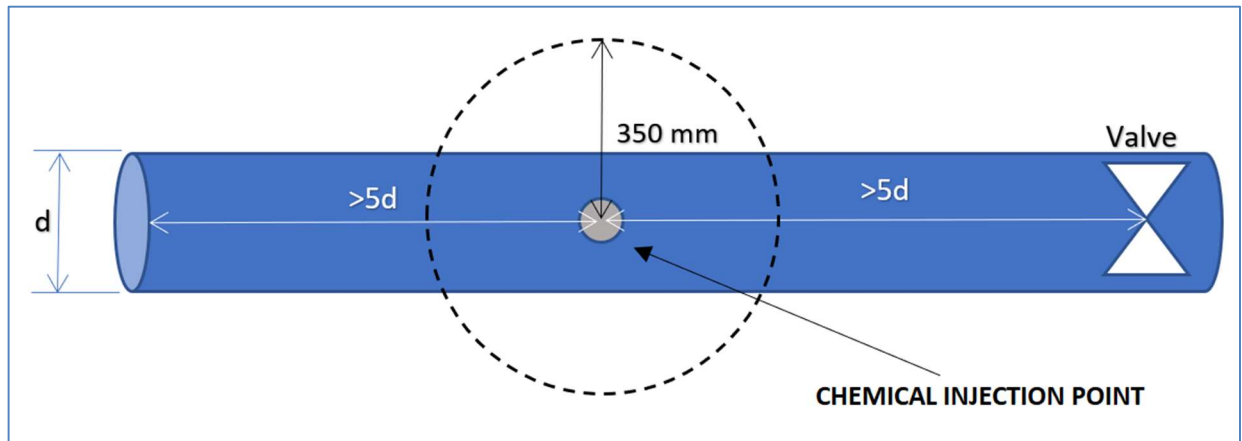


Figure 4 – Top View

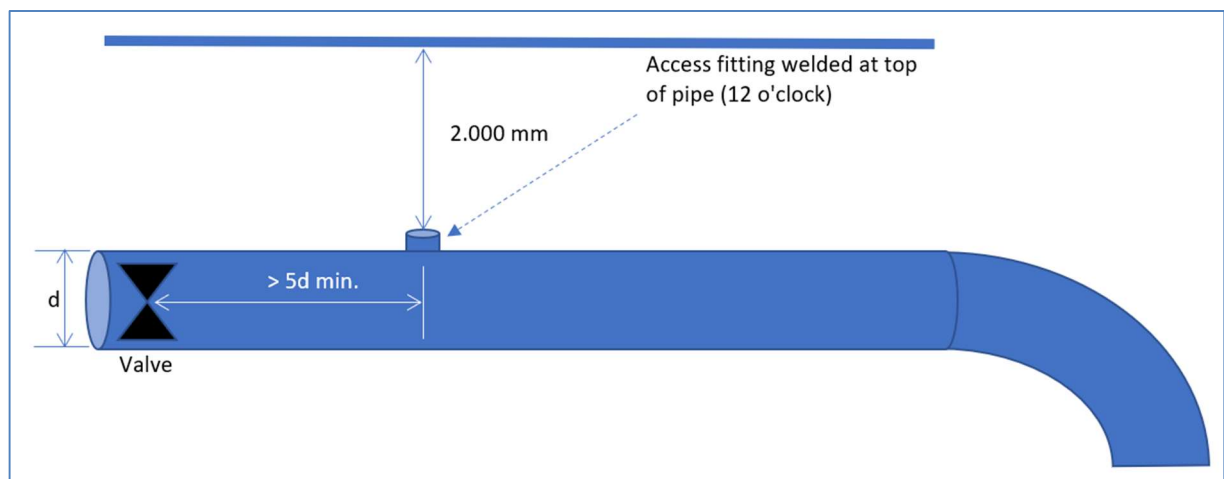


Figure 5 – Side View

6 TAG NUMBERING

6.1 GENERAL

- 6.1.1 Tagging of all instruments, electrical, mechanical, and piping items, including valves, shall be in accordance with latest revision of I-ET-3000.00-1200-940-P4X-001 – TAGGING PROCEDURE FOR PRODUCTION UNITS DESIGN.
- 6.1.2 Tag numbers for remaining ancillary equipment shall be given after purchase order placement.

7 SCOPE OF SUPPLY AND SERVICES

- 7.1.1 A complete retrieval tool kit is in the scope of supply.
- 7.1.2 The scope of supply includes, but is not limited to:
- Executive procedures of installation and commissioning



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TITLE: **CHEMICAL INJECTION POINTS**

INTERNAL

ESUP

- b) Datasheets of equipment
- c) Material certificates
- d) Welding documentation
- e) Drawings for each equipment
- f) Installation drawings including general arrangement, electrical diagrams, wiring diagrams, cable list, material list, equipment list
- g) Supply of equipment, materials and accessories required to carry out the construction, installation, and pre-operation of the system, as well as spare parts required for two years of operation.
- h) Installation and commissioning of the chemical injection point