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Technical Specifications:

Supply of Seamless Grade TP304L Pipe and Grade WP304L Pipework Fittings to the ITER Organization (IO).

Contents

1 Terms and Acronyms

Specific terms used throughout this document with contextual meaning are given in Table 1.

Term/ Acronym	Contextual Meaning
ASN	French Nuclear Safety Authority
Customer	Places the task order for the pipework, responsible for payment, responsible for ensuring the manufacture, inspection, testing, cleaning, packaging and delivery of pipe work components as per the technical specification of the task order – the IO.
IAEA	International Atomic Energy Agency
IO	ITER Organization, The Operator under the scope of [1]
Pipework components	Stainless Steel, seamless pipe & pipework fittings (tees, elbows reducers etc.)
PIC	Protection Important Components (as defined in [1])
Supplier / Contractor	Responsible for execution of manufacture, testing, cleaning, packaging and delivery of pipework components

Table 1 Specific terms

2 Background

A network of pipework of approximately 10 km in length is required to interconnect between vacuum chambers, vacuum pumps and auxiliary vacuum systems.

In the main pipework to be supplied under the scope of this technical specification is intended for vacuum use (0.1 MPa differential pressure, vacuum internal). Some pipework will operate with internal pressure up to 0.2 MPa and falls under the scope of Sound Engineering Practice (SEP) compliant with [2].

3 Document Scope

The scope of this document is to define the requirements pertaining to the supply of stainless steel pipes and pipe fittings (pipework components) to the IO for use on the ITER vacuum systems.

4 Scope of Supply

The scope of supply includes manufacture, testing, cleaning, packaging and delivery of TP 304L pipe and WP304L pipe fittings to the IO site, France.

The envisaged amount of pipe (grade, DN and schedule) are provided in Table 2. Dimensions for pipes shall comply with [3][1].

The envisaged amount of pipe fittings (grade, DN and schedule) is provided in Table 3. The dimensions of pipe fittings shall be compliant with [4][2].

Table 2 & Table 3 are provided for the purpose of costing.

[1] See table for DN 150 wall thickness

[2] See table for DN 150 wall thickness

Component	Grade	Diameter Nominal (DN)	Schedule(SCH.)	Meters
Pipe	TP 304L	25	10s	2600
		32	10s	200
		40	10s	300
		65	10s	200
		100	10s	620
		150	10s	1300
			20s*	20
			40s	20
		250	10s	140
			20s	250
		300	20s	150
*Where specified as DN 150 sch. 20 wall thickness = 6.35 mm				

Table 2 Indicative quantities - pipe

Component	Grade	Diameter Nominal (DN)	Schedule (SCH.)		
Elbow	WP 304L			**Standard Radius**	**Long Radius**
				Number of Units	
		25	10s	550	550
		32	10s	25	25
		40	10s	180	150
		65	10s	10	70
		100	10s	90	40
		150	10s	165	110
			20s*	10	10
			40s	10	10
		250	10s	40	10
			20s	60	20
		300	20s	40	5
Tee	WP 304L	25	10s	80	
		32	10s	25	
		40	10s	5	
		65	10s	5	
		100	10s	10	
		150	10s	15	
			20s*	15	
			40s	15	
		250	10s	5	
			20s	5	
		300	20s	5	
Reducer Tee 100x100x40	WP 304L		10s	5	

Reducer Tee 150x150x65			10s	60
Reducer Tee 250x250x150*			10s	5
			20s	
			40s	5
Concentric Reducer 300x150*			20s	10
			40s	10
Concentric Reducer 250x150*			10s	5
			20s	5
Concentric Reducer 100x40			10s	30
Concentric Reducer 65x40			10s	35
Cap		150	10s	10
			20s*	5
			40s	5
*Where specified as DN 150 sch. 20 wall thickness = 6.35 mm				

Table 3 Indicative quantities - fittings

5 Regulatory Requirements

Some pipe and pipework fittings procured under the scope of this contract shall perform a confinement function[3].

As defined in the French Order of 7th February 2012 establishing the general rules for licensed nuclear installations [1] components which perform a safety function (e.g. provide confinement) are classified as Protection Important Components (PIC) and hence shall satisfy the requirements of the said order.

PIC pipework components shall satisfy the requirements of QC1 arising from [5].

Where pipework components are to comply with the French Order [1] it will be clearly stated as such on the Customer Order.

5.1 Additional Surveillance Requirements

ITER Organisation is the Nuclear Operator and has the ultimate responsibility for the application of the INB Order [1] within the IO and in its chain of suppliers. IO must undertake additional surveillance for those components which are classified as Protection Important Components.

The Supplier shall therefore grant access to the IO and ASN representatives to its facilities and records and those of its subcontractors for the purposes of surveillance of defined requirements during the design, construction, manufacturing, commissioning, assembly, maintenance and surveillance of a PIC. This surveillance shall also include the examination of all protective important actions and follow-up and verification of any corrective actions which are to be implemented.

[3] Confinement is the term used for the physical enclosure of hazardous substances (e.g. tritium).

6 Technical Requirements

Vacuum pipework systems are being designed to ASME B31.3 fluid category M [6]. Under the scope of the contract, where specified in this technical specification the Supplier shall supply to the IO, vacuum pipework components which satisfy the requirements as specified in Table 4 and other additional requirements as described in this technical specification.

Component	Schedules	DN	Material	Requirements
Seamless (SML) pipe	10, 20,40	25 to 300	TP304L	[7]
Seamless (S) Pipe fittings (tees, elbows, reducers)			WP304L	[8]

Table 4 Generic Requirements

In accordance with [7], [8] The "M" designation (SI units) shall prevail.

6.1 Tests to be Performed

Pipework components shall be subjected to testing as defined in Table 5.

Test Category	Extent of Test	Number of test pieces per test sample
Chemical Analysis - heat	1 per heat	1
Chemical Analysis - product	2 per heat	2
Tensile test	2 per lot[1]	
Surface finish	2 per lot[2]	
Flattening Test	5% pipe per lot, not less than two lengths	Varies by lot size[1]
Dimensional Inspection	According to [7] for pipes and [8] for fittings	
Visual inspection		
Cleanliness check	Each product	100% each component
Leak Check		
Non-destructive electrical test		

[1]Lot definition [7] for pipe and [9] for fittings.
[2] Follow lot definition for tensile testing [9].

Table 5 Tests to be performed, test units and extent of testing

6.2 Chemical Composition

Pipe and pipework fittings shall meet the chemical composition requirements for materials as specified in [7], [8] respectively. In addition pipework components shall meet the requirements pertaining to chemical composition as detailed in Table 6.

Chemical Compositions (max wt%)		
Co	Ta	Nb
0.20	0.05	0.10

Table 6 Chemical Composition

6.3 Hydrostatic Test

Pipe shall not be subjected to hydrostatic testing. Pipe shall be subjected to non-destructive electrical test in accordance with [7] .

6.4 Leak Testing

Where specified in the Customer order, the vacuum performance with respect to helium leak rate shall be confirmed by leak testing in accordance with the ITER Vacuum Handbook [10].

The Supplier shall submit with the reply to the call for tender a procedure for leak testing of components.

Where a leak test is specified the maximum allowable leak rate is 1 x 10^{-10} Pa.m^3.s^{-1} at ambient temperature with 0.1 MPa (±20%) helium differential pressure with helium applied to external surface of pipework components.

6.5 Cleanliness

In addition to the requirements as specified in [7] (for pipe) & [8] (for fittings) the following requirements pertaining to cleanliness shall be satisfied.

6.5.1 Pickling and Passivation

Pipework components shall be pickled. Pickling shall be followed by passivation.

Picking and passivation of pipework components shall comply with the requirements of the ITER Vacuum Handbook [10].

6.5.2 Internal Cleanliness

Pipework components shall be internally cleaned in compliance with the ITER Vacuum Handbook [10].

The Supplier shall submit with the reply to the call for tender a draft cleaning procedure which the Supplier will follow in order to meet the requirements of this technical specification[4].

The cleanliness of the internal surfaces of pipework components shall be confirmed by a wet wipe test in accordance with the IO standard wipe test for cleanliness [11]. The wipe test shall be performed at a distance, when measured from any end of the component, of no less than the 2DN of the component. The test can be performed on any internal surface of the pipework component.

6.5.3 External Cleanliness

The external surfaces of pipework components shall be scale free and free of gross contamination.

The cleanliness of external surfaces of the pipework components shall be confirmed by dry wipe test in accordance with [11]. The test shall be performed at a distance, when measured from any end of the component, of no less than the 2DN of the component. The test can be performed on any external surface of the pipework component.

6.6 Surface Finish

The maximum average (internal and external) surface roughness, Ra, of pipework components shall be 12.5 µ.

The measurement of the surface roughness shall be performed using the electric stylus measurement technique in accordance with [12].

6.7 Pipework Component End Preparation

Pipework components shall be supplied with square (plain) ends free from burrs.

6.8 Repair by Welding

Repair of pipework components by welding is not permitted.

7 Packaging

7.1 Transportation Packaging

The packaging for the pipes and fittings shall meet the minimum requirements of Level “C” for overseas shipment in accordance with [13].

[4] There is no requirement to vacuum condition (bake) components supplied under the scope of this contract.

7.2 End Caps

"Clean" Pipe component ends shall be capped to prevent the ingress of material to the component internal. In accordance with [14] the ingress protection shall be IP66.

Caps shall be fabricated from stainless steel or non-halogenated material.

7.3 Marking

In addition to the requirements for marking specified in [7], [8] the following requirements pertaining to marking the pipework components shall be satisfied;

Marking of pipework components shall utilize marking paint or ink.

Marking paint or ink shall only be applied to the external surfaces of the pipework components.

Fluids used for marking shall be approved by the IO and shall have a halogen content <200 ppm.

Pipework components shall be marked with heat and lot number of pipe material.

8 Quality Assurance

The Supplier's Quality Assurance Programme (QAP) is subject to approval by the IO in accordance with the ITER QA Programme and shall be applied to all work carried out as a result of any contract arising from this specification.

The ITER QA Programme is based on IAEA Safety Standard GS-R-3 and on conventional QA principles and integrates the requirements of the French Order dated 7th February 2012 [1] on the quality of design, construction and operation of Licensed Nuclear Installations. For this purpose, the Supplier shall ensure that any subcontractors carrying out work placed under the prime contract are in compliance with the QA requirements under the relevant QA classifications.

The general requirements are detailed in ITER Integrated Safety, Quality and Security Management System [15] and ITER Procurement Quality Requirements [16] whilst the specific requirements for the overall supervision plan of external intervener's chain for Protection Important Components, Structures and Systems and Protection Important Activities detailed in [17].

8.1 Quality Plan

Prior to commencement of the work, a Quality Plan [16] must be submitted for IO approval giving evidence of the above and describing the organisation for this task; the qualification and experience of the workers involved including named individual(s) who will act as Independent Reviewer(s) and Checkers(s) and any anticipated sub-contractors.

8.2 Manufacturing and Inspection Plan

Prior to the commencement of any manufacturing, a Manufacturing and Inspection Plan [18] must be approved by ITER.

As some of the pipework components to be supplied are PIC a specific management system must be implemented by the Supplier and any subcontractor working on Protective Important Activities (as defined in [1]), on the basis of activities defined and executed by the Supplier and Subcontractor.

This system could be included in the Manufacturing and Inspection Plan or the Quality Plan.

8.3 Deviations and Non-Conformances

All deviations and non-conformities must strictly follow the procedure detailed in ITER Requirements Regarding Suppliers Deviations and Non Conformities [19].

9 Ordering Information

Supply Orders for material in accordance to this specification shall include the following as required:

- Customer Technical Specification
- Component description
- Quantity (meters, or number of lengths, number of units)
- Name of material and grade
- Process (seamless)
- Size (DN)
- Length (where applicable)
- Schedule
- Supplementary requirements (Cleanliness, leak testing, internal surface finish etc.)
- End finish

10 Certification

The Supplier shall provide material certification of type 3.1 in accordance with [20].
The certificate shall;

- Identify to a specific pipework component
- Reference to the Customer technical specification for supply
- Identify the Contract and/or Supply order number and a description of the items as ordered, provided and certified in satisfaction of the Contract and/or Supply order and all applicable agreed upon changes
- Identify any procurement requirements that have not been satisfied with reference to any relevant non-conformance or deviation requests
- Identify the heat number of the component
- Test reports including:
  - Heat number
  - Heat analysis - chemical composition
  - Product analysis - chemical composition
  - Tensile properties
  - Non-destructive electrical test method and acceptance
  - Dimensional inspection report and acceptance
  - Flattening test report and acceptance
  - Results of supplementary requirements (Cleanliness, leak testing, internal surface finish etc.)
  - Pickling and passivation reports
  - End finish

11 Delivery

Pipework components shall be delivered to the IO in Cadarache, France.

12 Reference

[1] Order dated 7 February 2012 relating to the general technical regulations applicable to INB - EN (ITER_D_7M2YKF).

[2] French Decree 99-1046 concerning pressure equipment- Pressure Equipment Directive 97/23/EC [ESP/PED].

[3] ASME B36.10M, 2004.

[4] ASME B16.9M, 2012.

[5] Quallity Classification Determination (ITER_D_24VQES v4.1).

[6] ASME B31.3, 2010.

[7] ASTM A312M, 2013.

[8] ASTM A403M, 2013.

[9] ASTM A960, 2013.

[10] ITER Vacuum Handbook (ITER_D_2EZ9UM).

[11] Standard Wipe Test for Cleanliness (ITER_D_3PEAK3).

[12] ISO 4287: 2000.

[13] ASME NQA-1-2012, “Quality Assurance Requirements for Nuclear Facility Applications”.

[14] IEC standard 60529.

[15] ITER Integrated Safety, Quality and Security Management System (ITER_D_4HCWJU v3.0).

[16] ITER Procurement Quality Requirements (ITER_D_22MFG4 v4.0).

[17] Overall supervision plan of external interveners chain for Protection Important Components, Structures and Systems and Protection Important Activities (ITER_D_4EUQFL v5.0).

[18] Requirements for Producing a Manufacturing and Inspection Plan (ITER_D_22MDZD v3.0).

[19] Requirement for DA / Supplier/ Subcontractors Deviations and Nonconformities (ITER_D_22F53X v6.1).

[20] EN 10204, 2004.

[21] MQP Deviations and Non Conformities (ITER_D_22F53X v6.1).

[22] Order dated 7 February 2012 relating to the general technical regulations applicable to INB - EN (ITER_D_7M2YKF v1.6).

[23] Overall supervision plan of external interveners chain for Protection Important Components, Structures and Systems and Protection Important Activities (4EUQFL v5.0).

[24] Requirements for Producing a Contractor Release Note (ITER_D_22F52F v5.0).