

Specifications (In-Cash Procurement)

Technical Specification for the supply of the DMS vacuum system

This technical specification details the supply of Vacuum flanges Bellows liners TIV parts Vacuum pipes and pumping domes for EQ UP ISS and PCSS Pipes for Cryogenic components and port cell installation All components shall be made from 316L(N)-IG

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1 Preamble

This Technical Specification is to be read in combination with the General Management Specification for Service and Supply (GM3S) – Ref [1] that constitutes a full part of the technical requirements.

In case of conflict, the content of the Technical Specification supersedes the content of Ref [1].

2 Purpose

This technical specification covers the manufacturing and supply of the vacuum system components for the ITER DMS. This includes the manufacturing of 316L(N)-IG austenitic steel flanges which will be partly used for the subsequent vacuum system manufacturing, partly for use in other DMS system, as well as the manufacturing of various injector parts. Furthermore, supply of various sizes of tubes made from 316L(N)-IG shall also be covered by this contract.

The 316L(N)-IG steel specified here is grade 316L(N) steel with narrower alloying element ranges and controlled impurities. The closest analogy is X2CrNiMo17-12-2 with controlled nitrogen content austenitic stainless steel described in the RCC-MR Code, Edition 2007.

The supply covers the following items:

- Manufacturing of the different vacuum flanges in the requested quantities from 316L(N)-IG
- Manufacturing of the different bellows liners for the vacuum extensions in the requested quantities from 316L(N)-IG
- Manufacturing of different injector parts in the requested quantities from 316L(N)-IG
- Manufacturing of the vacuum system sub-assemblies in the requested quantities from 316L(N)-IG
- Supply of the 316L(N)-IG tubes in the requested quantities and dimensions
- Organization of quality at works
- Elaboration of all procedures required for the manufacturing, inspection (including analyses), cleanliness, packaging, storage and delivery
- Time schedules and documentation

3 Acronyms & Definitions

3.1 Acronyms

The following acronyms are the main one relevant to this document.

Abbreviation	Description
CRO	Contract Responsible Officer
DMS	Disruption Mitigation System
GM3S	General Management Specification for Service and Supply
IO	ITER Organization
PRO	Procurement Responsible Officer
PT	Penetrant Test
RT	Radiographic Test
UT	Ultrasonic test

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4 Applicable Documents & Codes and standards

4.1 Applicable Documents

This is the responsibility of the Contractor to identify and request for any documents that would not have been transmitted by IO, including the below list of reference documents.

This Technical Specification takes precedence over the referenced documents. In case of conflicting information, this is the responsibility of the Contractor to seek clarification from IO. Upon notification of any revision of the applicable document transmitted officially to the Contractor, the Contractor shall advise within 4 weeks of any impact on the execution of the contract. Without any response after this period, no impact will be considered.

Ref	Title	IDM Doc ID	V
1	General Management Specification Service Supply (GM3S)	82MXQK	1.4
2	Manufacturing drawings of vacuum flanges	DA78Z8	
3	Manufacturing drawings of bellows liners	FY3MEM	
4	Manufacturing drawings of Injector parts	FDCAQ2	
5	Manufacturing drawings of vacuum system	DA766K	
6	Procedure for management of Nonconformities	22F53X	10.3
7	Procedure for the management of Deviation Requests	2LZJHB	9.1
8	MQP L3 Working Instruction for Manufacturing Readiness Review	44SZYP	5.1
9	Working Instruction Delivery Readiness Review (DRR)	X3NEGB	3.0
10	ITER Vacuum Handbook	2EZ9UM	2.5
11	Quality Requirements for IO Performers	22MFG4	6.4

4.2 Applicable Codes and Standards

This is the responsibility of the Contractor to procure the relevant Codes and Standards applicable to that scope of work.

Ref	Title	Doc Ref.	V
CS1	Metallic products: Type of inspection documents	NF-EN 10204	2004
CS2	Steels - Micrographic determination of the apparent grain size	NF-EN ISO 643	2013
CS3	Hot rolled round steel bars for general purposes — Dimensions and tolerances on shape and dimensions	NF-EN 10060	2003
CS4	Standard test methods for determining the inclusion content of steel	ASTM E45-13	2018
CS5	Standard Test Methods for Permeability of Feebly Magnetic Materials.	ASTM A342-14	2021
CS6	ASME Boiler and Pressure Vessel Code Section V – Non-destructive examinations	ASME V	2025
CS7	Process piping	ASME B36.19	2024
CS8	Buttwelding Fittings Standard	ASME B16.9	2024

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In case of change of edition year or issuing standard, which supersede above mentioned, the use of new Standards is allowed only in case of demonstration of equivalency with prior written Client's approval.

The use of EN but non-NF Standards is also allowed demonstrating equivalence with the corresponding NF version of the Standard.

Other equivalent national or international standards and codes proposed by the supplier may be acceptable with prior written Client's approval, provided conformity assessment to all criteria is satisfied.

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5 Scope of Work

This section defines the specific scope of work, in addition to the contract execution requirement as defined in Ref [1].

5.1 Manufacturing of vacuum flanges

5.1.1 Description

Flanges that need to be manufactured:

- 120x Half nipple KF16 L30 (DF3ZMS_v3)
- 16x Half nipple KF25 L30 (GAMQEA_v1)
- 580x Half nipple KF40 L20 (DF44YD_v4)
- 140x Half nipple KF40 L40 (DJB5TJ_v4)
- 70x Half nipple KF50 L30 (DJKJ6H_v3)
- 110x Half nipple QCF63 L30 (DLKBZ4_v3)
- 40x Half nipple CF63 L40 (FXJFFG_v3)
- 70x ISO tapered flange NW80 (GQ3FFZ_v1)

Raw material for the flanges shall be procured by the contractor.

Table 1: Classifications

	Safety class	Quality class	Seismic class	Vacuum class	PED/ESPN class	Tritium class	RH class
Half nipple KF16 L30	PIC/SIC2	QC-2	SC1 (S)	VQC-3A	NA	TC 1A	NA
Half nipple KF25 L30	Non-SIC	QC-3	NA	VQC-3A	NA	NA	NA
Half nipple KF40 L20	PIC/SIC2	QC-2	SC1 (S)	VQC-3A	NA	TC 1A	NA
Half nipple KF40 L40	PIC/SIC2	QC-2	SC1 (S)	VQC-3A	NA	TC 1A	NA
Half nipple KF50 L30	Non-SIC	QC-3	SC1 (S)	VQC-3A	NA	TC 1A	NA
Half nipple QCF63 L30	Non-SIC	QC-3	SC1 (S)	VQC-3A	NA	TC 1A	NA
Half nipple CF63 L40	Non-SIC	QC-3	SC1 (S)	VQC-3A	NA	TC 1A	NA
ISO tapered flange NW80	Non-SIC	QC-3	NA	VQC-3A	NA	NA	NA

5.1.2 Design requirements

[DMS.VAC.001] The flanges shall be manufactured according to the provided manufacturing drawings.

5.1.3 Material, welding and fabrication requirements

[DMS.VAC.002] The material from which the flanges are machined shall be 316L(N)-IG.

[DMS.VAC.003] Material certificate EN 10204 Type 3.1 shall be supplied for all rounds, from which the flanges are made.

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- [DMS.VAC.004] Contents of
- Co < 0.05 wt%
 - Nb < 0.01 wt%
 - Ta < 0.01 wt%

Shall be demonstrated by certification or by test.

- [DMS.VAC.005] Lubricants used during manufacturing shall be chosen in agreement with the vacuum handbook [10].
- [DMS.VAC.006] The flanges shall be cleaned after manufacturing to be free of grease, oils and other contaminants.
- [DMS.VAC.007] Surfaces shall be free of discoloration.
- [DMS.VAC.008] The fabrication method shall be chosen by the supplier.

5.1.4 Marking

- [DMS.VAC.009] An ITER part number (PNI) will be marked on each item. The Contractor shall receive from the IO the catalogued Part Numbers of ITER (PNI) for the scope of supply, prior to the packaging.

Each flange shall be legibly identified with following information:

- Manufacturer name or symbol.
- Round number or unique identification number related to material history.
- Grade of material.
- Heat number.
- PNI number.

5.1.5 Packing, preservation & shipping

- [DMS.VAC.010] The sealing surfaces of the flanges must be protected against contamination, scratches and dust.
- [DMS.VAC.011] The welding interfaces of the flanges must be protected against contamination, deformation and scratches.

5.1.6 Delivery Time

- [DMS.VAC.012] The following quantities shall be shipped to IO:

16x Half nipple KF25 L30
 230x Half nipple KF40 L20
 35x Half nipple KF50 L30
 60x Half nipple QCF63 L30
 70x ISO tapered flange NW80

- [DMS.VAC.013] The maximum expected duration from the contract signature to the supply of the scope of work is 6 months.

The rest of the flanges shall be used for manufacturing the vacuum system components, described in section 5.4.

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5.2 Manufacturing of bellows liners*5.2.1 Description*

Liners that need to be manufactured:

- 70x Bellows end piece (FXJJ4Q_v1)
- 35x Bellows outer tube (FXJLWM_v2)
- 35x Bellows inner tube (FXJJ6R_v2)

Raw material for the liners shall be procured by the contractor.

Table 2: Classifications

	Safety class	Quality class	Seismic class	Vacuum class	PED/ESPN class	Tritium class	RH class
Bellows end piece	PIC/SIC1	QC-1	SC-1 (SF)	VQC-1A	NA	TC 1A	NA
Bellows outer tube	PIC/SIC1	QC-1	SC-1 (SF)	VQC-1A	NA	TC 1A	NA
Bellows inner tube	PIC/SIC1	QC-1	SC-1 (SF)	VQC-1A	NA	TC 1A	NA

5.2.2 Design requirements

[DMS.VAC.014] The liners shall be manufactured according to the provided manufacturing drawings.

5.2.3 Material, welding and fabrication requirements

[DMS.VAC.015] The material from which the liners are machined shall be 316L(N)-IG.

[DMS.VAC.016] The base material shall be made from cross-forged material which is Electro-Slag Remelted (ESR) or Vacuum Arc Remelted (VAR).

[DMS.VAC.017] Material certificate EN 10204 Type 3.1 shall be supplied for all rounds, from which the liners are made.

[DMS.VAC.018] Contents of

- Co < 0.05 wt%
- Nb < 0.01 wt%
- Ta < 0.01 wt%

Shall be demonstrated by certification or by test.

[DMS.VAC.019] Lubricants used during manufacturing shall be chosen in agreement with the vacuum requirements.

[DMS.VAC.020] The liners shall be cleaned after manufacturing to be free of grease, oils and other contaminants.

[DMS.VAC.021] Surfaces shall be free of discoloration.

[DMS.VAC.022] The fabrication method shall be chosen by the supplier.

5.2.4 Marking

[DMS.VAC.023] An ITER part number (PNI) will be marked on each item. The Contractor shall receive from the IO the catalogued Part Numbers of ITER (PNI) for the scope of supply, prior to the packaging.

Each liner shall be legibly identified with following information:

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- Manufacturer name or symbol.
- Round number or unique identification number related to material history.
- Grade of material.
- Heat number.
- PNI number.

5.2.5 *Packing, preservation & shipping*

[DMS.VAC.024] The welding interfaces of the liners must be protected against contamination, deformation and scratches.

5.2.6 *Delivery Time*

[DMS.VAC.025] The maximum expected duration from the contract signature to the supply of the scope of work is **6** months.

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5.3 Manufacturing of Injector components**5.3.1 Description**

Assemblies that need to be manufactured:

- 12x TIV assembly EQL (Variant 1) (FNC9TF_v3)
 - 1x Reducer (Variant 1)
 - 1x Spacer
 - 1x Half Nipple KF40 L20
 - 1x Inlay
- 4x TIV assembly EQL (Variant 2) (FNC9TF_v3)
 - 1x Reducer (Variant 2)
 - 1x Spacer
 - 1x Half Nipple KF40 L20
 - 1x Inlay
- 12x TIV assembly EQR (GFVYXR_v2)
 - 1x Reducer
 - 1x Spacer
 - 1x Half Nipple KF40 L20
 - 1x Inlay
- 30x Injector bellows (FNBE29_v4)
 - 1x Injector bellows left flange
 - 1x Injector bellows right flange
- 28x CF40->KF40 adapter (FNBQ9E_v3)
- 54x Stage AB flange (FNAY2R_v5)
 - 1x CF200 AB flange
 - 1x Half Nipple KF40 L40
- 27x Stage A extension (GVCH32_v2)

Raw material for the parts shall be procured by the contractor. Half nipples shall be taken from the lot produced under 5.1. Gate valves will be free-issued by IO.

Table 3: Classifications

	Safety class	Quality class	Seismic class	Vacuum class	PED/ESPN class	Tritium class	RH class
TIV assemblies	PIC/SIC1	QC-1	SC-1 (SF)	VQC-1A	NA	TC 1A	NA
Injector bellows	PIC/SIC2	QC-2	SC1 (S)	VQC-1A	NA	TC 1A	NA
CF40>KF40 adapter	PIC/SIC2	QC-2	SC1 (S)	VQC-1A	NA	TC 1A	NA
Stage AB flange	PIC/SIC2	QC-2	SC1 (S)	VQC-1A	NA	TC 1A	NA
Stage A extension	PIC/SIC2	QC-2	SC1 (S)	VQC-1A	NA	TC 1A	NA

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5.3.2 *Operating requirements*

[DMS.VAC.026] The vacuum components operate in a pressure range between 10^{-6} mbar and 1 bara. A Helium leak test shall be performed by the supplier on all welded sub-components.

5.3.3 *Design requirements*

[DMS.VAC.027] The parts shall be manufactured according to the provided manufacturing drawings.

5.3.4 *Material, welding and fabrication requirements*

[DMS.VAC.028] The material from which the parts are machined shall be 316L(N)-IG.

[DMS.VAC.029] The base material shall be made from cross-forged material which is Electro-Slag Remelted (ESR) or Vacuum Arc Remelted (VAR).

[DMS.VAC.030] Material certificate EN 10204 Type 3.1 shall be supplied for all rounds, from which the parts are made.

[DMS.VAC.031] Contents of

- Co < 0.05 wt%
- Nb < 0.01 wt%
- Ta < 0.01 wt%

Shall be demonstrated by certification or by test.

[DMS.VAC.032] Lubricants used during manufacturing shall be chosen in agreement with the vacuum requirements.

[DMS.VAC.033] The parts shall be cleaned after manufacturing to be free of grease, oils and other contaminants.

[DMS.VAC.034] Surfaces shall be free of discoloration.

[DMS.VAC.035] The fabrication method shall be chosen by the supplier. The welding procedure shall be qualified for the application (WPS, PQR).

[DMS.VAC.036] All welds shall be carried out by a qualified welder (WPQ as per ASME Sec. IX or equivalent).

5.3.5 *Quality Control Provisions*

[DMS.VAC.037] All welds shall be numbered for later PT testing.

[DMS.VAC.038] Visual inspection and dimensional inspection shall be carried out for each complete weld assembly according to the dimensions on the drawings.

5.3.6 *Non-destructive testing*

[DMS.VAC.039] All welds shall be subject to PT testing. PT shall be performed as per CS6 reference, PT personnel shall be qualified as per SNT-TC-1A. Acceptance criteria as per CS6 apply.

[DMS.VAC.040] All welds shall be subject to volumetric inspection, either UT or RT. The selected procedure shall be performed as per CS6 reference, personnel shall be qualified. Acceptance criteria as per CS6 apply.

5.3.7 *Marking*

[DMS.VAC.041] An ITER part number (PNI) will be marked on each item. The Contractor shall receive from the IO the catalogued Part Numbers of ITER (PNI) for the scope of supply, prior to the packaging.

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Each part shall be legibly identified with following information:

- Manufacturer name or symbol.
- Round number or unique identification number related to material history.
- Grade of material.
- Heat number.
- PNI number.

5.3.8 *Packing, preservation & shipping*

[DMS.VAC.042] The welding interfaces of the parts must be protected against contamination, deformation and scratches.

5.3.9 *Delivery Time*

[DMS.VAC.043] Delivery shall be organized in batches.

Batch 1 (delivery no later than **6** months after contract signature):

- 2x TIV assembly EQL (Variant 2)
- 5x Injector bellows
- 2x CF40->KF40 adapter
- 2x Stage AB flange
- 2x Stage A extsion

Batch 2 (delivery no later than **12** months after contract signature):

- 6x TIV assembly EQL (Variant 1)
- 6x Injector bellows
- 6x CF40->KF40 adapter
- 6x Stage AB flange
- 6x Stage A extension

Batch 3 (delivery no later than **16** months after contract signature):

- 1x TIV assembly EQL (Variant 2)
- 1x Injector bellows
- 1x CF40->KF40 adapter
- 1x Stage AB flange
- 1x Stage A extension

Batch 4 (delivery no later than **20** months after contract signature):

- 6x TIV assembly EQL (Variant 1)
- 12x TIV assembly EQR
- 1x TIV assembly EQL (Variant 2)
- 19x Injector bellows
- 19x CF40->KF40 adapter
- 19x Stage AB flange
- 19x Stage A extension

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5.4 Manufacturing and delivery of the DMS vacuum components**5.4.1 Description**

For the purpose of evacuating the ITER DMS, each bank is equipped with two pumping systems, one for tritiated gas and one for non-activated gas and cryo-vacuum. The flanges produced under the scope in 5.1, that haven't been shipped to IO, shall be used for this manufacturing. Pipes and fittings shall be procured by the manufacturer.

Parts that need to be manufactured:

- 2x ISS EQL vacuum pipes (GFYJAN_v2)
 - 6x Stage B pumping pipe EQL
 - 6x Stage B pumping jumper EQL
 - 1x Cryostat pumping pipe EQL
 - 1x Injector pumping manifold EQL
 - 1x ISS pumping jumper EQL
- 2x ISS EQR vacuum pipes (GFYM4R_v2)
 - 6x Stage B pumping pipe EQR
 - 6x Stage B pumping jumper EQR
 - 1x Cryostat pumping pipe EQR
 - 1x Injector pumping manifold EQR
 - 1x ISS pumping jumper EQR
- 4x ISS UP vacuum pipes (GJ4HDG_v2)
 - 1x Stage B pumping pipe UP
 - 1x Stage B pumping jumper UP
 - 1x Stage A pumping manifold UP
 - 1x Cryostat pumping pipe UP
 - 1x Cryostat pumping jumper UP
 - 1x ISS pumping jumper UP
- 8x Active pumping dome (DLPLYA_v3)
 - 1x Active dome cap
 - 4x Dome latch
 - 1x Dome stabilizing ring
 - 1x Dome tube
- 8x Non-active pumping dome (DLPXVH_v2)
 - 1x Non-active dome cap
 - 4x Dome latch
 - 1x Dome stabilizing ring
 - 1x Dome tube
- 2x PCSS EQL vacuum pipes (GFW8F7_v1)
 - 1x DTL pumping pipe EQL
 - 1x Gas board pumping manifold EQL
 - 1x ISS pumping pipe EQL
 - 1x Non-active diagnostic pipe EQL
 - 1x Non-active manifold jumper EQ
 - 1x Non-active manifold EQL
 - 1x Non-active SVS pumping pipe1 EQL
 - 1x Non-active SVS pumping pipe2 EQ
 - 1x SVS active pumping pipe EQL
 - 1x Type2 pumping pipe EQL
 - 1x Type2 pumping jumper EQL

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- 1x SVS active branch EQ
- 1x Non active SVS jumper EQL
- 1x Type2 pumping outlet EQL
- 2x PCSS EQR vacuum pipes (GFWB4K_v2)
 - 1x DTL pumping pipe EQR
 - 1x Gas board pumping manifold EQR
 - 1x ISS pumping pipe EQR
 - 1x Non-active diagnostic pipe EQR
 - 1x Non-active manifold jumper EQ
 - 1x Non-active manifold pipe EQR
 - 1x Non-active SVS pumping pipe1 EQR
 - 1x Non-active SVS pumping pipe2 EQ
 - 1x SVS active pumping pipe EQR
 - 1x Type2 pumping pipe EQR
 - 1x SVS active branch EQ
 - 1x Type2 pumping outlet EQR
- 4x PCSS UP vacuum pipes (GG5ERD_v2)
 - 1x DTL pumping pipe UP
 - 1x Gas board pumping manifold UP
 - 1x ISS pumping pipe UP
 - 1x Non-active manifold jumper UP
 - 1x Non-active manifold UP
 - 1x Non-active SVS pumping pipe1 UP
 - 1x Non-active SVS pumping pipe2 UP
 - 1x SVS active pumping pipe UP
 - 1x Type2 pumping pipe1 UP
 - 1x Type2 pumping pipe2 UP
 - 1x SVS active branch UP
- 8x RGA (GF8HGP_v2)
 - 1x RGA vacuum tube
 - 1x Mu metal tube
 - 1x Magnetic shielding
 - 1x Mu metal Orifice
 - 10x CF40 RGA flange
 - 10x KF40 RGA flange

Table 4: Classifications

	Safety class	Quality class	Seismic class	Vacuum class	PED/ESPN class	Tritium class	RH class
Stage B pump. pipe	Non-SIC	QC-2	SC-1 (SF)	VQC-1A	NA	TC 1A	NA
Other Pipes	Non-SIC	QC-3	SC-1 (SF)	VQC-3A	NA	TC 1A	NA
Pumping domes	Non-SIC	QC-3	SC-1 (SF)	VQC-3A	NA	TC 1A	NA
RGA	Non-SIC	QC-3	SC-1 (SF)	VQC-3A	NA	TC 1A	NA

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5.4.2 *Operating requirements*

[DMS.VAC.044] The vacuum components operate in a pressure range between 10^{-6} mbar and 1 bara. A Helium leak test shall be performed by the supplier on all welded sub-components.

5.4.3 *Design requirements*

[DMS.VAC.045] The parts shall be manufactured according to the provided manufacturing drawings.

5.4.4 *Material, welding and fabrication requirements*

[DMS.VAC.046] Flanges from section 5.1 shall be used for this scope. Parts that need to be machine in addition, as well as the pipes shall be 316L(N)-IG.

[DMS.VAC.047] The base material for pipes and fittings shall be made from cross-forged material which is Electro-Slag Remelted (ESR) or Vacuum Arc Remelted (VAR).

[DMS.VAC.048] Material certificate EN 10204 Type 3.1 shall be supplied for all rounds, from which the parts are made.

[DMS.VAC.049] Contents of

- Co < 0.05 wt%
- Nb < 0.01 wt%
- Ta < 0.01 wt%

Shall be demonstrated by certification or by test.

[DMS.VAC.050] Lubricants used during manufacturing shall be chosen in agreement with the vacuum requirements.

[DMS.VAC.051] The finished products shall be cleaned after manufacturing and welding to be free of grease, oils and other contaminants.

[DMS.VAC.052] Surfaces shall be free of discoloration.

[DMS.VAC.053] The fabrication method shall be chosen by the supplier. The welding procedure shall be qualified for the application (WPS, PQR).

[DMS.VAC.054] All welds shall be carried out by a qualified welder (WPQ as per ASME Sec. IX or equivalent).

5.4.5 *Quality Control Provisions*

[DMS.VAC.055] All welds shall be numbered for later PT testing.

[DMS.VAC.056] Visual inspection and dimensional inspection shall be carried out for each complete weld assembly according to the dimensions on the drawings.

5.4.6 *Non-destructive testing*

[DMS.VAC.057] 10% of welds shall be subject to PT testing. PT shall be performed as per CS6 reference, PT personnel shall be qualified as per SNT-TC-1A. Acceptance criteria as per CS6 apply.

[DMS.VAC.058] 10% of welds shall be subject to volumetric inspection, either UT or RT. The selected procedure shall be performed as per CS6 reference, personnel shall be qualified. Acceptance criteria as per CS6 apply.

[DMS.VAC.059] 100% of welds on the VQC-1A pipes shall be subject to volumetric inspection, either UT or RT. The selected procedure shall be performed as per CS6 reference, personnel shall be qualified. Acceptance criteria as per CS6 apply.

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5.4.7 *Marking*

[DMS.VAC.060] An ITER part number (PNI) will be marked on each item. The Contractor shall receive from the IO the catalogued Part Numbers of ITER (PNI) for the scope of supply, prior to the packaging.

Each part shall be legibly identified with following information:

- Manufacturer name or symbol.
- Round number or unique identification number related to material history.
- Grade of material.
- Heat number.
- PNI number.

5.4.8 *Spare Parts*

Left over flanges shall be shipped together with the finished pipe assemblies.

5.4.9 *Packing, preservation & shipping*

[DMS.VAC.061] The sealing surfaces of the flanges must be protected against contamination, scratches and dust.

[DMS.VAC.062] Open connectors shall be plugged with plastic caps to avoid internal contamination with dust. Components shall be wrapped in bubble wrap for shipping.

5.4.10 *Delivery Time*

[DMS.VAC.063] Delivery shall be organized in batches.

Batch 1 (delivery no later than **6** months after contract signature):

- 2x UP ISS vacuum pipes
- 1x UP PCSS vacuum pipes
- 1x Active pumping dome
- 1x Non-active pumping dome
- 1x RGA

Batch 2 (delivery no later than **12** months after contract signature):

- 1x EQL ISS vacuum pipes
- 1x EQL PCSS vacuum pipes
- 1x UP PCSS vacuum pipes
- 2x Active pumping dome
- 2x Non-active pumping dome
- 2x RGA

Batch 3 (delivery no later than **16** months after contract signature):

- 1x UP ISS vacuum pipes
- 1x UP PCSS vacuum pipes
- 1x Active pumping dome
- 1x Non-active pumping dome
- 1x RGA

Batch 4 (delivery no later than **20** months after contract signature):

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- 1x EQL ISS vacuum pipes
- 1x EQL PCSS vacuum pipes
- 2x EQR ISS vacuum pipes
- 2x EQR PCSS vacuum pipes
- 1x UP ISS vacuum pipes
- 1x UP PCSS vacuum pipes
- 4x Active pumping dome
- 4x Non-active pumping dome
- 4x RGA

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5.5 Supply of pipes

5.5.1 Description

Round materials to be supplied:

- 70x pipe: DN40 Sch10, L = 6000 mm
- 15x pipe: DN65 Sch10, L = 6000 mm
- 2x pipe: DN80 Sch10, L = 6000 mm
- 15x pipe: DN125 Sch5, L = 6000 mm
- 15x pipe: DN150 Sch5, L = 2500 mm

Table: Classifications

	Safety class	Quality class	Seismic class	Vacuum class	PED/ESPN class	Tritium class	RH class
DN40 Sch10	Non-PIC	QC-3	SC1 (S)	VQC-3A	NA	TC 1A	NA
DN65 Sch10	Non-PIC	QC-3	SC1 (S)	VQC-3A	NA	TC 1A	NA
DN80 Sch10	Non-PIC	QC-3	SC-2	NA	NA	NA	NA
DN125 Sch5	Non-PIC	QC-3	SC-2	NA	NA	NA	NA
DN150 Sch5	Non-PIC	QC-3	SC-2	NA	NA	NA	NA

5.5.2 Design requirements

[DMS.VAC.064] The tolerances for diameter, length, straightness, ovality shall comply with CS7.

5.5.3 Material, welding and fabrication requirements

[DMS.VAC.065] The material from which the pipes are machined shall be 316L(N)-IG.
 [DMS.VAC.066] Material certificate EN 10204 Type 3.1 shall be supplied for all rounds.
 [DMS.VAC.067] Contents of

- Co < 0.05 wt%
- Nb < 0.01 wt%
- Ta < 0.01 wt%

Shall be demonstrated by certification or by test.

[DMS.VAC.068] The relative magnetic permeability of the finished rounds shall be measured at room temperature after solution annealing. The value measured shall be lower than or equal to 1.03 (for fields of over 80000 A/m (1000 Oe) as per Test method 2 or measured with a low μ permeability indicator as per method 3 of ASTM A342-14. Specimen for testing shall be cut at least one diameter wide into the length of the round and from 0.25*d depth from the radial surface. Measurements of permeability made with other physical methods (e.g. permascope, magnetoscope, etc.) are accepted provided information about type and trademark of apparatus uses and information about calibration.

[DMS.VAC.069] The grain size number as determined in accordance with NF-EN ISO 643:2013 shall be greater than 2. The grain size homogeneity shall be ± 1 around the true average value. The presence of a few grains of index 1 or 0 is tolerated. The amount of

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non-metallic inclusions shall meet standard ASTM E45-13. Macroinclusions are strictly forbidden and are cause of rejection.

The mechanical properties of the pipes are shown in Table 4.

Table 5: Mechanical properties

Test temperature	Tensile Strength, (Rm) min (MPa)	Yield Strength (Rp0.2%) min (MPa)	Elongation A, (5d) min (%)
Room temp.	525-700	220	45
250 °C	415	135	-

[DMS.VAC.070] The properties shall be demonstrated by certificate.

[DMS.VAC.071] Pipes shall be visually examined. Their surfaces shall be plain, uniform and free from wrinkles, buckles, blowholes, tears, cracks and inclusions. If in doubt, a liquid penetrant examination shall be performed.

Criteria:

Indications with one dimension exceeding 1 mm shall be considered as a recordable condition.

The following are acceptable:

- Linear indications of 8 mm or less for pipes DN 40 or less, and of 10 mm or less for rounds more than DN 40.
- As the operating conditions of the pipes could lead to a risk of lamellar tear, the only acceptable indications are those with a cumulative length over the most densely covered meter as follows:
 - Less than 30 mm for pipes up to DN 40.
 - Less than 40 mm for pipes over DN 40.

Two separate indications are considered as one if the distance between them is less than twice the length of the smaller of the two. The length of the indication is then equal to the sum of the length of the two indications plus the distance between them.

If these criteria are not respected, no repair welds shall be authorized and the part is rejected.

However, if there are special and highly localized indications (which can be checked by shear wave ultrasonic examination) this zone can be eliminated by grinding and the plate accepted if its dimensions remain within the acceptable tolerances.

The Supplier may remove surface defects by grinding, providing that:

- The remaining thickness is within the tolerances specified by the drawing or the purchase order.
- The cavity blends smoothly with the surrounding surface.
- After removal, the surface is subject to liquid penetrant examination in accordance with RMC 4000 of RCC-MR 2007.

The following criteria shall be applied for the liquid penetrant examination. An indication greater than 1 mm shall be considered recordable conditions.

The following are unacceptable:

- Linear indications.
- Rounded indications with one dimension greater than 2 mm.

Welding repairs are not permitted.

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5.5.4 *Marking*

[DMS.VAC.072] An ITER part number (PNI) will be marked on each item. The Contractor shall receive from the IO the catalogued Part Numbers of ITER (PNI) for the scope of supply, prior to the packaging.

Each pipe shall be legibly identified with following information:

- Manufacturer name or symbol.
- Round number or unique identification number related to material history.
- Grade of material.
- Heat number.
- PNI number.

5.5.5 *Packing, preservation & shipping*

[DMS.VAC.073] Safety class and quality class shall determine the requirements for packaging, preservation and shipping.

[DMS.VAC.074] Prior to the shipments of the material, the supplier shall ensure that each pipe shall confirm the identification marking with respect to delivery reports/documents to ensure the traceability. The DRR deliverables (Contractor Release Note, Delivery Report, Packing List) shall be approved prior to the delivery, as per GM3S specification Ref [1] (section 10).

5.5.6 *Delivery Time*

[DMS.VAC.075] The maximum expected duration from the contract signature to the supply of the scope of work is **12** months.

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6 Location for Scope of Work Execution

[DMS.VAC.076] The Contractor can perform the work at their own location.

7 IO Documents

7.1 IO Documents:

Under this scope of work, IO will deliver the following documents by the stated date:

Ref	Title	Doc ID	Expected date
1	Manufacturing drawings of vacuum flanges	DA78Z8	
2	Manufacturing drawings of bellows liners	FY3MEM	
3	Manufacturing drawings of injector components	FDCAQ2	
4	Manufacturing drawings of vacuum system	DA766K	

8 List of deliverables

The Supplier shall provide IO with the documents and data required in the application of this technical specification, the GM3S Ref [1] and any other requirement derived from the application of the contract. You can find here below a minimum list of documents, but not limited to, that are required within the expected timing:

Technical Design Family (TDF)	Generic Document Title (GTD)	Further Description	Expected Timing (T0+x) *
Quality plan			T0+1
Manufacturing input	Manufacturing Flow or Assembly Sequence		T0+2
	Manufacturing inspection plan		T0+2
	Manufacturing Instruction or Procedure		T0+2
	Non-destructive Examination Procedure		T0+2
	Manufacturing Process Qualification Report		T0+2
	Factory acceptance test procedure		T0+2
	Training or Qualification Record		T0+2
	Data Sheets		T0+2
Manufacturing Dossier	FAT results		T0+12
	Complete list of critical subcontractors		T0+12
	Certificates conformity		T0+12
	Cleaning report		T0+12
	Material certificates		T0+12
Delivery readiness	Contractor release note		T0+12
	Delivery report		T0+12
	Packing list		T0+12
	Storage & Preservation Requirements Form.		T0+12

(*) T0 = Commencement Date of the contract ; X in weeks.

Supplier shall prepare their document schedule based on the above and using the template available in the GM3S Ref [1] appendix II ([click here to download](#)).

9 Quality Assurance requirements

The Quality class under this contract is [QC-1], [QC-2], [QC-3]. GM3S section 8 applies in line with the defined Quality Class.

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The contractor shall have ISO 9001 certified quality system or QA program approved by QARO.

10 Safety requirements

The scope under this contract covers for PIC and/or PIA and/or PE/NPE components, [1] GM3S section 5.3 applies.

Components classifications can be found in section 5.

11 Specific General Management requirements

Requirement for [1] GM3S section 6 applies in full.

NCR procedure [6] and DR procedure [7] shall be applicable.

11.1 Contract Gates

A Kick-off meeting shall be held to clarify the any open points before start of the project (e.g. material required by the Supplier).

A Manufacturing Readiness Review (MRR) according to [8] shall be held at the latest 4-6 weeks after the KoM. Quality Plan and Manufacturing input shall be delivered for this MRR.

A Delivery Readiness Review (DRR) according to [9] shall be held before shipping. The Manufacturing dossier and the delivery readiness shall be prepared for this DRR.

The supplier shall organize these meetings and produce the Minutes of the Meeting.

11.2 Work Monitoring

Work monitoring is done by regular meetings via videoconference. The supplier shall organize these meetings and produce the Minutes of the Meeting.

Site visit to the supplier premises may be arranged during contract execution.

11.3 Meeting Schedule

Meeting schedule can be set at kick-off meeting.

11.4 CAD design requirements

This contract does not imply CAD activities.

11.5 Delivery location

The delivery location is ITER Organization site, Cadarache, France.