# CLARIFICATIONS

**Clarification Log 1** **Date 24/03/2022**

**Title: Development and Supply of the VVPSS Rupture Disc Assembly**

IO is providing following further clarifications for better understanding on the requirements of the Rupture Disc Assembly (RDA).

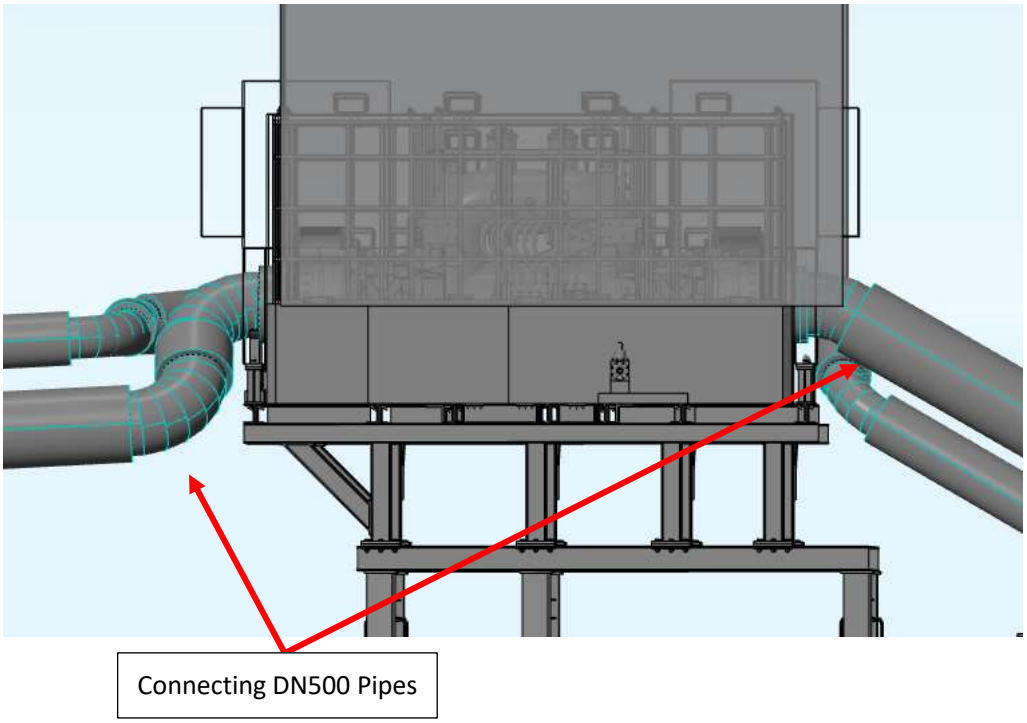
1. IO is providing the 3D model (attached) for better understanding of the system and a visibility. It is a pre-conceptual design. The scope is to develop a preliminary and final design based on this pre-conceptual design.

2. The Rupture Disc Assembly is not pressure equipment, therefore the piping components do not need to be provided by an ASME stamped organization. However, the ITER Vacuum Vessel, which is protected by the rupture disc assembly is pressure equipment (ESPN); hence the rupture discs shall be provided by an organization with demonstrated capability to provide high quality equipment.

3. IO is providing following clarifications on the vacuum flange remote bolting and unbolting requirement as per the technical specifications. IO has developed a design and manufactured a prototype for the vacuum flange bolting / unbolting tool. IO can share the design of this bolting tool to the successful Supplier. The Supplier shall manufacture a suitable tool, in line with the design provided by IO. Some update to the design of the bolting tool may be required to ensure integration with the prototype rupture disc assembly designed by the Supplier. Remote operation of the bolting tool does not need to be demonstrated, but integration of remote tool shall be demonstrated in the 100% scale prototype phase.

4. Regarding the Leak tightness requirement following a remote installation, the supplier has to demonstrate the functionality of the leak tightness manually only and not by remote operation.

5. Clarification on connecting pipes: The “connecting pipes” refers to the VVPSS Relief Pipes, to which the Rupture Disc Assembly is attached upstream and downstream. The connecting pipes are DN500 Schedule 80S pipes. These pipes have defined displacements during normal and accidental operation. These displacements shall be simulated and the leak tightness of the vacuum flanges verified.




6. Special experience requirement such as the Bellows, the Supplier may sub-contract with any organization considered to be of suitable quality. IO prefers a sub-contractor relationship to ensure the responsibility for overall delivery is clearly with the Supplier.

| Query No. | Ref. Clause No. | Reference clause requirements in specification | Description of the query | ITER Response |
|---|---|---|---|---|
| 1 | 4.1.1 | Double Rupture Disc Sub-assembly | The size of Rupture Disc is DN 500. Pl confirm. | Rupture disc to fit with DN500 holder. RD to be provided/designed to fit accordingly |
| 2 | 4.1.1 | Double Rupture Disc Sub-assembly | Please provide recommended make of Rupture Disc. | IO has no specific recommended RD. The Contractor shall identify appropriate RDs in line with the tech spec requirements. |
| 3 | 4.1.2 | Remote handled vacuum flange and double bellow sub assembly | Kindly provide preliminary existing design of bellow compression tool. | The conceptual design of the bellow compression mechanizm is presented on the 3D model of the RDA. |
| 4 | 4.1.2 | Remote handled vacuum flange and double bellow sub assembly | please provide recommended make for vacuum flange. | IO has no specific recommended vacuum flange. The contractor shall identify appropriate vacuum flange supplier |
| 5 | 4.1.2 | Remote handled vacuum flange and double bellow sub assembly | The demonstration of bolting, unbolting has to be done by RH tool? Please confirm.<br>If yes, please be noted that the infrastructure has to be created at the manufacturer's workshop for demonstration of Remote Handling operation. | No.<br>IO has developed a design and manufactured a prototype for the vacuum flange bolting / unbolting tool. IO can share the design of this bolting tool to the successful Supplier. The Supplier shall manufacture a suitable tool, in line with the design provided by IO. Some update to the design of the bolting tool may be required to ensure integration with the prototype rupture disc assembly designed by the Supplier. Remote operation of the bolting tool does not need to be demonstrated, but integration of remote tool shall be demonstrated in the 100% scale prototype phase. |
| 6 | 4.1.2 | Remote handled vacuum flange and double bellow sub assembly | Please share the details about the operation of RH tool and detail of RH tool. | IO has developed a design and manufactured a prototype for the vacuum flange bolting / unbolting tool. IO can share the design of this bolting tool to the successful Supplier. The Supplier shall manufacture a suitable tool, in line with the design provided by IO. Some update to the design of the bolting tool may be required to ensure integration with the prototype rupture disc assembly designed by the Supplier. Remote operation of the bolting tool does not need to be demonstrated, but integration of remote |
| 7 | 4.1.2 | Remote handled vacuum flange and double bellow sub assembly | Any lateral or torsional movement is expected on bellow? | Yes. A document with all loads and movements will be shared at the contract signature stage. |
| 8 | Figure 6 | RDA and Support Frame Dimensions | The bottom frame shown in figure is not in scope of supply. Pl confirm. | The bottom frame is not in the scope of supply. The bottom support frame is not in a scope of supply. The support frame is presented only for information and better understanding how the RDA will be installed later. |

| | | | | |
|---|---|---|---|---|
| 9 | 4.4 | Phase 3 – 100% Scale Prototype Qualification | It is mentioned that all the activities shall be done by remote operation - e.g. leak tightness following remote installation, vacuum flange bolting and unbolting remotely, remote compression of the bellow, Removal of RDA from and replacement of the RDA to the support frame. Please confirm. If yes, please be noted that the infrastructure has to be created at the manufacturer's workshop for demonstration of Remote Handling operation. | No. All mentioned activities can be done by manually that to verify an operability of the RH components in line with the specified requirements. There is no need to create the RH infrastructure on the manufacturer's workshop for demonstration of Remote Handling operation. All operations with the RH components of the RDA shall be done by manually. Bolt tightening torques and torques applied to the bellows compression mechanism shall be controlled. |
| 10 | 6 | Rupture Disc Assembly Description and Specifi | The thermal insulation is not in scope of supply. Pl confirm. | The thermal insulation is not in scope of supply. |
| 11 | 6.2 | Rupture Disc, Holders and Sub-Assembly Requ | Any recommended or existing design of RD holder with hinges arrangement. | IO has no specific recommended RD holder. The Contractor shall identify appropriate holders/ hinges in line with the tech spec requirements. |
| 12 | Figure 7 | Mounting guide rails and circular rack gear | Any recommended model number for bought out item? | IO has no specific recommended bought items. The Contractor shall identify appropriate equipment in line with the tech spec requirements. |
| 13 | Figure 8 | Flange sub-assembly with opposite flange | The counter blind flange is in scope of supply? Pl confirm. | Yes. The counter flanges are in a scope of supply. |
| 14 | 6.3 | Remote Handled Vacuum Flanges | In page 17, it is written that quantity and sizes of the bolts shall be agreed with the seal manufacturer to provide the specified leak tightness. However, in page 19, bolting torque of RH bolts are already provided. We understand this will be detailed out during execution phase and both requirement will be met. | Page 17 refers to the bolts and torques for the vacuum flange. The bolting torque of 185Nm on page 19 is the limit for the RH tool. |
| 15 | 6.3 | Remote Handled Vacuum Flanges | The recommended gasket is helicoflex type. Any specific requirement in terms of halogen free etc.??<br>Any recommended vendor for gasket? | 1. IO recommends a Helicoflex supplied double metallic (silver) jacketed gasket seal for remote handling maintenance. The details of this design will be discussed during the contract execution.<br>2. Halogenated materials, sulphur and phosphorus limits are specified in section 10.1 |
| 16 | 6.4 | Bellow Sub-assembly | The model numbers of bellow are recommended bellows to be used or it is just used for analysis purpose. Pl confirm. | The indicated bellows models are those used in the concenptual design. The contractor shall confirm their suitability with any final design. |

| | | | | |
|---|---|---|---|---|
| 17 | 6.6 | Remote handling mechanism | Can you pl share ITER RH code of practice? | All ITER documents will be delivered to the Contractor after the contract sign using exchage folder. |
| 18 | 9.1 | Stress Analysis | Can you pl share Instructions for structural analysis document and load case specifications document? | All ITER documents will be delivered to the Contractor after the contract sign using exchage folder. |
| 19 | 26.1 | Contract schedule | We propose to use MS project instead of Primavera. Pl confirm. | This is acceptable. |
| 20 | | General | Can you pl share preliminary BOM and conceptual 3D model for estimation purpose. | Conceptual 3D model has been shared. |
| 21 | 10.3 | Material requirement | It is mentioned that piping and fitting shall be seamless. However, it seems difficult to get it for DN 500 seamless pipe and fittings from the market. We propose to consider it as a welded pipe. Please confirm. | Only seamless pipes and fitting shall be used for the RDA. |
| 22 | 10.4 | Low Activation Materials | The requirement for chemical content of cobalt, Niobium and Tantalum is applicable for Bellows and Rupture Discs. Pl confirm. | The requirements for low-activation materials can be deviated for small quantities of specialist equipment such as RDs and bellows. |
| 23 | 5.3 & 24.3 | Components Classification & Audits | Clause 5.3, Rupture Disc - ESPN classification is not applicable. However according to clause 24.3, it is written that IO, ANB and French regulator ( for PIC ) reserves right to conduct announced or unannounced inspection and audits at contractor's premises.<br><br>We understand, there is no ANB/any TPI appointment in the scope of contractor. Please confirm. | Correct, no ANB is required to be involved in the contract. The equipment is not ESPN. |

| Sr. No. | Section | Query / Alternate proposal | ITER Response |
|---|---|---|---|
| 1 | 4.1<br>16 | Do we need to only qualify DN 300 vacuum flange & double bellows? Should we supply them? Please clarify. | No. Vacuum flange and double bellows shall be qualified at DN500. The Contractor shall also develop the Vacuum Flange and Double Bellows Sub-assembly for DN300 scale. The Contractor shall supply DN300 as a design only. |
| 2 | 4.1.2<br>(Figure 4) | What are the parameter / configuration / functionality for DN 300 vacuum flange & double bellows? Is it same as DN 500? | Functionality is same as for DN500 scale. Pressure rates, leak tightness are same. Loads and compensation movements are presented in Report on Stress Analysis of VVPSS Relief Lines and Loads Case Specification VVPSS -RL. All IO's reference documents will be tranfered to the Contractor after contract sign. |
| 3 | 5.4 | Do we need to arrange process fluid mentioned in specification for qualification phase or can we use alternate medium like air or steam? | Contractor shall use steam as the process fluid |
| 4 | 5.5<br>(Figure 6) | We understand that thermal insulation box is out of scope for RDA. Is our understanding correct? Do we need to replicate RDA thermal insulation box with support frame of lesser height or can we design our own arrangement with simulating constraints of thermal insulation box? Will drawings of thermal insulation box be shared with us for this purpose? | The RDA thermal insulation box is out of scope of supply.<br>It is anticipated that a suitable thermal insulation enclosure will be required to execute all specified tests. |
| 5 | 5.5<br>(Figure 6) | Can we use ferritic steel for thermal insulation box with proper painting and keeping RDA mating surface SS avoiding contamination of RDA? | The RDA thermal insulation box is out of scope of supply.<br>Testing thermal enclosure may be any appropriate material.<br>No carbon steel contamination shall be present on Final RDA. |
| 6 | 6 | Will SVS capillaries be terminated on distributer plate attached to RDA body? Will further line from distributer plate be designed and procured by ITER? Do we need to design attachment to RH system for remote connection & disconnection of fittings on distributor plate or will be designed & procured by ITER? | Yes. SVS capillaries shall be terminated on distributer plate attached to RDA body by the weld. The SVS connectors shall be installed and fixed on the plate how it presented on Figure 5 of the TS and on 3D model. The capillaries and SVS connectors are part of the RDA. The further lines which will be located above SVS connectors are out of scope of supply. |
| 7 | 6.3<br>(Figure 8) | We understand that opposite flange with 200mm pipe extension closed with blind flange is required during qualification, transportation & storage. Is our understanding correct? | The counter flanges with 200mm pipe extension closed with blind flange are only required for final RDA.<br>During testing and qualification the contractor shall decide what interface is required. |
| 8 | 6.6 | We could identify following interfaces between RDA & RH tool.<br>1. Mechanism for Bellow Compression<br>2. Disassembly of Bellow from pipework<br>3. Disassembly of RDA from Support Frame<br>4. Interface of RH tool with lifting frame<br>Is there any other interface planned by IO? Can we have drawings / schematic of RH tool portion which will have interface with RDA? We understand that we need to design only interface and RH tool will be provided by ITER in NB cell. Is it correct? | It is correct that IO will provide RH tools.<br>Interfaces are correctly identified.<br>Where additional RH interfaces are identified, the Contractor will be notified during the design stage. |
| 9 | 7.1 | We understand following test frequency will be applicable for Rupture Disc Subassembly (RDSA).<br>1. HLT - leak test on one disc at RT & baking temperature<br>2. Baking testing - on one disc<br>3. Burst testing - on three discs<br>4. Back pressure resistance testing - on one disc<br>Sr. no. 1, 2 & 4 shall be conducted on one disc. Sr. no. 3 shall be conducted on one disc used in previous three tests and two more discs will be taken. All discs will be subjected to conditions specified in para 7.1 prior to testing. | The following test with the RD Sub-Assembly shall be executed:<br>1. Three times of the burst pressure at Normal Environmental Conditions (Sec. 14.1) and 14.2 Normal Operational Conditions (Sec. 14.2) at 100°C ±10°C that to demonstrate a reproducibility of the burst pressure with specified tolerance.<br>2. Baking testing+leak test+burst test<br>3. Pressure cycling+leak test+burst test<br>4. Seismic test+leak test+burst test |

| | | | |
|---|---|---|---|
| 10 | 7.1.2 | Specification only mentions heating & cooling of RDSA in Baking Testing. No acceptance criteria specified. We presume that if test sr. no. 2 of above query is conducted first and remaining tests of above query are done in order of Sr. no. 1, 4 & 3, it will meet specification requirement. Please confirm. All discs will be subjected to conditions specified in para 7.1 prior to testing. Kindly confirm. | Acceptance criteria is the specified leak rate after each testing: baking, pressure cycling, seismic shaking and burst pressure.<br>The following test with the RD Sub-Assembly shall be executed:<br>1. Three times of the burst pressure at Normal Environmental Conditions (Sec. 14.1) and 14.2 Normal Operational Conditions (Sec. 14.2) at 100°C ±10°C that to demonstrate a reproducibility of the burst pressure with specified tolerance.<br>2. Baking testing+leak test+burst test<br>3. Pressure cycling+leak test+burst test<br>4. Seismic test+leak test+burst test |
| 11 | 7.2 | Acceptance criteria are not clearly specified for Bellow Testing. We presume that leak testing is required to be carried out after Vacuum Flange & Bellow Subassembly is subjected to conditions specified in the para 7.2. One Vacuum Flange & Bellow Subassembly is required to be tested. Kindly confirm. | The understand is correct. |
| 12 | 7.4 | Clarity required for activity to be done & acceptance criteria for "Establishing operating and baking temperatures". Please provide. | The final RDA shall be heated to normal operating and to baking temperature |
| 13 | 14.1 | Do we need to create magnetic field & radiation environment as per specification during prototype testing & qualification process? Please confirm. | There are no requirements concerning a qualification of the RDA for magnetic field & radiation conditions. |
| 14 | 7.1<br>14.2 | It is understood from both the sections that temperature during baking is 200° C. | Yes. The baking temperature is 200°C. |
| 15 | 15.1 | Kindly provide list of applicable standards for qualification of PIC component if they are other than RCC-M Volume Q and IEC 60068-3-3. | IO has specified all applicable standards. Additionally IO gives the reference to ITER Equipment Qualification Program. The objective of the Equipment Qualification is to plan, perform, provide evidence (document) and maintain (preserve) the capability of Protection Important Component (PIC) to perform the required safety function(s) without experiencing common-cause failure during<br>normal, incidental and accidental conditions. |
| 16 | 17 | Is submission of Hard Copy mandatory? Do we need to submit original documents or copies if hard copy submission is mandatory? | No. All documentation shall be submitted on IDM. |
| 17 | 17.1 | We presume that specific design characteristics listed in specification are not applicable for RDA assembly. | Section 17.1 shall be fullfilled in totality. |
| 18 | 18.2 | What height to be considered for accidental drop of RDA assembly to decide shock absorbing material? | The packaging of the RDA shall ensure no accelerations greater than 3g are applied to the equipment |

1. **Clarification:** We would like to know if the double sealing ring had been successfully developed by the Helicoflex company. Can we procure it directly without any development work?

   **Answer:** The development of the double sealing ring has been completed. You may directly communicate with the manufacturers (Helicoflex and Technetics) to clarify any questions.

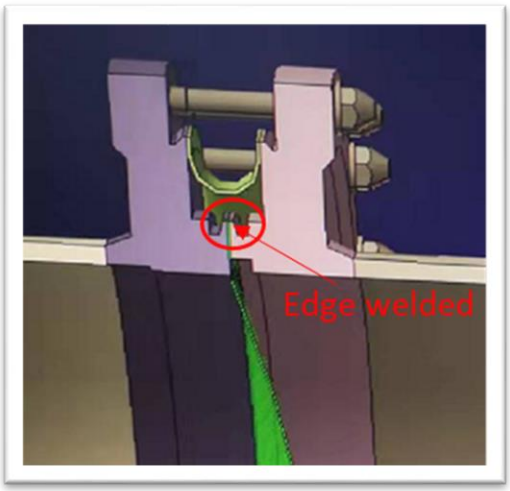
2. **Clarification:** Basically silver is limited to be applied on ITER, especially for the components related to the primary vacuum. From the TA, it seems that the double sealing ring with silver coating is accepted by ITER, could you please confirm it?

   **Answer:** IO confirms that the double sealing ring with silver coating is acceptable

3. **Clarification:** In the current design, it seems that the RD "holder" is the assembly of the two flanges. It is difficult to be assembled and disassembled. Could you please provide us more details about this point?

   **Answer:** The holder is a specific piece of equipment that is designed to clamp the rupture disc into the assembly. IO anticipates that in order to achieve the leak-tightness requirements, the edges of the holder and disc will require to be welded. See below:

   This edge, which is to be welded, shall be sufficiently large to enable 3 times




   welding a new rupture disc before the holder needs to be replaced.

   If the contractor can achieve the leak tightness requirements without welding, then this would be acceptable to IO and an advantage.

   A secondary enclosure is then formed by an outer seal, creating a small enclosure that can be monitored for leaks.

# Clarification Log-5

(i) **Clarification:** In the load specification, it is required that the upstream of the VVPSS shall be baked based on electrical heating. On the RDA 3D model, there is no information of such heating technique indicated. Could you inform us the detailed information about this point please? For baking tests of the RDA subassembly, 100% prototype and the final RDA, what kind of heating methods do ITER prefer?

**Answer:** The IO technical specification does not specify a kind of normal heating or baking heating method. The Contractor shall propose a system that is capable of achieving the temperature requirements (100°C normal operation, 200°C baking). The 100% prototype shall be heated by the proposed system, and not an external heating system, as part of the equipment development and testing is the demonstration of the normal heating and baking capability. External heating in a tank would be suitable for the sub-assemblies.

(ii) **Clarification:** In TS section 7.1 and 7.2, it states that “Following SL3 seismic shaking at normal environmental and operational conditions”. We would like to confirm if the seismic tests shall be performed with vacuum condition and temperature condition （100 degree）. It should be not convenient to do so. Could we do the seismic test under room environment and room temperature?

**Answer:** The seismic test of the 100% RDA prototype can be executed under room environment conditions and room temperature.

(iii) **Clarification:** In TS section 4.4, it states that “Structural integrity and leak tightness of the RDA following seismic loading on a shaker table”. However, in 7.3, the seismic test is not required to perform with the 100% RDA prototype. We would like to know if the seismic test of the 100% RDA prototype need be performed in phase 3, please confirm.

**Answer:** IO specifies the seismic test as a part of the qualification testing in section 15.1. The seismic test of the 100% RDA prototype is mandatory requirement for the equipment qualification.

(iv) **Clarification:** The bursting tests of the RD sub-assembly in phase 1 and the bursting tests of the 100% RDA prototype in phase 3 shall use steam as the working gas.
Could you please confirm it?
**Answer:** Contractor shall use steam as the process fluid.

(v) **Clarification:** In chapter 8 in TS, the inlet parameters of the steam were presented in Table 3. In the table the mass flow is 15 kg/s, the velocity is 150 m/s.
This is only for the bursting test of the 100% RDA prototype, is it right?
For the bursting tests, do we need to fully mimic the mass flow of the steam? 15 kg/s is a large value for tests.
**Answer:** It is not necessary to generate a flow rate of 15 kg/s for the burst tests, however, sufficient volume upstream of the RDA shall be included in the test rig to ensure that the bursting performance is not affected by the test rig. 15kg/s shall be used for the demonstration of pressure loss through the 100% prototype RDA.

(vi) **Clarification:** In section 7.1.3 in TS，“The pressure of the primary vacuum side of the RD Sub assembly will be gradually increased until the rupture discs open”
This is only for the bursting test of the RD sub-assembly, could you please confirm?
**Answer:** A bursting demonstration is also required for the 100% Prototype RDA. IO expects that the pressure will be gradually increased to the bursting point to reflect the real operational conditions.

(vii) **Clarification:** In section 4.1 of the TS, “the development of the Vacuum Flange and Double Bellows Subassembly shall be done at both DN300 and DN500 scale.”In 22, “Successful demonstration of the DN300 Vacuum Flange and Bellows Sub-Assembly to meet all performance requirements”.
Do we need to manufacture at least one DN300 vacuum flange and bellows sub-assembly for tests?
**Answer:** Correct. Vacuum flange and double bellows sub-assembly shall be demonstrated at both DN300 and DN500 scale.

**Clarification Log 6** **Date 28/04/2022**

**Title: Development and Supply of the VVPSS Rupture Disc Assembly**

**Question:**

- Can IO provide bill of material for the components need to supply in TA? This will be helpful to get quotations from the supplier.

**IO Answer:**

- IO does not provide Bill of Material for this Task Agreement. The BoM is developed with the detailed design, which the winner of this TA will perform. The BoM is also developed and approved at the final design. However, tentative BoM to submit the price can be concluded from the detailed Technical Specifications and the scope defined.

1. Helium Leak Testing has been further clarified. Helium leak testing shall be done using vacuum methods and is expected to be performed without the use of an external vacuum chamber. Helium testing shall be performed at ambient temperature and also at operating temperature, but is not required to be performed at baking temperature. This change should enable the use of the relatively simple approach to apply vacuum inside the component, and use a bag containing helium outside the component (Method A1 as per ISO 20485:2017).

2. A new section on the prototype heating system has been added. This section defines the requirements and expectations of the system that maintains the RDA at operating and baking temperatures. All heating of the components for leak testing is expected to be performed using this heating system, further negating the need for an external chamber with heating system.

3. Pressure loss assessment shall be undertaken using analysis only. The relevant sections have been clarified to remove the need for a physical demonstration of the pressure loss through the system. The input to this analysis will be inspection of the rupture discs following bursting testing.

4. Burst testing shall be performed with air. No steam is required for physical testing of the components, simplifying the equipment necessary for qualification activities.

5. Details of the remotely-handled components have been added throughout the specification. The IO has undertaken a number of development activities to manufacture and test remotely-handled components. The details of these components and reference documentation is now included in the specification to remove the need for the contractor to develop these components.

In addition, the IO have further developed the preliminary Rupture Disc Assembly model to reduce the quantity of design development necessary by the contractor. The technical specification is based upon a preliminary model that includes a number of custom piping components that would be challenging to manufacture. The pipework components of the RDA model have been standardized to a greater degree, limiting the non-standard components to a pair of wye-pieces. The RDA model has been generally improved to incorporate details of mechanical equipment already developed by IO contracts.

| ITER-India | Title: Development and Supply of the VVPSS Rupture Disc Assembly | GeM Bid No. |
|---|---|---|
| | | GEM/2023/B/3744658 |

## Pre-bid Clarifications to the bidders (GEM/2023/B/3744658)

| Sr No. | Document no. | Clause | Requirement | Query | Reply |
|---|---|---|---|---|---|
| 1 | 3DXML CAD model 7YJQ93 | -- | Sliding support, gear box & its mechanism | We understand that theses components are not in scope of supply. | Understanding is correct |
| 2 | 3DXML CAD model 7YJQ93 | | Actuation system +Twist lock arrangement along with universal linkage | We understand this arrangement is in scope of supply, pls confirm and provide details of the arrangement like model numbers, specifications, electronic or pneumatic actuation, etc. | Not in Scope |
| 3 | 3DXML CAD model 7YJQ93 | | SVS assembly including tubing's, connectors, bends and manifold | All details of the SVS system is not shown in the model. Request to provide further details to cover it in scope of work. | Length of tubes can be identified from 3dxml model. Details will be shared at the time of KoM |
| 4 | 3DXML CAD model 7YJQ93 | | Pop up bolts, springs, flange washers, etc. at Vacuum flange for bolt retainer plate | Please provide dimensional standards and material of construction for fasteners. | Material Shall be austenitic steel as per Section 10.3 |
| 5 | 3DXML CAD model 7YJQ93 | | inserts and Fasteners for rupture disc assembly | Please provide dimensional standards and material of construction for fasteners. | Material Shall be austenitic steel as per Section 10.3 |
| 6 | 3DXML CAD model 7YJQ93 | | Acceptance of high strength bolting materials for Vacuum flanges | SA- 453 Gr. 660 class 1 fasteners for vacuum flanges is acceptable instead of SA-193 Gr. B8, pls confirm | Technical Specification shall be followed. |

| | | | | | |
|---|---|---|---|---|---|
| 7 | 3DXML CAD model 7YJQ93 | | RH Lifting interfaces shown in the CAD model | We understand that the interfaces can be made from high thickness plats and not mandatory to be forging. Pls confirm<br>Also provide details of the fasteners for attachment of interfaces | Understanding is correct. Will provide at the time of KoM |
| 8 | 3DXML CAD model 7YJQ93 | | Lifting frame shown in CAD model | Hollow box sections are shown with dimensions 120 x 80, however thicknesses are not specified. Pls provide thickness detail. | Section can be modified respecting interfaces |
| 9 | 3DXML CAD model 7YJQ93 | | Bellow assembly interface with DN500 Vacuum flange side pipe | Junction of bellow assembly with the pipe is showing some hole locations. We understand that the bellow assembly is to be welded with the pipe and the bolt hole locations are to be ignored. Pls confirm | Holes cannot be ignored. |
| 10 | 3DXML CAD model 7YJQ93 | | Remote handling tool attachments for RDA not shown | Please provide details of the remote handling tool interface with RDA. | Refer Section 6.6 |
| 11 | 3DXML CAD model 7YJQ93 | | L channels for mounting of the guide rails and pinion | L-channels can be made from plates by welding and shall be fillet welded with pipes. Pls confirm | Structural Integrity shall be demonstrated |
| 12 | Technical specification of VVPSS RDA | Clause 4.2 on page 14 of 80 | Demonstrate the integration of the prototype RDA into the NBC environment | We understand that this assembly is to be shown virtually (in CAD model) for RDA assembly with the adjacent assemblies in NBC. Pls confirm. | Understanding in correct |
| 13 | Technical specification of VVPSS RDA | Clause 5.1 page 16 of 80<br>Clause 5.4 on page 18 of 80 | Clause 5.4 specifies tolerances of +/-7 KPa for the differential burst pressure of the primary and secondary RD. whereas in clause 5.1 tolerance on burst pressure is mentioned as +/- 5%. | Please confirm which one is to be followed. | Tolerance +/- 7 KPa as this is design parameter |

| | | | | | |
|---|---|---|---|---|---|
| 14 | | Clause 5.4 on Page 18 of 80 | Molecular weight and heat capacity | Please provide molecular weight and heat capacity of the process fluid mentioned in clause 5.4 | This will be provided before start of Analysis, although it is clarified in Annexure_Part_A_II_Technical_Clarifications that prototyping can be done with air |
| 15 | Technical specification of VVPSS RDA | Clause 6.3 on page 25 of 80 | The open flange ends will be closed by insertion of confinement plugs by remote handled confinement tool. | The plugs are not in scope of supply, pls confirm. | No. Not for supply but required for testing. |
| 16 | Technical specification of VVPSS RDA | Clause 6.3 on page 24 of 80 | Counter blind flanges are shown which are to be supplied and used for testing also | All flanges of RDA shall be forged however the counter mating flange and blind flange can be made from high thickness plate. Pls confirm | YES. |
| 17 | Technical specification of VVPSS RDA | Clause 6.5 on page 27 of 80 | Heating systems for baking and temperature elevation | Heating system is not in scope of supply, pls confirm. | Heating System is for testing. Not a scope of supply |
| 18 | Technical specification of VVPSS RDA | Clause 10.4 on page 38 of 80 | Controlled chemistry for lower activation materials specified | We propose to procure standard material of SS304L or 304 or dual marked material for all phases of this project. | Technical specification shall follow, Refer Annexure_Part_A_II_Technical_Clarifications Clarifications. |
| 19 | | | | Standard grade fasteners will be procured meeting basic material specification as mentioned in tender requirement. | Refer Section 10.3 |
| 20 | | | | Available Plates of Cryostat as per material specification 7NT9NS can be used in Phase-5. pls confirm | If material is complied to technical specification, Supplier can submit the material specifications for approval for new or procured material |
| 21 | | | | The controlled chemical composition is not applicable to the welding material and only Cobalt content to be reported. Pls confirm. | Ok |

| | | | | | |
|---|---|---|---|---|---|
| 22 | Technical specification of VVPSS RDA | Clause 11.2. on page 42 of 80 | All wetted surfaces of the RDA (internal surfaces of the assembly) and sub-assembly shall be polished to a surface roughness (Ra) of less than 1.6µm. | This requirement calls for procurement of Shell forging followed by its machining to achieve required surface finish. Pls confirm. We propose to procure the pipes with the surface finish which is practically feasible as per standard mill manufacturing process. | Technical requirements need to be met. |
| 23 | Technical specification of VVPSS RDA | | g' for corresponding Pressure values are not specified | Wherever, 'g' not specified those pressure values are absolute. Pls confirm | Yes |
| 24 | Technical specification of VVPSS RDA | -- | RD membrane direction | We understand that there is no restriction on RD membrane direction. Both reverse acting or forward acting are acceptable for the primary as well as secondary RD. Pls confirm | Yes. Technical requirements need to be met. Refer Reference 56 for details |
| 25 | Technical specification of VVPSS RDA | -- | Manufacturing and testing environment | We understand that all testing's are to be performed in normal manufacturing shop environment without controlled conditions. pls confirm | For testing there is no specific requirement of simulating NB cell environment |
| 26 | Technical specification of VVPSS RDA | Clause 4.1.1 (Page 12 of 80) | Detailed design & manufacturing of the assembly. | Drawing and test procedures will be provided. | Supplier to develop drawings and procedures and submit for I-I/IO approval |

| | | | | | |
|---|---|---|---|---|---|
| 27 | Technical specification of VVPSS RDA | Clause 6.2 (Page 21 & 22 of 80) | Stainless steel material of the seal shall be suggested. Category M fluid service and assembly where rupture disc is installed is designed as per ASEM B31.3 | i. No seal required welded rupture disc assembly (rupture disc welded to the holder) offered to fulfil leak tightness requirements. Fabrication and testing as per ASME guidelines, certification acc. to factory burst certificate. Pressure < 15psi g.<br><br>ii. Kindly note that for burst pressures of up to 1 bar-g, we can offer RD which can be installed directly between the flanges and would not require a holder. Kindly confirm if the same is acceptable. | i) Ok<br>ii) Technical requirements shall be met current requirements are with holders |
| 28 | Technical specification of VVPSS RDA | Clause 6.2 (Page 21 & 22 of 80) | Each rupture shall not have an area of opening less than 80% following bursting. The rupture disc shall not fragment, or a fragment catcher shall be included | With the given information and the low burst pressure an opening area of 80% can't be guaranteed at this project stage. Disc could be possible fragmenting a protection grid to catch the fragments can be installed in this case. Opening area always depending on volume, pressure and opening dynamic. | Technical requirements need to be met. Refer Reference 56 for previous R&D done. |
| 29 | Technical specification of VVPSS RDA | Clause 6.2 (Page 22 of 80) | Provisions shall be made in order to design the RD holders in such a way that it must be impossible to install the discs and holders in the wrong position. | Arrows indicate the flow direction on the rupture disc holder which shall prevent the incorrect installation. | Ok. |

| | | | | | |
|---|---|---|---|---|---|
| 30 | Technical specification of VVPSS RDA | Clause 6.2 (Page 22 of 80) | Each RD holder shall be designed for multiple replacements of the RDs. The holder's design shall provide at least three times an assembling/disassembling of the RD holder, including any welding or cutting of the RD seal. | Rupture disc and holder are welded to each other. Disc and holder can't be disassembled. Disassembling could be possibly damaging the rupture disc membrane and influence the burst pressure as well as the leak tightness in a way that the requirements aren't fulfilled anymore, and the rupture disc isn't reliable anymore. | Note. Technical requirements need to be met, although proposal of welding RD on Holder for multiple replacements can be discussed and proposal shall be submitted for I-I/IO approval |
| 31 | Technical specification of VVPSS RDA | Clause 6.4 (Page 26 of 80) | The bellows shall be designed and manufactured in accordance with ASME B31.3 process piping code /EJMA/ASME Sec VIII Div. 1 process piping code [7]. | We understand that RCC-M requirements are not applicable and bellows are to be manufactured as per ASME B31.3 process piping code /EJMA/ASME Sec VIII Div. 1 only. | Yes |
| 32 | Technical specification of VVPSS RDA | Clause 6.4 (Page 26 of 80) | Generic | i. We believe there must a strict requirements of Destructive Testing's (please provide details along with numbers of expansion bellows to be tested).<br>ii. Details are required for non-destructive test (with reference to specific code & standards).<br>iii. Please provide bellows design parameters as per Annexure-I (attached in this file, next sheet)<br>iv. Is there any vent or drain connection required between inner or outer bellows?<br>v. Connections for the Outer Bellows are to be detailed.<br>vi. Pls specify the no. of cycles for which bellows needs to be qualified for fatigue life cycle test. | i) Shall be proposed by supplier ii) As per Technical Specs.iii) Refer Reference 20 and Section 5.4 of Technical Specification iv) SVS connection required v) As per standard practice/Provided in 3Dxml model vi) Refer reference 52 |

| | | | | | |
|---|---|---|---|---|---|
| 33 | Technical specification of VVPSS RDA | Clause 7.1 (Page 29 of 80) | iii. Structural integrity and leak tightness after subjecting the assembly to following conditions:<br>• Normal environmental and operational conditions<br>• Normal environmental and baking conditions<br>• Following SL3 seismic shaking at normal environmental and operational conditions<br>• Following an appropriate number (preliminary 20) of thermal cycles from ambient temperature (below 40°C) to baking temp (200°C)<br>• Following an appropriate number (preliminary 20) of pressure cycles from vacuum (below 10 Pa) to atmospheric (100 kPa) pressure<br>• Following repeated displacement of the vacuum flange to the maximum displacements and loading to the maximum interface forces and moments. | Normal environmental conditions: Gamma equivalent and magnetic field can't be applied with current test facilities.<br>Please provide SL3 characteristic for seismic test.<br>Pressure resistance testing: 1 bar g back pressure will be applied instead of vacuum in front of the disc.<br>Please provide more detailed information to understand the test set-up. Test at this point not possible with current test facilities. | i) Ok<br>ii) Refer Section 28 of technical specifications<br>iii) Differential pressure shall be respected<br>iv) Refer Reference 56 for previously tested RDs |
| 34 | Technical specification of VVPSS RDA | Clause 7.1.1 (Page 30 of 80) | The leak test shall be successful when a leak-rate of less than or equal to 1x10-10 Pa.m³/s is demonstrated. | Leakage rate of 1x10^-9 mbar/Lbs tested with helium leakage test can be confirmed. (1,0×10^-9 mbar·l/s = 1,0×10^-10 Pa·m³/s) | Section 7.4.3 of Technical specification shall be followed |

| | | | | | |
|---|---|---|---|---|---|
| 35 | Technical specification of VVPSS RDA | Clause 7.1.2 (Page 30 of 80) | The ITER machine required to withstand 500 baking cycles from the commissioning phase to the end of life of ITER. | Baking test with 500 baking cycles not possible with the available test equipment. Max. 5- 20 cycles realizable.<br>Duration of the 500 baking cycles would be more than one year with the currently available test equipment. | Requirements of Section 7.1.2 need to be followed. |
| 36 | Technical specification of VVPSS RDA | Clause 7.1.3 (Page 30 & 31 of 80) | Burst testing | i. The burst pressure for the primary RD has been considered as 110 kPa @ 100 deg C and that of the secondary RD as 92 kPa @ 100 deg C. This is to inform you that the RD manufacturing is done based on a specific burst pressure value only and burst pressure cannot be specified as a range. Kindly confirm that the above values are correct.<br><br>ii. Each rupture disc will be tested in style of ASME separately at ambient temperature and at specified burst temperature. The assembly can be tested as “double disc assembly” only at ambient temperature. The burst pressure of each disc can be recorded with a pressure gauge.<br>Special sensors to record “Pressure temperature and acceleration parameters shall be recorded throughout the burst test with instrument sensitivity to record high speed phenomena” are not available.<br>Please explain in which way you want to asses the length of the interspace between the primary and secondary disc shall be to mitigate an impact of the downstream volume on the dynamic of the secondary Disc bursting and back wave.<br>iii. Petal positions means the shape of the bursting disc segments after bursting. | i) Technical requirements need to be met.<br>-Burst differential pressure of the secondary RD*: 50 - 92 kPa ±7kPa<br>*The Secondary RD shall have a forward direction burst pressure of as low as possible given the requirement for a 100kPa back-pressure resistance. A vacuum guard could enable this requirement to be met, but the use of a guard is permitted only with the demonstration that the overall flow requirement can be met.<br>-Back-pressure minimum resistance of the RDs**: 100kPa<br>**The back-pressure resistance shall take into account the manufacturing tolerance of the RDs, a RD at the minimum value in the bursting range shall also resist the specified back-pressure.<br>ii) Length of interspace is already specified in Tech Specs. Requirements regarding instrumentation of sufficient sensitivity to record the high-speed phenomena shall be met.<br>iii) Yes and no fragments should be detached.<br>iv) Technical requirements need to be met. |

| | | | | | |
|---|---|---|---|---|---|
| | | | | Please confirm.<br><br>iv. Please note that as per ASME Sec. VIII, for burst pressures lower than 30 psi (206.84 kPa), the burst tolerance has been specified as 2 psi (13.79 kPa). This translates to approximately 12.6% burst tolerance for the primary RD and 15% burst tolerance for the secondary RD. | |
| 37 | Technical specification of VVPSS RDA | Clause 7.1.4 (Page 31 of 80) | Back-pressure Resistance Testing | Back pressure to be defined. Second disc back pressure 10kPa differential pressure or vacuum conditions behind the disc. Please clarify. | Refer Section 5.4 for principal design parameters |
| 38 | Technical specification of VVPSS RDA | Clause 10.3 (Page 38 of 80) | The RD stainless steel material shall be suggested by the Contractor and submitted to IO for review and approval. | We propose SS304/SS304L/SS316/SS316L for rupture disc & its holder with standard chemical composition & mechanical properties. | Supplier has to propose RD and Holder Material and approval by I-I/IO, Refer Clarifications |
| 39 | Technical specification of VVPSS RDA | Clause 13 (Page 44 of 80) | NDE Examination<br>Full penetration welds shall be subjected to 100% volumetric examination and 100% visual examination as per Vacuum Handbook (IDM ID 2EZ9UM). | Please provide information which requirements have to be fulfilled acc. to Vacuum Handbook (IDM ID 2EZ9UM). | Vacuum Handbook is already provided. |
| 40 | Technical specification of VVPSS RDA | Clause 14.2 (Page 45 of 80) | Normal Operational Conditions | i. Bursting pressure equal to operating pressure is not possible. Bursting pressure must be defined at specific burst temperature. Interspace between primary and secondary disc must be monitored, kept pressure less or both.<br><br>ii. Downstream secondary rupture disc: Is 10KPa a differential pressure back pressure or are there vacuum conditions behind the second disc, please clarify.<br><br>iii. Due to burst tolerances rupture disc can open during normal operation. A operation | Refer Section 5.4 v) Not required |

| | | | | | |
|---|---|---|---|---|---|
| | | | | ratio (Operating pressure divided by burst pressure) of minimum 80-90% is needed. Temperature has an influence on the specific burst pressure. Pressure in interspace does have an influence on burst pressure of first Rupture disc and must be considered. The pressure behind the second disc does have an influence on its burst pressure.<br><br>iv. The operating pressure has been considered as vacuum for the primary RD and that for secondary RD as atmospheric pressure. Also, the overpressure source is upstream of the primary RD only and the rupture of the discs has to be designed accordingly. Kindly confirm.<br><br>v. Does the RD require a Tell-Tale indicator or a signalling cable arrangement which will intimate if the RD is burst or not? | |
| 41 | Technical specification of VVPSS RDA | Clause 14.3 (Page 45 of 80) | Accidental Environmental Conditions | When does these conditions appear? After bursting? Please explain. | These are external conditions in NB cell |
| 42 | Technical specification of VVPSS RDA | 10.1 (Page 37 of 80) | The Contractor shall provide Inspection certificates Type 3.1 or Type 3.2, in accordance with EN 10204 [11]. The certificate shall include the information defined by EN 10168 [12]. | We understand welding filler material shall be procured with 3.1 certification in line with EN 10204. Kindly confirm. | Filler Material is accepted with Type 3.1 in line with EN 10204 if supplier is ISO 9001 certified |

| | | | | | |
|---|---|---|---|---|---|
| 43 | Technical specification of VVPSS RDA | 11.1.1 (Page 40 of 80) | The filler shall be qualified according to the approved weld procedure specification (WPS) and approved by IO Welding Quality Control engineer. Filler metals and auxiliary materials shall comply with Section 328.3 of ASME B31.3 [7] and approve with the IO/ITER-India. | We understand welding filler material shall be procured inline with Section 328.3 of ASME B31.3 [7] requirements referring ASME Sec II-C requirements. Test certificate with 3.1 certification will be submitted to IO for approval. Kindly confirm.<br><br>Additionally, please confirm IO approval is not required for filler metals Test Certificate to be used for the Prototype fabrication. Supplier Welding engg. will approve the Test Certificate. | 1) Ok.<br>2) IO approval is required for all filler metal test certificates including prototype fabrication |
| 44 | Technical specification of VVPSS RDA | 11.1 (Page 39 of 80) | The welding procedures and welders' examinations for the RD, RD's holders and flanges shall be qualified in accordance with code requirements of the project. | <u>Please confirm following understanding for Final RDA manufacturing.</u><br>1. For Vacuum boundary welds - WPS, PQR, Welder or welding operator shall meet the requirements of Section 7 of ITER Vacuum Handbook.<br>2. For all other welds - WPS, PQR, Welder or welding operator shall meet the requirements of ASME Sec IX. Ed.2019.<br><br>For both the above cases, previously qualified WPS, PQR, welders or operators can be used without repeat qualification or additional testing.<br><br><u>For Prototype RDA manufacturing, please</u> | 1) OK<br>2)OK<br>Ok if meeting technical specifications and code requirements are complied and need to be submitted for approval |
| 45 | Technical specification of VVPSS RDA | 11.1.3 (Page 40 of 80) | The welding processes for use on vacuum sealing welds shall be compliant for VQC-1A with the ITER Vacuum Handbook [18]. For VQC-1A the boundary to air full penetration welds are required in accordance with Section 7 of ITER Vacuum Handbook [18]. | | |

| | | | | | |
|---|---|---|---|---|---|
| 46 | Technical specification of VVPSS RDA | 11.1.5 (Page 41 of 80) | In order for a WPS to be qualified, conformance with all of the applicable requirements of the relevant part of ASME Section IX [7] is required for each type of joint, including the welding type, base metal type, filler material type, main WPS parameter, the fillet weld size and distance, etc. | <u>confirm following understanding:</u><br>Supplier approved WPS, PQR, Welder & Operator will be used for prototype fabrication. Kindly confirm. | Can be used for Phase 1 and phase 2 with approval |
| 47 | Technical specification of VVPSS RDA | 13.4 (Page 44 of 80) | Radiographic examination shall be in accordance with ASME BVP Code Section V Article 2 [4]. Radiography shall be performed after final post weld heat treatment. | We understand, stainless steel 304L is exempted from PWHT as per ASME Section VIII Div.1 so necessary RT will be done after complete weld. Kindly confirm. | Understanding is correct |
| 48 | Technical specification of VVPSS RDA | 13.1. Examination Personnel (Page 44 of 80) | Examination personnel shall be qualified and certified in accordance with Section 342 of ASME B31.3 [7] and/or ISO 9712 - Non-destructive Testing - Qualification and Certification of NDT Personnel [14]. | NDE Personnel qualified and certified in accordance with ASNT SNT-TC-1A (as mentioned in ASME B31.3) & Supplier WRITTEN PRACTICE. Please confirm. | Noted. Need to be submitted for approval. |
| 49 | Technical specification of VVPSS RDA | 7.1.1 | Leak testing is not required at baking temperature, but shall be performed following thermal cycling to baking temperature. | HLT to be perform at 2 Temperature one at ambient and one at operational temperature. Any other temperature is required or not? | No |
| 50 | Technical specification of VVPSS RDA | 7.1.1 | Helium leak testing at Operational temperature. _ Thermal insulation may be used around the equipment to protect the enveloping bag from high temperatures. | What is the Minimum Vacuum level requirements?<br>Is there any known thermal insulation for meeting requirement of vacuum handbook? | i) Refer Section 5.4 for principal design parameters and Section 7.4.3<br>ii) No |

| | | | | | |
|---|---|---|---|---|---|
| 51 | Technical specification of VVPSS RDA | 7.1.3 | Burst Test | Is there any procedure available for Burst test? | No, Supplier shall develop the testing procedure |
| 52 | Technical specification of VVPSS RDA | 7.1.4 | Back pressure resistance testing | Is there any procedure available for back pressure resistance test? | No, Supplier shall develop the testing procedure |
| 53 | Technical specification of VVPSS RDA | 15.1 | Qualification Process | Is separate qualification is required for equipment to start prototype or equipment will be qualified along with prototype. What will be the extent of qualification | Supplier shall submit qualification program for I-I/IO approval in which Supplier shall justify if separate qualification is not required |
| 54 | | | Price Adjustment | We request you to consider the price adjustment will be allowed up-to a ceiling of +/- 40% of the total contract value. Considering the long project duration. | No |
| 55 | Applicable GST | | | The applicable GST will be 18% as per prevailing rate. | Refer Section 9.3 Part-A (III): Terms and Conditions of Contract (Corrigendum-1) |
| 56 | Delivery | | | Delivery Tems shall be DAP(Nearest Port) INCOTERMS 2020. | RDA shall be delivered to ITER Site. Refer Section 18.3 for Address of Delivery |

| Inner Bellows (DN500) | | |
|---|---|---|
| Design Pressure Internal (maximum) | | kPa |
| Design Pressure External (maximum) | | kPa (a) |
| Design Temperature Internal (maximum) | | Degree Celsius |
| Design Temperature External (maximum) | | Degree Celsius |
| Pneumatic Test Pressure Internal (maximum) | | bar (g) |
| Pneumatic Test Pressure External (maximum) | | bar (g) |
| **Outer Bellows (DN600)** | | |
| Design Pressure Internal (maximum) | | kPa (g) |
| Design Pressure External (maximum) | | kPa (a) |
| Design Temperature Internal (maximum) | | Degree Celsius |
| Design Temperature External (maximum) | | Degree Celsius |
| Pneumatic Test Pressure Internal (maximum) | | bar (g) |
| Pneumatic Test Pressure External (maximum) | | bar (g) |
| | | |
| **Inner Bellows (DN300)** | | |
| Design Pressure Internal (maximum) | | kPa (g) |
| Design Pressure External (maximum) | | kPa (a) |
| Design Temperature Internal (maximum) | | Degree Celsius |

| | | |
|---|---|---|
| Design Temperature External (maximum) | | Degree Celsius |
| Pneumatic Test Pressure Internal (maximum) | | bar (g) |
| Pneumatic Test Pressure External (maximum) | | bar (g) |
| **Outer Bellows (DN400)** | | |
| Design Pressure Internal (maximum) | | kPa (g) |
| Design Pressure External (maximum) | | kPa (a) |
| Design Temperature Internal (maximum) | | Degree Celsius |
| Design Temperature External (maximum) | | Degree Celsius |
| Pneumatic Test Pressure Internal (maximum) | | bar (g) |
| Pneumatic Test Pressure External (maximum) | | bar (g) |