

TENDER NO. IPR/TN/PUR/TPT/ET/19-20/29 DATED 12/09/2019

*Technical Specification*

Manufacturing, Testing and Supply of  
**TWIN Source Grid Holding Boxes**

Dispatch Site



**Institute for Plasma Research**

Near India Bridge, Bhat Village, District Gandhinagar, Gujarat

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**1.0.Introduction:**

The tender document explains the manufacturing, and testing requirement of grids holder boxes for Twin Source grids (extraction system) to be used for mounting of three nos. of grids (Plasma Grid, Extraction grid and acceleration grid).

System Description

Twin source grid holder boxes consist of two sub-assemblies:

- EG(Extraction grid) Holding box
- GG (Ground grid) Holding box

Each sub-assembly consist of grid support frame and mounting flange. Grid support frame holds the grid segment. Grid segment along with support frame is finally supported on mounting flange. Mounting flanges are supported vertically in cantilevered position using ceramic based post insulators (not included in vendor's scope). All assembly of grid holder boxes are made of stainless steel.

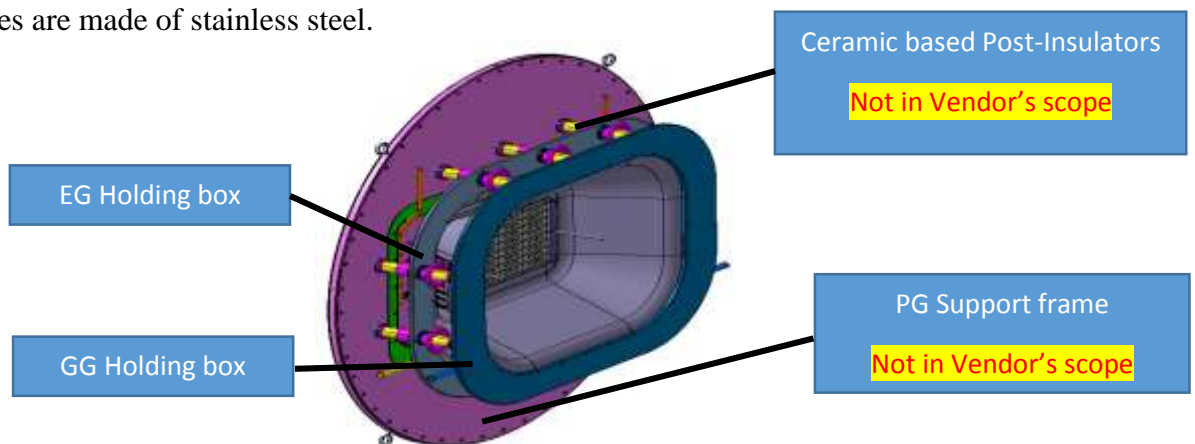


Figure 1: Grid holder box assembly

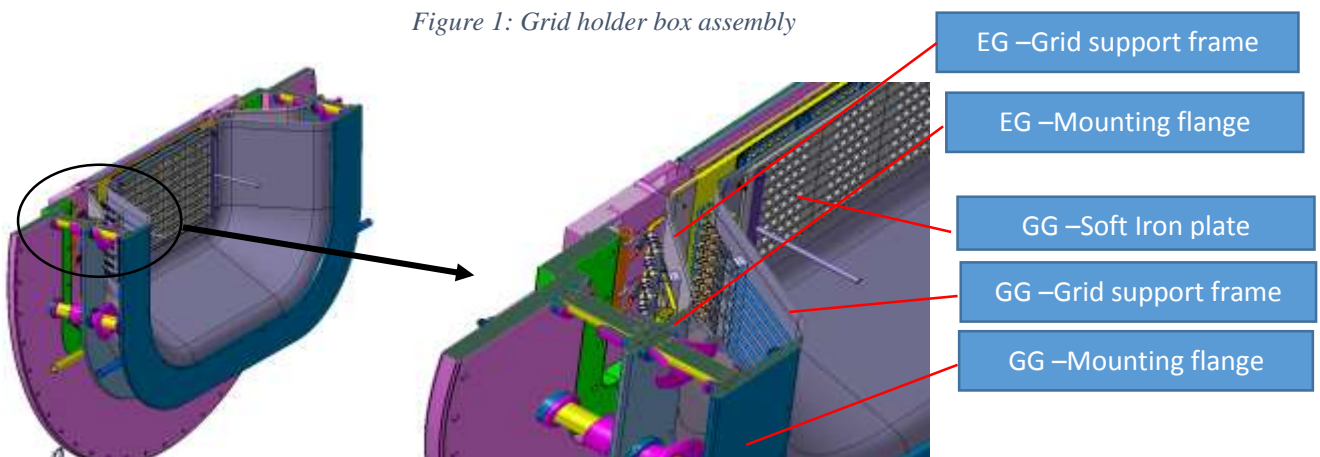


Figure 2: Section View grid box assembly

Grid support frame is 3 mm thick while mounting flange is 20 mm thick. Grid support frame is attached with cooling pipe assembly which is mechanically supported over support frame

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profile. Grid support frame and mounting flange are mechanically connected with through bolts. Cooling pipe assembly contains stainless steel pipes, flexible bellows (short length-44 mm) and dock-weiler end connections. Ground grid box sub-assembly also contains soft iron plate as deliverables.

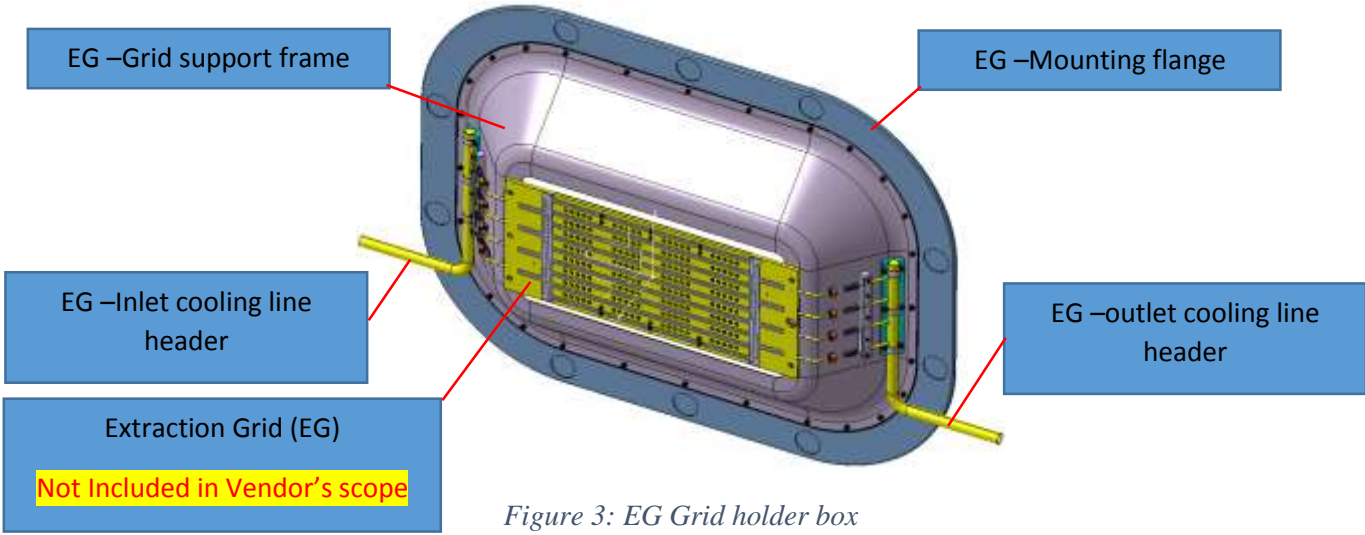


Figure 3: EG Grid holder box

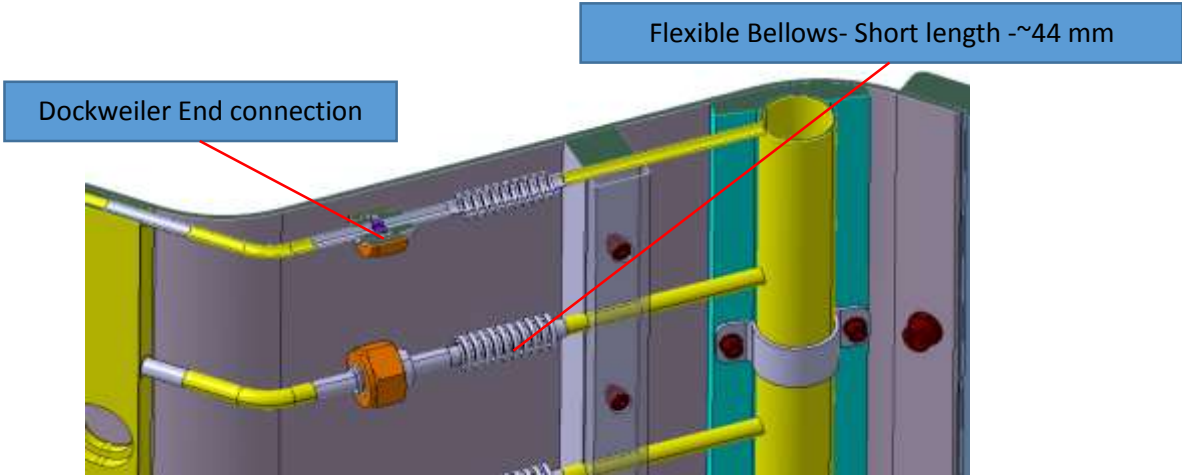
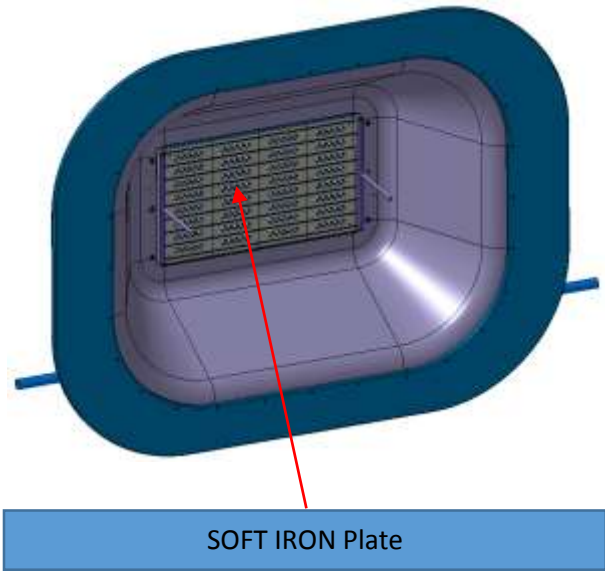
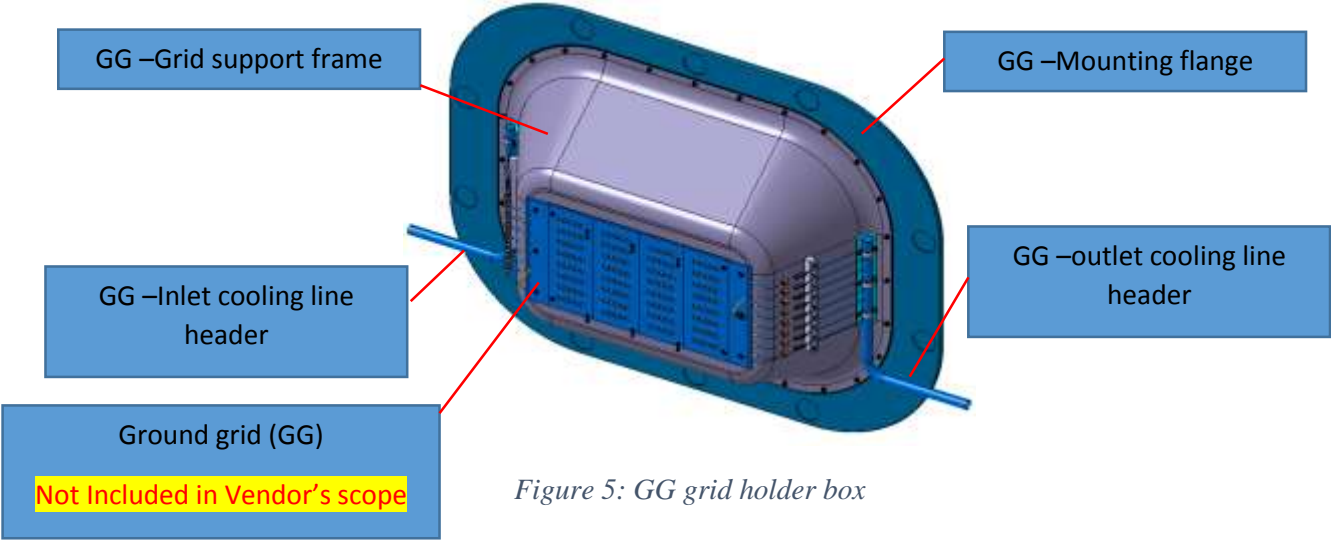


Figure 4: EG Support frame cooling line assembly

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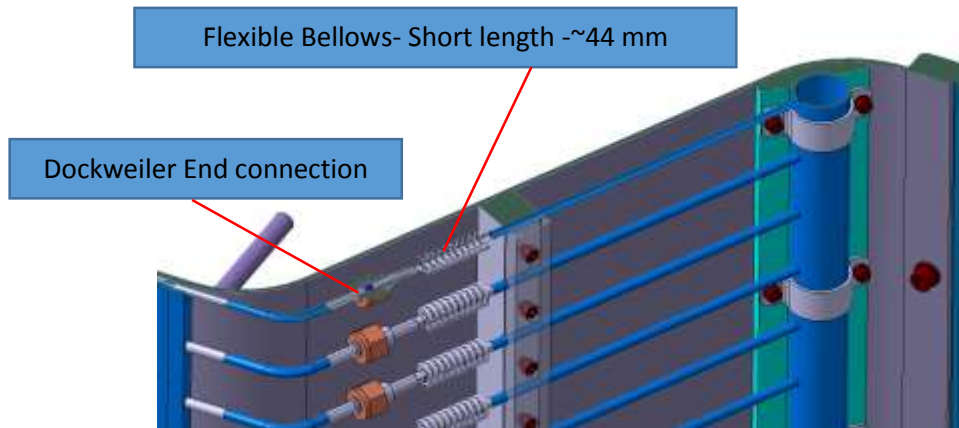


Figure 6:GG Support frame cooling line assembly

List of components as Deliverables:

Table 1: List of components to be delivered

<p><u>Extraction Grid Holder Box- Sub assembly</u></p>	<p><i>List of items included:</i> EG grid support frame with cooling line assembly - 01 no,( EG Mounting flange- 01 no. (Including Hardware, bellows, Dockweiler end connections)</p> <p><i>Manufacturing Options:</i> Machining , forming and TIG Welding</p> <p><i>Material:</i> SS 304L</p> <p><i>Reference Drawing No:</i> TS-GHB-EG-00-00, TS-GHB-EG-00-01, TS-GHB-EG-00-02-00, TS-GHB-EG-00-02-01, TS-GHB-EG-00-02-02</p>
<p><u>Ground Grid Holder Box- Sub assembly</u></p>	<p><i>List of items included:</i> GG grid support frame with cooling line assembly - 01 no, GG Mounting flange- 01 no, Soft Iron Plate- 01 no. (Including Hardware, bellows, Dockweiler end connections)</p> <p><i>Manufacturing Options:</i> Machining , forming and TIG Welding</p> <p><i>Material:</i> SS 304L</p> <p><i>Reference Drawing No:</i> TS-GHB-EG-00-00, TS-GHB-EG-00-01, TS-GHB-EG-00-02-00, TS-GHB-EG-00-02-01, TS-GHB-EG-00-02-02, TS-GHB-EG-00-03</p>

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*Note- Hardware, bolts, washers required for structural integrity of system also comes under vendor's scope. Systems, sub-systems and instruments required during factory acceptance test of the components conforming to the requirements mentioned in this tender document also comes under vendor's scope*

**2.0.Detailed Scope of Work:**

IPR provides the vendor with the engineering drawings. Vendor should follow the design inputs from IPR and check its manufacturing feasibility, material specifications and then proceed for manufacturing as per following detailed scope of work:

- a. Review of Engineering design with a feasibility assessment on manufacturing and testing requirements, suggest changes if required. Any such changes will only be accepted by IPR with written approval. Vendor may require attending the follow up meeting with IPR for design review. During review of engineering drawing, Vendor must scrutinize the drawings provided by IPR for any discrepancy or lack of information. Information will also be provided with 3D model in .stp/.3dxml file.
- b. Preparation of manufacturing drawings and all subsidiary drawings of assembly in these specifications.
- c. Preparation of manufacturing and inspection plan (MIP) and quality assurance plan (QAP) as per the described format by IPR. Vendor may suggest alternate MIP and QAP format as per their regular practices, which may be accepted or reject by IPR.
- d. Procurements of all necessary materials, items and equipment with test certificates recognised for government approved laboratory.
- e. Development and manufacturing of tools, jigs, fixtures and other accessories required for manufacturing of various components.
- f. Manufacture all components according to Manufacturing/fabrication drawings and assembly procedures approved by IPR.
- g. Testing & Inspection of the materials, parts, components & assembly at appropriate Stages as per approved MIP.
- h. Factory acceptance tests as per approved plan.
- i. Preparation of as built drawings after the final manufacturing.
- j. Packaging, insurance and delivery of components to IPR Site with appropriate Unloading instructions at IPR site. Final payment would be released only after successful completion of site acceptance test (excluded from vendor's scope) which may be witnessed by Vendor's representative.

**3.0. List of Deliverables:**

- A. List of deliverable components/Hardwares:

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<i>Item Description</i>	<i>Quantity</i>	<i>Reference drawing Number</i>
Extraction Grid Box –sub assembly	01 nos.	TS-EG-GB-00-00
Ground Grid Box- sub assembly	01 nos.	TS-GG-GB-00-00

*Bolt, washers, orings or any tools required for assembly of components while ensuring structural integrity also comes under vendor's scope.*

**B. List of Documents to be delivered:***Table 3: List of documents to be delivered*

Before start of manufacturing	Vendor's approved and dully stamped manufacturing drawings- <i>For approval from IPR</i> Vendor's Approved and dully stamped MIP and quality assurance plan- <i>For approval from IPR</i>  Details of suppliers/sub-suppliers & Purchase order copy (if any) Material test certificates- <i>For approval from IPR</i>  WPS, PQR and Shop Weld Plan - <i>For approval from IPR</i>
During manufacturing	Stage wise inspection reports – Includes dimensional inspections reports, weld test reports.
Before Dispatch	Final acceptance test reports/PDI reports- <i>For approval from IPR</i> As built drawings, RT films and NDT reports( as applicable) - <i>For approval from IPR</i>

**4.0.General Remarks & Technical Conditions:**

- ASME rules are applicable for fabrication processes.
- Vendor is required to deliver the components, sub-assemblies and final assembly mentioned as per engineering drawing with dimensional accuracy and satisfying the test criteria.
- All materials components, fabrication procedures must be compatible to their use in a high vacuum ( $1 \times 10^{-06}$  mbar) and high voltage environment (up to 50k V). Hence, the sharp corners & edges must be avoided in all the cases.

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- d. In case, some work is to be outsourced to any sub-contractor, same should be brought in notice to IPR and a formal approval should be taken.

**5.0. Information required with Bid Proposal:**

- a. The vendor is required to comment on each and every clause of this document. If the vendor is unable to accept a clause in whole or part, this fact shall be recorded with full explanation. The vendor may also wish to comment on any clause, even if that clause is fully accepted.
- b. A list of proposed deviations from the specification shall be submitted (if any).
- c. Outline time schedule in the form of bar chart.

**6.0. Delivery Schedule**

The delivery schedule shall be reckoned from the date of release of purchase order as per following manner:

*Table 4: Delivery Schedule*

Release of Purchase order	$T_0$ (in months)
Review of engineering drawing and submission of manufacturing drawing and manufacturing inspection plan, QAP	$T_1$ (in months) = $T_0 + 2$ month
Approval of manufacturing drawing from IPR	$T_2$ (in months) = $T_1 + 1$ month
Procurement, fabrication, testing assembly	$T_3$ (in months) = $T_2 + 8$ months
Final acceptance(PDI), cleaning, packaging and shipment to IPR	$T_4$ (in months) = $T_3 + 1$ month
<b>Total Duration (from date of release of purchase order)</b>	<b>12 months</b>

**7.0. Engineering Drawing and 3d CAD model:**

Engineering drawing and 3D model (.stp file) would be supplied by IPR along with tender document. Vendor needs to review the engineering drawing and 3d model in detail prior to bid submission. Vendor may suggest minor modifications with feasibility assessment over achievable dimensional accuracy and tolerances during bid submission which may be accepted or rejected by IPR. However, any dimensional changes in the approved drawings or specifications are not permitted during the execution of project. List of engineering drawings supplied with this tender document are listed below:

*Table 5: List of engineering drawing*

<i>Components description</i>	<i>Drawing Number</i>
EG Grid holder box assembly	TS-EG-GB-00-00
TS-EG-Header Support	TS-EG-GB-00-01



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TS-EG-Header Support clamp	TS-EG-GB-00-02
TS-EG-Header Support Assembly	TS-EG-GB-00-01-01
TS-EG-Tube and Header 1	TS-EG-GB-00-03
TS-EG-Tube and Header 2	TS-EG-GB-00-04
TS-EG-Tube Support 1	TS-EG-GB-00-05
TS-Extractor grid Mounting Flange	TS-EG-GB-00-06
TS- Extractor Grid Seg Support Frame	TS-EG-GB-00-07
GG Grid Holder Box assembly	TS-GG-GB-00-00
TS-GG-Header Support	TS-GG-GB-00-01
TS-GG-Header Support Clamp	TS-GG-GB-00-10
TS-GG-Header Support Assembly	TS-GG-GB-00-02
TS-GG Tube and Header 1	TS-GG-GB-00-03
TS-GG Tube and Header 2	TS-GG-GB-00-04
TS-GG Tube Support 1	TS-GG-GB-00-05
TS Ground grid Mounting Flange	TS-GG-GB-00-06
TS Grounded Grid segment support frame	TS-GG-GB-00-07
TS-GG-SOFT Iron Plate	TS-GG-GB-00-08
TS-GG-SOFT Iron Plate Pipes	TS-GG-GB-00-09

*Bolt, washers, orings or any tools required for assembly of components while ensuring structural integrity also comes under vendor's scope.*

Note for engineering drawing

- 1. It is likely to have some modifications or minor dimensional change(that would not merely effect manufacturing processes or cost) in the drawings submitted with this tender document. IPR would submit its final version of engineering Drawings after the award of contract including such minor dimensional changes.*
- 2. Vendor is required to scrutinize the engineering drawings submitted with the tender document and should bring out any discrepancy/missing information to IPR during bid submission and must be clarified immediately prior or after award of contract during the review phase of engineering drawing. Any modification must not be allowed f(after approval of manufacturing drawing.*

**8.0.Manufacturing:****8.1.Manufacturing Drawing and Documents:**

Supplier shall submit the manufacturing drawings to IPR for approval before start of manufacturing. IPR will approve the same. Drawings for dies, punches, jigs, fixtures and tooling shall be prepared by supplier and submitted to IPR for information. Supplier shall prepare Manufacturing drawings for all sub components, sub-assemblies & final assembly indicating required details like Bill of material , Weld joint design , welding, dimensional tolerance , examination details, classification of component , surface finish etc. All other manufacturing and quality assurance documents such as quality assurance plan, manufacturing procedure, welding procedure, weld data sheet, assembly procedures, packing procedure, inspection and testing procedures etc. shall be

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prepared by the supplier and submitted to IPR for approval before taking up the manufacturing.

**8.2.Tolerances:**

The critical tolerance requirements are highlighted in engineering drawings supplied by IPR and those critical tolerances are to be reflected in manufacturing drawings prepared by Vendor.

**8.3.Welding Specifications:**

Welding and brazing requirements are applicable as per ASME rule section IX.

Welding:

- a. Suggested Welding procedure is TIG welding.
- b. Welding shall be done on the job, strictly following the approved welding procedures. Vendor need to suggest the welding procedure and specification which shall be approved by IPR prior to manufacturing.
- c. The Supplier shall prepare written procedures for distortion control for each typical joint giving the sequence of assembly, sequence of welding; heat input to weld etc. The Supplier shall submit the same to the IPR before taking up manufacturing. The same shall be displayed in the Supplier's shop during welding.
- d. *Weld Plan*: The Supplier shall submit a Weld Plan to IPR for approval prior to start fabrication. *Weld Plan shall include weld joint mapping identifying all the welds by proper numbering system, applicable WPS, Process used, type of joint with sketch, NDT requirements and welds requiring production proof samples.* The weld plan is a drawing which cross references of each welded joint to a supporting weld procedure specification (WPS). Weld Plan, in conjunction with the following documents shall be submitted to IPR before start of welding activity:
  - i. Welding Procedure Specification
  - ii. Procedure Qualification Record
  - iii. Welder Qualification Record
- e. *Welding coupon/Test Piece*: Number and dimension of test piece/weld coupons shall be produced as per relevant codes and standard. The weld coupon must be examined with destructive and non-destructive testing methods.
- f. *Qualification for weld coupons*: During destructive examination (bend, tensile, metallography) fracture shall be observed at parent material for acceptance. The tensile strength of the test specimen shall not be less than the corresponding specified minimum value for the parent metal unless otherwise specified prior to testing. For parent metal joints the tensile strength shall not be less than the minimum value specified for the parent material having the lowest tensile strength. Tensile test shall be done at a temperature defined in Parent material

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specification. The bend test specimen shall have no pen defects exceeding 2mm measured in any direction on the convex surface after bending. Non-destructive examination (RT & UT) shall be qualified as per sec VIII, Div-1 of ASME.

- g. *Acceptance test for Production weld on actual components:* 100 % volumetric examination (Radiographic testing, Ultrasonic testing & Visual examination shall be done on the welded joints.
- h. The build-up of internal stresses shall be avoided as far as possible.
- i. The selected welding technique shall produce a clean, pore free weld with minimal oxidation.

**Brazing:**

- a. Brazing shall be carried out in a vacuum atmosphere.
- b. Brazing filler materials could be be Ni based eutectic alloy like BNi<sub>3</sub>. For SS-SS joints.
- c. Braze joint should be lap joint that ensure minimum tensile strength equivalent to that of parent material.
- d. The joint clearance should be in range of 40-50 microns at the brazing temperature.
- e. *Braze Joint assembly fixture:* To hold brazing assembly in proper position with correct alignment during brazing for capillary action to work, brazing joint assembly fixture should be used. Fixture should be designed for least mass and least contact. Material used for fixture must be poor heat conductor like Stainless steel, ceramics and Inconel.
- f. *Pre-cleaning of braze surface:* All the braze surface must be cleaned with mechanical and chemical cleaning methods to ensure proper wetting and capillary movement of molten filler alloy. Polished surface/highly finished surface must be avoided for brazing application.
- g. *Production proof sample/braze Coupon/test piece:* Each brazing cycle must be accompanied with production proof samples. Number and size of production proof sample may be decided on the basis of required qualification tests as per relevant codes and standards. However it may also be decided as per mutual agreement in between IPR and supplier in case appropriate information are not available.
- h. *Qualification test for production proof sample/braze coupons/test pieces:* Braze coupons must be tested for destructive testing like: Peel testing, transverse tensile and shear testing and metallographic examination. Tensile testing must ensure minimum tensile strength equivalent to parent material.
- i. *Acceptance test for production braze joints on actual component:* Production braze joint must be visually examined for any flaws, voids or irregularities.
- j. The use of LPT shall be prohibited on braze joints.

**8.4.Manufacturing General Requirements:**

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- a. A detailed description of all manufacturing process shall be submitted by the Supplier prior to start manufacturing.
- b. The raw material, subassemblies and finished components shall be covered with polythene sheets to avoid contamination during storage.
- c. The pipes shall be fitted with end plugs in addition to covering by polythene sheets.
- d. Cleaning after manufacturing.
- e. Vacuum baking to guarantee compatibility with the operation in an ultra-high vacuum environment.
- f. Assembling of parts and sub-systems keeping as much as possible the clean conditions reached after vacuum baking.
- g. Marking shall not result in contamination of the material, significant strain hardening or sharp discontinuities.
- h. Marking shall be carried out in areas of minimum /no loading. No marking is permitted in areas of stress concentrations or in weld heat affected zones.
- i. Marking shall not affect interpretations of NDE results.
- j. Marking with ink stamps, indelible ink, paint and adhesive taps which are not vacuum compatible are not allowed.
- k. Cutting can be done either machining, grinding, shearing or plasma cuttings.

**8.5. Marking:**

- a. Marking shall not result in contamination of the material, significant strain hardening or sharp discontinuities.
- b. No marking is permitted in areas of stress concentrations or in weld heat affected zones.
- c. Marking shall not affect interpretations of NDE results.
- d. Marking with ink stamps, indelible ink, paint and adhesive taps which are not vacuum compactible are not allowed.

**8.6. Cutting:**

- a. Cutting can be done either machining, grinding, shearing or plasma cuttings.
- b. In case of shearing the strain hardened zone is subsequently to be removed by machining / grinding.
- c. During grinding local over heating of the material is to be avoided.

**9.0. Material Specifications:**

Material used for construction of High Vacuum components should be of listed (as below) specification. Suppliers have to submit the test certificates for each of the raw material used for construction and the traceability of same is to be ensured at each level of fabrication work. All material shall be free from all the kinds of defects

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like cracks, fissures, pits, lamination or any other defects which would make it incompatible with a high voltage and ultra- high vacuum environment.

- a. *Stainless steel*: This shall be a type of chromium-nickel 18-10 with the following specifications:

ASTM grade	304L (A312,A240), Seamless Piping
C %	0.030(max)
Mn%	2(max)
S%	00.030(max)
P%	0.045(max)
Si%	0.75(max)
Ni%	8-12
Cr%	18-20
N%	0.010(max)
Tensile strength (N/mm <sup>2</sup> )	>500
0.2% Proof stress (N/mm <sup>2</sup> )/ Yield strength	>170
Modulus of Elasticity(GPa)	193-200
Shear Modulus(GPa)	>80
Poisson's Ratio	0.30
Elongation on 50 mm	30%
Hardness range	130 < HB < 180
Relative magnetic permeability in 200 Oersted field	< /=1.05

- b. *Water Coupling/ Connector*: Dockweiler water coupling shall be provided as tube end-connection. Detailed reference of the parts is to be provided in engineering drawing supplied with this tender.
- c. *Flexible short length bellow*: Specification for short length flexible bellows should conform to following:

<b>HYDRA Metal Bellows : Single Ply , Suggested Make: Witzanman type</b>	
Typ:	BAO 8,0 x 13,0 x 1 x 0,10 10W 1.4571
Cuff type:	J/J-cuff
Tag No:	
Pressure level:	26 bar
Inner diameter, di	8.0 mm
Outer diameter, da	13.0 mm

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<b>Design data</b>	
Pressure internal [bar]	20.0
Test pressure internal [bar]	25.0
Temperature [°C]	150
Axial [mm]	3.0 +0.0/-3.0
Load cycles	1000
<b>Details</b>	
Inner diameter [mm]	8.0/6.0 -0.4/+0.1
Outer diameter [mm]	13.0 ±0.5
Number of plies	1
Thickness per ply [mm]	0.1
Number of corrugations, nw	10
Corrugated length, lg [mm]	18.0
Effective cross section [cm <sup>2</sup> ]	0.9
Diameter - cuff, d3 [mm]	8.0 +0.2
Length - cuff, l1 [mm]	6.0
Length - cuff, l2 [mm]	6.0
Total length [mm]	30.0 ± 0.8
Springrate/Bellows at 20°C	
Axial [N/mm]	38.5 ± 30 %
Angular [Nm/grad]	0.01 ± 30 %
Lateral [N/mm]	19.7 ± 30 %
<b>Material</b>	
Bellows	1.4571
Fittings	End connection –welded type
<b>Examinations:</b>	

**10.0. Inspection and Testing:**

- a. The Supplier shall submit an Inspection procedure for Dimensional inspection, Nondestructive examination, and any other test required by drawing / Specification for IPR's approval.
- b. The Supplier shall maintain record of all inspection and testing which shall be made freely available to the purchaser or their authorized representative.

## SECTION-C

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- c. The Supplier shall prepare & submit Manufacturing Inspection Plan giving the stage of inspection indicating witness, review & hold points by the IPR representative to IPR for approval.
- d. The NDT personnel employed by the Supplier shall be qualified as per ISO 9712, EN 473 or ASNT Level II.
- e. The following test and inspection procedure shall apply to components during manufacturing and to finished components before they are assembled to form the ion source:

Test Description	Components	Acceptance Criteria/Reference Document
Visual Inspection	EG Grid holder box sub-assembly, GG grid holder box sub-assembly	Free from all kinds of surface defects.
Dimensional Inspection- Using coordinate measuring machine (CMM)/ Faro Arm/any 3d profile measuring techniques	EG Mounting flange, EG Grid support frame, GG Mounting flange, GG Grid support frame	Approved manufacturing drawings and procedure as per MIP
Geometrical Tolerances- Flatness & Positional accuracy USING coordinate measuring machine (CMM)/ coordinate measuring machine (CMM)/ Faro Arm/any 3d profile measuring techniques	EG Mounting flange, EG Grid support frame, GG Mounting flange, GG Grid support frame	Approved manufacturing drawings and procedure as per MIP
Surface Roughness- By Stylus probe method	EG Mounting flange, EG Grid support frame, GG Mounting flange, GG Grid support frame	Approved manufacturing drawings and procedure as per MIP
Hydrostatic pressure testing @ 15 bar	Bellows , All cooling line assemblies	Hold time for 30 minutes shall result in no failure or breakage.
MSLD leak tightness test	Bellows , All cooling line assemblies	Less than $5 \times 10^{-9}$ mbar-lit/sec in local leak testing by vacuum method at Room Temperature
NDE –Examination – Radiographic & Ultrasonic	All weld joints	100% as per ASME sec VIII, Div. I, UW52.

The components shall conform to this specification unless a deviation is approved in the form of a written change to the specification from IPR, this document with addenda, amendments and revisions in effect on the date of the purchase contract shall

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apply. Further Modifications if any would be subject to mutual agreement between the vendor and IPR. In the event components fail to satisfy the test requirements, the vendor shall document the failure and submit a proposal to IPR for correcting any faults or failures. Written approval from IPR shall be required before any corrective Action is taken.

**11.0. Acceptance Tests:**

**11.1. Factory Acceptance Test:** The Supplier is responsible for checking that all items conform to the contractual requirements as set out in the contracts between the Supplier and IPR. The Supplier shall ensure that the items are in line with regulatory requirements and documentation. The Supplier shall make all components and parts available for Factory Acceptance Tests at the Supplier's site for IPR.

Factory Acceptance Test aims and criteria are to check:

Compliance with the Technical Requirements specified in this Technical Specification and enclosed appendix, attachments and drawings.

- Successful completion of all the tests described in this Technical Specification
  1. Visual Inspection
  2. Dimensional tests
  3. Weld Qualification
  4. Production welds inspections and tests

Only after positive results of the Factory Acceptance Tests satisfying the conformance with the requirements as set out in the contract, the transport and delivery of manufactured items will be released by IPR. Acceptance of the tests results and certificates does not relieve the Supplier of the responsibility for compliance with all the contractual requirements. If any of the Factory Acceptance Tests prescribed in the present specification reveals a defect or a fault of the components, the Supplier shall perform a timely and effective repair or shall guarantee the replacement the faulty deliverable free of charge, managing the repair or replacement by means of a proper non conformity management procedure.

**11.2. Site Acceptance Test:**

After delivery of components to Site, IPR will inspect every component and check the physical state and condition of the packing for possible damage during transportation.

Final Site Acceptance Test include

- Checks of the physical state and condition of the packing for possible damage during transportation.
- Unpacking and checks of the component cleaning and conservation.
- Successful completion of all the tests as per below:



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- 1. Visual Inspection**
- 2. Dimensional tests**

If any of the Site Acceptance Tests prescribed in the present specification reveals a defect due to a fault or damage during transport or unloading, the Supplier shall perform an urgent and effective repair or shall guarantee the replacement of the faulty component free of charge, managing the repair or replacement by means of a proper non conformity management procedure.

**12.0. Inspection measuring Instruments:**

All inspection measuring equipment (mechanical, electrical, thermal, physical etc.) used for inspection and testing shall be maintained and calibrated. Calibration must be traceable. Documentation and recording of all checking, calibration, quarantine and repair, traceability, certification, including a “Recall system” to warn of future calibration periods.

**13.0. Personnel qualification:**

The vendor shall be responsible for assuring that non-destructive examination personnel have been qualified and certified prior to performing and evaluating examination.

**14.0. Packaging and Transportation:**

- a. The Supply of components shall be delivered with proper protection systems in order to minimize the risk of damage and distortions.
- b. Protection elements are to be designed and manufactured to protect the assemblies and all other components during transport and storage against weather effects, mechanical damage and destruction of cleanliness and finish machining achieved by specific surface treatment.
- c. Components and its sub-assemblies shall be transported with all the necessary precautions to guarantee full protection of all the surfaces prepared and cleaned to be vacuum compatible.
- d. Particular care shall be given for packing and fixing of fragile components as the electrical insulating elements, requiring proper special protections against damage during transportation.
- e. Material shall be used to insure a low humidity during shipment and storage.

During storage and transport all the components and assemblies suitably cleaned before transportation shall be packed in new, clean, sealed polythene bags or sealed aluminium foils. They shall be individually located in purpose built plywood containers to avoid damage during handling and transport and to provide medium term storage (up to 2-3 months) on Site. On the packaging all references to the

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contents and other information shall be clearly shown in English language, including at least:

- Contents description;
- Dimensions;
- Weight;
- Centre of gravity;
- Lifting Points.

The complete assembly and sub-assembly of components should be delivered to IPR, Gandhinagar.

**15.0. Documents**

The components relevant to procurement deliverables shall be supplied with all the manufacturing documentation required to satisfy reviews, validations, testing and verifications. These documents shall be transmitted to IPR in appropriate time before the associated milestone. All the other documents related to the design, fabrication and testing (internal procedures, QA controls etc.) are to be kept available to IPR throughout the manufacture of the components.

**Table 1: Documents to be supplied before starting of Manufacturing**

Document to be supplied	Provider	Milestone*
Procurement specification and technical contracts between IPR and Supplier	IPR	With Tender
<i>3D Model and 2D Engineering Design Drawings</i>	IPR	With Tender
Initial follow-up documents (Quality Plan and Manufacturing & Inspection Plan)	Supplier	Within two months after signature of the Contract award
Manufacturing Plan	Supplier	BS
Deviation Request (if Applicable)	Supplier	BS
Material documentation (incl. Procurement specification, material certificates, test and examination results)	Supplier	BS
List of Supplier's sub-contractors	Supplier	BS
Manufacturing drawings and components part list	Supplier	BS
Components identification and marking procedure	Supplier	BS

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Document to be supplied	Provider	Milestone*
Materials (base and filler) identification and marking procedure	Supplier	BS
WPS, PQR and Weld Plan / Brazing specification Procedure and Braze plan	Supplier	BS
NDT procedures	Supplier	BS
Detailed Schedule including manufacturing activities and documents completion dates	Supplier	BS

**BS = Before start of Manufacturing**

**Table 2: Documents to be submitted during manufacturing**

Documents to be supplied	Provider	Milestone**
Welding /Brazing data package	Supplier	Before start of welding
Welders and operators qualification including supporting certificates (As applicable for welding/Brazing)	Supplier	Before start of welding
NDT/Pressure test/Flow test/Leak test reports	Supplier	During manufacturing or Testing
Non Conformance Report (If applicable)	Supplier	During manufacturing or Testing

**Table 3: Documents to be supplied before final acceptance in the factory**

Documents to be supplied	Provider	Milestone***
Inspection reports (dimensional checking, visual inspection, results of leak rate tests (including size and location of leaks found),Pressure Testing, NDTs , cleaning report,, etc.) ,	Supplier	AC

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End of Manufacturing Report (Release Note) including as-built drawings. As built Manufacturing Drawings .	Supplier	EF
Release for procurement transport and delivery	IPR	EF

*AC= After completing of activity*

*EF = End of the factory acceptance*

**16.0. Notification, Authorization to proceed, witness and Hold Point**

IPR shall monitor the production activity of the supplier and possible sub-contractors in accordance with an approved Manufacturing and Inspection Plan.

This monitoring shall include Notification Points (NP), Witness Points (W), Authorization-To-Proceed Points (ATPP) and Hold Points (H) at critical steps in the Supplier's manufacturing plans.

A Notification Point is a milestone where the Supplier is required to notify IPR, about specific operation or deliverable. A Notification Point is meant to give the opportunity to IPR to witness a critical manufacturing operation at the Supplier's or sub-contractor's premises.

A Witness Point is a milestone where the Supplier is required to notify IPR, about specific operation or deliverable. A Witness Point indicates a mandatory inspection to witness a critical manufacturing operation at the Supplier's or sub-contractor's premises.

An Authorization-To-Proceed Point is a milestone where the Supplier is required to notify IPR, about specific operation or deliverable. The Supplier must wait for an authorization from IPR before proceeding to the next operation or to the next action on the specific deliverable. IPR shall allow the Authorization To Proceed on the basis of clearly identified Quality Control data and Acceptance test results. In case of authorization from IPR , the Supplier shall proceed to the next operation or to the next action on the specific deliverable. In case of rejection, the Supplier shall prepare the recovery plan and submit to IPR for approval and shall only be authorized to proceed after confirmation from IPR. An Authorization-To-Proceed Point shall only affect the specific operation or the specific deliverable it is associated with and shall not interfere with the execution of other operations or of the production of other deliverables.

A Hold Point is a milestone where the Supplier is required to notify IPR, about specific operation or deliverable. The Supplier must stop the associated processes until a Hold Point Clearance is issued. The Hold Point Clearance shall be issued on the basis of

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clearly identified Quality Control and data and acceptance test results. In case of rejection, Supplier shall prepare the recovery plan and submit to IPR for approval and shall only be authorized to proceed after confirmation from IPR.

Activity	IPR	Comment
Approval of Procurement follow-up documentation (like Quality Plan , Manufacturing and Inspection Plan (MIP), Manufacturing drawings ,Manufacturing and Inspection & Testing Procedures etc)	H	
List of Supplier's sub- contractors	H	
Kick off Meeting with Supplier	H	
Raw Material receipt inspection	NP	
Jigs & Tooling design and manufacturing	ATPP	Supplier to provide details of Jigs & Fixture to be used.
Marking And Cutting of Material	ATPP	
Machining and Drilling of parts	ATPP	
Dimensional inspection of Parts	H	
Welding/Brazing Qualification (Procedure & Welders)	H	
Visual & Dimensional inspection of Component	H	
Non Destructive Testing of welds	H	
Cleaning ,baking and outgassing of component	H	
Packing & Transportation	H	
Factory Acceptance Tests	H	
Preparation of End of Manufacturing report/As built manufacturing drawing	H	
Shipment clearance by IPR	H	
Site Acceptance Tests	H	

**17.0. Manufacturing & Inspection Plan (MIP):**

- a. Sample format of manufacturing inspection plan(MIP) has been provided by IPR as per annexure- C.
- b. Vendor needs to prepare a detailed format of MIP based on the guidelines provided by IPR in annexure- C
- c. For the various phases of test, manufacturing and inspection, MIP should be signed accordingly by both the parties (as applicable).
- d. The draft MIP should be submitted to IPR with manufacturing drawing for approval to IPR.
- e. The approved MIP may be kept updating manually accordingly during various phases of Project execution as per need or on the basis of accepted DR or NC. However each revision should be approved and dully signed by IPR representatives.

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- f. Original Copy of Final updated MIP after completion of project should be submitted to IPR dully signed and approved. Vendor shall retain one copy of the same.

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*Appendix- A***Bidder's profile:**

This part describes the information required by the bidder at the time of bid submitting the bids. Bidder will enclose the technical bid in this format in Part – A of bid. Bidder shall submit two set of documents in support of the information provided in this Annexure:

1. Information about the Bidder:

Sr. No.	Requirements	Bidder's Response
1	Bidder's Profile: Over all profile and organization structure	
2	Bidder's Sub suppliers: Probable List of bidder's sub suppliers.	

2. Bidder's Experience:

Sr. No.	Requirements	Bidder's Response
1	Manufacturing Experience: Bidder's experience in manufacturing equipment's with complex shapes and high dimensional accuracy, use of stainless steel,– Any one example can be submitted.	
2	Bidder's experience in manufacturing of components having vacuum applications.	

3. Other Required Infrastructure:

Sr. No.	Requirements	Bidder's Response
1	Sources for purchase of raw materials like stainless steel plate & pipes, welding consumables, braze filler alloy etc.	
2	Details of proposed procedure for inspection and testing's of components at controlled temperature and the facilities available in this regards	
3	Ultrasonic testing, Radiography and other NDE facilities with bidder or his sub supplier with detailed specifications	

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4. Quality System Assurance:

Sr. No.	Requirements	Bidder's Response
1	Quality system (a) Details of ISO 9001:2008 certifications along with valid certificate.	
2	Quality Assurance (a) Bidder's proposed methodology to carry out dimensional inspection. The specific emphasis should be on the large quantity and profile measurement of plates. The bidder shall confirm and give details of qualified operators, equipment and facilities for the following testing and non-destructive examination (NDE) a. Radiographic Examination b. Ultrasonic Examination  In case of any of facility mentioned is not available with the bidder, the name of sub supplier where or by whom the work is proposed to be done shall be given.  The capability of carrying out the above testing and inspection as per the requirement of this specification has to be confirmed by submission of appropriate methodology.	

5. Codes and Standards:

Sr. No.	Requirements	Bidder's Response
1	Codes and standards Experience (a) Bidder's experience in using ASME/ISO/EN for manufacturing, material and inspection and testing vacuum equipment. Give details with projects.	

6. High Vacuum Components technical compliance sheet:

Sr. No.	Scope of Supply	Bidder's confirmation



## SECTION-C

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1.	Procurement of all the materials required for the job including those for qualifications (welding/brazing) and for production test coupons (if required) etc, as per the specification and manufacture, assembly, inspection, testing, surface treatment, packing.	
2.	Preparation of manufacturing drawing, MIP&QAP and getting approval on the same by IPR.	
3.	Design and manufacture (with supplier's material) jigs, fixtures and tooling required for manufacture, handling assembly, inspection and testing of grid holder boxes	
4.	Manufacturing of all the three grids grid holder boxes as per approved manufacturing drawing.	
5.	Carry out inspection and testing's at various stages before / after / during manufacturing as asked by the various sections and annexures of this specification and drawing.	
6.	Loading, safe delivery, transportation, handling, unloading at identified location at IPR site.	
7.	The issuance of "Inspection Release Note" / "Shipping Release" / "Dispatch Clearance" from the purchaser or his authorized representative shall be considered as "Factory acceptance test"	

7. Bidder's deviations from technical specifications, terms and conditions, if other than specified in part-A and associated appendices:

Bidder may specify his deviation from technical specifications, terms and conditions, if other than specified in Part-A & its appendices. However these changes will become applicable on technical merit after discussion with purchaser and acceptance of the same by purchaser.

- I. Any additional information bidder wants to give in support of his bid.
- II. Delivery schedule along with project execution milestone chart.
- III. Confirmation letter from bidder:

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Proposed MANUFACTURING AND INSPECTION PLAN			
Document Number:		Revision Number:	
IPR PO Number:		Title of Item:	
Name of Customer:		Supplier:	
Prepared by supplier:		IPR Acceptance:	Code*
Name & signature:		Name & signature	<b>HP: Hold Point</b> <b>ATPP: Authorization to Proceed Point</b> <b>NP: Notification Point</b> <b>W: Witness of Operation</b> <b>S1: 100% Inspection, S2: Random Inspection</b> <b>R: Review Report</b>
Position:		Position:	
Date:		Date:	

Annexure-C

Components <sup>1</sup> (Like Drawing, manufacturing, inspection tests etc)/List of Operations	Type of Check Applicable procedures, codes, acceptance, instructions, etc.				Inspection Point (Inspection Body)				Records (report, non-conformance number, etc)	Observation(s)/Remarks
	Type of Check <sup>2</sup>	Ref Codes <sup>3</sup> /Standards/documents	Acceptance Norms <sup>4</sup>	Verifying Documents <sup>5</sup>	Supplier		IPR			
					Code(*)	Name & Signature	Code(*)	Name & Signature		



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- 1: Components may include Design/drawing approval, raw materials, and welding procedures, weld test coupons, in process inspection, weld quality, leak testing, final inspection etc.
- 2: Type of Check may include Design verification, visual inspections, dimension checks, review of test certificates, WPS/PQR/WPQR, deflection, leak rate etc.
- 3: Ref codes/standards/documents may include ASME/ISO/ASTM/approved drawings/documents etc.
- 4: Acceptance norms may include ASME Sec VIII, DIV-1,2 / ASME Sec-IX, ASTM SA240/SA578, AWS etc.
- 5: Verifying Documents may include approved drawings, approved QAP, Test certificates, WPS/PQR/WPQR, leak test reports, inspection and test reports etc.