

Title	GeM Bid No. GEM/2025/B/6747089 for Manufacturing and Supply of Two Nos. of Tritiated Targets (Tritium Targets) along with one Target Holder Assembly
Subtitle	PART-A(II): Technical specifications for Two Nos. of Tritiated Target (Tritium Target) along with one Target Holder Assembly



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1 Introduction & System Description

This document contains the specification for scope of supply, drawing, fabrication work, assembly of “tritiated target” and “Target holder Assembly”. This document is also containing the codes and standard to be followed while fabrication and various test for the acceptance of the system. This document also outlines the requirements, terms, and conditions for the acceptance, transport, unloading and warranty of the “**Tritiated Target** (Tritium Target) along with target holder Assembly” for 14 MeV neutron generator at IPR.

Tritiated Target (Tritium Target) along with target holder Assembly is a part of Accelerator based 14 MeV Neutron Generator which will be used for holding a Tritiated Target. This target holder is water cooled (to remove heat generated by deuterium beam), electrically isolated (to measure deuterium beam current) and placed in vacuum. It also features a provision for real-time temperature profiling of the tritium target, using infrared camera.

2 Scope of Supply

Standard components to be supplied to purchaser along with fabricated parts for the assembly:

Table 1: Standard Components to be Supplied

Sr. No.	Description of material	specification	Total quantity
1.	Tritium target	Table no 3	2 Nos.
2.	Pneumatic 100 CF gate valve	Table no 4	1 Nos.
3.	100 CF Vacuum ceramic break	Table no 5	1 Nos.
4.	40 KF Vacuum ceramic break	Table no 6	2 Nos.
5.	Oil Free Scroll Vacuum Pump	Table no 7	1 Nos.
6.	ZnS window	Table no 8	1 Nos.
7.	IR camera	Table no 9	1 Nos.
8.	40KF Vacuum flexible hose	Table no 10	1 Nos.
9.	40 KF clamp	Standard 11	5 Nos.
10.	40 KF cantering ring	Standard 12	5 Nos.

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3 Scope of Work

The scope of this project includes the following but not restricted,

- Study of the supplied guide line drawing and preparation of fabrication drawings.
- Procurement of standard components as defined in table 2
- Procurement of raw material
- Fabrication/ Manufacturing
- Testing of fabricated/ manufactured components
- Integration, Assembly and Testing of the complete system
- Packing, transport and delivery
- Unloading, and Site acceptance testing at delivery site

3.1 Study of the supplied guide line drawing and preparation of fabrication drawings

Vendor shall prepare the fabrication drawing along with details with respect to supplied guide line drawings and submit the same to purchaser for review and approval within 30 (thirty) days from date of purchase order.

All the fabrication drawings complete with dimensions and tolerances shall be checked by purchaser and only after approval of these drawing by purchaser, the fabrication shall commence. Vendor shall specifically bring out any deviation from drawings separately in a covering sheet.

3.2 Procurement of Standard Components and Raw Material:

The vendor shall procure standard component and raw material required for fabrication and assembly. Details of the standard components is given in the Table 1 and the details of components that has to be fabricated is given in the guideline drawings supplied with this document as Annexure-1.

3.3 Fabrication/ Manufacturing

- a) Vendor shall fabricate the components using the material indicated in the engineering drawing.
- b) A detailed fabrication / manufacturing plan shall be prepared by the vendor before fabrication.
- c) All the surfaces of the fabricated components should have 3 ∇ surface finishes after machining.

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- d) All the SS metal surfaces shall be electro polished after machining.
- e) All SS parts shall be TIG welded (where required) and shall be carried in Argon gas environment.
- f) All the flange mating joints shall be with 'O' ring or CF flange as indicated in the drawings. (O ring and copper gasket required in the assembly shall be provided by vendor at no extra cost.)
- g) All flanges shall be as per ISO standards (as applicable).
- h) All the joints, seals etc. making vacuum enclosure shall qualify for a local leak rate of $\leq 1.0 \times 10^{-8}$ mbar-l/s. by helium gas/trace gas.
- i) SS304 fasteners with proper washers shall be used where ever required.
- j) Before brazing/welding, all parts should be cleaned with detergent and de-oxidized at brazing/welding location.
- k) All welds/brazing should be flush with adjoining surfaces with convex curvature with an adjoining wall everywhere before the leak test.
- l) Care shall be taken to avoid damage (dent and scratches) during handling and storing of the raw material, semi finish products and finished products.
- m) Localized roughness/scratches on the inner surfaces exposed to vacuum shall be avoided. During machining/electro polishing, the vacuum sealing surfaces should be protected from damage. No buffing should be carried out on sealing surfaces.
- n) Ultrasonic cleaning of all fabricated components
- o) Proper fixtures should be used before welding to keep various components (e.g. flanges) in position and to maintain proper parallelism and perpendicularity. Flatness in grid plates and flanges are within +/- 0.1 mm. Parallelism between grids is within +/- 0.1 mm.
- p) Dimensional measurement and assembly shall be performed in dust free environment.
- q) Assembly of the components: Only after confirmation of the dimensions with respect to approved fabrication drawings, vendor shall assemble the system.
- r) All detailed technical specifications are included in drawings. All the other fabrication related details have to be worked out by vendor and approval should be taken from purchaser.

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3.4 Factory Acceptance Tests:

- (i) The following minimum tests shall be performed by the vendor on “Target Assembly” at vendor’s site prior to the dispatch. Vendor shall submit a FAT template to purchaser for review and approval.
 - a. Dimension check: -All components shall be checked for dimensions and surface finish.
 - b. Assembly check: -All identical components shall be checked for interchangeability. Once all the individual components are accepted for their vacuum compatibility, it should be assembled (dummy assembly) to make a check for mechanical integrity, dimensional requirements.
 - c. Vacuum leak test: -Helium leak ($\leq 5 \times 10^{-8}$ mbar l/s)
 - d. Water leak test: - in the assembled unit for the parts shown in drawing sheet (Annex-1)
- (ii) Following factory acceptance test should be carried on tritiated target at manufacturer site and test report should be submit for purchaser’s approval before shipment.
 - Tritium activity measurement.
 - Tritium/ Titanium ratio
 - Tritium mass

3.5 Site Acceptance Tests

Following tests will be carried out by the purchaser at the purchaser site. Final acceptances will be given only after successfully completion of these tests.

- a. All components shall be checked for dimensions of target holder assembly.
- b. All parts of target holder assembly shall be assembled (dummy assembly) to make a check for mechanical Integrity, dimensional requirements etc.
- c. Vacuum test for 2×10^{-3} mbar or better.
- d. Water leak test: - in the assembled unit for the parts shown in drawing sheet (Annex-1)
- e. Vacuum leak test: -Helium leak ($\leq 5 \times 10^{-8}$ mbar l/s)

4 Responsibility Matrix between Purchaser and Supplier (Optional)

Sr. No.	Activity	Responsibility Owner
1.	Preparation of Manufacturing Drawing	Supplier

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2.	Review and Approval of Manufacturing Drawing	Purchaser
3.	Getting necessary approvals for procurement of Tritium Target	Purchaser
4.	Procurement of Target	Supplier
5.	Procurement/ Manufacturing of subsystems/ components	Supplier
6.	Manufacturing of Target Holder Assembly	Supplier
7.	Factory Acceptance Test	Supplier
8.	Submission of Test Report	Supplier
9.	Review and Approval of test Report	Purchaser
10.	Dispatch Clearance	Purchaser
11.	Packing	Supplier
12.	Dispatch and Delivery	Supplier
13.	Site Acceptance Test	Purchaser

5 Technical Specifications

Following are the technical specifications of standard components:

Table 2: Technical specification of Tritiated Target (Tritium Target)

Sr. No.	Particulars	Specification
1.	Target Type	Disk Target
2.	Disk Dimension	Diameter: 45mm \pm 5 mm Thickness: 1 mm \pm 0.1 mm
3.	Disk Material	Copper OFHC (Oxygen free high conductive Copper)
4.	Titanium Layer	Diameter: 35 mm \pm 2mm Active area: \approx 9.6 cm ² Thickness: 2250 μ g/cm ² \pm 10%
5.	Tritium Loading Ratio: T/Ti	\geq 1.5
6.	Tritium Content	20 Ci (0.74 TBq) \pm 10%
7.	Purity	> 99%

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8.	Quantity	2 Nos.
9.	Each target should be delivered with an inspection sheet giving the individual characteristics (mass of the titanium, amount of tritium and T/Ti ratio.	
10.	Packing and Transport: Each target should be packed in an individual metallic vessel, under vacuum. The vessel should be easily openable. Tool for opening the vessel should be provided.	
11.	All the target should be wrapped individually and shipped vacuum tight vessel Tool for the opening the tight vessel should be provided with the targets.	

Table 3: Technical specification of Pneumatic 100 CF gate valve

Sr. No.	Particulars	Specification
1.	Pressure	Min: 1.33×10^{-8} mbar Max: 10^{13} mbar
2.	Helium Leak Rate	$\leq 5.00 \times 10^{-8}$ mbarl/s
3.	Shaft Seal Type	Bellows Sealed
4.	Cycle Life	$\geq 100,000$
5.	Actuator Type	Pneumatic Double Acting
6.	Max Differential Pressure Before Open	35 mbar
7.	Valve Body Material	Stainless Steel
8.	Flange	DN100CF

Table 4: Technical specification of 100 CF Vacuum ceramic break

Sr. No.	Particulars	Specification
1.	Isolation/insulation voltage	≥ 10 kV
2.	Flange	DN100CF
3.	Vacuum	Up to 8×10^{-7} mbar
4.	Thermal range	10 to 200° C (or better)
5.	Insulator material	Alumina
6.	Inner Diameter of the break	≥ 80 mm

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Table 5: Technical specification of 40 KF Vacuum ceramic break

Sr. No.	Particulars	Specification
1.	Isolation/insulation voltage	≥ 5 kV
2.	Flange	DN 40KF
3.	Vacuum compatible	Up to 8×10^{-7} mbar
4.	Thermal range	10 to 200 ⁰ C (or better)
5.	Insulator material	Alumina
6.	Inner Diameter of the break	≥ 30 mm

Table 6: Technical Specifications Oil Free Scroll Vacuum Pump

Sr. No.	Particular	Specifications
1.	Type of vacuum pump	Oil free scroll pump
2.	Pumping speed	> 14 m ³ /h
3.	Attainable ultimate pressure without gas ballast	≤ 0.01 mbar
4.	Leak rate	$< 5 \times 10^{-6}$ mbarl/sec
5.	Maximum inlet pressure	1100 m bar
6.	Maximum inlet pressure continuous	200 m bar
7.	Emission sound pressure	≤ 55 dB (A) (at Average weighted frequency)
8.	Ambient Temperature	10 ⁰ C to 40 ⁰ C
9.	Inlet flange	DN 25 ISO-KF or DN 40 ISO-KF
10.	Exhaust flange	DN 25 ISO-KF or DN 16 ISO-KF
11.	Cooling	Air cooling
12.	Weight	< 30 Kg
13.	Dimension	$\leq 450 \times 350 \times 330$ mm
14.	Power supply	$230 \pm 10\%$ VAC, 50Hz $\pm 5\%$
15.	Warranty	Pump shall be warranted for a period of minimum 1 year from the date of Site Acceptance.
16.	Documents (in English)	Operating manuals
17.	Standard accessories	Mains cables etc. $230 \pm 10\%$, 50Hz $\pm 5\%$

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Table 7: Technical specification of ZnS window

Sr. No.	Particulars	Specification
1.	Diameter	50 mm \pm 0.1mm
2.	Thickness	5 mm \pm 0.1mm
3.	Material	ZnS
4.	Wavelength range	1650 – 3000 nm
5.	density	5.27 g/cm ³

Table 8: Technical specification of IR camera

Sr. No.	Particulars	Specification
1.	Optical Resolution	320 pixel X 240 pixel or better
2.	Focal Length	50mm
3.	Temperature range	10 °C to 500 °C or better
4.	Temperature measurement accuracy	Maximum of either $\pm 2\%$ of reading in °C or 2 °C
5.	Measurement field /field of view	12°-7.5° X 8.9°-5.6°
6.	I/O ports	For connecting the camera to a computer e.g. RS485/RS 232/Ethernet
7.	Compatible software	Window 11 or later based software 1.stream and capture thermal video and thermal image 2. Display temperature 3. Temperature data export to text/MS Excel.
8.	Standard accessories	Mains cables/ DC power supply (if required) I/O cables etc. 230 \pm 10% V, 50Hz \pm 5%

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Table 9: Technical Specifications 40KF Vacuum flexible hose


Sr. No.	Particulars	Specification
1.	length	1000 cm
2.	Material	Stainless steel 304/316
3.	Ends	40 KF flange
4.	features	Formed bellow, highly flexible and unbraided
5.	Thermal range	10 ⁰ C to 150 ⁰ C

6 Document deliverables:

- a) Fabrication drawing along with details (eg. Make, model and quantity) of the bought-out parts (ref. Table 1) within 30 days from the date of release of Purchase Order. (Section 4.1 and 11)
- b) Test report of FAT should be submitted before shipment. (Section 4.4)

7 Input drawings / documents:

Attached as Annexure-1

	ITER-India
	Indent document for item name

Technical Compliance Format

The supplier must fill, sign, and stamp the below table as part of compliance to the requirements. If the item under procurement is a COTS product the following clause may be added.

As an evidence of offered specifications the supplier shall submit appropriate documentary evidences such as product data sheets, catalogues, manuals etc. Simply specifying Comply / Yes etc. without proper verifiable evidences may not be considered.

Specifications for item name from ITER-India		Offered specification (to be filled by the supplier)	Remark (to be filled by the Supplier)
Specification	Values		
Fabrication	fabrication as per drawing and technical specification		
Documents to be provided	(a) Fabrication drawing within 30 days from the date of release of Purchase Order. (Section 4.1 of the technical specification and section 11) (b) Test report of FAT should be submitted		

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	before shipment. (Section 4.4 of the technical specification)		
Procurement of material	According to section 4.2 of technical specification		
Ultrasonic cleaning	Of all fabricated part section 4.3 point(n) of technical specification		
Surface finish	All the surfaces of the fabricated components should have 3 ∇ surface finishes after machining.		
Electro polishing	all the internal and external surfaces of the SS parts		
welding	All SS parts shall be TIG welded and shall be carried in Argon gas environment.		

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Brazing of copper pipes	According to Section 4.3 point (j) and (k) of technical specification.		
Assembly	According to Section 4.3 point (q) of technical specification.		
Factory Acceptance test (at vendor site)	According to section 4.4 of technical specification.		
Dispatch Clearance	After submission of Factory Acceptance test report and approval from purchaser.		
Handling, Packing, Transport and unloading	According to point 4.6 of technical specification.		
Acceptance test (at Purchaser's site)	According to point 4.7 of technical specification.		
Final acceptance	Only after successful completion of Site Acceptance test		

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Warranty	Warranty for the performance of the full system for twelve months from the date of final acceptance.		
Delivery Schedule	According to point 6 of technical specification.		
Delivery	280 Days from the date of purchase order		

Technical Compliance of Tritiated Target (Tritium Target)

Specifications for item name from ITER-India		Offered specification (to be filled by the supplier)	Remark (to be filled by the Supplier)
Specification	Values		
Target Type	Disk Target		
Disk Dimension	Diameter: 45mm \pm 5 mm Thickness: 1 mm \pm 0.1 mm		
Disk Material	Copper OFHC (Oxygen free high conductive Copper)		
Titanium Layer	Diameter: 35 mm \pm 2mm Active area: \approx 9.6 cm ²		

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	Thickness: 2250 $\mu\text{g}/\text{cm}^2 \pm 10\%$		
Tritium Loading Ratio: T/Ti	≥ 1.5		
Tritium Content	20 Ci (0.74 TBq) $\pm 10\%$		
Purity	$> 99\%$		
Quantity	2 Nos.		
Each target should be delivered with an inspection sheet giving the individual characteristics (mass of the titanium, amount of tritium and T/Ti ratio.			
Packing and Transport: Each target should be packed in an individual metallic vessel, under vacuum. The vessel should be easily openable. Tool for opening the vessel should be provided.			

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Technical Compliance of Pneumatic 100 CF gate valve

Specifications for item name from ITER-India		Offered specification (to be filled by the supplier)	Remark (to be filled by the Supplier)
Specification	Values		
Pressure	Min: 1.33×10^{-8} mbar Max: 1013 mbar		
Helium Leak Rate	$\leq 5.00 \times 10^{-8}$ mbarl/s		
Shaft Seal Type	Bellows Sealed		
Cycle Life	$\geq 100,000$		
Actuator Type	Pneumatic Double Acting		
Max Differential Pressure Before Open	35 mbar		
Valve Body Material	Stainless Steel		
Flange	DN100CF		
Quantity	1 Nos.		

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Technical Compliance of 100 CF Vacuum ceramic break

Specifications for item name from ITER-India		Offered specification (to be filled by the supplier)	Remark (to be filled by the Supplier)
Specification	Values		
Isolation/insulation voltage	≥ 10 kV		
Flange	DN100CF		
Vacuum	Up to 8×10^{-7} mbar		
Thermal range	10 to 200 ⁰ C (or better)		
Insulator material	Alumina		
Inner Diameter of the break	≥ 80 mm		
Quantity	1 Nos.		

Technical Compliance of 40 KF Vacuum ceramic break

Specifications for item name from ITER-India		Offered specification (to be filled by the supplier)	Remark (to be filled by the Supplier)
Specification	Values		
Isolation/insulation voltage	≥ 5 kV		

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Flange	DN 40KF		
Vacuum compatible	Up to 8×10^{-7} mbar		
Thermal range	10 to 200 ⁰ C (or better)		
Insulator material	Alumina		
Inner Diameter of the break	≥ 30 mm		
Quantity	2 Nos.		

Technical Compliances Oil Free Scroll Vacuum Pump

Specifications for item name from ITER-India		Offered specification (to be filled by the supplier)	Remark (to be filled by the Supplier)
Specification	Values		
Type of vacuum pump	Oil free scroll pump		
Pumping speed	$> 14 \text{ m}^3/\text{h}$		
Attainable ultimate pressure without gas ballast	≤ 0.01 mbar		

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Leak rate	$< 5 \times 10^{-6}$ mbarl/sec		
Maximum inlet pressure	1100 mbar		
Maximum inlet pressure continuous	200 mbar		
Emission sound pressure	≤ 55 dB (A) (at Average weighted frequency)		
Ambient Temperature	10 °C to 40 °C		
Inlet flange	DN 25 ISO-KF or DN 40 ISO-KF		
Exhaust flange	DN 25 ISO-KF or DN 16 ISO-KF		
Cooling	Air cooling		
Weight	<30 Kg		
Dimension	$\leq 450 \times 350 \times 330$ mm		
Power supply	230 \pm 10% VAC, 50Hz \pm 5%		

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Warranty	Pump shall be warranted for a period of minimum 1 year from the date of Site Acceptance.		
Documents (in English)	Operating manuals		
Standard accessories	Mains cables etc. 230 ± 10% VAC, 50Hz±5%		
Quantity	1 Nos.		

Technical Compliance of ZnS window

Specifications for item name from ITER-India		Offered specification (to be filled by the supplier)	Remark (to be filled by the Supplier)
Specification	Values		
Diameter	50 mm ± 0.1mm		
Thickness	5 mm ± 0.1mm		
Material	ZnS		
Wavelength range	1650 – 3000 nm		
density	5.27 g/cm ³		
Quantity	1 Nos.		

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Technical Compliance of IR camera

Specifications for item name from ITER-India		Offered specification (to be filled by the supplier)	Remark (to be filled by the Supplier)
Specification	Values		
Optical Resolution	320 pixel X 240 pixel or better		
Focal Length	50 mm		
Temperature range	10 °C to 500 °C or better		
Temperature measurement accuracy	Maximum of either $\pm 2\%$ of reading in °C or 2 °C		
Measurement field /field of view	12°-7.5° X 8.9°-5.6°		
I/O ports	For connecting the camera to a computer e.g. RS485/ RS 232/ Ethernet		
Compatible software	Window 11 or later based software 1.stream and capture thermal video and thermal image		

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	2. Display temperature 3. Temperature data export to text/MS Excel.		
Standard accessories	Mains cables/ DC power supply (if required) I/O cables etc.		
Quantity	1 Nos.		

Technical Compliances 40KF Vacuum flexible hose

Specifications for item name from ITER-India		Offered specification (to be filled by the supplier)	Remark (to be filled by the Supplier)
Specification	Values		
length	1000 cm		
Material	Stainless steel 304/316		
Ends	40 KF flange		
features	Formed bellow, highly flexible and unbraided		
Thermal range	10 ⁰ C to 150 ⁰ C		
Quantity	1 Nos.		