



ITER-India
(Institute For Plasma Research)



Title	Tender No. I-I/ET-TPT/GTE/23007/23-24 dated 12-01-2024 for Supply of Soft X-ray calibration source
Sub Title	PART-A (II): Scope of Supply, work and technical specifications


ITER-India, Institute for Plasma Research

Block A, Sangath Skyz, Bhat-Motera Road, Koteswar,

Ahmedabad 380005, Gujarat, India


<http://www.iterindia.in>



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Background


This is a proposal for procuring soft X-ray light source which is to be used at ITER-India, IPR, India. This document describes the complete technical and application details to the manufacturers or suppliers. This is to enable the vendors to quote all relevant products with complete details, complying ITER-India requirements

I. Application details

Institute for Plasma Research is a premiere research institute pursuing research on plasma science and technology in India. ITER-India is an Indian domestic agency (IN-DA, a center of IPR, carries out research and development to deliver the in-kind components/systems to the International Thermonuclear Experimental Reactor (ITER). As a part of IN-DA deliverable, ITER-India needs design, develop and deliver a broad band X-Ray crystal spectrometer (XRCS) and a high-resolution X-Ray Crystal Spectrometer to ITER. These spectrometers will be used to monitor impurities, measure impurity concentration and ion temperature of the ITER plasma, respectively.


These XRCS spectrometers have set of crystals and detector assemblies and operated in high vacuum. The radiations emitted from ITER-Plasma are dispersed using set of crystals and detected on a large area photon counting detectors. For the XRCS-Survey, the measurable energy range is 124eV-13keV and the XRCS-Edge, the measurable energy is ~ 3 – 6keV.

The integrated intensity of X-Ray characteristic line emission will be measured and postprocess to determine the plasma and impurity parameters required to fulfil measurement goals of this diagnostics. Therefore, an absolute calibration both (intensity and wavelength) is required to be carried out for both the spectrometer in the soft X-ray range to test their performances. The proposed soft X-ray calibration source is intended to be used in the prototype developmental activities carried out at ITER-India laboratory.

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II. Scope of Supply

S. No	Item Name	Unit	Quantity
1.	X-ray source system as per the detailed specifications	Set	01
2.	Standard accessories (refer Section-II (G-18 as per above table)	Set	01
3.	Additional accessories, if any.	Set	Please provide the details of all included accessories required to meet the functional specification and scope.

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III. Technical specifications Soft X-ray source


ITER-India intends to procure one integrated X-ray source system comprising of source head, source power supply, source electronics and controller and other required accessories. The required technical specifications are given below.

Sr. No.	Parameter	Unit	ITER-India specification
A. Source Emission			
1.	Source Type	-	Accelerated electrons from filament impinging on solid metal targets of different Z, selectable
2.	Energy Range	-	Characteristics line emission in energy range from 100 eV to 10.00keV band
3.	Power output	W	0.25 and up to 30 watts max, continuous operation
B. Source head			
4.	Vacuum chamber		<ul style="list-style-type: none"> - Stainless steel (such as 304, 316) - multiple anode selectable in-vacuum - Two output ports of DN40CF: one for X-ray out and other for monitoring
5.	Operating Pressure	Torr	10 ⁻⁵ or better
C. Electron Beam			
6.	Beam Current (tube current)	mA	0.1 to ≥ 3, variable
7.	Beam Energy (Maximum anode potential)	kV	≥ 10, variable
D. Target/Anode			
8.	Anode Assembly, Anodes on single assembly	-	Multiple anode selectable in vacuum 6 or more.
9.	Target element purity		All elements should be pure ≥ 99 %
10.	Target elements list	Abbreviation, Name	Al, Aluminum Si, Silicon Fe, Iron Mn, Manganese Ni, Nickel Ti, Titanium Au, Gold Mg, Magnesium Mo, Molybdenum B, Boron Y, Yttrium,

			Ru, Ruthenium Rh, Rhodium Sc, Scandium Zr, Zirconium
11.	Target shape, size	mm	Circular or other, ~ 4±1 nominal diameter
12.	Target quantity	#	2 of each
E. Filter wheel			
13.	Operation	-	In-vacuum, motorized/manual for selection filter
14.	Filter shape, size	mm	Circular, specify diameter
F. Power supply and controller			
15.	HV power supply	-	Including voltage and current set point and monitor supplied along with the source
16.	Filament power supply	-	To be supplied along with the source.
17.	Cables and connectors	-	All cables and connectors to be supplied for operation
G. Accessories			
18.	Standard accessories	-	All standard accessories required for the operation of the source including mounting hardware, vacuum feedthrough, electrical feedthrough, DN40CF gate valve and cables should be provided
19.	Additional accessories supplied, if any required to meet the system functionality and specified scope		Details to be provided by supplier. In case if an x-ray detector is proposed to be specifically procured to meet the requirement of pre-dispatch tests at factory and the costs are included in the bid then the same shall be included as a part of supply under additional accessories

Additional requirements:

- Power supply compatible to 230 V AC, 50 Hz power
- Operation manuals
- One-year warranty

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IV. A) Acceptance test criterion

The final acceptance of the integrated Source system will be given after the following two tests:


1. Pre-dispatch test at factory site by the vendor (ITER-India reserves the right to carryout Pre-dispatch Inspection (PDI) of the ordered item/s by ITER-India personnel at factory site)
2. Final acceptance test at ITER-India.

Part I: Pre-dispatch tests/Factory acceptance tests

1. Before dispatching the Source system, the supplier needs to send a complete test report (details of the tests are attached in Appendix-1) for Purchaser's review and approval.
2. ITER-India reserves the option to be present at supplier site during testing and inspection of Soft X-ray source.

Part II: Acceptance tests at ITER-India laboratory/Site acceptance tests

At ITER-India lab, installation, testing and demonstration of system's performance has to be carried out either physically or remotely by the principal or by their Indian representative. After successful commissioning at ITER-India, a final acceptance will be given only when it complies with all the technical specifications.

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Appendix-1


Proposed Acceptance tests

Tests to be carried out for confirming the following functionalities of the X-ray source and test results (wherever applicable) need to be supplied before pre-dispatch. These tests carried out before dispatch also needs to be demonstrated during commissioning of the source at ITER-India site.

Acceptance test report/certificate containing the following information:

1. Source function for continuous operation (burn-in test)
2. *Vacuum test for complying leak tightness $< 1 \times 10^{-9}$ Pa m³/s.
3. The source must be shown to be producing X-rays from targets mentioned in (parameters #10) at maximum power within (safety margin) using an energy dispersive detector (Silicon drift detector or equivalent detector). The test report along with measured data file from SDD shall be supplied for shipment clearance.

** " Other than the deliverable items, any specific test and measurement equipment that are necessary to perform the Site Acceptance Tests at ITER-India site (such as Helium Leak Detector etc.), shall be arranged by ITER-India"*

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Appendix-2

Technical Compliance Matrix

Sr. No.	Parameter	Unit	ITER-India specification	Offered Specifications by Bidder	Compliance Yes/No
A. Source Emission					
1.	Source Type	-	Accelerated electrons from filament impinging on solid metal targets of different Z, selectable	To be filled by Bidder	To be filled by Bidder
2.	Energy Range	-	Characteristics line emission in energy range from 100 eV to 10.00keV band	To be filled by Bidder	To be filled by Bidder
3.	Power output	W	0.25 and up to 30 watts max, continuous operation	To be filled by Bidder	To be filled by Bidder
B. Source head					
4.	Vacuum chamber		<ul style="list-style-type: none"> - Stainless steel (such as 304, 316) - multiple anode selectable in-vacuum - Two output ports of DN40CF: one for X-ray out and other for monitoring 	To be filled by Bidder	To be filled by Bidder
5.	Operating Pressure	Torr	10 ⁻⁵ or better	To be filled by Bidder	To be filled by Bidder
C. Electron Beam					
6.	Beam Current (tube current)	mA	0.1 to ≥ 3, variable	To be filled by Bidder	To be filled by Bidder
7.	Beam Energy (Maximum anode potential)	kV	≥ 10, variable	To be filled by Bidder	To be filled by Bidder
D. Target/Anode					



8.	Anode Assembly, Anodes on single assembly	-	Multiple anode selectable in vacuum 6 or more.	To be filled by Bidder	To be filled by Bidder
9.	Target element purity		All elements should be pure $\geq 99\%$	To be filled by Bidder	To be filled by Bidder
10.	Target elements list	Abbreviation, Name	Al, Aluminum Si, Silicon Fe, Iron Mn, Manganese Ni, Nickel Ti, Titanium Au, Gold Mg, Magnesium Mo, Molybdenum B, Boron Y, Yttrium, Ru, Ruthenium Rh, Rhodium Sc, Scandium Zr, Zirconium	To be filled by Bidder	To be filled by Bidder
11.	Target shape, size	mm	Circular or other, $\sim 4 \pm 1$ nominal diameter	To be filled by Bidder	To be filled by Bidder
12.	Target quantity	#	2 of each	To be filled by Bidder	To be filled by Bidder
E. Filter wheel					
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14.	Filter shape, size	mm	Circular, specify diameter	To be filled by Bidder	To be filled by Bidder
F. Power supply and controller					
15.	HV power supply	-	Including voltage and current set point and monitor supplied along with the source	To be filled by Bidder	To be filled by Bidder
16.	Filament power supply	-	To be supplied along with the source.	To be filled by Bidder	To be filled by Bidder
17.	Cables and connectors	-	All cables and connectors to be supplied for operation	To be filled by Bidder	To be filled by Bidder



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18.	Standard accessories	-	All standard accessories required for the operation of the source including mounting hardware, vacuum feedthrough, electrical feedthrough, DN40CF gate valve and cables should be provided	To be filled by Bidder	To be filled by Bidder
19.	Additional accessories supplied, if any required to meet the system functionality and specified scope		Details to be provided by supplier. In case if an x-ray detector is proposed to be specifically procured to meet the requirement of pre-dispatch tests at factory and the costs are included in the bid then the same shall be included as a part of supply under additional accessories		

Bidder Signature

Name of the signatory & Title

Name

Title

Bidder's Official seal

Place & Date

Place

DD-MM-YYYY