

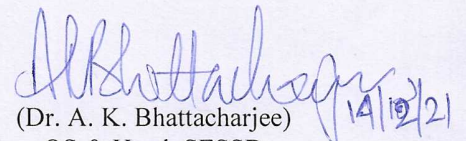
**Government of India  
Bhabha Atomic Research Centre  
Security Electronics & Software Systems Division**

Ref: BARC/SESSD/AKB/2021/ I/8963/2021

Date: 15/12/21

Sub: Invitation of Quotation for "Fabrication, Supply and warranty of Secondary Electron Detectors as per annexures"

1. Quotations are invited for supply of **10 sets** of deliverables against the aforementioned minor fabrication work order, as per specifications enclosed.
2. Supplier shall quote for the entire work involved in this fabrication including raw materials.
3. Taxes/GST/IGST/other charges shall be quoted separately.
4. **Technical and Commercial parts of the offer have to be furnished separately in the offer. Technical Evaluation Proforma enclosed as Annexure-IV shall be considered for technical evaluation of the bid. Offer must accompany duly filled Technical Evaluation Proforma, failing which the offer will be rendered technically unsuitable and rejected.**
5. The quotation must reach Head, SESSD by 31/12/21, **1830 Hrs** and must be sent in sealed envelope super scribed with the reference number & the due date given above. The quotations must be sent through Indian Postal Service only. Quotations received through any other means shall be rejected outright. The sealed quotation envelope shall contain Technical and Commercial parts of the offer in two separate sealed envelopes, differentiated clearly by the terms "TECHNICAL" and "COMMERCIAL" super-scribed on the respective envelopes.
6. The address on the envelope should read:  
Head,  
Security Electronics & Software Systems Division,  
BARC, Trombay,  
Mumbai – 400085.  
(Kind Attn: Shri S. S. Pany, SO/E)
7. For clarifications, if any, in respect of the job, the indenter may be contacted through email id [sspany@barc.gov.in](mailto:sspany@barc.gov.in), [sskrish@barc.gov.in](mailto:sskrish@barc.gov.in) or through telephone no. 022-25594435/4899/4826.
8. Final delivery shall be made at SESSD Office, 3rd floor, E&SC Building, BARC, Trombay, Mumbai – 400085, within **5 months** of issue of final work-order.
9. The undersigned reserves the right to accept or reject any or all quotations without assigning any reason.
10. Delivery charges, if any, must be clearly mentioned in the offer.
11. Supplier should be registered under Goods & Services Tax (GST) – Center, State and Inter-State and GST as applicable as per the extent order on the work shall be paid by the bidder to the concerned tax authorities. The Commercial part of offer should include the supplier's GSTIN and PAN number. The offer should clearly be indicative of GST as per applicable rate and shall be payable by the bidder and BARC will not entertain any claim whatsoever in this respect. However, component of GST at the time of supply of service (as provided in CGST Act, 2017) provided by the supplier shall be varied if different from that applicable on the last date of receipt of tender including extension, if any.
12. Supplier is required to comply with ITR requirements stipulated as per Section 206AB of Income Tax Act, 1961.
13. Transport charges shall be restricted to 3% or else original proof payment of the entire charge shall be furnished.
14. Any delay which is attributable to the contractor is liable for imposition of penalty @ 0.5% per week (max 10%) on the contractor.
15. Income Tax @ 2% will be deducted from total bill amount.

  
(Dr. A. K. Bhattacharjee) 14/12/21  
OS & Head, SESSD

**ए के भट्टाचारजी / A. K. Bhattacharjee**  
अध्यक्ष, एसईएसएसडी / Head, SESSD  
भापअ केंद्र, मुंबई / BARC, Mumbai

Enclosure: Annexure-I to IV

## Annexure-I

### Specifications for Secondary Electron detector

#### 1. Gist:

The job concerns fabrication, inspection, testing and supply of **10 sets** of Secondary Electron Detector assembly (hereinafter referred to as the “detector”), intended for use with Scanning Electron Microscope (SEM). The deliverables include mechanical assembly of the detector along with clear fused Quartz optical light guide, Photomultiplier (PMT) with appropriate resistive divider assembly & magnetic field shielding, and HV high vacuum feedthroughs, cables and accessories for the detector assembly. The individual components shall be delivered to the users which shall be integrated separately at the users’ lab after testing and technical qualification of the deliverables.

#### 2. General description of job:

The detector is used in SEM for imaging topography and elemental contrast of specimen under investigation. The assembly primarily consists of an inorganic scintillator coupled to clear fused Quartz light guide which couples the optical signals generated during scintillator-electron interaction, with PMT, which amplifies the optical signal thus obtained and converts into electrical signal which is further processed and compiled into SEM micrograph. HV feedthroughs in the detector are used for supply of scintillator and electron attractor voltage supply for the detector. The detector assembly is intended for use in very high-vacuum conditions i.e. in pressure of the order of  $10^{-6}$  Torr.

*NB: Special attention be paid to all points highlighted in bold and underlined.*

#### 3. Scope of work:

Design detailing, high precision fabrication, metrology, testing and supply of detector components, clear fused Quartz light guide, PMT with resistive dividers, HV feedthroughs and cables.

#### 4. Mechanical fabrication process considerations:

- a) A general assembly diagram of the detector has been shown in annexure-II. **Detailed fabrication drawings of the detector components shall be shared with prospective fabricators, upon receipt of request for the same, accompanied by a signed copy of the “Confidentiality Clause” (ref: annexure-III), conveying their adherence to it. Request for detailed fabrication drawings should be made to the email ID: [sspany@barc.gov.in](mailto:sspany@barc.gov.in) and [sskrish@barc.gov.in](mailto:sskrish@barc.gov.in).**
- b) Unless otherwise specified, general dimensional tolerances should adhere to IS: 2102 (fine) standards.



- c) Unless otherwise specified, all internal sharp corners are to be rounded with  $R=0.4$  and external sharp corners are to be chamfered by  $0.4 \times 45^\circ$
- d) All components in the assembly are intended to be used under very high vacuum conditions. Fabricator should have thorough experience in fabrication and handling of components intended for use under very high vacuum conditions.
- e) Surface roughness of the components should be better than 3.2 micron (Roughness Grade number: N8).
- f) Unless otherwise specified, metric standards are to be adopted for threads and tapings.
- g) The fabricator should be agreeable to accommodate minor changes in the design if felt necessary by the indenter with mutual agreement before fabrication.
- h) **Selection of material and fabrication process optimization should be adopted during fabrication of the detector components to ensure that the finished components are devoid of any remnant magnetic field. All fabricated components shall be subjected to magnetic field measurement at users' lab. Components with magnetic field in excess of 0.1 Gauss shall not be accepted.**

#### 5. Specifications for PMT and resistive divider

General Specifications		
1.	Spectral response	300 – 650 nm
2.	Wavelength of maximum response	Within 370-420 nm
3.	Photocathode material	Bialkali
4.	Minimum effective area	25 mm dia.
5.	Number of gain stages	11
6.	Outer dia.	$28.5 \pm 0.5$ mm
7.	Overall Length	$112 \pm 2$ mm
8.	Magnetic field shield material	Mu-metal or Permalloy
Functional characteristics		
9.	Min. Cathode sensitivity	60 $\mu$ A/lm
10.	Min. Anode sensitivity	50 A/lm
11.	Peak quantum efficiency	20% or higher for maximum response wavelength
12.	Peak cathode radiant sensitivity	90% or higher for maximum response wavelength
13.	Typical Anode dark current (after 30 min storage in darkness)	2 nA or better at room temperature
14.	Max. Anode dark current (after 30 min storage in darkness)	10 nA at room temperature
15.	Typical electron transit time	30 ns
Electrical characteristics		
16.	Max. supply voltage b/w Anode & Cathode	1500 Vdc
17.	Max. average Anode current	100 $\mu$ A
18.	Max. Supply voltage	1500 V

19.	Max. divider current	350 $\mu$ A
20.	Leakage current	< 0.1 nA
21.	Max. linear output in DC mode	< 20 $\mu$ A at max. supply voltage

## 6. Specifications for HV feedthroughs

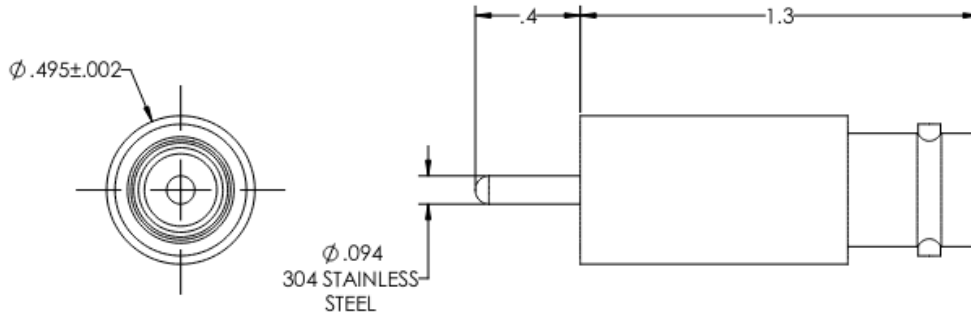


Figure 1: Schematic of MHV-5kV Attractor voltage supply feedthrough

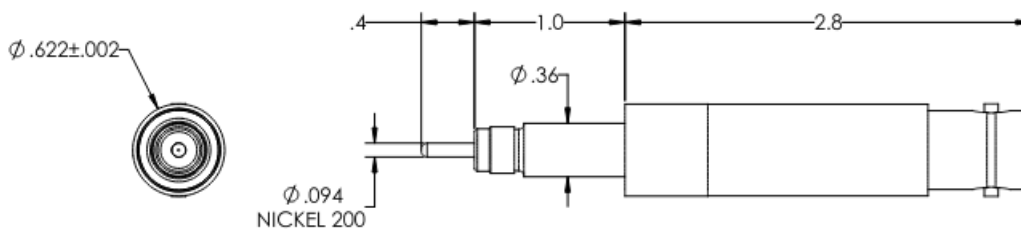


Figure 2: Schematic of SHV-20kV scintillator voltage supply feedthrough

- All dimensions in the schematic are in inches.
- Figures are for representation purpose only.
- Minor deviation in actual dimension of the feedthroughs is acceptable yet, shall be deemed to be approved only after consultation with the users.

### **d. Respective Air-side plugs must also be supplied for the feedthroughs**

Specifications for SHV-20kV feedthrough		
SI. No.	Parameter	Value
1.	Housing material	SS 304
2.	Pin material	Nickel
3.	Insulation	Alumina Ceramic
4.	Max. voltage rating	20kV DC
5.	Max. current rating	10 mA
Specifications for BNC feedthrough		
1.	Housing material	SS 304
2.	Pin material	SS 304
3.	Insulation	Alumina Ceramic



4.	Max. voltage rating	5kV DC
5.	Max. current rating	10 mA

***Feedthrough welding Considerations:***

**a. Fabricator must strictly adhere to the welding specifications and instructions prescribed by feedthrough OEM.**

b. The components are intended for use under very high vacuum conditions, proper procedures should be adopted for welding of the feedthroughs.

c. All the welds should be made on vacuum side of the flange to prevent possibilities of virtual leaks from small spaces or gaps where the components mate.

d. In regards with dimensions of weld-lip on port and feedthrough welding procedures, supplier shall strictly adhere to the directions of feedthrough manufacturers.

**7. HV Cable:**

<b>Specifications for Coaxial shielded HV cable</b>		
<b>Sl. No.</b>	<b>Parameter</b>	<b>Value</b>
1.	DC Rated Voltage	20 kV
2.	DC Rated Current	1 mA
3.	Inner Conductor	Tinned copper
4.	Dielectric material	Ethylene Propylene Rubber
5.	Braiding	Single braided copper
6.	Jacket material	Polyolefin (flame-retardant)
7.	Max. overall cable diameter	6.5 mm

**8. List of deliverables**

<b>Sl. No.</b>	<b>Item description</b>	<b>Total quantity</b>
1.	Detector Mechanical components, including SS Alan bolts and O-rings for mechanical assembly, as per BOM	10 sets
2.	PMT, with appropriate HV divider and Magnetic field shielding	10 sets
3.	Quartz light-guide	10 nos.
4.	SHV-20kv weldable VHV feedthrough, with air-side connector	10 nos.
5.	SHV-5kv weldable VHV feedthrough, with air-side connector	10 nos.
6.	20 kV Shielded coaxial HV cable	200 m
7.	20 kV HV heat-shrinkable sleeve 16/6	30 m
8.	SYLGUARD 170 2-part Silicone Elastomer	1 L

**9. Packaging**

a. The items being delicate and intended for use in high precision instrumentation under high vacuum, the mechanical assembly is needed to be packaged with utmost care and attention to prevent dust contamination, mechanical deformation, abrasion or rupture during transportation and normal handling.

b. **Due consideration need to be taken while packaging to ensure that the items should not have grease and other machining lubricants present on the surface during packaging of the same.**

c. **All the mechanical components must be degreased and thoroughly cleaned using warm water and detergent, followed by cleaning using Iso-propyl alcohol or Acetone. The cleaned components should then be dried using clean cloths and dry air-dryer and seal packed in clean, air-tight polyethylene bags before dispatch.**

d. Items delivered damaged, either partially or fully, shall be rejected outright and supplier has to accordingly replace the damaged components.

## **10. Transportation**

Due consideration, suitable for high precision vacuum grade instruments, need to be taken for transportation of the deliverables.

## **11. Warranty**

The deliverables should have warranty against defective materials or workmanship for a period of not less than **one year** from the date of final receipt at purchaser's premises. In case of repair/replacement during warranty period, if equipment has to be sent to supplier's site, the freight charges shall be borne by vendor. Suitable warranty certificate indicating this should be provided.

## **12. Acceptance Criteria**

The deliverables shall be deemed acceptable subject to satisfactory adherence to the following points:

a) **Dimensions**: Adherence to dimensional specifications including tolerances and surface finishing specifications of fabricated components as per the respective fabrication drawings.

b) **Material and fabrication process**: Material and fabrication specifications of fabricated components must strictly adhere to that specified in the respective drawings. If deemed necessary, material qualification of the components shall be carried out at users' lab through X-ray Fluorescence or Energy Dispersive X-ray Spectroscopy. No fabricated components must have remnant magnetic field anywhere exceeding 100 mG. Qualification of the components shall be carried out by measurement of fabricated components using gauss-meter. Remnant field measurement shall be in the scope of the users.

c) PMT and resistive divider: Performance evaluation of PMTs with resistive divider shall include anode dark current measurement. Dark current levels for the PMTs should be within the prescribed limit of 2nA after 30 minutes of application of supply voltage. Qualification of PMTs and resistive dividers shall be in the scope of the users.

d) Quartz light-guide: Technical acceptance of the component shall be subject to adherence to dimensional and surface finish specifications prescribed in the fabrication drawing. Critical surfaces of the light-guide need to be cleared. Physical examination of the component shall be carried out to rule-out possibilities of aberrations either on the surface or bulk. If deemed necessary, spectral transmission test of the component shall also be carried out within the spectral range of the PMT. This test shall be in scope of the user.

e) Feed-throughs: SHV and BNC weldable feedthroughs should be from reputed manufacturers and QA certificate of original manufacturers should be furnished to the users if deemed necessary. Performance evaluation of feedthroughs shall be carried out through measurement of leakage currents using dielectric testers.

e) HV cable: For qualification of HV cable, a sample of length 3m shall be subjected to dielectric testing. DC voltage of rated value for cable shall be maintained across terminals of the test sample for 30 minutes. Steady-state leakage current during the test should not exceed 5 micro-Amperes. The sample cable will also be subjected to dielectric testing at 1.5 times of DC rated voltage for 5 minutes, during which steady-state leakage current should not exceed 8 micro-Amperes.

### **13. Technical evaluation of offer and supplier**

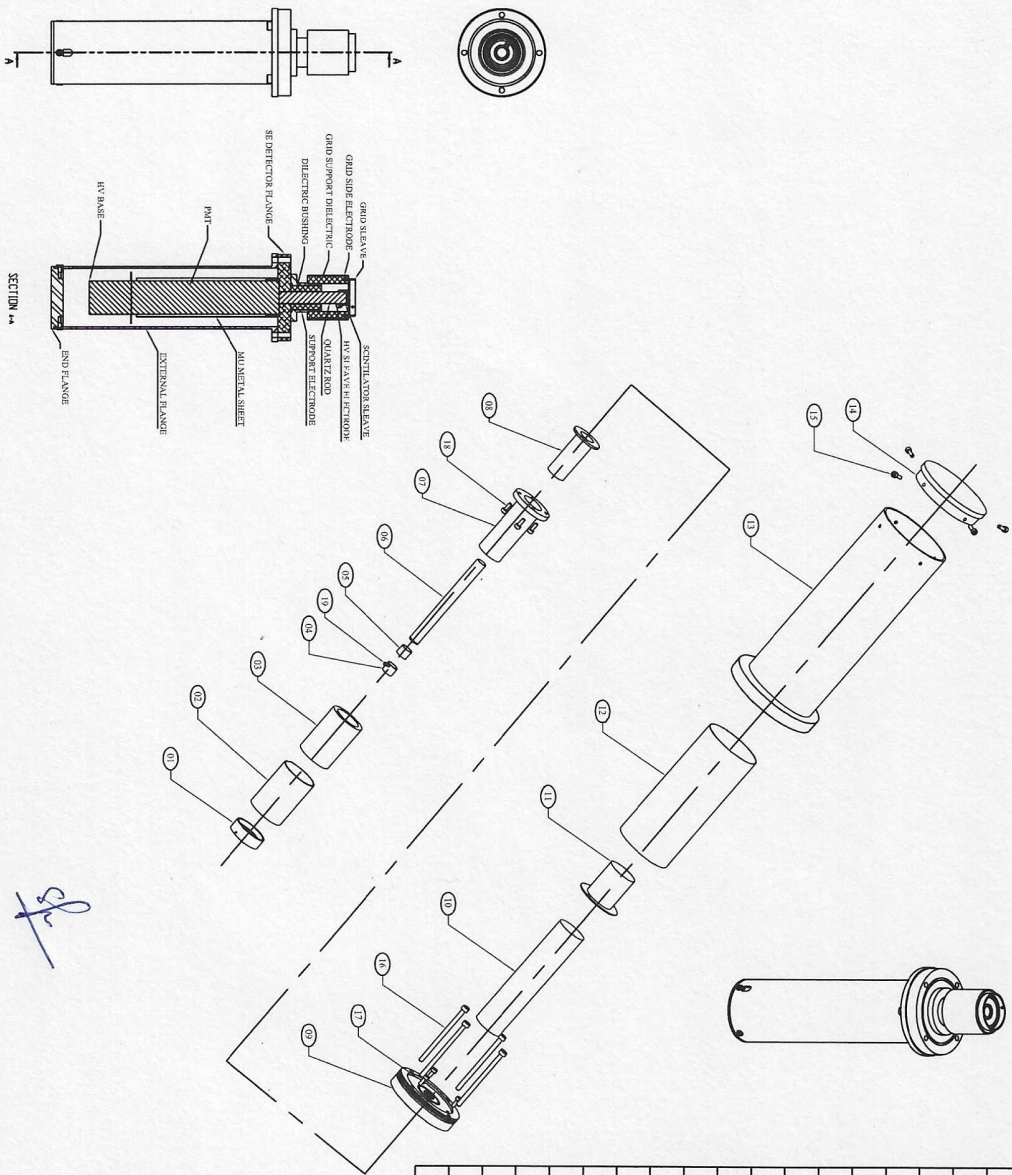
Technical Compliance Proforma is enclosed as annexure-IV for technical evaluation of offer and prospective vendor competence. **All offers must accompany duly filled Technical Compliance Proforma bearing signature and stamp of authorized signatory of the company, failing which the offer shall be considered technically unsuitable and rejected outright without.**

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# Annexure-II

IF IN DOUBT, ASK



ITEM NO.	PART NO.	DESCRIPTION	MATL.	QTY.	DRG. NO.	REMARKS
01		SE DETECTOR ASSEMBLY	-	01	100	-
01		GRID SLEAVE	ETP-Cu	01	101	-
02		GRID SIDE ELECTRODE	AL 6061	01	102	-
03		GRID SUPPORT DIELECTRIC	TEFLON	01	103	-
04		SCINTILLATOR SLEAVE	ETP-Cu	01	104	-
05		HV SLEAVE ELECTRODE	SS 304	01	105	-
06		QUARTZ ROD	QUARTZ	01	106	-
07		SUPPORT ELECTRODE-1	SS 304	01	107	-
08		DIELECTRIC BUSHING	TEFLON	01	108	-
09		SE DETECTOR FLANGE	SS 304	01	109	-
10		PMT	-	01	STD	-
11		HV BASE	-	01	STD	-
12		MU METAL SHEET	MU	01	STD	-
13		EXTERNAL FLANGE	SS 304	01	113	-
14		TOP FLANGE	SS 304	01	114	-
15		M3 CSR HEAD SCREW	SS	4	STD	10mm LONG
16		M4 SOCKET HEAD SCREW	SS	4	STD	12mm LONG
17		M3 SOCKET HEAD SCREW	SS	04	STD	10mm LONG
18		M3 SOCKET HEAD SCREW	SS	04	STD	8mm LONG
19		M2 SCREW	SS	01	STD	6mm LONG

GENERAL TOLERANCE UNLESS OTHERWISE SPECIFIED		PROJECT OR SECTION		TITLE	
LINEAR DIMENSIONS	LENGTH OF SHORTE	SEM		SE DETECTOR ASSEMBLY	
UP TO - 6	1 - 6 ± 0.15	DRN DATE		BHABHA ATOMIC RESEARCH CENTRE	
6 - 30	6 - 30 ± 0.20	DRN CHGD.		SECURITY ELECTRONICS & SOFTWARE SYSTEMS DIVISION	
30 - 120	30 - 120 ± 0.25	DES		SCALE: 1:3	
120 - 150	120 - 150 ± 0.3	APPD.		FRONT	
150 - 300	150 - 300 ± 0.4	4001 & ABOVE		D-SED-100	
300 - 600	300 - 600 ± 0.5	NO. LOC.		DRG. NO.	
600 - 1000	600 - 1000 ± 0.6	DESCRIPTION		REV.	
1000 - 2000	1000 - 2000 ± 0.8	REVISIONS		05	
2000 - 4000	2000 - 4000 ± 1.0	DRG. NOS.			
4000 & ABOVE	4000 & ABOVE ± 1.5				

**Annexure-III**  
**Confidentiality Clause**

1. No party shall disclose any information to third party concerning the matters under this contract generally. In particular, any information identified as "PROPRIETARY" in nature by the disclosing party shall be kept strictly confidential by the receiving party and shall not be disclosed to any third party without the prior written consent of the original disclosing party.
2. "RESTRICTED INFORMATION" categories under section 18 of the Atomic Energy Act, 1962 and "OFFICIAL SECRETS" under section 5 of the official Secrets Act, 1923: Any contravention of the above mentioned provisions by any contractor, sub-contractor, consultant, advisor or the employees of a contractor will invite penal consequences under the aforesaid legislation.
3. Prohibition against the use of BARC's name without permission for publicity purposes:-The contractor or sub-contractor, consultant, advisor or the employees engaged by the contractor shall not use BARC's name for Publicity purpose through any public media like press, radio, T.V. or internet without the prior written approval of BARC. (Vide circular ref: 2/Misc-9/Lgl/2001/92 dated April 30, 2001).

**Annexure-IV**  
**TECHNICAL COMPLIANCE PROFORMA**

Sl. No.	Requirements	Compliance by Offered product (YES / NO)	Remarks
	Previous experience in fabrication and supply of products of similar nature		
	Previous experience in fabrication of systems for operation under vacuum of the order of $10^{-6}$ Torr.		
	Mechanical fabrication to adhere to IS: 2102 (fine) Standard		
	Roughness Grade Number of fabricated components: N8 (3.2 microns) or better		
	Access to CNC for fabrication of mechanical components and facility for dimensional metrology of fabricated components		
	List of make and model no. of bought-out items for this offer, included with quotation?		
	Air-side plugs offered for 20kV and 5kV HV feedthroughs respectively?		
	All items in the respective quantities offered, as per point no. 8 in annexure-I?		
	Supplier agreeable to accommodate for minor changes in design of mechanical components, before fabrication?		
	Supplier agreeable to refabricate components deemed technical unsuitable during inspection?		
	Supplier has access to Helium leak detection system and TIG welding facility for lip-welding of HV vacuum feedthroughs?		
	Any deviation in the technical specifications detailed in annexure-I?		

Signature and Seal of  
Authorized signatory for  
the Supplier