



**BHARAT HEAVY ELECTRICAL LIMITED**  
**UNIT'S ADDRESS:**  
**CONTACT PERSON'S NAME/DESIGN /PHONE NO./E-MAIL (FROM PURCHASE DEPT.)**

**Enquiry No. :**  
**Due Date :**  
**Supplier Qtn. No.:**  
**Date :**

**SPECIFICATION CUM COMPLIANCE CERTIFICATION FOR DUST FREE ENCLOSURE (DFE)**

**NOTE:-**

1. The "Offered" Column and where applicable, the "Deviations" & "Remarks" Column of this format shall be filled in by the Bidder and submitted along with the offer. Inadequate / incomplete, ambiguous, or unsustainable information against any of the clauses of the specifications/requirements shall be treated as non-compliance.

**2. The offer and all documents enclosed with offer should be in English language only.**

**NAME & ADDRESS OF THE SUPPLIER :**

**TELEPHONE NOS.:**

**FAX NOS.:**

**E-MAIL ADDRESS :**

**Scope : DESIGN, SUPPLY, INSTALLATION, COMMISSIONING & VALIDATION OF DUST FREE ENCLOSURE (DFE) WITH SPECIFICATIONS, IN MINIMUM AS TO**

1. Movable roof to open up to 10 M in each direction from centre, totalling 20 M in direction of Length(Refer sketch enclosed as Annexure-1)
2. Wall Panelling with provisions for mounting of Lights, HVAC Ducts, Power supply & air lines
3. Epoxy Flooring( on plain floor and bed plates)
4. Air Shower arrangement for personnel entry Cabin
5. Emergency Door
6. HEPA filters with Terminal Boxes
7. HVAC System
8. Air Ducting between Clean Room and HVAC Plant
9. Compressed air supply system
10. Argon Evacuation system
11. Lighting & Electricals
12. Clean Room Accessories
13. Instruments
14. Spares

The Scope of Work shall include design / engineering, supplying, erection, TAB (Testing, Adjusting, & Balancing) and commissioning of all the above mentioned facilities which are further deliberated in the subsequent points. For carrying out TAB, all the required Calibrated Instruments, accessories, consumables and service personnel shall be in the scope of the Bidder. All the testing equipments shall be calibrated in a NABL accredited Lab. The supplier shall provide the valid certificates along with testing equipments.

The Scope of Work shall also include all materials, labour, equipment, appliances and incidental work, whether specifically mentioned or not, but are necessary and customary to make complete installation. It shall include all fittings, accessories, hardware, foundation bolt and arrangement, terminal plugs, cable glands, junction boxes etc for proper and efficient working of equipment.

The Supplier shall carry out and complete in every respect all the work under this tender in conformity with tender documents specifications. All the items of the work shall be executed strictly to fulfil the requirements laid down under Basis of Design and Design Objectives and testing specified as per ISO-14644 Standard alongwith requirements mentioned at Sl. No.1.2. All the works shall be carried out on a "turnkey" basis with single point responsibility.

THE ORDER HAS TO BE MADE ON TURNKEY BASIS, THE REQUIRED BILL OF MATERIALS (BOM) SHALL HAVE IN-BUILT TOLERANCES W.R.T THE QUANTITIES AND ARE TO BE ABSORBED BY THE BIDDER. BIDDERS ARE ADVISED TO VISIT SITE BEFORE SUBMISSION OF OFFER.

The Bidders shall submit the price bid accordingly. NO FURTHER CHANGES IN THE SCOPE/PRICE SHALL BE ENTERTAINED.

| S.NO    | DESCRIPTION FOR BHEL REQUIREMENT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Specification                                                                                                                                                                             | Offered | Deviation | Remark |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-----------|--------|
| 1.1     | Inside Dimensions : L x W x H                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 30 m x 15 m x 8 m                                                                                                                                                                         |         |           |        |
| 1.2     | Cleanliness standard                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1. Class ISO-8/FED Std Class 100,000 (In operation).<br>2. Better than Class 10,000 (ISO Class-7) as built.<br>3. Better than Class 10,000 (ISO Class-7) at Rest condition.               |         |           |        |
| 1.3     | Suitable for fabrication work of Stainless steel components with cleanliness limited to 10 ppm and particle size limited to 1 µm inside DFE.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Bidder to confirm                                                                                                                                                                         |         |           |        |
| 1.4     | Suitable for job size which is approx. 8 m in diameter and weights approx. 100 Tons.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Bidder to confirm                                                                                                                                                                         |         |           |        |
| 1.5     | Facility of an inside EOT crane of for handling small components Pendant controlled as per Annexure A spec for Crane.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 2.5 MT capacity (Minimum)                                                                                                                                                                 |         |           |        |
| 1.6     | The roof shall be movable type(mototrized) to allow easy loading and unloading of the jobs using overhead cranes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | MINIMUM OPENING SIZE : 20 m X 15 m-Leaf type retractable of size 5 m X 15 m each side with effective clear opening 20 Mtr in Length as per drawing Annexure-1 (Bidder to furnish details) |         |           |        |
| 1.7     | Suitability of DFE to be constructed inside production block which has concrete cemented floor having rough surface. Block possess Overhead 2 Nos Cranes , is well ventilated, having brick wall upto 8 feet , side galvanium sheet & having PUF sheet roof. Bidder shall be responsible for leveling of floor, if required. Vendor may visit site for further information.                                                                                                                                                                                                                                                                                                                                                                                                                                    | Bidder to Note.                                                                                                                                                                           |         |           |        |
| 1.8     | Wall Panels/Coving/ Doors/View Panels (in walls)/Flooring                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                           |         |           |        |
| 1.8.1   | Wall Panels                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                           |         |           |        |
| 1.8.1.1 | The wall panel shall be double skin type, 80 mm thick, sandwiched with self-extinguishing quality PUF of density not less than 40 Kg/Cum. The inner and outer skin shall be of powder coated galvanized steel sheet. The thickness of inner skin and outer skin of the panel shall not be less than 0.8 mm. The powder coated steel sheet shall be hot dip galvanized with zinc coating not less than 180gms/Sq.m. Both side of the panel smooth finished and both side of the panel off-white colour. The panels covered with peel off film to ensure that the material is protected against scratches and indentation during transit and storage. Transparent RTV Silicon Sealant shall be provided for a complete seal of ceiling system. Gaskets are to be provided for a complete seal of ceiling system. | Bidder to confirm                                                                                                                                                                         |         |           |        |

|         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                   |  |  |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|--|--|
| 1.8.1.2 | Provision shall be made to mount grills, ducts, HEPA filters, Various measurement systems, Power supply – terminal boxes, Air supply lines, Ethernet connection terminals, Various measurement systems, safety system such as fire alarm and other accessories such as fire extinguisher equipment mountings, mountable on the wall, which are mentioned subsequently in this specification. All mountings including grills, fire etc should be flushed with the cleanroom side surface of the panel i.e., no projection or depression. | Bidder to confirm |  |  |
| 1.8.1.3 | Modular PUF (flame resistant) filled PPGS Partition Panels.                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Bidder to confirm |  |  |
| 1.8.1.4 | Panel to Panel connections to be maintained with precision & uniform seams. Seams are to be sealed with food grade silicon with a perfectly flush finishing.                                                                                                                                                                                                                                                                                                                                                                            | Bidder to confirm |  |  |
| 1.8.1.5 | Proper sealant to be used at joints to avoid any contamination due to ingress.                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Bidder to confirm |  |  |
| 1.8.1.6 | View Panels at wall panel: View panels of size 1000mm x 1000mm - 18 nos. Double-glazed panel with both sides flush double toughened glass 5mm thick & Air Gap with argon Gas and inside SS frame with SS cover plate and breather holes with silica gel as desiccant shall be provided at the wall panel of the clean room. Sufficient size hermetically sealed glass glazing is required to be flushed to the wall for either sideviewing panels. Location of view panels shall be intimated after the placement of P.O.               | Bidder to confirm |  |  |
| 1.8.1.7 | All attachments such as Power supply terminal boxes, inlet / outlet ducts etc. should be flush with the surface of the wall panels. No projection / cavity shall be permitted to avoid the setting of dust.                                                                                                                                                                                                                                                                                                                             | Bidder to confirm |  |  |
| 1.8.2   | <b>Roof:</b><br>Motorized sliding roof made-up of suitable structure with covering of acrylic Material. Flexible PVC for the opening size of 20x15 meters at top with all arrangements for guide in customise aluminium profile with supporting arrangements. Balance fixed part of the roof should also be in same material.                                                                                                                                                                                                           | Bidder to confirm |  |  |
| 1.8.3   | <b>Coving &amp; other accessories:</b><br>Extruded Anodized Aluminium Coving at corners at Inside & outside Clean Rooms: Inside and Outside Surface must have Coving type Corners of Extruded Anodized Aluminium, i.e., Coving for wall to floor, wall to wall and wall to ceiling joints. This gives Clean-Room inside with no sharp edges to retain dust Particles and outer aesthetic look. All coving is flush to the wall. All corners are rounded to avoid dirt and particle build-up.                                            | Bidder to confirm |  |  |

**Doors:**

Doors are to be provided with SS 304 Ball Bearing hinges, SS 'D' type of handles on pull side & SS Push Plates on push side, automatic door bottom seal, SS kick plates and standard arm door closure and both side key operated locking arrangement. Flush door, roller hinged type single leaf fabricated out of similar material to wall panels specification above. The view window shall be of size 300mm width x600 height, 5mm thick double glass duly fixed and sealed to the door panels. The door shall be provided with door closer and lock as per Layout. The thickness of door shall be 42 mm. Size and Qty shall be as per layout.

**EMERGENCY EXIT DOOR :** Emergency exit door of size :1500 mm x 2100 mm with Push Bar Latch system to be provided , as shown in sketch (Annexure-1). The construction of same shall be without air leakage, without dust collecting ledges and crevices.

1.8.4

Bidder to confirm

**Anti static Flooring:**

Self Levelling Anti-static Epoxy Flooring 3 mm screed( on plain floor and bed plates). All floor to wall coverings must be covered with anti-static 1 mm(approx.) thick epoxy coating. Masonry work for levelling the floor including materials is in the scope of Bidder.

The primer should be earthed with copper strips anchored to the sub-floor and connected to earth point provided by BHEL per 200 sq. mtr.

1.8.5

Bidder to confirm and furnish details of earthing

1.8.6 Light illumination intensity to be maintained at the working level (between 1.0 M and 2.5 M level from the ground) is 400 Lux Minimum.

Bidder to confirm

**1.9 Vertical & Horizontal Members for Enclosure & EOT crane supporting structure**

1.9.1 Material: RHS/SHS/Built-up MS section conforming to IS 4923/ IS 2062/ IS 800 of reputed make such as SAIL, Tata, JINDAL or equivalent

Bidder to confirm

1.9.2 Section of material: Light section capable of taking the total acting load. Suitable stiffeners wherever required to be provided in the structure to restrict the deflection within permissible limit.

Bidder to Specify.

1.9.3 Maximum distance between each vertical column as per design requirement.

Bidder to Specify.

1.9.4 Maximum distance between each Horizontal column as per design requirement.

Bidder to Specify.

1.9.5 Foundation of Column: The foundation shall be via heavy fasteners on MS Base plate as per design. Self supporting chemical fasteners shall be used for anchoring conforming to IS 1364/1367. The top of base plate to be matched with the FFL of the enclosure & crane, chiseling and concreting required for this purpose will be under the scope of vendor.

Bidder to confirm

1.9.6 Designing, drawing, Fabrication and Erection of brackets & crane Girder for resting of EOT crane of 2 Ton. These cranes supporting structures shall be enclosed inside the enclosures such that the brackets are installed over columns of wall panels. The top of Gantry shall be up to 7 Mtr Approx from the FFL. Final data shall be provided during drawing concurrence by BHEL.

Bidder to confirm

1.9.7 Span of Crane :-14000 mm SPAN ( + 500 mm)

BHEL

for enclosure

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| 1.9.8   | Foundation Bolt details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                           |
| 1.9.8.1 | Design of Foundation Bolt including Nos, Dia & length to be specified by vendor.                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Bidder to Specify.        |
| 1.9.8.2 | The top of MS base plate of the columns should be matched with the FFL such that there is no elevation difference between the two.                                                                                                                                                                                                                                                                                                                                                                                                         |                           |
| 1.9.8.3 | All the civil work pertaining erection of EOT crane shall be done by the vendor.                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                           |
| 2.0     | <b>ELECTRICAL WORKS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                           |
|         | Electrical Works comprises of following :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                           |
| 2.1     | <b>Roof Opening Shutter</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                           |
|         | Motorised roof opening shutters. Make of motors: Siemens, ABB, Mitsubishi, CG or reputed make as acceptable to BHEL. The shutters open/close arrangement should be at approachable area for operation and maintenance point of view.                                                                                                                                                                                                                                                                                                       | Bidder to confirm         |
| 2.2     | <b>Lighting &amp; Electricals</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                           |
|         | Electrical Supply: 415 (+/- 10%), 50 Hz, (+/- 3%), 3 Phase AC (3 wire) power supply and an earthing point will be provided by BHEL at a single point near the Clean Room, as per lay out recommended by Bidder. Earthing for all Welding appliances shall be separate earth pits and will be provided by BHEL.                                                                                                                                                                                                                             |                           |
| 2.2.1   | All cables, connections, circuit breakers etc. required for connecting BHEL's power supply in the Clean Room shall be in the scope of Bidder. No neutral will be provided. 220V & 24 V for control circuits are to be provided by step-down transformers of required capacity, which will be in the scope of supplier. Supply and installation of electrical items including cabling inside clean room and cabins will be in Bidder's scope. Detailed electrical wiring diagram shall be submitted for BHEL approval before start of work. | Bidder to confirm         |
| 2.2.2   | The internal light units shall be purpose designed to meet Clean Room standards. 200 W LED lamps and fittings rated for 50,000 working hours (continuous) shall be used. Light levels should be minimum 400 lux at work level ht. of 1 m inside clean room. Light should be serviceable from side walls outside the clean room and EDT crane top. Make: Crompton Greaves, GE or reputed makes that are acceptable to BHEL. Each lamp shall be controlled individually through a MCB inside a double door Distribution board.               | Bidder to provide details |
| 2.2.3   | All Electrical and electronic panels should be provided with T5 fluorescent lamps for sufficient illumination and power receptacles of 220 Volts, 5/15 Amp AC. All adapters/receptacles should have compatibility with Indian equivalents.                                                                                                                                                                                                                                                                                                 | Bidder to confirm         |
| 2.2.4   | Cables shall be routed through totally enclosed cable trays. There shall not be cable trenches. The cable trays should have smooth surfaces without any dirt/water traps and without any loose parts.                                                                                                                                                                                                                                                                                                                                      | Bidder to confirm         |

for person

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| 2.2.5  | All current carrying conductors and cables should be of Zopper. Makes: RPG, Delton, Reliance, Fort Gloster, ACC, CCI, NICO, Radiant, Toshniwal, Universal, Elkay, Havells, Siechem, RR, Finolex.                                                                                                                                                                                                                                                                                | Bidder to confirm |  |  |  |
| 2.2.6  | All electrical & electronic control cabinets & panels should be vermin and dust proof. All electric enclosures shall have IP 54 protection.                                                                                                                                                                                                                                                                                                                                     | Bidder to confirm |  |  |  |
| 2.2.7  | All indication lamps should be provided with LED Indication lamp                                                                                                                                                                                                                                                                                                                                                                                                                | Bidder to confirm |  |  |  |
| 2.2.8  | All components/devices/terminals are to be incorporated with numbered ferrules.                                                                                                                                                                                                                                                                                                                                                                                                 | Bidder to confirm |  |  |  |
| 2.2.9  | Limit switches, Gauges and temperature controllers should be for heavy duty application and wired up with flexible PVC insulated screened cables running in conduits and converging to common terminal block. Terminal blocks shall be of reputed make acceptable to BHEL. Make: Siemens, L&T, P&F, Omron, Schneider, Telemechanique, Baumer, Balluf, ASM, BCH, Heidenhain, C&S, Honeywell.                                                                                     | Bidder to confirm |  |  |  |
| 2.2.10 | Bidder should ensure the proper earthing for all the installations and panel boards.                                                                                                                                                                                                                                                                                                                                                                                            | Bidder to confirm |  |  |  |
| 2.2.11 | Supply and installation of electrical items including lighting, switches etc for service areas (ducting areas) & around DFE will be in bidder scope. All the electrical modular switches, power receptacles plugs and socket points shall be be flushed along the wall panels. Makes: Siemens, Legrand, GE or any other reputed make which shall be acceptable to BHEL. The contractor shall submit all the material planned for electrical work along with Electrical drawing. | Bidder to confirm |  |  |  |
| 2.2.12 | Electrical Power receptacles with Modular Switches, Plug & Sockets Points for 220 V AC/5-15 Amp, 50 Hz Single Phase and 415 V AC, 15/30 Amp, 50 Hz, Three Phase electric supply must be flushed with SS304 Outer-covering including Wiring must be incorporated inside the Wall Panels. Electrical points as required for Welding Machines, Clean Room accessories are also need to be incorporated.                                                                            | Bidder to confirm |  |  |  |
| 2.3    | To facilitate welding operations, following shall be provided:                                                                                                                                                                                                                                                                                                                                                                                                                  |                   |  |  |  |
| 2.3.1  | Three nos. of 63 A/ 415 V/ 3 Phase plug, Sockets and MCB<br>Two nos. of 5 A/220 V/ Single Phase Switch and Sockets<br>Two nos. of 15 A/220 V/ Single Phase Switch and Sockets<br>Two nos. of 5 /24 V plug, socket and MCB (for hand lamps)                                                                                                                                                                                                                                      | Bidder to confirm |  |  |  |
| 2.4    | All electrical motors and equipments must be accessible for maintenance. All the electrical components must be laid in proper fashion with neatly dressed control wiring having ferrules & properly soldered lugs/terminal inside control panel.                                                                                                                                                                                                                                | Bidder to confirm |  |  |  |
| 2.5    | All electrical equipment such as motors, fans, AC units shall be energy efficient as per BEE norms. EFF-1 rating for Electric motors as per IEC. Make of motors: Siemens, ABB, Mitsubishi, CG or reputed makes acceptable to BHEL.                                                                                                                                                                                                                                              | Bidder to confirm |  |  |  |
| 2.6    | Total connected load in KW for all equipment and accessories.                                                                                                                                                                                                                                                                                                                                                                                                                   | Bidder to furnish |  |  |  |

## 2.7 Compressed Air Supply System

2.7.1 Compressed air is being required for driving pneumatic tools to dress the weld edges, weld beads, removal of defects etc occasionally. BHEL will provide filtered compressed air supply at 5 to 6 bar pressure at a single point, outside the clean room, indicated by the bidder.

Bidder to confirm

2.7.2 Compressed air lines and tapping points with valves are to be provided for each welding booth. Approximately 5 nos. of compressed air tapping points shall be provided.

Bidder to confirm

2.7.3 All lines, ball valves and connectors shall be of materials made of stainless steel. Compressed air line shall be laid outside the concrete building and properly drawn inside the clean room, Ball valve size be 1/2 inch. Compressed air line size shall be 1/2 inch.

Bidder to confirm

## 3.0 HVAC SYSTEM

The basic purpose of this HVAC system is to have dust free air conditioned environment inside enclosure to maintain inside humidity and temperature as per given parameter. HVAC system comprising of Air Handling Unit, Dehumidifier, Air distribution system, Filters, Risers, Dampers/grills etc.

### 3.1 Scope of Bidder:

3.1.1 Bidder has to give the basis of design explicitly with BOQ(Bill of Quantities), detail spec. & makes their 'Technical Bid' for scrutiny in addition to confirmation/ deviation of the technical specification.

Bidder to confirm

3.1.2 The scope of work shall include engineering, design, supplying, installing, testing, commissioning and proving of air conditioning system as described in the technical specification. The contractor shall carry out and complete in every respect all work under this contract in conformity with the P. D. with required inside condition, as given in clause no 3.2.

Bidder to confirm

3.1.3 All items of work shall be executed strictly to fulfill the requirements laid down under the Basis of design. The type of equipment, material specification, method of installation and testing and type of control shall be in accordance with the BHEL approved drawing and the relevant Indian Standards.

Bidder to confirm

3.1.4 The scope of work shall include all materials, labour, equipment, appliances and incidental work, whether specifically mentioned or not, but are necessary and customary to make a complete installation. It shall include all fittings, accessories, hardware, foundation bolts, terminal lugs, cable glands, junction boxes and other items whether specifically mentioned or not, but are useful and necessary for proper and efficient work.

Bidder to confirm

3.1.5 Bidder has to visit the site physically to check the location for installation of HVAC unit, SA(Supply Air) & RA(Return Air) ducts, grills, diffusers etc. All structures for mounting the package unit, ducts etc. will be in the scope of the Bidder.

Bidder to confirm

|         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                    |  |  |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|--|--|
| 3.1.6   | Bidder has to submit detail bill of material with specification & makes, proposed system configuration, heat- load calculation sheet, etc. in their technical bid for technical scrutiny.                                                                                                                                                                                                                                                                                                                                                | Bidder to furnish                  |  |  |
| 3.1.7   | The complete work of above HVAC system must be carried-out by the bidder on TURNKEY BASIS. Complete Erection & commissioning of the system at BHEL site will be in the supplier's scope. All necessary designs, location of the units, ducting routes etc. are to be submitted to BHEL for approval within two weeks after placement of order.                                                                                                                                                                                           | Bidder to confirm                  |  |  |
| 3.2     | <b>Basis of Design</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                    |  |  |
| 3.2.1   | Dimensions of Enclosures to be air-conditioned:<br>30X15X8 mtr (LXWXH) having operable top for loading & unloading of material through overhead crane.                                                                                                                                                                                                                                                                                                                                                                                   | Bidder to note                     |  |  |
| 3.2.2   | Outside condition during and heat load:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Bidder to note                     |  |  |
| 3.2.3   | Summer: 44°C dbt max.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Bidder to note                     |  |  |
| 3.2.4   | Winter: 7°C dbt min.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Bidder to note                     |  |  |
| 3.2.5   | Rain RH: 90% Max.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Bidder to note                     |  |  |
| 3.2.6   | Heat Input due to welding will be 200KJ approx. (maximum)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Bidder to note                     |  |  |
| 3.2.7   | 10 personnel will be present at a time inside the enclosure during working.                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Bidder to note                     |  |  |
| 3.2.8   | <b>Inside condition required in enclosure:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                    |  |  |
| 3.2.8.1 | Temperature to be maintained inside DFE is 20-26 degC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Bidder to note & confirm           |  |  |
| 3.2.8.2 | RH less than 60% throughout the year                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Bidder to note & confirm           |  |  |
| 3.2.8.3 | DFE shall be kept at positive pressure 10-15 Pa.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Bidder to note & confirm           |  |  |
| 3.2.8.4 | Nos of Air Change : 10 cycles/ hour                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Bidder to note & confirm           |  |  |
| 3.2.8.5 | Fresh air-cycling: 10-15% Fresh Air inside the enclosure.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Bidder to note & confirm           |  |  |
| 3.3     | <b>Air Conditioning System:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                    |  |  |
| 3.3.1   | <ul style="list-style-type: none"> <li>Design, Supply, Installation, Testing and commissioning of capacity of 2 X 40 TR (Minimum) – Air Cooled Heat Ventilation &amp; Air Conditioning system to cater the requirements of clean room.</li> <li>Bhopal environment shall be considered for deciding the HVAC system.</li> <li>The supplier shall be provided two units for regular operation to meet the design requirement</li> </ul> The air distribution system has to be designed for the specified clean room standard class limits | Bidder to confirm                  |  |  |
| 3.3.2   | AHU: 22000 cfm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Bidder to confirm                  |  |  |
| 3.3.3   | Refrigerant Gas: Pre charged -Energy-efficient, Non-CFC, Eco-friendly.                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Bidder to confirm, furnish details |  |  |
| 3.3.4   | AC system may be installed outside the manufacturing block (New Hydro Turbine) near North Sidewall, on suitable fabricated platform, shade and civil work, if required.                                                                                                                                                                                                                                                                                                                                                                  | Bidder to note                     |  |  |



3.3.5 The air conditioning system must be of reputed make preferably Blue Star, Carrier, Voltas, Toshiba, York etc., as per below mentioned specification. Evaporator section comprising of DX cooling coils with distributor and thermostatic expansion valve. Hand shut-off valve for each circuit, insulated drain pan, HDPE washable filter, centrifugal blower, and microprocessor based control panel. The cabinet should be of aluminium /GI channels sturdy design with GI powder coated panels, condensing section should have scroll/ screw compressor, factory made coils shall be of copper tubes mechanically expanded with aluminium fins, axial fans with motor. HP/LP pressure controls, factory fabricated & completely internally wired control panel and all other items necessarily required for satisfactory performance of system.

Bidder to confirm, indicating make of system

3.4 Air Handling Unit: 22000 cfm(2 X 11000 cfm Double Blower System)

3.4.1 Supply and install the double skin DX type air handling unit complete with the all accessories and control system. The housing/casing of the AHU shall be 45mm thick including the metal cladding with double skin construction. The framework shall be in aluminium sections. The frame joint shall be with sturdy, strong and self-supporting framework. The casing shall be with pre-painted galvanized steel sheet of thickness 0.6mm inside and 0.8mm outside with polyurethane insulation injected in between. These panels shall be screwed on to the framework with soft gasket on aluminium frame to make the joint airtight. The density of PUF insulation shall be 40kg/Cum. There shall be provision for exhaust system through damper at the AHU whenever required by manual operation.

Bidder to confirm

3.4.2 Blower shall be metallic, backward curve centrifugal blower (Make Kruger/Nikotra/Edm/Nadl), Motor: 3ph

Bidder to confirm and specify RPM

3.4.3 Bidder has to specifically provide total energy efficiency in KW/Tr of the complete AC system with methodology & calculation.

Bidder to furnish

3.4.4 AC units shall have panels of heavy gauge galvanized steel fixed in a structure of aluminium/GI channels.

Bidder to confirm

3.4.5 It shall be air cooled condensing type with scroll/ screw compressor driven by 3phase power supply.

Bidder to confirm

3.4.6 The AC unit shall be of lightweight design, completely factory assembled and tested under load conditions before dispatch and shipped with full operating charge of refrigerant.

Bidder to confirm

3.4.7 Each independent refrigerant circuit per compressor must be connected using formed copper refrigerant pipe, resulting in a highly reliable and leak proof system. Complete refrigerant piping shall be copper with standard nitrile rubber closed-cell or better insulation.

Bidder to confirm

3.4.8 The compressor shall be direct-driven scroll/screw type. It shall be suitable for reduced inrush starting current. The compressor shall have rain-tight (IP55) terminal box.

Bidder to confirm

|         |                                                                                                                                                                                                                                                                                                  |                                            |  |  |  |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|--|--|--|
| 3.4.9   | Provision of crankcase heater shall be included with each compressor to maintain oil temperature above 24°C during shutdown period.                                                                                                                                                              | Bidder to confirm                          |  |  |  |
| 3.4.10  | The condenser coil shall be constructed of copper tube and die formed aluminium fins having self-spacing collars. Fins are to be mechanically bonded to the tubes. Refrigerant sub-cooling shall be incorporated.                                                                                | Bidder to confirm                          |  |  |  |
| 3.4.11  | The condenser shall have direct driven, heavy duty, dynamically and statically balanced high static axial fans. The fan motor shall be induction type with F insulation & internal overloads and shall be permanently lubricated. Guards of heavy gauge, powder coated must be provided.         | Bidder to confirm                          |  |  |  |
| 3.4.12  | The electrical control panel shall be wired to permit fully automatic operation during initial start-up, normal operation, shut down condition. The microprocessor based control panel shall be user friendly and display message in simple English language and must provide automatic control. | Bidder to confirm                          |  |  |  |
| 3.4.13  | The AC unit should have communication port for remote connectivity for status & fault indication including all necessary software & hardware.                                                                                                                                                    | Bidder to confirm                          |  |  |  |
| 3.5     | <b>Ducts:</b>                                                                                                                                                                                                                                                                                    |                                            |  |  |  |
| 3.5.1   | All rectangular ducts shall be of bright-galvanized steel sheets with no watermarks. The galvanized steel sheets shall conform to IS 277. The duct fabrication & installation shall be as per approved drawings.                                                                                 | Bidder to confirm                          |  |  |  |
| 3.5.2   | Thickness of sheet shall be as under:<br><b>Duct longer side</b><br><b>Sheet thickness</b><br><u>Up to 750mm</u> 24 gauge<br><u>751mm to 1500</u> 22 gauge<br><u>1501mm to 2250</u> 20 gauge<br><u>2251mm and above</u> 18 gauge                                                                 | Bidder to confirm                          |  |  |  |
| 3.5.3   | All grill shall be of powder coated aluminum construction in rectangular shape & shall have adjustable front louvers for vertical deflection. All air supply grills shall be provided with flow control dampers operated from front face by removable key.                                       | Bidder to confirm                          |  |  |  |
| 3.6     | <b>Dehumidifier:</b>                                                                                                                                                                                                                                                                             |                                            |  |  |  |
| 3.6.1   | Suitable dehumidifier system for maintaining required relative humidity in rainy season.                                                                                                                                                                                                         | Bidder to confirm; Details to be furnished |  |  |  |
| 3.7     | <b>Clean Air Equipments- Material Air Shower, Personal Air Shower, Garment Cubicle, Shoe rack</b>                                                                                                                                                                                                | Bidder to confirm                          |  |  |  |
| 3.7.1   | <b>Air shower for arrangement for personnel entry Cabin with Biometric entry system.</b>                                                                                                                                                                                                         |                                            |  |  |  |
| 3.7.1.1 | Air shower for arrangement for personnel entry Cabin with Biometric entry system                                                                                                                                                                                                                 | Bidder to furnish details                  |  |  |  |

These Air Showers shall be a complete pre-fabricated enclosure containing the following compartments: i) Garment Storage Area, ii) Dress Change Area, and iii) Personnel Air Shower Area. In the Dress change room, people have to wear protective clothes & caps. There shall be a storage system for storing the "fresh protective clothes and caps" and "Collection bins" for collecting the used items at the time of exit. Entrance of this compartment only will be exposed to outside atmosphere. Exit of this compartment will be the entry for "Personnel Entry Cabin".

Bidder To Submit.

3.7.1.3 Area available for the construction of "Personnel Entry Air Shower Cabin" is less than 3000mm (L) x 3000mm (W). However, size of the cabin shall be restricted to the requirements.

Bidder to Note.

3.7.1.4 Personnel Air shower area should be able to accommodate a maximum of two persons at a time.

Bidder to confirm

3.7.1.5 The personnel air shower cabin with dress change cabin shall be attached to the above clean room in the indicated space by meeting the following requirements: The Air shower system shall be Integral location (clean room wall and Air shower system) shall be hermetically sealed. Air shower system shall inject High velocity HEPA filtered air to dislodge the particles that are clinging to the garments. The positive pressure inside various areas shall be as follows: 1 Change room : (+) Positive pressure. 2 Air shower : (++) Positive pressure 3 Clean room : (++++) Positive pressure.

Bidder to confirm

3.7.1.6 The air shower system shall be a high velocity, low pressure type, providing a normal entrance to and exit from a contamination controlled area. Air fluid velocity and the air pressure shall be comfortable to the persons passing through the Air shower system.

Bidder to confirm

3.7.1.7 The system shall be suitably designed and it shall not harm or injure the persons passing through the air shower system. The system shall be suitably designed such that the shower will operate for few minutes after the persons entered in the shower area and closed the door. Clean room side door shall open only after the stoppage of air shower and evacuation of dusty air from the shower area.

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| <p>3.7.1.8</p> <ul style="list-style-type: none"> <li>• Material of Construction- Inner surface of Air Shower: Powder coated outside and SS 304 Inside</li> <li>• Heavy-duty doors with 3/16"(5mm) safety tempered glass glazing.</li> <li>• Top loaded High Efficiency Particulate Air (HEPA) UL 900 Filter, 99.97% efficient @ 0.3 micron in an anodized aluminum frame.</li> <li>• Versatile and ergonomic design</li> <li>• High Efficiency direct drive 230V-3-Phase motor blowers.</li> <li>• Motors/Blowers are standard type acceptable to BHEL.</li> <li>• Adjustable air nozzles on walls and ceiling shall be white plastic construction sized and spaced to provide an average of 25 ~ 35 m/s air flow at the face of the nozzle.</li> <li>• Fluorescent lighting mounted in the interior ceiling with prismatic refractive lens cover.</li> <li>• Anodized aluminum entry and exit doors with push/pull hardware, hydraulic door closures and acrylic, polycarbonate or safety glass inserts.</li> <li>• Three speed switch features low, medium, and high settings; standard.</li> <li>• Solid-state speed control available.</li> <li>• Direct drive, high pressure radial vane blower</li> <li>• Snap-in prefilter allows for easy replacement and maintenance.</li> <li>• Programmable Logic Controller (PLC) shall be used to control the sequence of operation of the Air Shower.</li> <li>• Emergency Diff button (EMO) shall be located inside and outside of the Air Shower in a conspicuous location.</li> <li>• Activating the EMO switch shall cause the cycle to immediately end, and release all interlocks &amp; Lights shall remain on.</li> <li>• Door sensors shall be 24 volt DC magnetic reed switches.</li> <li>• Door interlocks shall be 24 volt, located in the door jamb.</li> <li>• All locks shall automatically release upon loss of power or when the (EMD) button is pressed.</li> <li>• The entire material air lock and Air shower floor area must have 4mm thick self-levelling epoxy coating.</li> <li>• All the side wall to floor intersection shall be properly sealed with RTV Silicon Sealants.</li> <li>• View panels shall be provided at the front entrance door and Clean room side door.</li> <li>• They should be of Double -glazed panel with both sides flush double toughened glass 5mm thick - inside SS frame with SS cover plate and breather holes with silica gel as desiccant</li> <li>• Size of view panels :300x 300mm</li> </ul> | <p>Bidder to confirm.</p>                                                   |
| <p>3.7.1.9</p> <p>Air Curtain, Air Shower shall also be provided. Digital display facility of temp, RH with display size 6 inch(Width) X 12 Inch(Length) to be provided at the entry of DFE.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <p>Bidder to confirm</p>                                                    |
| <p>3.7.1.10</p> <p>Access Control system with Biometric recognition: Supply, Design, Erection &amp; Commissioning of standalone Biometric Access flushed with the outside Clean room wall panel near personnel entry point. It must be user friendly full graphical LCD display but locked with password, tactile alpha numeric keypad, built in data encryption for secure data transfer across the network by LAN &amp; browser based software with easy to use graphical interfaces and context help, quick biometric registration &amp; authentication, access control system along with PLC control magnetic door-opening. This shall be at main entry point. There shall be provision for 50 people. Add-on facility for up to 70 people at a later period to be provided. Biometric entry - recognition shall be by comparing the impressions of index finger of right or left hand or the thumb of right hand.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <p>Bidder to confirm &amp; provide details of the system being offered.</p> |
| <p>3.8</p> <p><b>Air Ducts:-</b></p> <p>3.8.1</p> <p>Supply air duct shall be insulated with 13 mm thick aluminum foil faced XLPE by using SR998/SRS05 adhesive-Trocylene/Supreme/Equivalent</p> <p>3.8.2</p> <p>Return air duct shall be insulated with 9 mm thick aluminum foil faced XLPE by using SR998/SRS05 adhesive-Trocylene/Supreme/Equivalent</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <p>Bidder to confirm</p> <p>Bidder to confirm</p>                           |

|          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                  |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| 3.9      | Four Nos portable fume extraction system will be used there . It will only recirculate the welding fumes separating hazardous chemicals from fumes. It will be of very low capacity and will be placed near the welding area only.                                                                                                                                                                                                                                                                             | Bidder to confirm & specify.                                                                     |
| 3.10     | SS piping for Argon Gas/Argon Extraction system                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Bidder to confirm & specify.                                                                     |
| 3.11     | <b>HEPA Filter with Terminal Boxes :</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                  |
| 3.11.1   | HEPA filters for "Air Filtration Level of 99.97% efficient High Efficiency Particulate Air (HEPA) Filters" to catch 0.3 µm particles (Applicable Standards for Testing: IES-RP-CC 00612) shall be provided to have the desired cleanliness standard as specified above.                                                                                                                                                                                                                                        |                                                                                                  |
| 3.11.2   | HEPA Filters shall be of nominal size, qty location and capacity shall be clearly indicated in the form drawing along with technical bid.                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                  |
| 3.12     | <b>CLEAN ROOM ACCESSORIES:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                  |
| 3.12.1   | The Bidder has to install & commission the following mentioned measurement systems and other accessories for the effective and safe working of the personnel and equipment.                                                                                                                                                                                                                                                                                                                                    | Bidder to confirm                                                                                |
| 3.12.2   | 10 No. of Washable Walk over- Sticky mats of good quality are to be supplied to use at the entrances of personnel air shower and material air shower cabins. Size shall be : 36" x 45"                                                                                                                                                                                                                                                                                                                         | Bidder to confirm                                                                                |
| 3.12.3   | Cleanroom compatible Shoe Rack: One number of clean room (smoothly finished Stainless steel make with proper covering arrangement ) shoe rack for storing and preserving 60 pairs of shoes.                                                                                                                                                                                                                                                                                                                    | Bidder to specify.                                                                               |
| 3.12.4   | <b>Clean room Garments Cabinet &amp; Garments:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                  |
| 3.12.4.1 | Garment Cabinet Powder coated construction with provision for 25 garments and racks for keeping the extra garments. Stainless steel hangers and number labels also required.                                                                                                                                                                                                                                                                                                                                   | Bidder to specify.                                                                               |
| 3.12.4.2 | 25 sets of Clean room Garments along with Head cover and hand gloves: Limited lining non-static proprietary fabric. Attractive styles in two shades - white and light blue, Tailored to exceed prevailing clean room norms. Short coat & trouser PVC sole with zip & nylon tie laces overshoes -ankle hold shoes /Boots 25pairs ( of standard size 7 number 2 qty, 8 number 16 qty, 9 number 6 qty and 10 number 1). Fabric to be check type with 99% nylon, 1% carbon fibers. 23no. for men & 2 no for women. | Bidder to specify.                                                                               |
| 3.13     | <b>Air Lock Room for Material Entry:</b> Area available for the construction of "Emergency exit/Material Entry" is less than 3000mm (L) x 1500mm (W) X 3000mm(H). However, size of the cabin shall be restricted to the requirements.                                                                                                                                                                                                                                                                          |                                                                                                  |
| 4        | <b>INSTRUMENTS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                  |
| 4.1      | Air Balancing Test Instrument, Chloride contamination testing instrument, Temperature & Relative Humidity measuring instrument, Filter Integrity Test instrument & Oscilloscope instrument for particulate count, Magnetic gauges etc.                                                                                                                                                                                                                                                                         | Bidder to confirm and furnish details of each instrument such as qty, make, range, accuracy etc. |
| 5        | <b>Pre-dispatch Inspection (PDI)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                  |
| 5.1      | BHEL may insist on inspection of any items, components of DFE at any stage before dispatch, if required.                                                                                                                                                                                                                                                                                                                                                                                                       | Bidder to Note.                                                                                  |

for provision

## 6 Validation and Performance test

6.1

On-site validation and Testing of the complete Clean room System: After completion of E&C of all equipment and accessories, validation test shall be conducted as described below:  
Testing & Validation as per ISO 14644 (Velocity, Particulate count, Temp, Humidity, filter, integrity tests to be carried out at the site by Vendor/Bidder) witness by BHEL. A comprehensive on-site validation and certification service for clean room installation is in the scope. These includes leak detection, clean room level measurement and certification, air flow pattern analysis, dead zone identification and elimination and comprehensive documentation with regard to maintenance & validation procedure.

Bidder has do the following validation & testing of the installed clean -room twice, initially during final commissioning of the above clean room project & second with in the last month before handing over the project to BHEL on completion of guarantee period:

Cleanliness levels as per ISO 14644

Air Quality Monitoring: Limited to 10 PPM as per clause 1.3

Particle size Efficiencies and quantity count:1 µm

Air Velocity Measurement & Air-flow Quantity Measurement

Temperature control range tests(To be less than 26 degC)

Humidity control range tests(To be less than 60%)

On-site HEPA filter leak test (By cold DOP)

Filter pressure drop measurements

Air flow pattern and strength (by titanium chloride aerosol Test)

Light level checks at 1m working height in clean room

Room pressurization

Oxygen level measurement, etc.

During a typical certification test, the bidder will identify areas of concern and make the user aware of them. Adjustments will be made as necessary to bring the room into compliance with BHEL specification and /or other pertinent standards. Recommendations and the cost estimates for procedures necessary to bring the facility into compliance will also need to be offered. Upon completion of the test procedure, a certificate of performance and supporting test report has to be submitted to BHEL.

6.2

Bidder to confirm and furnish brief details on procedure/standards(if applicable) for carrying out test

6.3

**Performance Test:** After the completion of validation test, The entire plant - all equipment and accessories shall run continuously for three days - 16 hours per day without any break. If any stoppage occurs, the test will be re started again for three days from that time onwards. Bidder must include the total cost for Erection, commissioning, validation test & performance test and all other sundry expenses towards E&C as lump sum cost in their 'price-bid' as cost of Erection & Commissioning Charges.

Bidder to confirm

7

## Documentation

Mandatory/Recommended Spares list, necessary documentation(like test certificates etc., wherever applicable) & maintenance manuals are required(4 sets) for all equipments & instrumentation. Design qualification, installation qualification & operational qualification to be submitted.

7.1

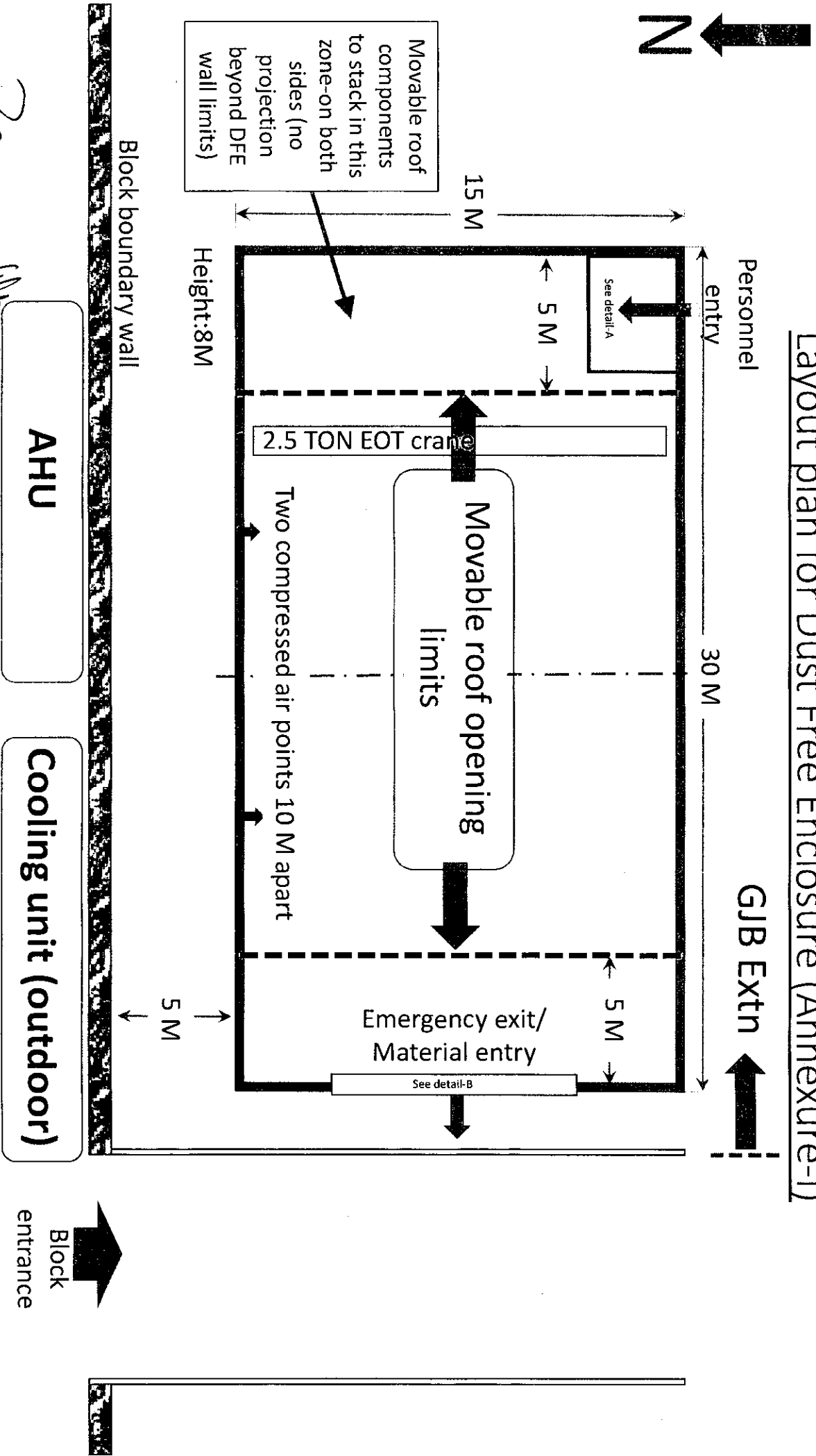
Bidder to confirm

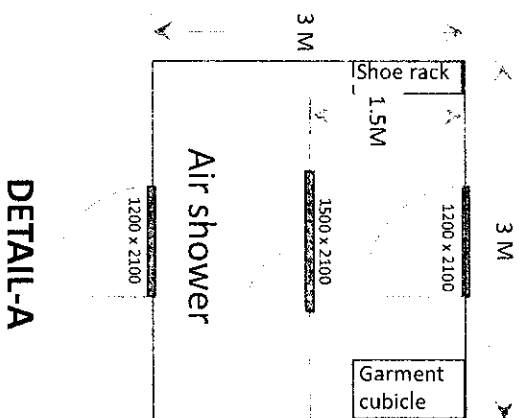
|      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                    |  |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|--|
| 7.2  | Drawing Concurrence: Before taking up manufacturing, the manufacturer has to visit the BHEL for taking the exact dimensions and layout and should get the G.A. drawing of their proposed system duly concurred by us. However the responsibility of proving would lie with the manufacturer.                                                                                                                                                                                                                                                                                                                                     | Bidder to confirm  |  |
| 7.3  | Design Calculation for the enclosure and EOT crane supporting structure. The design has to be vetted by a certified Chartered Engineer.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Bidder to confirm  |  |
| 8    | <b>Training</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                    |  |
| 8.1  | Bidder shall demonstrate & train BHEL personnel in reference to daily operation and regular maintenance of the complete system. Bidder has to give special extensive training on microprocessor repair, handling of electrical equipment & maintenance.                                                                                                                                                                                                                                                                                                                                                                          | Bidder to confirm  |  |
| 9    | <b>SPARES &amp; AFTER SALES SERVICE:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                    |  |
| 9.1  | All types of spares for total machine and accessories could be available for at least ten years after supply of the machine. If machine or control is likely to become obsolete in this period, the vendor should inform BHEL sufficiently in advance and provide drawings of parts/details of spares & suppliers to enable BHEL to procure these in advance, if required.                                                                                                                                                                                                                                                       | Bidder to specify. |  |
| 9.2  | Complete list of spares for machine and accessories, along with specification/ type / model, and name & address of the spare supplier shall be furnished along with documentation to be supplied with the machine. Itemised list of spares are to be offered (with unit price of each spares). The spares will be offered as per requirement. Note: The Price of the spares will not be considered for the evaluation of the machine cost(L1 criteria).                                                                                                                                                                          |                    |  |
| 9.3  | Bidder should provide prompt after sales service to ensure smooth trouble free working of the DFE & associated equipments/instruments and provide spares during and after guarantee period.                                                                                                                                                                                                                                                                                                                                                                                                                                      | Bidder to confirm  |  |
| 10   | <b>PACKING:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                    |  |
| 10.1 | Sea worthy & rigid packing for all items of complete DFE, all Accessories and other supplied items to avoid any damage/loss in transit.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Bidder to confirm  |  |
| 11   | <b>Warranty &amp; Performance guarantee:</b> The supplier shall Warranty/guarantee for the successful operation of all the equipments and accessories for a period of 24 months from the date of successful completion of Performance test at BHEL works/acceptance of the equipment. Equipment /Sub-assemblies/ components found defective due to deficiency in design, material or workmanship shall be replaced by new ones or to be rectified at free of cost and such replacements / rectifications shall carry the successful operation for the further period of 24 months from the date of replacements / rectifications | Bidder to confirm  |  |
| 12   | <b>AMC:</b> Bidder must quote Annual Maintenance Contract rate for the complete clean room project with HVAC system - comprehensive with material, giving affidavit for further 3 years of AMC. Detailed scope of work shall be specified by the Bidder. This shall be optional.                                                                                                                                                                                                                                                                                                                                                 | Bidder to specify. |  |
| 13   | <b>QUALIFYING CONDITIONS :</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                    |  |
| 13.1 | Agency/Firm, which have designed/commissioned/Dust free enclosure of ISO Class 7 or better at more than one place, in last 7 years and it should be supported by following documents:-                                                                                                                                                                                                                                                                                                                                                                                                                                           | Bidder to Confirm  |  |

|                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                     |                                                |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|--|
| Any documentary evidence like unpriced PO copy & invoice copy etc of Dust Free Enclosure supplied to clients. Minimum 1 feedbacks/certificates of satisfactory performance, issued from the clients for clean room/DFE-shall be of ISO Class 7 or better for industrial application regarding satisfactory supply & use of DFE/Clean Room supplied for more than one year after commissioning and acceptance. |                                                                                                                                                                                                                                     |                                                |  |
| 13.1.1                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                     | Bidder to confirm                              |  |
| 13.1.2                                                                                                                                                                                                                                                                                                                                                                                                        | All jobs are to be in India so that sites can be visited.                                                                                                                                                                           | Bidder to confirm                              |  |
| 13.2                                                                                                                                                                                                                                                                                                                                                                                                          | Vendor should have an average turnover of Rs 75 Lakhs for last 3 Consecutive financial years ending March 2019 and it should be supported by Annual report(Balance Sheet and Profit & loss account).                                | Bidder to confirm                              |  |
| 13.3                                                                                                                                                                                                                                                                                                                                                                                                          | In case of foreign bidders, business information report issued by D & B/Experian etc to be submitted along with offer.<br>All jobs to be considered for pre-qualification will have to be completed before the date of bid opening. | Bidder to confirm & furnish completion reports |  |
| 14                                                                                                                                                                                                                                                                                                                                                                                                            | <b>GENERAL</b>                                                                                                                                                                                                                      |                                                |  |
| 14.1                                                                                                                                                                                                                                                                                                                                                                                                          | Plant layout drawing shall be submitted alongwith the offer in line with the space available.                                                                                                                                       | Bidder to note                                 |  |
| 14.2                                                                                                                                                                                                                                                                                                                                                                                                          | Bidder can visit the site to physically accustom with the nature & quantum of work before quoting the rates.                                                                                                                        | Bidder to note                                 |  |

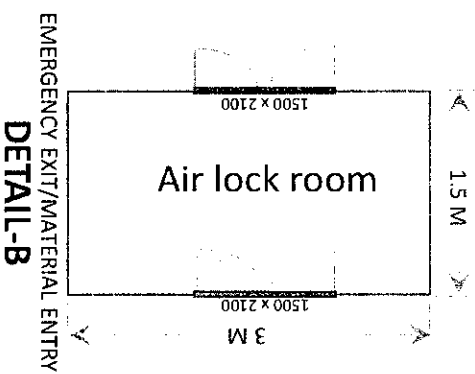


Layout plan for Dust Free Enclosure (Annexure-I)





**DETAIL-A**



**DETAIL-B**