GAS TURBINE INTAKE AIR-FILTER SYSTEM

1.0 SCOPE :

1.1 This specification covers the minimum requirements for the air filtration system used on gas turbines, located in both inland and marine environments subject to high ambient, dust and salt concentrations.

1.2 The system specified is intended for continuous duty, high efficiency air filtration at a constant system pressure drop.

1.3 Air filtration systems are specified to be of the automatic pulse jet self-cleaning type, single stage & without element dust re-entrainment.

1.4 The pulse cleaning electrical system, pneumatic system, the support structure & foundation hardware.

1.5 If called for in Var-Table-I, vendor to supply air handling system package consisting air compressor & the air drier unit.

2.0 GENERAL:

2.1 The inlet of the air filtration systems is to limit the ingestion of airborne contaminants such as sand, dust and alkali metal salts, so as to prevent compressor erosion, fouling, cooling air passage blocking and hot corrosion of turbine super alloys.

2.2 The filter must be designed to with stand the weather conditions prevailing on the installations at site(as defined in Var-Table-I):

- Altitude
- Temperature
- Humidity
- Earthquake factor

2.3 Applicable Documents: Latest edition, devision/addendum of the following or equipment of the following or equivalent are applicable for this specification, as minimum.

- ASTM – A36
- ASTM – A 53
- ASTM – A 269-TP 304l
- ANSI – B 31.1
- SAE – J 726d, 83 1262 (Bulletin),
- National Electric Code – (NEC-USA)
- Uniform Building Code – (USA)
- Steel Structural Painting Council – (SSPC)
- American Society of Civil Engineers (ASCE)
- American Welding Society (AWS)
- American Institute of Steel Construction (AISC)
- American Society of Non-destructive Testing (ASNT)

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- International Electrotechnical Commission (IEC)
- Sea Worthy Packing – BHEL Specification – GT14024 (Cl 11.0).
- Commercial Blast Cleaning process specification – SSPC-SP6.
- ASHRAE-52.1.
- EN 779 : 2012

3.0 OPERATING CONDITIONS:

3.1 Airflow ISO (Var- Table- 1). Filter to design for 5% extra flow.

3.2 Initial pressure drop clean: max. 30mm WG

3.3 Stabilized operating delta P: max. 70mm WG

3.4 **Additional Requirements:**

3.4.1 Bank of 2 stacked elements must be installed horizontally

3.4.2 Elements must be conical/cylindrical with individual supporting system (one per stack).

3.4.3

a) The elements must have:

- A double metallic protection: one inner and one outer liner made of perforated steel sheet with 60% open area
- Hot dip galvanized.
- A media to ensure the specified efficiency and dust loading.

The media must be:

- Water-resistant and water washable.
- Corrugated to ensure the pleat spacing and the dust holding capacity.
- Permanently fixed at given intervals, to resist the stress and to avoid premature wear, caused by continuous pulsing.
- Designed to operate continuously at 100% relative humidity and upto 55^{0}C ambient temperature.
- Designed to withstand a min. differential pressure of 15.0 inches of water column at rated airflow without damage or loss of filtration efficiency.
- Such as the speed of aging – under the operating conditions ensure the proper protection of the turbine, for at least 18 months. 2 years of actual operating experience under the described operating conditions must be demonstrated.
- The operating delta – P must stabilize in the environmental conditions, and so, must comply with the dust capacity and efficiency test requirements described below.
- Each element shall a seal that prevents unfiltered air from entering the clean air path.

b) It shall be possible to attach the elements to the plenum without any special tool & designed such that allows attaching only in the correct way. Automatically aligned & given a positive stop to ensure proper compression of the seal.

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3.4.4 **Efficiency requirements to ensure proper protection:**

3.4.4.1

A. **Test dust:** ASHRAE Fine dust.

Test method: Simultaneous measurement upstream and downstream by means of an Optical system calibrated on 0.3 micron particles per SAE 83 1262 bulletin.

Results:

- **Efficiency on clean media (with 0.5grams of dust loading)**
- Min. 98.50 % on 0.5 micron of ASHRAE Fine Dust Particle.
- Min. 99.20 % on 1.0 micron of ASHRAE Fine Dust Particle.
- Min. 99.97 % on 5.0 micron of ASHRAE Fine Dust Particle.
- **Efficiency at 3500 gr dust loading**
- Min. 99.90 % on 0.5 micron of ASHRAE Fine Dust Particle.

B. **Test dust:** ASHRAE fine dust + NaCl (90% dust +10% NaCl Mixture). NaCl to be sized from 0 to 5 microns, with a mean diameter of 2microns.

Test method:

- Equipment: min 6 elements.
- The dust feeder: With dust, injectors per SAE J726d. shall feed at a uniform and continuous rate and the dust injectors shall disperse the dust uniformity across the air inlet face.
- Air sampling: ISO kenetic probes with Gelman membrane of 0.45 micrometer.
- Dust Mixture concentration: 0.57gr/m^3.
- Flow conditions: As in operating conditions.

Results:

- Min 99.95percentage Nacl efficiency, even over 90% RH.

3.4.4.2 **Dust capacity:**

A. Per Cl 3.4.4.1 (A) above.

- Min 3500 gr of dust holding capacity at recommended flow to 75mm WG delta P - rise

B. Per Cl.3.4.4.1 (B) above.

- Feed dust continuously at an inlet concentration of 0.57 gr/m^3 for a minimum of 50 hours.
- The system shall not show a rising pressure characteristic and the efficiency shall not be less than 99.95% on NaCl during the whole test period

C. After cl.3.4.4.2 (B) above the pulse clean mechanism shall be de-activated and test dust shall be fed continuously at 0.57 gr/m^3 until the pressure drop across the self-cleaning filter reaches 2.5KPA. (Relative humidity staying over 40%).

- When the pulse clean mechanism is reactivated, the pressure drop should come back to the value of Cl.3.4.4.1 (B) above.

3.4.4.3 Design site dust load 450 micro gr/m^3.

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3.4.5 **Integrity of elements:**

- Certified evidence that the filter elements can withstand rough handling. Min.15 hours continuous shaker testing to US Army Corps. Manual 136-300-178, without sustaining structural damage or loss of dust collection efficiency (element alone, without transport packing).

3.4.6

- The cleaning will be controlled by means of pressure switch and a clock. The manual switch should allow the P.S. to be overridden. The cleaning is made by reverse flow air pulsejets. (One jet per element) with sufficient energy to ensure proper operations of the system. A time sequencer will control the pulse interval and dwell time. The cleaning sequence will be such as the elements are cleaned from top to bottom to minimize the repollutions of the already cleaned elements.

3.4.7

- The air pulsejet operation is achieved through complination working of solenoid valves (protection-class IP 65) & air-valves (Protection class IP 65). Pulse air being available upto the Solenoid. Dry airline is connected to the airline input point (NPT conn. & plugged) of the filter unit. The dry air requirement shall be furnished by vendor at offer stage with Tech.data.

3.4.8

- The pulse sequence is controlled from a control box mounted on the Air-Filter unit structure at a convenient location and in shed-area. The control box shall house the sequence controller (Field adjustable) relays, photohelic differential pr.switch, Power module etc. All components & circuitry suitable for operation at given site ambient temperature & supplied fully interconnected. All devices shall be identified with the nameplate. Control Box shall be provided with expl. Proof Cable gland for input of electrical power cable (220/230V-1ph-AC & frequency as defined in Var-Table-I) from “others” Read also cl.7.2 below, for electrical protection- class requirement.
- Separate TB shall be provided to photohelic switch cum gauge in control box for extending UPS power supply – 110V / 230V AC (from others).
- All instruments and its electrical accessories shall be certified for Zone-1, Gas Group IIA/IIB, Temperature class T3 as minimum.
- All Electronic/Electrical instruments and equipment’s shall be suitable for area classification as per IEC codes and shall be tested by any recognized authority like BASEEFA,FM,PTB,CMRI etc. and shall be certified by Petroleum and Explosives Safety Organization (PESO) / Chief Controller of Explosives(CCE), Nagpur or Director General of Mines Safety (DGMS) in India.

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3.4.8.1 **"Loss of Power" - Relay**

- A relay shall be supplied to provide a signal to the gas turbine control that power has been lost to the air-filter Timer/Sequencer(s). The relay shall be of industrial quality with contacts rated for 0.1 amperes at 125 volts direct current. The relay(s) shall be located in the control box.

3.4.9 **Pressure Switches:**

- Three (3) pressure switches shall be provided to sense the true static pressure in the clean air plenum downstream of the filter elements. The pressure switches shall be placed in a position, which is easily accessible during operation of the Gas Turbine. Each switch shall have a separate pressure sensing line. The high-pressure port shall be vented to atmosphere. Insect proof barriers shall be installed on all ports. A local DP display gauge is to be provided as well. Each switch shall be identified by a nameplate with the device code as listed in as below:

Table – A : Pressure Switch Summary

Pressure Switch Designation	Set point (inches of W.C.)	Function
63TF-1	6"	Alarm
63TF-2A	8"	Shutdown
63TF-2B	8"	shutdown

3.4.9.1 **Pressure Transmitter**

- One number differential pressure transmitter 96CS-3 (Smart type with Local indication) shall be provided in Inlet Air Filter control Box along with differential pressure switches. The differential pressure Transmitter shall be Exproof (Exd) and make of Rosemount / Yokogawa / Fuji. This is required for remote monitoring of filter differential pressure.

3.4.9.2 **Solenoid Valves**

- Solenoid Valves shall be ex proof (Exd) suitable to NEC class I, Div. II, Gr - C&D and make shall be Goyen / ASCO / Mecair.

3.4.10 **Compressed Air Switch (63 CA-1)**

- A single pressure switch shall be supplied to sense the pressure in the compressed Air Supply system. The switch will be used in the Gas-Turbine control system and will initiate an alarm when the pressure drops below the set point. The switch shall be located in an easily accessed position with the preferred position being mounted near the control system. The switch shall be **factory preset at 60.0 psig decreasing pressure.**

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3.4.11 The air inlet will create into the dirty airside a velocity directed downwards, to entrain the cleaned dust towards a hopper. The inlet arrangement will also provide protection against weather conditions.

3.4.12 **Dust Evacuation System:**

- Secondary air fans are not acceptable.
- Hopper with compressed air activated rubber flaps will be preferred so that the separated dust us evacuated automatically without any reentrainment risk.

3.4.13 **Air Handling system:**

3.4.13.1

- Air handling system shall consist of the package air compressor & the Air-drying unit.
- Package Air Compressor skid shall be suitable for pulse air requirements of Air Filter unit offered. Air-Compressor skid shall include following components assembled on a skid with complete piping, instrumentation and control system as a package of complete Air System. The air outlet quantity pressure & temperature shall be such that it shall suit the requirement of the air filter pulse enclosure. Unit shall be housed in a weatherproof enclosure. The painting requirement as per Cl.10.0. (Colour shade-later). All electrical system shall be designed for area classification-Ref.Var.-Table-I. Single point 3-phase power supply will be provided per Var.Table-I.
- The compressor skid shall be standing design i.e. no foundation bolting arrangement envisaged.
  a) One Screw Compressor shaft/belt driven with electric motor.
  b) Inlet Air Cyclonic separator and Air Filter.
  c) Forced Air Cooled system lube oil and air circuit.
  d) Receiver tank with required Air- oil separator and oil filter.
  e) Fine oil separator at outlet to achieve the guaranteed oil content (ppm level) at outlet, which is acceptable for the Air Filter Elements.

3.4.13.2

- 2 x 100% Air drying towers with auto-change air facility of airflow & designed to achieve the required dew point at air outlet leading for Air pulsing of the self-cleaning air filter unit. Each drying towers shall contain desiccants and alternately come into service at regulated time interval from its own control panel (working on single phase-AC-power supply- Ref. Var-table-1). Complete interconnecting piping-of SS-304-Seamless. Valves/fittings-Carbon steel – A105/A216-WCB & A234-WPB grades-respectively. Necessary instrumentation required. The drying unit shall be housed inside the compressor housing.

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4.0 MATERIALS AND CONSTRUCTION & DESIGN:

4.1 The clean air side shall be fully welded. Unless otherwise noted in "Remarks" – Var-Table-1, the clean airside shall be reinforced Carbon steel sheets of Min.3mm (indicative) unless listed separately in the variant table. No bolting arrangement permitted in the clean airside, unless protected otherwise in exception cases. The dirty airside shall also be made of min.3 mm thick reinforced carbon steel sheets unless listed separately in the variant table.

4.1.1 In both the above cases, complete design shall be adequate to meet all the structural & various load combination requirements. The wind loads and differential pressure loads shall be considered to act concurrently with the differential pressure.

4.2 The clean airside which is subjected to (-VE) suction pressure of GT, shall be designed for 10 inches of water column without any adverse effect on its operation.

4.3 All major components/Assemblies, which require lifting during transport/Erection, shall have provision for lifting lugs (all such provisions clearly shown in erection manual & marked on each piece). 100% D.P.T. required for each such lugs.

4.4 **Assembly-** To reduce the erection time & also problems arising due to erection at site, to the extent feasible the assemblies shall be completed in all respect in factory itself. The max. Size & weight of such assemblies shall be decided taking into consideration of transportation/handling constraints (modes may by trucks, rail, ship, crane, lift-trucks etc.). The data on such item sizes & weights shall be furnished in the erection manual (furnished min, 6wks. In advance of scheduled delivery).

4.5 **Structural-** Supports for the filter system shall be Hot-Dip / spray galvanized. Bolted construction shall be utilized and field welding shall not be specified unless it is necessary for adjustments. (All such field welds are to be clearly marked in erection manual).

4.6 **Outlet Duct Flange:**

4.6.1 Unless noted otherwise in Var-Table-1, the centerline of the outlet duct flange shall have elevation from ref. ground level E.L. of 0.0m, as follows:

GAS TURBINE	ELEVATION(MM)	NOTE
FR- 3	5337.0	a) The filter unit support steel foot pads are placed on concrete pedestals of ht=400mm from ref. ground level EL-0.0m. b) Ladder supports required from 0.0 m. E.L.
FR- 5P	7566.5	
FR- 6B	7566.5	
FR- 9E	9309.0	

4.6.2 Unless noted otherwise in Var-Table-I, the outlet flange interface dimension shall

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match with standard Inlet duct interface dimensions of above-mentioned GT's (frame size wise).

4.7 **Drift Eliminators / Droplet Separators**

4.7.1 Vertical Vane Type, Aluminum/ polypropylene based material having both ultraviolet & salt resistance to be fitted in weather hood.

4.7.2 The filtration system moisture separator shall have capture efficiency greater than or equal to 90.0% on 30 microns diameter water droplets.

4.7.3 Height of vanes, thickness and spacing is to be specified as a part of the enquiry.

4.8 **Coalescer Pads**

Coalescer demister pads to be provided after Drift eliminator/ Droplet separator. These elements shall ensure superlative durability, high arrestance, long useful lifetimes & high cost efficiency. The media shall be washable and reusable.

5.0 SERVICING:

5.1 The elements must be removable from the dirty air side- while the turbine is running. Access to the elements is made thru access doors (bolted & gasketted) and with fixed service platforms. (See also cl.9.0 below).

5.2 External staircase required to access all modiles. Cat ladders are not acceptable. Internal ladders to be provided with fall protection. Manual hoist shall be provided for handling the filter elements.

6.0 PNEUMATIC SYSTEM

Compressed air (max. 90^0C – free of liquid and dust) will be provided by "others". However, the filter vendor must indicate the compressed air requirement. The filter shall be provided with the manifold, (galv) blow-pipe, SS-tubing & SS double compressor tube fillings (SWAGELOK) solenoid and pneumatic valves, pressure regulator (with gauge), cartridge type 5 microns, air filter (moisture separator at input point), all mounting hardware's, clamps, etc., To minimize erection time, maximum shall be pre-plumbed.

7.0 ELECTRICAL:

7.1 The control system (control panel & box) shall be located for easy maintenance access from the ground level. The FRLS armoured cables and cable trays up (Under vendors scope) to control panel and control box shall be estimated and supplied for this requirement. All electronic panels shall be provided with canopy. To reduce the erection time, maximum items shall be pre-wired at factory itself. All pressure / DP gauges shall be mounted on a separate instrument panel (with canopy) and wiring of transmitters shall be brought to the control box.

7.2 Unless noted otherwise in Var. Table-I, complete electrical system design & selection

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of items shall be suitable for hazardous area classification per NEC-Class-I, Div.-II, GR-C & D (Exd).

8.0 FOUNDATION HARDWARE & FASTENERS:

8.1 All foundation hardware's (cement Coated Bolts, galv nuts & washers) shall be necessarily supplied by vendor.

8.2 All other fastness (galvanized) shall be supplied with 10 % spare for each size.

9.0 RELIABILITY,DESIGN LIFE, MAINTAINABILITY,& SAFETY:

9.1 Reliability:

The Inlet Air filter components shall be designed and selected for maximum reliability and minimal downtime due to component failure.

9.2 Design Life:

9.2.1 Structural:

The plenum, modules, structural members, and access hardware shall have a useful life of 20 years. No repair or replacement shall be considered necessary during the life of the above components with the exception of paint repair.

9.2.2 Accessories:

Electrical and pneumatic components shall have a useful life of 25,000 hours of operation. An hour of operation shall be that in which the Gas-Turbine plant is operating. Components may be repaired with in the design life specified, but shall not be repaired or replaced more frequently than specified in paragraph 3.6.1.

9.2.3 Filter Elements:

Elements shall have a designed storage life of up to one year under storage conditions, which are dry and ambient temperatures of less than 50^0C. The elements shall have a designed operational life of two calendar years which immediately follows the above specified storage time. During the operational life, tears or rips in the media, failure of any part of the elements or a differential pressure exceeding an average of 5.0 inches of water column shall not be experienced.

9.3 Maintainability:

The filtration system shall be designed for ease of maintenance with a minimum of cost, parts and labor. A safe means of access shall be provided to all parts, which require maintenance, including valves, solenoids and electrical devices. Any special tools required for maintenance shall be provided for each system. Recommend maintenance schedules shall be established and presented in an O&M-Manual. On multilevel Installations, hoists or other suitable means shall be provided to elevate replacement filter elements to reach upper level.

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9.4 **Safety:**

The supplier shall assess the safety of his product and shall advice BHEL, in writing, of all warnings and instructions which, in the opinion of the supplier, are necessary to preclude occurrence of hazardous conditions or to define and minimize the risk of potentially hazardous conditions.

10.0 Painting & Surface Finish:

All carbon steel surface that are not otherwise protected for corrosion shall be prepared as follows:-

10.1 Both the internal and external surfaces of the air filter/Air compressor/Air drying unit including all parts, components & assemblies be surface Grit Blast cleaned (process specification No.SSPC –SP6).

10.2 All parts, components and assemblies thoroughly cleaned prior to painting. This shall include the removal of all loose, scattered or excess welding material or solder material, weld flash, metal chips or any other foreign matter, burns or sharp edges.

10.3 Structural Surface – Ref. Cl.4.5 above.

10.4 Painting shall be in line with the details mentioned in the variant.

10.5 **Stock Paint:**

Upon completion, vendor to supply 1% each of Colour used as stock for future patch up.

11.0 Cleanliness & Workmanship:

All parts, components and assemblies shall be thoroughly cleaned prior to and after assembly and after assembly and test, including removal of all loose, spattered, excess welding materials, weld-flash, metal-chips or any other foreign matter, burrs and sharp-edges. All openings are to be securely covered against entry of foreign material after cleaning.

Workman ship shall be done in a manner resulting in full compliance with the requirements of the specification.

12.0 Drawings./Documents/Nameplates & Product Markings:

12.1 **Doc./Information required with offer:**

a) G.A.drgs. of Air Filter unit, Air compressor skid and the Air drying unit. The drawings shall include interface dim, footprint, foundation-arrangement detail etc.

b) Complete tech-data on filter-elements indicating the flow capacity/element.

c) Schematic and Technical data Air Compressor and Air Drying Unit.

d) Filled-up data & confirmation per tech-data sheet (enclosed in this specification-Annexure-I).

e) Control systems write up & panel Drg. With detail.

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f) Cat. Information on bought-out components.

g) Quotation for Cl.15.0 & 16.0 below.

h) Deviation list (without which it will be construed that vendor will comply with the specification fully).

12.2 **Doc. Required after placement of LOI:**

a) **Within 4wks. Time:** (For review /approval by BHEL)

i. Final drgs-per Cl. (12.1.a) above.

ii. Bill of Materials (BOM) indicating all despatchable loose components & assemblies.

iii. Electrical Control system-write up, Schematic, cable Inter connection diagram etc., indicating part/position No. of items per BOM.

iv. Pneumatic system- components final data & detail, schematic diagram, tubing/piping layout indicating part/position No. of items per BOM.

v. Filter unit components Assly-break-up drg. (Isometric-preferred) Indicating part/posn. Nos. per BOM.

vi. Final cat-info. On bought- out components.

vii. Quality Assurance Plan (Ref. Cl.13.2 below).

viii. Sample O&M & the erection manual (2 copies) for review by BHEL.

12.3

A. 20 copies of O & M & the erection manual at the time of dispatch of item to site and O & M and approved drawings soft copies on CD also.

B. Furnishing to all tests & the guarantee Certificate to the inspection agency- during final inspection at works.

13.0 Quality Assurance Provision:

13.1 The manufacture is responsible for the performance of all test and inspection requirements. Except as otherwise specified, the manufacturer may utilize his own facilities or any, commercial laboratory acceptable to BHEL & or, BHEL's customer/AI. In addition, BHEL &/or, BHEL's customer/AI reserves the right to perform any of the required inspections and tests are considered to be necessary to assure that the item supplied conforms to the requirements of this specification.

13.2 **Inspection and Tests:**

Supplier is responsible for establishing a production quality program assuring and documenting compliance to the requirements of this specification, ordering document and purchase order. The Q.A plan shall be submitted & it shall include the inspection and tests as defined in the following paragraphs for each filter system.

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(BHEL/BHEL's Customer may indicate "Hold-points" in the Q.A plan for stage & Final Inspections).

13.2.1 **Control System**

Functional and premature failure testing of the system.

13.2.2 **Pneumatic system:**

Individual module pneumatic systems leak tests and cycle tests of all valves at rated pressure.

13.2.3 **Electrical Systems:**

Cycling of all Solenoids.

13.2.4 **Purchase Components and sub-contract Work.**

Verification of conformance to applicable standards and requirements & the test-certificates applicable.

13.2.5 **Manufacturing Practices, Procedures and Processes.**

Verification of conformance to applicable standards and requirements.

13.2.6 **Test Certificates:**

Test certificates of sub-delivery & Raw Materials, tests conduct at supplier's works at different stages of production, assembly & functional tests - are to be furnished by vendor along with the supply. Vendor to provide test certificates complying to EN779:2012 for filters.

14.0 Marking, Packing, & Shipment:

14.1 Marking:

All despatchable loose parts/assemblies, shipping packets, containers etc. shall be individually, permanently and legibly marked/tagged, for part-number identification as per the BOM, so as to store, locate & identify the items conveniently, easily & quickly at site.

14.2 Packing

The supplier shall make shipment using the minimum number of shipping containers consistent with the requirements of safe transit, available modes of transportation and routing. It shall be the supplier's responsibility to determine that packaging as done is adequate to preserve the integrity of the equipment after having met the satisfactory visual check & such that all equipment shall arrive at its destination in an undamaged condition and ready for its intended use.

14.3 **R27** packing, preservation & shipping should be in line with BHEL spec GT14024. To retain the finish of painted surfaces, all packing must be covered during transport. If the items are being shipped by sea, all enclosures must be packed in an environment, which will remain salt free.

14.4 **NOTE:**

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All the packing shall be made in such a way that a portion can be opened without any damage of the packing for inspection inside, by the customs authority at ports. It shall be possible to replace & close the opening to its original condition.

14.4.1 **Shipment:**

For specific shipping instructions, see the Purchase Order or quotation Request. Approval to ship must be obtained from the BHEL purchasing Department.

If certain shipment items become the late dispatching, due to unavoidable reasons, approval of all such items must be obtained from BHEL Purchasing Department at least two weeks prior to shipment. At the time of shipment two copies of the packing list and/or shortage with ref to BOM with the promised shipping dates if applicable, must be intimated to the Purchasing Department.

Ship the filter elements, instruments and electronic items in non-refundable container.

14.5 **Spare Parts:**

The vendor shall supply 10% spare nuts, bolts, clamps, washers, cables, gaskets, etc. These items are part of main supply. It shall be marked & packed & necessarily noted in the BOM.

15.0 Services from vendor & separate quotation:

15.1 Vendor shall quote separate price for the following:

15.1.1 Erection of commissioning of the equipment at site. Vendor shall indicate no.of personnel with estimated time required for completion of this activity for one unit.

15.1.2 Only “Supervision Charge” Per Unit during erection & commissioning of the equipment at site by “others”. Per – Diem charge only shall be indicated for this service.

NOTE: No other charges payable by BHEL for services CL.15.1.1 or 15.1.2 above.

16.0 Spares (O&M):-

16.1 Vendor shall quote separate price for operation & maintenance spares required for 2 years. Recommended spares list with item wise quantity to be furnished along with the offer.

17.0 Guarantee:-

17.1 Vendor shall furnish a guarantee certificate indicating guaranteed performance of the equipment at site for a period of eighteen months from the date of delivery or for a period of 12months from the date of commissioning at site, whichever is earlier.

17.2 Review/approval of documents & data by BHEL shall not relieve the vendor from its responsibilities for compliance of all applicable codes, regulation standards and good engineering practice for the system supplied.

18.0 Erection and Commissioning Spares:-

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In addition to clause 14.5, vendor shall supply the following items as minimum commissioning spares along with main supply.

1. Filter Elements and Decron Sleeves - 10Nos.
2. Solenoid & Diaphragm Valve - 5Nos.
3. Solenoid & Diaphragm Valve repair kit - 5Nos.
4. Sequencer Timer Card - 1Nos.
5. Filter Element Assembly hardware - 1Set.

19.0 Welding shall be in line with BHEL spec GT54031.

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ANNEXURE-I

TECHNICAL DATA SHEET

***BHEL Spec: - GT54198 Var No. _____ Rev.No. _____**

***Item: _____Model:-_____**

***Supplier Name:-_____BHEL Enquiry:-_____**

***Total Pieces:-_____ Date:-_____**

SL.NO.	PARAMETERS	REQUIREMENTS	VENDOR'S CONF.
1.0	**INLET CONDITION(FILTER)**		
1.1	INLET AIR FLOW	VAR-TABLE-I	
1.2	AMBIENT CONDITION FOR DESIGN	TEMP(-) 8^0C TO 55^0C RH 0% TO 100% RAIN UPTO100"/YR	
1.3	DESIGN WIND VELOCITY	VAR-TABLE-I	
1.4	SESMIC DESIGN	VAR-TABLE-I	
1.5	PULSE AIR-SUPPLY AVAILABLE		
2.0	**DESIGN REQUIREMENTS(FILTER)**		
2.1	AIR FLOW VELOCITY THRU MEDIA		
2.2	APPROACH VEL.& MAX. VEL. BETWEEN FILTERS.		
2.3	FILTER EFFICIENCY	99.95%	
2.4	AIR FLOW CAPACITY/ ELEMENT-NUMBER OF COMBINATION FILTERS REQD. & THEIR MODEL NO'S.	CFM/(m^3 per hour)	
2.6	FILTER ELEMENT DESIGN D.P.		
2.7	FILTER SYSTEM DESIGN PR.	10"W.C.	
2.8	ELEMENT LIFE	1YR STORAGE/ 2YR OPERATION	
2.8.1	FILTER MEDIA SOURCE	VENDOR TO INDICATE MAKE &ADDRESS	
2.9	NO. OF ELEMENTS CLEANED AT A TIME	10%(MAX)	
2.10	FILTER ELEMENT MEDIA MATERIAL	VENDOR TO SPECIFY MEDIA OFFERED	

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2.11	EXTRA FILTRATION	5% (MIN)	
2.12	DRIFT ELIMINATOR/ DROPLET SEPARATOR	REQUIRED	
2.13	COALESCER PADS	REQUIRED	
3.0	**CONSTRUCTIONAL REQUIREMENTS(FILTERS)**		
3.1	PLENUM AND MODULE SHEET THICK		
3.2	PIPING MATERIAL	ASTM-A53	
3.3	TUBING MATERIAL	ASTM-A269	
3.4	ALL STRUCTURALS,GRATING FASTENERS	GALV.	
3.5	PR.SWITCHES(3+1 NO.S)	INDICATE\ENCLOSE-MAKE MODULE CATALOGUE	
3.6	SOL. VALVES	INDICATE\ENCLOSE-MAKE MODEL CATALOGUE	
3.7	FILTER (PULSE AIR INPUT LINE) 5MICRONS.	INDICATE\ENCLOSE-MAKE MODEL CATALOGUE	
3.8	NO.OF FILTER ELEMENTS PROVIDED	INDICATE NUMBER & MODEL NO.	
3.9	FILTRATION AREA PER ELEMENT & SIZE	INDICATE AREA IN m^2 SIZE IN DIA X LENGTH (mm)	
3.10	HEIGHT OF C.L. OF AIR FILTER OUTLET TO BOTTOM REF.CL.4.6.1	FINAL, DURING DRG.APPR. STAGE	
3.11	ACCESS PLATFORM AND MANDOORS	REQUIRED	
3.12	ELECTRICAL HOIST (225KG.)	REQUIRED	
3.13	PROTECTIVE COATING & SURFACE FINISH	CL.10.0	
3.14	PULSE AIR (QTY. PRESS. & TEMP.)		
4.0	COMPLETE ELECTRICALS SYSTEM (EXACT REQUIREMENTS-VAR-TABLE-I)	CL.7.2	
5.0	POWER REQUIREMENTS	REF.VAR.TABLE-I Separate TB for PDISLH to extend UPS supply	

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6.0	DEVICES WEATHER PROOFING	IP65	
7.0	CONTROL PANEL DESIGN	CL.7.2	
8.0	VENDOR DRGS/ DOCUMENTS	WITH OFFER	
8.1	G.A DRAWING(FILTER)	DRG.NO.	
8.2	G.ADRAWING (COMPRESSOR)	DRG.NO.	
8.3	G.A DRG. (DRYING UNIT)	DRG.NO.	
8.4	CONTROL SYSTEMS WRITE-UP AIR FILTER, COMPRESSOR, AIR DRYING UNIT.	DOC.NO.	
8.5	CONTROL PANEL DRGS.	DRG.NO.	
8.6	FILTER ELEMENT DRG/CAT	DRG.NO.	
8.7	FOUNDATION DRG.	DRG.NO.	
9.0	Q.A.PLAN	REQUIRED(CL.13.2)	
10.0	DOC. SUBMISSION	CL.12.2 &12.3	

PREPARED BY: **SIGNATURE:**

NAME: **DATE:**

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ANNEXURE-II

Mandatory Spares for Var – 38

Sl No	Material Description	Quantity
1	Differential Pressure Switch (63)	01 No
2	Pressure Switch (63)	01 No
3	Differential Pressure Gauge with Hi – L Limit Switches	01 No
4	Sequencer Card for pulsation	01 No
5	Electronic Diff Pressure Transmitter with Zener Barrier	01 No
6	Differential Pressure Gauge	01 No
7	Solenoids & Diaphragm Valves	10% Installed Capacity
8	Filter Elements	10 Nos
9	Solenoids & Diaphragm Valves	5 Nos
10	Solenoids & Diaphragm Valve Repair Kit	5 Nos
11	Sequencer Timer Card	1 No
12	Filter Element Assembly Hardware	1 Set

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VAR - NO.	G.T FRAME	SITE	SITE CONDITIONS	G.T. AIR FLOW (ISO) - Kg/sec	SYSTEM WITH PACKAGE COMPR. & DRYER UNITS - CL. 3.4.13	AVAILABLE EL. POWER SUPPLY / SYSTEM PROTECTION REQD.	CL OF AIR O/L FLANGE	REMARKS	BHEL CODE
01	3x FR-5	QURAYAT - SAUDI ARABIA	ALTITUDE :- 600m above MSL AMB. TEMP :- (-8)°C to 50°C WINDSPEED :- 175 Kmph SIESMIC FACTOR :- ZONE-1, US BUILDING CODE	122.22 * [see Remarks]	yes & only Comp. Unit 100% standby Required with auto Change over	380V - 3PH - 60 Hz & 220V - 1 PH - 60Hz / CL. 7.2	PER CL 4.6.1.	* (1) Addl air flow of 36.945 kg/sec to cater GT. Encl. Vent. System. (2) For conn. refer drg. enclosed 4-36408-59003	GT9754198012
02	1xFR-6	OMAN CEMENTS, OMAN	ALTITUDE :- 150 mts above MSL. 980 m bar. AMBIENT TEMP. :- 5°C (min.) 50°C (max.) 50°C (Design) RELATIVE HUMIDITY - 50% DESIGN WIND PRESSURE & DIRECTION - 130 Kmph, East to West. SEISMIC DATA - 0.05g AS PER UBC CODES.	138.33 (240,266 CFM)	NOT APPLICABLE	415V - 3PH - 50Hz & 220V - 1 Ph - 50Hz / VENDOR TO QUOTE OPTIONAL PRICE FOR EXPLOSION PROOF AND NON-EXPLOSION PROOF REQUIREMENTS Cl. 7.2	• 7166.5mm FROM G.T. MBL • AIR FILTER SHOULD HAVE MIN. GROUND CLEARANCE OF 8mts.	• TOTAL INLET AIR FILTER FLOW REQT. IS 278,280 CFM (240,266 CFM + 5% Extra AS PER ARAMCO SPECN. FOR G.T. INLET AIR FILTER AND 26,000 CFM FOR VENT FANS) • ALSO REFER TO INDENT REMARKS APPENDIX - I	GT9754198020
03	FR-5	HPCL, MUMBAI (1 x FR-5 GT's) COGEN.	ALTITUDE :- 17 mts above MSL. AMBIENT TEMP :- MIN - 10°C MAX - 42°C DESIGN - 40°C RELATIVE HUMIDITY - 50%. WIND SPEED - 160 Kmph (max) Seismic Data - Zone IV	122.22 kg/sec at ISO Condition	NOT APPLICABLE	Same as in VAR - 02	* 3466 mm to filter floor level & AIR FILTER IS LOCATED AT A HIGHER ELEVATION	* VENDORS TO QUOTE FOR CROSS FLOW TYPE (HORIZONTALLY MOUNTED FILTER) FILTER ARRGT. ONLY & WEATHER HOODS SHALL HAVE MOISTURE SEPERATOR PANELS (SS/POLY. PROPYLENE TYPE)	GT9754198039

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VAR NO	G.T. FRAME	SITE	SITE CONDITIONS	GT AIR FLOW (ISO) Kg/sec	SYSTEM WITH PACKAGE COMPRESSOR & DRYER UNITS – CL.3.4.13	AVAILABLE ELECTRICAL POWER SUPPLY. / SYSTEM PROTECTION REQUIRED	℄ OF AIR OUTLET FLANGE	REMARKS	BHEL MATERIAL CODE
04	FR-6	SUJANA, TUTICORIN & SUJANA GANGAI-KONDAN	ALTITUDE – 8 m above MSL MIN. TEMP : 20°C MAX. TEMP : 37°C DESIGN AMB. : 29°C RH : 80 %.	138.33	NOT APPLICABLE	415V–3Ph–50Hz & 220V–1Ph–50Hz Vendors to quote optional price for Explosion proof & Non-Explosion proof requirements Cl.7.2 seperately.	• 7166.5 mm from GT MBL. • Air filter should have minimum ground clearance of 5 mts from lowest weather hood.	* Vendors to quote for cross flow type filter arrangement * VENDORS TO QUOTE WITH ELECTRICAL HOIST ARRANGEMENT. * Weather hoods shall have SS insects screen at inlet (air inlet) side and MUNTERS INDIA Make drift eliminators (SS/ Poly propylene type) at outlet of weather hoods.	GT9754198047
05	FR-6 SPLIT BASE (PG 6561B)	HUBARA POWER PLANT, PETROLEUM DEVELOPMENT OMAN LLC, SULTANATE OF OMAN.	REFER PDO SPECIFICATIONS, ERDs & DEPs REGARDING PROJECT SPECIFIC DATA AND ITEM INFORMATION. SPECIAL REMARKS: All instrumentation will be designed to function correctly with an ambient temperature of 60°C if shaded or 80°C if not shaded.	138.33	NOT APPLICABLE	415V–3Ph–50Hz & 220V–1Ph–50Hz Vendor to quote optional price for Explosion proof & Non-Explosion proof requirements Cl.7.2 seperately.	• 7166.5 mm from GT MBL. • Air filter should have minimum ground clearance of 3.5 mts from lowest weather hood.	• Vendors to quote for cross flow type filter • A mist eliminator shall be provided. • All tube fittings shall be of SWAGELOK make only. • Electric hoist is reqd. • Replacement of filters should be made possible through a stainless steel adaptor which allows exchange of the filter media only. • Refer to ordering specn. GT64002, Rev-00. • Control panel will be located in control room	GTW512097002

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VAR NO	G.T. FRAME	SITE	SITE CONDITIONS	AIR FLOW (ISO) Kgs/sec.	SYSTEM WITH PACKAGE COMPRESSOR & DRYER UNITS - CL 3.4.15	AVAILABLE ELECTRICAL POWER SUPPLY / SYSTEM PROTECTION REQUIRED	℄ OF AIR OUTLET FLANGE.	REMARKS	BHEL MATERIAL CODE
06	FR-6FA	TNEB, KOVILKALAPAL	• SIESMIC ZONE - V (IS: 1893) • WIND LOAD - 200 Kmph (IS-875)	• FOR GT 196 Kgs/sec i.e, 354076 CFM • VENDOR SHOULD CONSIDER 5% MORE FLOW. • GT FLOW INCLUDING 5% MORE FLOW 371780 CFM • GENERATOR VENT AIR FLOW 80000 CFM • TOTAL AIR FLOW TO BE CONSIDERED FOR AIR FILTER DESIGN IS 451780 CFM.	NOT APPLICABLE	415V - 3Ph - 50Hz & 220V - 1Ph - 50Hz VENDOR TO QUOTE OPTIONAL PRICE FOR EXPLOSION PROOF AND NON-EXPLOSION PROOF REQUIREMENTS CL. 7.2	• AIR FILTER SHOULD HAVE MIN. GROUND CLEARANCE OF 5 mts. • SUPPORT STRUCTURE TO BE DESIGNED TO ACCOMODATE EQUIPMENTS BELOW FILTER UNIT. BOTTOM OF STEEL REFERENCE OF AIR FILTER MODULE SUPPORT STRUCTURE IS 7537 mm FROM GT MBL. • ℄ OF OUTLET FLANGE TO GT MBL IS 9754 mm. • SEPERATE PARTITION IN AIR-FILTER MODULE IS REQUIRED FOR GENERATOR AIR FLOW.	• EVAPORATIVE COOLER PER BHEL SPECN. GT54239, VAR-01, REV-00 SHALL BE PART OF AIR FILTER VENDOR SUPPLY.	GT9754198063
07	FR-6FA	ETA	— do —	— do —	— do —	— do —	— do —	• Evaporative cooler not applicable • FOOT PRINTS FOR AIR FILTER WILL BE FURNISHED BY BHEL.	GT9754198071

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VAR NO	G.T. FRAME	SITE	SITE CONDITIONS	AIR FLOW (ISO) Kgs/Sec	SYSTEM WITH PACKAGE COMPRESSOR AND DRYER UNITS CL. 3.4.13	AVAILABLE ELECTRICAL POWER SUPPLY / SYSTEM PROTECTION REQUIRED	℄ of AIR OUT LET FLANGE	REMARKS	BHEL MATERIAL CODE
08	FR-6 (PG6561B)	RVUNL RAMGARH	ALTITUDE: 165m above MSL AMB. TEMP: min = 5°C, max = 50°C, Design = 27°C RELATIVE HUMIDITY: 60%	136.39 (240,266 CFM) VENDOR SHOULD CONSIDER 5% MORE FLOW.	NOT APPLICABLE	415V-3Ph-50Hz & 220V-1Ph-50Hz VENDOR TO QUOTE OPTIONAL PRICE FOR EXPLOSION PROOF AND NON-EXPLOSION PROOF REQUIREMENTS CL. 7.2 SEPARATELY	• 7166.5 mm FROM GT MBL. • AIR FILTER SHOULD HAVE MINIMUM GROUND CLEARENCE OF 5 m FROM LOWEST WEATHER HOOD.	EVAPORATIVE COOLER AS PER BHEL SPEC NO: GT54238 VAR 02, REV 01 * Vendors to quote for cross flow type filter arrangement * Vendors to quote with electrical hoist Arrangement. * Weather hoods shall have SS insects screen at inlet (air inlet) side and MUNTER'S INDIA make drift eliminators (SS/ poly propylene type) at outlet of weather hoods.	GT9754198080

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VAR NO	GT FRAME	SITE	SITE CONDITIONS	AIR FLOW (ISO) Kgs/sec	SYSTEM WITH PACKAGE COMPRESSOR AND DRYER UNITS CL. 3.4.13	AVAILABLE ELECTRICAL POWER SUPPLY / SYSTEM PROTECTION REQUIRED	℄ of AIR OUT LET FLANGE	REMARKS	BHEL MATERIAL CODE
09	FR-6FA	GSECL DHUVARAN	ALTITUDE : 15.5 m ABOVE MSL AMB. TEMP: MIN : 8.3°C MAX : 50°C DESIGN : 32.6°C RELATIVE HUMIDITY : 64% MIN : 18% MAX : 86% DESIGN WIND PRESSURE : 158.4 KMPH SEISMIC DATA : As Per IS1893 Zone III	FOR GT 196 Kg/sec ie 354076 CFM • VENDOR SHOULD CONSIDER 5% MORE FLOW. • GT FLOW INCLUDING 5% MORE FLOW 371780 CFM	NOT APPLICABLE	415V - 3Ph - 50 Hz & 220V - 1Ph - 50 Hz VENDOR TO QUOTE OPTIONAL PRICE FOR EXPLOSION PROOF AND NON-EXPLOSION PROOF REQUIREMENTS CL.7.2	• AIR FILTER SHOULD HAVE MIN GROUND CLEARENCE OF 5 mts. • SUPPORT STRUCTURE TO BE DESIGNED TO ACCOMODATE EQUIPMENTS BELOW FILTER UNIT. BOTTOM OF STEEL REFERENCE OF AIR FILTER MODULE SUPPORT STRUCTURE IS 7537 mm from GTMBL. • ℄ of OUTLET FLANGE TO GTMBL IS 9754 mm	EVAPORATIVE COOLER AS PER BHEL SPEC NO : GT54238 VAR 03, REV02 SHALL BE PART OF AIR FILTER VENDOR SUPPLY. * VENDORS TO QUOTE WITH ELECTRICAL HOIST ARRANGEMENT * WEATHER HOODS SHALL HAVE SS INSECTS SCREEN AT INLET (AIR INLET) SIDE AND MUNTER'S INDIA MAKE DRIFT ELIMINATORS (SS/poly propylene) AT OUTLET OF WEATHER HOODS	GT9754198098

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VAR NO.	GT FRAME	SITE	SITE CONDITIONS	AIRFLOW (ISO) KGS/SEC	SYSTEM WITH PACKAGE COMPRESSOR AND DRYER UNITS CL.3.4.13	AVAILABLE ELECTRICAL POWER SUPPLY / SYSTEM PROTECTION REQUIRED	CL OF AIR OUTLET FLANGE	REMARKS	BHEL MATERIAL CODE
10	Fr-6B (6561)	KAZAKHSTAN TENGIZ	Altitude / Site Pressure 1.013 Bar . Min. Temp : (-) 40°C Max. Temp : 44°C Rh – 85% @0°C & - 33% @44°C Wind Pr. : 40 m/s Earth Quake intensity – Zero	Air Flow at (-) 40°C Ambient is 172 Kgs/sec. Air Filter should be sized for this flow.	Air compressor skid with storage tank and heatless air dryer to be included in scope of supply. Capacity-1335CFM Pressure – 105 psig (min) - 135 psig(max) Motor rating – 40 HP	415V-3φ-50Hz & 220V-1φ-50Hz Vendor to quote optional price for explosion proof & non-explosion proof Requirements per Cl.7.2	• Air filter should have min. ground clearance of 5mts.	• Filter Foundation already cast. Vendor offered filter should be suitable for already cast foundation. • Inlet filter construction should be with resilient steel and with thicker sheet metal. • Structural beams should be of resilient steel construction. • Ducts plenum / modules etc., should be of resilient steel construction. • Controls and instrumentation materials and piping should be suitable for (-)40°C amb. Temp. • vendor to quote for inlet bleed heating as an option or confirm that inlet bleed heating is not reqd., for this project.	GT975419810 1
11	Fr-5	IOCL, MATHURA	Altitude / Site Pressure 0.9943 Bar . Min. Temp : 2°C Max. Temp : 47°C Design Temp : 45°C RH (design) – 36% @45°C RH MAX : 96% RH MIN : 36% Wind Pr. : 150KMPH Seismic data zone IV	Air Flow at 2°C : 2,35,000CFM (Air Filter should be sized for this flow)	Not Applicable	415V-3φ-50Hz & 220V-1φ-50Hz	• CL of Air Filter Outlet flange to bottom support structure foot pad is 7166.5mm • Clear space from bottom of lower most weather hood to ground is 5mts.	• weather hoods should be provided with drift eliminators / droplet separators. • Coalescent filter media / D-fog arrangement should be provided on the drift eliminator. • Air Filter elements (with Synthetic media) should be provided with pre-filter wraps. • Face velocity should be less than 3 fpm. • All electricals, control panel, conduiting etc., should be of explosion proof design. • Pneumatic lines, blow pipes, headers etc., should be SS. • Filter elements, diaphragm valves should be suitable for pulsing pressure upto 10 kgs/cm²(g) REMARKS CONTD. • Refer to Project Specific Painting Scheme.	GT975419811 0

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VAR NO.	GT FRAME	SITE	SITE CONDITIONS	AIRFLOW (ISO) KGS/SEC	SYSTEM WITH PACKAGE COMPRESSOR AND DRYER UNITS CL.3.4.13	AVAILABLE ELECTRICAL POWER SUPPLY / SYSTEM PROTECTION REQUIRED	CL OF AIR OUTLET FLANGE	REMARKS	BHEL MATERIAL CODE
12	Fr-6B (6561)	IOCL, PANIPAT	Altitude / Site Pressure 0.97867Bar Min. Temp : -0.7℃ Max. Temp : 46.6℃ Design Temp : 40℃ RH(Design) : 80%@40℃ RH(Max) :100%@46.6℃ RH(Min) :42%@46.6℃ Wind Pr : 168km/hr Seismic data zone IV (As Per IS 1893)	Air Flow 2,72,880 CFM (Air Filter should be sized for this flow)	Not Applicable	415V-3φ-50Hz & 220V-1φ-50Hz	• CL of Air Filter Outlet flange to bottom support structure foot pad is 7166.5mm • Clear space from bottom of lower most weather hood to ground is 5mts.	• Cross flow filter house. • Weather hoods should be provided with drift eliminators / droplet separators (25 microns rating). • Air Filter elements should be provided with pre-filter wraps and water resistant media to be used. • Media velocity should be less than 3 fpm. • All electricals, control panel, conducting etc., should be of explosion proof design. • Pneumatic lines, blow pipes, headers etc., should be in SS 304 material. • Filter elements, diaphragm valves should be suitable for pulsing pressure upto 10 kg/cm²(g). • De-fog should be quoted as an option. Air filter should be suitable for refinery atmosphere.	GT9754198128
13	Fr-6B Generator Air Filter		Refer GT IAF system variant table.	Air Flow 45,000 CFM (Air Filter should be sized for this flow)	Not Applicable	415V-3φ-50Hz & 220V-1φ-50Hz	**Refer drawing No 33640761003-01 for interface dimensional details.**	• Weather hoods should be provided with drift eliminators/droplet separators. • Face velocity should be less than 3 fpm. • Pneumatic lines, blow pipes, headers etc, should be SS. • Filter elements, diaphragm valves should be suitable for pulsing pressure upto 10 kgs/cm²(g) ***All electical &Instrumentation item shall be explosion proof (Ex-d) and weather proof IP66 certified as per IEC 60079.** • F9 class blend of cellulose and synthetic filter elements. *** Packing shall be done as per GT14024**	GT9754198136

Surface	Surface Preparation & Pre-erection/Shop Primer	DFT (µ)	Primer: Paint	Primer: DFT (µ)	Intermediate: Paint	Intermediate: DFT (µ)	Finish Coat: Paint	Finish Coat: DFT (µ)	Total DFT (µ)	Finish shade Per BIS 5 or RAL No
Interior & Exterior	SSPC-SP-10 (Near white metal); & 1 coat of Inorganic zinc silicate @ 65-75 µ DFT/coat	65 to 75	1 coat of Epoxy zinc phosphate @ 40 µ DFT/coat	40	2 coats of polyamide cured epoxy resin medium suitably pigmented @ 100 µ DFT/coat	200	1 coat of Acrylic Polyurethane @ 40 µ DFT/coat	40	345 to 355	White (RAL 9010)

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14	Fr-6FA+	GSECL DHUVARAN	Same as Var 09	Air Flow 3,72,000 CFM Vendor should consider 5% more flow.	Not Applicable	Same as Var 09	Same as Var 09	Cross Flow Filter with Evaporative Cooler, Same as Var 09	GT9754198144
15	FR 9E	RVUNL, DHOLPUR	Altitude 200 M ABOVE MSL Min. Temp : 5℃ Max. Temp :47.8℃ Design Temp : 34℃ RH(Design) : 60%@34℃ RH(Max) : 90%@47.8℃ RH(Min) 30%@ 5℃ Wind Pr : 200 km/hr Seismic data ZONE IV (AS PER IS 1893)	Air Flow 7,31,100 CFM (Air Filter should be sized for this flow)	Not Applicable	415V-3φ-50Hz & 220V-1φ-50Hz	• CL of Air Filter Outlet flange to bottom support structure foot pad is 9309 mm • Clear space from bottom of lower most weather hood to ground is 5mts. • Refer drawing no 3168/79101 Rev 00 for Foundation and Flange details.	• Cross flow filter house. • Weather hoods should be provided with drift eliminators / droplet separators (25 microns rating). • Air Filter elements should be provided with pre-filter wraps • Media velocity should be less than 3 fpm. • All electricals, control panel, conducting etc., should be of explosion proof (Ex-d) design. • Pneumatic lines, blow pipes, headers etc., should be in SS 304 material. • Filter elements, diaphragm valves should be suitable for pulsing pressure upto 10 kg/cm²(g). • Evaporative Cooler as per BHEL spec. no: GT54238 Var 03, Rev 02 shall be part of air filter vendor supply.	GT9754198152
16	Fr- 9E Generator Air Filter		Same as Var 15	Air Flow 1,29,500 CFM (Air Filter should be sized for this flow)	Not Applicable	415V-3φ-50Hz & 220V-1φ-50Hz	Refer BHEL drawing 2-139-41-31021 Rev 00	No Evaporative Cooler, OWSA Var 15	GT9754198160

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17	Fr-6581B GT Cross Flow Type Inlet Air Filter System	Regency Power	Amb. Press. 1.0131 Bar Amb. Temp. Min 5 Deg. C Max 50 Deg. C Design 27 Deg. C Relative Humidity 60%	Air Flow 2,65,000 CFM (Consider 5% more flow for design)	Not Applicable	415V-3φ-50Hz & 220V-1φ-50Hz Vendor to quote optional price for explosion proof & non-explosion proof requirements Cl 7.2 seperately.	Refer BHEL drawing 33640761002-01 for Foundation and Outlet Flange details.	Same as var 08.	GT9754198176
18	Fr-5	IOCL-Haldia	Altitude Site Pressure 1.0131 bar Min Temp: 7 °C Max Temp: 42 °C Design Temp: 40 °C Rh: 92% @ 40	Air Flow: 2,35,000 CFM (Air Filter Should be sized for this flow)	Not Applicable	415V-3φ-50Hz & 220V-1φ-50Hz	• CL of Air Filter Outlet flange to bottom support structure foot pad is 7166.5mm • Clear space from bottom of lower most weather hood to ground is 5mts.	• Weather hoods should be provided with drift eliminators/droplet separators. • Coalescent filter media / D-fog arrgt should be provided on the drift eliminator. • Air Filter elements (with Synthetic media) should be provided with pre-filter wraps. • Face velocity should be less than 3 fpm. • All electricals, control panel, conduiting etc, should be of explosion proof design. • Pneumatic lines, blow pipes, headers etc, should be SS. • Filter elements, diaphragm valves should be suitable for pulsing pressure upto 10 kgs/cm²(g) • Vertical tube sheet, which holds the air filter catridges shall be of SS. • Refer to project specific for painting scheme.	GT9754198187

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19	Fr-9E	Kurdistan, IRAQ	Altitude 0 m above MSL Min Temp: -10 °C Max Temp: 55 °C Design Temp: 15 °C Relative Humidity Min: 12 % Max: 92 % Design: 38 %	Air Flow: 7,31,000 CFM (Air Filter Should be sized for this flow)	Not Applicable	415V-3φ-50Hz & 220V-1φ-50Hz	• CL of Air Filter Outlet flange to bottom support structure foot pad is 7166.5mm • Clear space from bottom of lower most weather hood to ground is 5mts.	• Weather hoods should be provided with drift eliminators/droplet separators. • Coalescent filter media / D-fog arrgt should be provided on the drift eliminator. • Air Filter elements (with Synthetic media) should be provided with pre-filter wraps. • Face velocity should be less than 3 fpm. • All electricals, control panel, conduiting etc, should be of explosion proof design. • Pneumatic lines, blow pipes, headers etc, should be SS. • Filter elements, diaphragm valves should be suitable for pulsing pressure upto 10 kgs/cm²(g) • Refer to project specific for painting scheme.	GT9754198195

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20	Fr-6	OPAL-Dahej	Site Pressure 1.0127 bar Min Temp: 5.6 °C Max Temp: 47 °C Design Temp: 40 °C RH Min: 60% Max: 100% Design: 60% Wind Speed 212 km/hr Seismic: Zone-3	Air Flow: 2,78,250CFM (Air Filter Should be sized for this flow)	Not Applicable	415V-3φ-50Hz & 220V-1φ-50Hz	• CL of Air Filter Outlet flange to bottom support structure foot pad is 7266 mm. • Clear space from bottom of lower most weather hood to ground is 5mts.	• Weather hoods should be provided with drift eliminators/droplet separators. • Face velocity should be less than 3 fpm. • Pneumatic lines, blow pipes, headers etc, should be SS. • Filter elements, diaphragm valves should be suitable for pulsing pressure upto 10 kgs/cm²(g) • Explosion proof electricals, control and instrumentations. • F9 class blend of cellulose and synthetic filter elements.	GT9754198209
21	Fr-6	GGSR Bhatinda	Site Pressure 203.2 m above MSL Min Temp: 1°C Max Temp:46.1°C Design Temp: 40 °C RH Min: 20% Max: 85% Design: 60%@42 °C Wind Speed 61 KM/HR Seismic: Zone-4	Air Flow: 2,78,250CFM (Air Filter Should be sized for this flow)	Not Applicable	415V-3φ-50Hz & 220V-1φ-50Hz	• CL of Air Filter Outlet flange to bottom support structure foot pad is 7266 mm. • Clear space from bottom of lower most weather hood to ground is 5mts.	• Evaporative cooler as per GT54238. • Weather hoods should be provided with drift eliminators/droplet separators. • Face velocity should be less than 3 fpm. • Pneumatic lines, blow pipes, headers etc, should be SS. • Filter elements, diaphragm valves should be suitable for pulsing pressure upto 10 kgs/cm²(g) • Optional quote for explosion proof electricals, control panel, conduiting etc.	GT9754198217

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22	Fr-6	GNFC Bharuch	MSL: 19.2 Meters. Min Temp: 5°C Max Temp: 48°C Design Temp: 40°C RH 80%@ 40°C Wind Speed 44 m/sec Seismic: Refer Customer Spec.	Air Flow: 2,78,250CFM (Air Filter Should be sized for this flow)	Not Applicable	415V-3φ-50Hz & 220V-1φ-50Hz Optional quote for explosion proof electricals, control panel, conduiting etc.	• CL of Air Filter Outlet flange to bottom support structure foot pad is 7266 mm. • Clear space from bottom of lower most weather hood to ground is 5mts.	• Weather hoods should be provided with drift eliminators/droplet separators. • Face velocity should be less than 3 fpm. • Filters shall be suitable for Chemical & Fertilizer industrial environments. • Filter elements, diaphragm valves should be suitable for pulsing pressure upto 10 kgs/cm²(g) • Refer customer spec for environment particle matter. • Optional quote for set of filter elements.	GT9754198225
23	Fr 6FA+	APGCL, Namrup	Pressure: 0.9986 Bar Min Temp: 5°C Max Temp: 38°C Design Temp: 35°C RH Min: 60% Max: 84% Design: 60% Wind Speed 50 m/sec Seismic: Zone V	Air Flow 3,72,000 CFM Vendor should consider 5% more flow.	Not Applicable	415V-3φ-50Hz & 220V-1φ-50Hz	• CL of Air Filter Outlet flange to bottom support structure foot pad is 9754 mm. • Clear space from bottom of lower most weather hood to ground is 5mts.	• Weather hoods should be provided with drift eliminators/droplet separators. • Face velocity should be less than 3 fpm. • Filter elements, diaphragm valves should be suitable for pulsing pressure upto 10 kgs/cm²(g) • Weather proof electricals & Instrumentation. • Filter media blend of synthetic & cellulose. • Pneumatic lines, blow pipes, headers etc, should be SS. • Filter module shall have the 5mm thick clean air side & 3 mm thick dirty air side.	GT9754198233

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24	Fr 5	MRPL, MANGALORE	Pressure: 1.0126 Bar Temperature: Min: 16 °C Max: 38 °C Design: 35 °C RH Design: 88% Wind Speed:50km/s Seismic: Zone-IV	Air Flow: 2,35,000 CFM (Air Filter Should be sized for this flow)	Not Applicable	415V-3φ-50Hz & 220V-1φ-50Hz	• CL of Air Filter Outlet flange to bottom support structure foot pad is 7166.5mm • Clear space from bottom of lower most weather hood to ground is 5mts.	• Weather hoods should be provided with drift eliminators/droplet separators. • Face velocity should be less than 3 fpm. • All electricals, control panel, conduiting etc, should be of explosion proof design. • Pneumatic lines, blow pipes, headers etc, should be SS. • Filter elements, diaphragm valves should be suitable for pulsing pressure upto 10 kgs/cm²(g) • Filter media blend of synthetic & cellulose. • SS filter house & vertical tube sheet, which hold the filter elements.	GT9754198241
25	Fr 5	Oil INDIA	Pressure:118.7M ABOVE MSL Temperature: Min: 8.8 DEG C Max: 40 DEG C Design:40 DEG C RH Design:87% Wind Speed:50M/Sec IS:875-1987,PART 3 Seismic: Zone- V	Air Flow: 2,35,000 CFM (Air Filter Should be sized for this flow)	Not Applicable	415V-3φ-50Hz & 220V-1φ-50Hz	• CL of Air Filter Outlet flange to bottom support structure foot pad is 7166.5mm • Clear space from bottom of lower most weather hood to ground is 5mts.	• Weather hoods should be provided with drift eliminators/droplet separators. • Face velocity should be less than 3 fpm. • All electricals, control panel, conduiting etc, should be of explosion proof design. • Pneumatic lines, blow pipes, headers etc, should be SS. • Filter elements, diaphragm valves should be suitable for pulsing pressure upto 10 kgs/cm²(g) • Filter media blend of synthetic & cellulose.	GT9754198250

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26	Fr 6	Narasiriyah, Iraq	Pressure: 1.0132 bar/3 M ABOVE MSL Temperature: Min:0 ℃ Max:50 ℃ Design:40 ℃ RH Design:25%(Des) RH Design:85% (max) Wind Speed:160 km/hr Seismic: Zone I	Air Flow: 2,78,250CFM (Air Filter Should be sized for this flow)	NOT APPLICABLE	415V-3φ-50Hz & 220V-1φ-50Hz	• CL of Air Filter Outlet flange to bottom support structure foot pad is 7266 mm. • Clear space from bottom of lower most weather hood to ground is 5mts.	• Evaporative cooler as per GT54238. • Weather hoods should be provided with drift eliminators/droplet separators. • Face velocity should be less than 3 fpm. • Pneumatic lines, blow pipes, headers etc, should be SS. • Filter elements, diaphragm valves should be suitable for pulsing pressure upto 10 kgs/cm²(g) • quote for explosion proof electricals, control panel, conduiting etc.	GT9754198268
27	Fr 6	MRPL, MANGALORE	Pressure: 1.0126 Bar Temperature: Min: 20℃ Max: 38 ℃ Design: 35 ℃ RH Design: 88% (Des) RH Design: 91%(Max) RH Design: 61% (Min) Wind Speed:50km/s Seismic: Zone-IV	Air Flow: 2,78,250 CFM (Air Filter Should be sized for this flow)	Not Applicable	415V-3φ-50Hz & 220V-1φ-50Hz	• CL of Air Filter Outlet flange to bottom support structure foot pad is 7186.5mm • Clear space from bottom of lower most weather hood to ground is 5mts.	• Weather hoods should be provided with drift eliminators/droplet separators. • Face velocity should be less than 3 fpm. • All electricals, control panel, conduiting etc, should be of explosion proof design. • Pneumatic lines, blow pipes, headers etc, should be SS. • Filter elements, diaphragm valves should be suitable for pulsing pressure upto 10 kgs/cm²(g) • Filter media blend of synthetic & cellulose. • SS filter house & vertical tube sheet, which hold the filter elements.	GT9754198276

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28	Fr 9	Grodno, Belarus	Pressure: 0.9889 BAR (125 M ABOVE MSL) Temperature: Min: -36 DEG C Max: 38 DEG C Design: -8.1DEG C RH Design: 60 % (Des) RH Design: 80 %(Max) RH Design: 60 %(Min) Wind Speed: 4.1m/sec Seismic: LATER	Air Flow: 7,31,000 CFM (Air Filter Should be sized for this flow)	NOT APPLICABLE	380V-3ϕ-50Hz	• CL of Air Filter Outlet flange to bottom support structure foot pad is 7166.5mm • Clear space from bottom of lower most weather hood to ground is 5mts.	• Weather hoods should be provided with drift eliminators/droplet separators. • Face velocity should be less than 3 fpm. • All electricals, control panel, conduiting etc, should be of explosion proof design. • Pneumatic lines, blow pipes, headers etc, should be SS. • Filter elements, diaphragm valves should be suitable for pulsing pressure upto 10 kgs/cm²(g)	GT9754198284
29	Fr 9	IOCL Paradeep	Pressure: 4.36m Above MSL Temperature: Min: 11.3 Deg C Max: 42.4 Deg C Normal: 39 Deg C Relative Humidity Min: 24.7% Max: 99.7% Design: 85% Wind Speed: 65 m/sec Seismic Zone: III	Air Flow: 7,31,000 CFM (Air Filter Should be sized for this flow)	NOT APPLICABLE	415V-3ϕ-50Hz & 220V-1ϕ-50Hz	• CL of Air Filter Outlet flange to bottom support structure foot pad is 9309mm. • Clear space from bottom of lower most weather hood to ground is 5mts.	• Weather hoods should be provided with drift eliminators/droplet separators. • Face velocity should be less than 3 fpm. • All electricals, control panel, conduiting etc, should be of explosion proof design. • Pneumatic lines, blow pipes, headers etc, should be SS. • Filter elements, diaphragm valves should be suitable for pulsing pressure upto 10 kgs/cm²(g) • Filter elements shall be non-hygroscopic suitable for high humidity • SS Filter House & Vertical Tube Sheet, which holds the filters.	GT9754198292

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30	Fr 5	MSIL Manesar	Altitude / Site Pressure 0.9943 Bar . Min. Temp : 2°C Max. Temp : 47°C Design Temp : 45°C RH (design) – 36% 45°C RH MAX : 96% RH MIN : 36% Wind Pr. : 150KMPH Seismic data zone IV	Air Flow: 2,35,000 CFM (Air Filter should be sized for this flow)	NOT APPLICABLE	415V-3p-50Hz & 220V-1p-50Hz	• CL of Air Filter Outlet flange to bottom support structure foot pad is 7166.5mm • Clear space from bottom of lower most weather hood to ground is 5mts.	• Weather hoods should be provided with drift eliminators/droplet separators. • Face velocity should be less than 3 fpm. • All electricals, control panel, conduiting etc, should be of explosion proof design. • Pneumatic lines, blow pipes, headers etc, should be SS. • Filter elements, diaphragm valves should be suitable for pulsing pressure upto 10 kgs/cm²(g)	GT9754198306
31	Fr 5	BCPL Lepetkata	Pressure: 1.005 Bar Temperature: Min: 1 Deg C Max: 39.8 Deg C Design: 32.2 Deg C Relative Humidity: 88% (Design) Wind Speed: 61 km/hr Seismic Zone: V	Air Flow: 2,35,000 CFM (Air Filter should be sized for this flow)	NOT APPLICABLE	415V-3p-50Hz & 220V-1p-50Hz	• CL of Air Filter Outlet flange to bottom support structure foot pad is 7166.5mm • Clear space from bottom of lower most weather hood to ground is 5mts.	• Weather hoods should be provided with drift eliminators/droplet separators. • Face velocity should be less than 3 fpm. • All electricals, control panel, conduiting etc, should be of explosion proof design. • Pneumatic lines, blow pipes, headers etc, should be SS. • Filter elements, diaphragm valves should be suitable for pulsing pressure upto 10 kgs/cm²(g) SS Filter House & Vertical Tube Sheet, which holds the filters.	GT9754198314

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32	Fr 5	GSPC Kakinada	Site Pressure:1.0129 Bar Min Temp:12 deg C Max Temp:47 deg C Design Temp:38 deg C RH(Design):74% Wind Speed:120 mph Seismic Zone:IV	2,35,000 CFM (Air Filter should be sized for this flow)	Not Applicable	415V-3φ-50Hz & 220V-1φ-50Hz	• CL of Air Filter Outlet flange to bottom support structure foot pad is 7166.5mm • Clear space from bottom of lower most weather hood to ground is 5mts.	• Weather hoods should be provided with drift eliminators/droplet separators. • Face velocity should be less than 3 fpm. • All electricals, control panel, conduiting etc, should be of explosion proof design. • Pneumatic lines, blow pipes, headers etc, should be SS. • Filter elements, diaphragm valves should be suitable for pulsing pressure upto 10 kgs/cm²(g)	GT9754198322
33	Fr6	RIL-DAHEJ	Site Pressure: 6.5 m from MSL Min Temp:-5.6 Deg C Max Temp: 47 Deg C Design Temp: 30 Deg C RH(Design):89% RH(Min): 56% RH(Max): 89% Wind Speed:15 mph Seismic Zone:IV	2,78,250 CFM (Air Filter should be sized for this flow)	Not Applicable	380V-3φ-50Hz & 240V-1φ-50Hz	• CL of Air Filter Outlet flange to bottom support structure foot pad is 7266.5mm • Clear space from bottom of lower most weather hood to ground is 5mts.	• Weather hoods should be provided with drift eliminators/droplet separators. • Face velocity should be less than 3 fpm. • All electricals, control panel, conduiting etc, should be of explosion proof design. (optional) • Pneumatic lines, blow pipes, headers etc, should be SS. • Filter elements, diaphragm valves should be suitable for pulsing pressure upto 10 kgs/cm²(g) • Provision for future chiller installation • 3 Nos DP transimitters instead of DP switches	GT9754198330

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VAR NO.	GT FRAME	SITE	SITE CONDITIONS	AIRFLOW (ISO) KGS/SEC	SYSTEM WITH PACKAGE COMPRESSOR AND DRYER UNITS CL.3.4.13	AVAILABLE ELECTRICAL POWER SUPPLY / SYSTEM PROTECTION REQUIRED	CL OF AIR OUTLET FLANGE	REMARKS	BHEL MATERIAL CODE
34	Fr 5	CPCL	Site Pressure:1.0131 Bar Min Temp:18 deg C Max Temp:45 deg C Design Temp:35 deg C RH(Design):70% Wind Speed:15 m/s Seismic Zone:II (IS 1893, IMPORTANCE FACTOR 1.5)	2,35,000 CFM (Air Filter should be sized for this flow)	Not Applicable	415V-3φ-50Hz & 220V-1φ-50Hz	• CL of Air Filter Outlet flange to bottom support structure foot pad is 7166.5mm • Clear space from bottom of lower most weather hood to ground is 5mts.	• Weather hoods should be provided with drift eliminators/droplet separators. • Face velocity should be less than 3 fpm. • All electricals, control panel, conduiting etc, should be of explosion proof design. • Filter elements, diaphragm valves should be suitable for pulsing pressure upto 10 kgs/cm²(g) *F9 class pulse filter made of fully synthetic media. *Filter house made of SS304L ,including the followings: 1.Weather hoods. 2.Pneumatic lines, blow -pipes & headers etc. 3.Filter yoke assembly(holder). 4.Pre-filter grid. 5.Vertical tube sheet, which hold the filter element. *M6 class prefilter installed upstream of the pulse filter, made of a fully synthetic media. *Pulsing to be through DCS,pulse -control board is not required. *Optional quote for intrinsically -safe solenoid valves.	GT9754198349

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VAR NO.	GT FRAME	SITE	SITE CONDITIONS	AIRFLOW (ISO) KGS/SEC	SYSTEM WITH PACKAGE COMPRESSOR AND DRYER UNITS CL.3.4.13	AVAILABLE ELECTRICAL POWER SUPPLY / SYSTEM PROTECTION REQUIRED	CL OF AIR OUTLET FLANGE	REMARKS	BHEL MATERIAL CODE
35	Fr 5	CALABAR NIGERIA	Site Pressure:1.0131 Bar Min Temp:18 deg C Max Temp:45 deg C Design Temp:35 deg C RH(Design):70% Wind Speed:15 m/s Seismic Zone:II (IS 1893, IMPORTANCE FACTOR 1.5)	2,35,000 CFM (Air Filter should be sized for this flow)	Not Applicable	415V-3φ-50Hz & 220V-1φ-50Hz	• CL of Air Filter Outlet flange to bottom support structure foot pad is 7166.5mm • Clear space from bottom of lower most weather hood to ground is 5mts. Ref.the drawing 3-36407-5-1001	• Weather hoods should be provided with drift eliminators/droplet separators. • Face velocity should be less than 3 fpm. • Filter elements, diaphragm valves should be suitable for pulsing pressure upto 10 kgs/cm²(g) *F9 class pulse filter made of blend of cellulose & synthetic. The following shall be made of SS304L 1.Pneumatic lines, blow -pipes & headers etc. 2.Pre-filter grid. 3.Vertical tube sheet, which hold the filter element. *M6 class prefilter installed upstream of the pulse filter, made of a fully synthetic media All electical &Instrumentation item shall be explosion proof (Ex-d) and weather proof IP65 certified as per IEC 60079. Packing shall be done as per GT14324	GT9754198357

PAINTING SCHEDULE

Surface	Surface Preparation & Pre-erection/Shop Primer	DFT (µ)	Primer		Intermediate		Finish Coat		Total DFT (µ)	Finish shade Per BIS 5 or RAL No
			Paint	DFT (µ)	Paint	DFT (µ)	Paint	DFT (µ)		
Interior & Exterior	SSPC-SP-10 (Near white metal); & 1 coat of Inorganic zinc silicate @ 65-75 µ DFT/coat	65 to 75	1 coat of Epoxy zinc phosphate @ 40 µ DFT/coat	40	2 coats of polyamide cured epoxy resin medium suitably pigmented @ 100 µ DFT/coat	200	1 coat of Acrylic Polyurethane @ 40 µ DFT/coat	40	345 to 355	White (RAL 9010)

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VAR NO.	GT FRAME	SITE	SITE CONDITIONS	AIRFLOW (ISO) KGS/SEC	SYSTEM WITH PACKAGE COMPRESSOR AND DRYER UNITS CL.3.4.13	AVAILABLE ELECTRICAL POWER SUPPLY / SYSTEM PROTECTION REQUIRED	CL OF AIR OUTLET FLANGE	REMARKS	BHEL MATERIAL CODE
36	Fr 5	ONGC URAN	Site Pressure: 0.999 BAR Min Temp: 10 deg C Max Temp: 40 deg C Design Temp: 38 deg C RH(Design): 98% Wind Speed: 70m/s Seismic Zone:III (IS 1893 - 2006)	2,35,000 CFM (Air Filter should be sized for this flow)	Not Applicable	415V-3φ-50Hz & 220V-1φ-50Hz	• CL of Air Filter Outlet flange to bottom support structure foot pad is 7166.5mm • Clear space from bottom of lower most weather hood to ground is 5mts. Ref.the drawing 3-36407-5-1001 Sheet -02	• Weather hoods should be provided with drift eliminators/droplet separators. •Face velocity should be less than 3 fpm. •All electricals, control panel, conduiting etc, should be of explosion proof design. •Filter elements, diaphragm valves should be suitable for pulsing pressure upto 10 kgs/cm²(g) Vendor to ensure that Diaphragm Valves online replacement is easy to perform. F9 class pulse filter made of blend of cellulose and synthetic •Filter house made of SS304L including the followings: 1.Weather hoods. 2.Pneumatic lines, blow -pipes & headers etc. 3.Filter yoke assembly(holder) 4.Pre-filter grid. 5.Vertical tube sheet, which hold the filter element. • G4 class prefilter installed upstream of the pulse filter, made of a fully synthetic media. Washable &Reusable Type. •Prefilter shall be removable for maintenance during turbine operation •Filter element, metallic perforated protection sheet and end covers shall be made of SS304L •Pr. switches are not allowed in this project. Pr.Transmitters shall be used in place of Pressure switches. Internally insulated (ex-proof electricals (EX-d). • All instruments and its electrical accessories shall be Explosion proof (Ex-d) certified for Zone-1, Gas group IIA/IIB & Temperature class T3 as minimum as per IS/IEC 60079. • All electrical /Instrumentation equipment's shall have CCOE/PESO approvals for Explosion proof (Ex-d) applicant. Ref.CL.3.4.8 for Instrumentation items requirement. All The Flow Path components shall be SS304L Electrical Hoist -225 Kg Packing shall be as per GT14024	GT9754198365

PAINTING SCHEDULE

Description of Item	Surface	Surface Preparation & Pre-erection/Shop Primer	DFT (µ)	Primer: Paint	Primer: DFT (µ)	Intermediate: Paint	Intermediate: DFT (µ)	Finish Coat: Paint	Finish Coat: DFT (µ)	Total DFT (µ)	Finish shade Per BIS 5 or RAL No	Design Temp (° C)
GT air filter	Interior & Exterior	Stainless steel material, no painting										
GT air filter support structure	Exterior	SSPC-SP-10 (Near white metal); & 1 coat of Inorganic zinc silicate @ 65-75 µ DFT/coat	65 to 75	1 coat of Epoxy zinc phosphate @ 40 µ DFT/coat	40	2 coats of polyamide cured epoxy resin medium suitably pigmented @ 100 µ DFT/coat	200	1 coat of Acrylic Polyurethane @ 40 µ DFT/coat	40	345 to 355	White (RAL 9010)	-14 to 80° C

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VAR NO.	GT FRAME	SITE	SITE CONDITIONS	AIRFLOW (ISO) KGS/SEC	SYSTEM WITH PACKAGE COMPRESSOR AND DRYER UNITS CL.3.4.13	AVAILABLE ELECTRICAL POWER SUPPLY / SYSTEM PROTECTION REQUIRED	CL OF AIR OUTLET FLANGE	REMARKS	BHEL MATERIAL CODE
37	Fr 5 Generator Air Filter	ONGC URAN	Site Pressure: 0-999 BAR Min Temp: 10 deg C Max Temp: 40 deg C Design Temp: 38 deg C RH(Design): 98% Wind Speed: 70 m/s Seismic Zone: III (IS 1893 - 2005)	45,000 CFM (Air Filter should be sized for this flow)	Not Applicable	415V-3φ-50Hz & 220V-1φ-50Hz	Refer drawing No 33640761003-01 for interface dimensional details.	• Weather hoods should be provided with drift eliminators/droplet separators. • Face velocity should be less than 3 fpm. • Pneumatic lines, blow pipes, headers etc, should be SS304L • Filter elements, diaphragm valves should be suitable for pulsing pressure upto 10 kgs/cm² • F9 class blend of cellulose and synthetic filter elements. • Electrical Hoist -225 Kg Packing shall be done as per GT14024 • Pr. switches are not allowed in this project Pr.Transmitters shall be used in place of Pressure switches. Internally insulated Ex-proof electricals (EX-d). • All instruments and its electrical accessories shall be flameproof (flame-d) certified for Zone-1, Gas group IIA/IIB & Temperature class T3 as minimum as per IS/IEC 60079. • All electrical /instrumentation equipment's shall have CCOE/PESO approvals for flameproof (flame-d) applicant. Ref CL. 3.4.8 for instrumentation items requirements.	GT9754198373

PAINTING SCHEDULE

Surface	Surface Preparation & Pre-erection/Shop Primer	DFT (µ)	Primer		Intermediate		Finish Coat		Total DFT (µ)	Finish shade Per BIS 5 or RAL No
			Paint	DFT (µ)	Paint	DFT (µ)	Paint	DFT (µ)		
Interior & Exterior	SSPC-SP-10 (Near white metal); & 1 coat of Inorganic zinc silicate @ 65-75 µ DFT/coat	65 to 75	1 coat of Epoxy zinc phosphate @ 40 µ DFT/coat	40	2 coats of polyamide cured epoxy resin medium suitably pigmented @ 100 µ DFT/coat	200	1 coat of Acrylic Polyurethane @ 40 µ DFT/coat	40	345 to 355	White (RAL 9010)

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BHEL Material Code	GT9754198381
Remarks (Additional Reqirements)	1. Inlet Plenum, module and the transition duct shall be made of SS304L with **minimum 4mm** thick sheet. Face Velocity should be less than 3 fpm. 2. Air filter support structure shall be designed to fit into the existing site foundation. The structural sizes specified in the drawing 33640751002-R00 are minimum. 3. Electrical (225 kg) hoist shall be provided for handling the filters at all levels. 4. Weather Hoods should be provided with drift eliminators / droplet separators along with demister pads. Refer CL 4.7 & 4.8 for additional details. 5. 3 nos of 2-wire **Gas Detectors** (Make MSA Model S 5000 IR with 4-20 mA output) to be provided. Detectors working voltage is 24V DC. The detectors shall be mounted in IAF housing and wired to Ex-D JB. 6. Photohelic Gauge shall suitable for 110 V AC supply 7. Vendor to provide test certificates complying to EN779:2012 for filters. 8. Filter Elements, diaphragm valves shall be suitable for pulsing presssure upto 10 kg/cm^2 (g) 9. All electrical & instrumentation items shall be explosion proof (Ex-d) certified to **NEC – Class I, Div-II Grade – C, D** and weather proof IP66 certified as per IEC 60079. CCOE / PESO approvals are to be included. 10. Filter house shall be made of SS – 304L including the following i. Weather Hoods. ii. Pneumatic lines, blow pipes & headers etc.. iii. Filter yoke assembly (holder) iv. Pre - filter grid. v. Vertical tube sheet which hold the filter element. vi. Fasteners and other hardware 11. The filtration system and the filters shall be designed to withstand an internal suction pressure of 15.0 and 10.0 inches of water column without any adverse effect on its operation / distortion respectively. 12. All parts in air flow path shall be SS – 304L. 13. **G4** Prefilter class to be installed upstream of the pulse filter. Prefilter shall be removable for maintenance during turbine operation. 14. **F9** (As per EN779 – 2012 std) class pulse filter made of blended media to be provided. 15. Filter element frame, metallic perforated sheet and end covers shall be made of SS304L 16. Water proof single phase power receptacle (15A) to be provided near clean air access entry door for convenience. 17. Access doors shall be provided for both the bottom and top levels of the filter house. Access for all levels to be provided externally via stairways along with internal cat ladders. 18. Lighting system shall be weatherproof with IP55 rating with 150 lux min rating. 19. Packing shall be as per GT14024. 20. All the instrumentation shall be provided with Isolation valves. 21. Piping for pulse cleaning shall be extended till the Air Processing Unit (By others) located below the Inlet Air Filter. 22. Foundation Nuts and washers shall be supplied. 23. **Mandatory spares** listed in Annex – II (Page - 17) & **Commissioning spares** listed in Clause 18 (Page 13) to be supplied as a part of the main order.
Interface Details	1. Refer drawing no **33640751002-R00** for interface details. 2. Centerline of the filter outlet flange to bottom support structure foot pad is 7166.5mm 3. Clear space from bottom of lowest weather hood to ground to be 5 mts (minimum) .
Available Electrical Power Supply	1. 425 V, 3ϕ, 50 Hz AC 2. 220 V, 1ϕ, 50 Hz AC
Package compressor & dryer units (CL 3.4.13)	Not Applicable
Air Flow (ISO)	**2,10,000 CFM (15°C, 101.3 kPa ,60% RH)**
Site Conditions	Pressure – 101.3 kPa ; Min / Max Temp – 4.4°C / 46°C ; Relative Humidity – 70% RH Windspeed – 44 m/s ; Seismic Zone – III (IS-1983) ; Rainfall – 1203 mm , Max 459 mm in 24 hr period.
Site	**ONGC, Hazira**
GT Frame	Fr – 5P
Var No	38

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RECORD OF REVISIONS

10.4.95

Rev. No.	Date	Revision Details	Revised	Approved
00	10-4-95	FIRST MODE	—	—
01	22-3-97	Var-02 added	(GRC)	
02	22-1-98	Var-03 added	(GRC)	
03	9-7-98	VAR-04 added	(GRC RAJU)	
04	7/9/98	VAR-05 added.	(GRC RAJU)	(B. BABU)
05	20/2/1999	VAR-06 added.	(GRC RAJU)	(B. BA
06	06/11/1999	VAR-07 added	(GRC RAJU)	(B
07	14/06/01	VAR-08 ADDED	(G.J.C)	
08	1/8/01	VAR-09 ADDED	(G.J.C)	
09	25/3/2002	VAR-10 ADDED		
10	04-03-03	Var. No. 11 added.	(GJC)	(GRC)
11	25-06-03	Var. No. 12, 13 & Clause 18.0 added.	(A. JAMESH)	(B. BABU)
12	01.04.04	Clauses 3.4.4.1, 3.4.4.3, 7.2 & 10.1 updated and Var 14 added.	(A. JAMESH)	(B. BABU)
13	06.07.04	Clauses 2.3,5.2, 10.2 to 10.5, 12.3 added/updated and Var 15 & 16 added.	(A. JAMESH)	(B. BABU)
14	09.02.05	Clauses 3.4.9.1 & 3.4.9.2 and Var 17 added and clause 7.1 updated.	(A. JAMESH)	(B. BABU)
15	05.01.07	Var 18 added	(A. JAMESH)	(BSN)
16	22.02.07	Var 19 added.	(A. JAMESH)	(BSN)
17	13.06.08	Var 20 and 21 added.	(A. JAMESH)	(BSN)
18	24.10.08	Var 22 added.	(A. JAMESH)	(BSN)
19	06.04.09	Var 23 and 24 added.	(A. JAMESH)	(BSN)
20	15.10.09	Var 25 to 28 added	(A. JAMESH)	(BSN)
21	24.05.10	Var 29,30 & 31 added. Var 28 remark updated.	(A. JAMESH)	(BSN)
22	15.11.10	Var 32 & 33 added	(Varun)	(A. JAMESH)
23	26.04.11	Var 20 Proj. Info. modified.	(A. JAMESH)	(BSN)
24	04.08.11	Clause 14.4.1 updated.	(SSA)	(AJH)
25	23.04.12	Var 33 Proj. Info. modified.	(A. JAMESH)	(BSN)
26	04.09.14	Variant 34 added.		(A. JAMESH)
27	29.09.14	Clause 14.2 updated. Clause 10.8 & 19.0 added.		(A. JAMESH)
28	30.06.17	Remarks in VAR-13 updated	CHKK	(A. JAMESH)
29	21.08.17	Variant 35 added.	CHKK	AJH

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30	14.05.18	VAR 36 ADDED	CHKK	AJH
31	10.08.18	VAR 37 ADDED	CHKK	SURESH.V
32	20.08.18	VAR 36&37 UPDATED	CHKK	SURESH.V
33	24.10.18	Cl 3.4.8 ; Cl 7.1 ; S No 5 in datasheet Updated	SS	KS
34	17.08.19	Retyped.	ART	Sanjay
35	14.12.19	Var 38 Added. Cl 4.7, 4.8 added. Generally updated.	ART	VSH
36	23.12.19	Var 38 Revised.	ART	VSH

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