



**ONGC TRIPURA POWER COMPANY LIMITED**

**TECHNICAL SPECIFICATION  
FOR  
GAS TURBINE INLET AIR FILTER CARTRIDGES**

**2 X 363.3 MW  
GAS BASED COMBINED CYCLE POWER PLANT,  
PALATANA, UDAIPUR, TRIPURA**

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Plant: 2X363.3 MW GAS BASED COMBINED CYCLE POWER PLANT

## TECHNICAL SPECIFICATION

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**SCOPE OF SERVICES**

1.0 **General:**

The purpose of the inlet air filtration system is to limit the ingestion of airborne contaminants such as sand, dust and alkali metal salts so as to prevent gas turbine compressor erosion, fouling, cooling air passage blocking, foreign object damage (FOD) and hot corrosion of the turbine super alloys.

2.0 **Intent of specification:**

The intent of specification is to procure and install filter cartridges in the existing self-cleaning air intake system.

3.0 **Scope of work:**

Design, engineering, procurement, manufacturing, testing (as per approved QAP), packing & delivery on FOR Palatana Power Plant basis of 3200 (Thirty Two Hundred Only) Sets of Gas Turbine Inlet Air Filter Cartridges. One Set comprises of 1 no. of Conical Air Filter Cartridge and 1 no. of Cylindrical Air Filter Cartridge. This quantity does not include test cartridges.

△

4.0 **Site condition:**

The details of inlet air filter cartridge and fixing arrangement of filter cartridges are detailed in the relevant drawings enclosed. The atmospheric condition are given at Appendix-A. The bidder is advised to visit the site in order to acquaint himself with the necessary information with respect to the ambient condition.

5.0 **General technical requirement:**

5.1 The filter system shall provide following efficiencies at rated flow-

Particulate efficiency (stabilized pre. Drop condition)	-	99.8% for particle size upto 3 microns 99% for particle size up to 1 micron
Particulate efficiency (clean condition)	-	80% for particle size up to 3 micron 60% for particle size up to 1 micron

Filter media:

Filter media will be 100% synthetic with moisture resistant capacity. Also the filter system shall provide a minimum NaCl capture efficiency of 99.95% of the rated air flow and stabilised operating pressure drop when tested in accordance with the procedure outlined in this specification. The initial pressure drop shall not exceed the following across the complete system (atmospheric to clean air plenum):

Entrance Loss	:	3.81 mm WC/0.15 inch WC
Filter Loss	:	24.13 mm WC/0.95 inch WC
Exit Loss	:	6.35 mm WC/0.25 inch WC
Total	:	34.29 mm WC/1.35 inch WC

- 5.2 The cartridge shall be capable of operating continuously at a constant pressure drop during simulated dust storm condition with an inlet dust concentration of 0.57 gm/cubic meter, when tested in accordance with the test requirements of this specification.
- 5.3 The system cartridges shall be capable of self-cleaning back to the stabilized operating pressure drop (77.2 mm WC/3 inch WC) from a pressure drop of not less than 2.5k pa ( 10 inches water gauge) across the pulse clean stage.
- 5.4 Pulsation can also be operated on continuous mode as and when required apart from other modes.
- 5.5 Individual filter element shall be capable of withstanding 3.7 k pa (15 inches water gauge) pressure differential without degradation of filter performance and shall be able to withstand 6.2 k pa (25.0 inches water gauge/635 mm WC collapse pressure) pressure differential without rupture of the media. Testing shall be in accordance with paragraph 8.3 of this specification.
- 6.0 **Sealing:**  
Gasket shall be attached to the filter elements such that new gaskets are provided at each filter change. A metal stop or similar device shall be incorporated to ensure correct, gasket compression. Filter media shall be protected from handling damage by a perforated metal sheet, or wire mesh face guard covering exposed surfaces wherever applicable. Suitable arrangement shall be made to keep pleat spacing of the media. Pleat spacing should not get disturbed, during the operating life of the filter. Month and year of manufacture shall be clearly marked on each element. As tightness of the filter is depends on the wing nut fixed on the tripod arrangement, supplier should ensure the leak free installation arrangement of filters.
- 7.0 **Other Technical, Test Requirement, Test Materials & Test Conditions (Apart from technical specifications as per Appendix B):**
- 7.1 **Test Requirements:**  
The test requirements are framed based on ARAMCO MATERIALS SYSTEM SPECIFICATION:- 32-AMSS-008. INLET AIR FILTRATION FOR COMBUSTION GAS TURBINES or as per EN 779: 2012
- 7.1.1 Scope: This section defines the tests to be carried out and procedures to carry out the tests.
- 7.1.2 Initial pressure drop test
- 7.1.3 Collection efficiency test
- 7.1.4 Efficiency by weight (arrestance) test
- 7.1.5 Efficiency by area (dust spot efficiency) test
- 7.1.6 Efficiency by particle count test.
- 7.1.7 Minimum efficiency reporting value (MERV Rating)
- 7.1.8 Most penetrating particle size efficiency test (MPPS) test
- 7.1.9 Cleanability and integrity of pulse jet self-cleaning air filtration system
- 7.1.10 NaCl capture test
- 7.1.11 Air flow test

- 7.2 Test Equipment: The test equipment shall consist of a complete air (as per Appendix D) filtration system including pulse-clean mechanism proposed by vendor to meet this specification), air flow system air sampling system and dust feeding system.
- 7.2.1 The test filter system shall consist of a full size module of 1.4 cubic meter/s (3,000 CFM) capacity, identical in component size, materials and fabrication to the existing design (Refer Appendix). the air valve flow coefficient  $C(v)$  divided by the sum of the areas of the orifices in the blow pipe shall not be greater than in the proposed design. The test filter house shall also confirm to clause 5.1 of technical specifications.
- 7.2.2 The air flow system shall consist of an exhauster with suitable controls and air flow measuring equipment to ensure constant air flow throughout the tests.
- 7.2.3 Air flow sampling shall be conducted using iso-kinetic probes and Gelman Closed face holders filtered with 0.45 micrometer type membrane filters of equal. Isokinetic probes shall be minimum length and the quantity of air sampled shall be measured by approved methods and corrected to standard conditions.
- 7.2.4 The dust feeding system shall consist of a dust feeder and one or more compressed air operated dust injectors. The dust feeder shall feed the dust at a uniform continuous rate and the dust injectors shall disperse the dust uniformly across the air inlet face of the test FILTRATION system. The dust injectors shall be configured per Figure 3F of S.A.E. J726C.
- 7.2.5 The test set up shall be in line with latest air cleaning test code:-S.A.E.-J726
- 7.3 **Test Materials:**
- 7.3.1 The test dust shall be silica and shall have a particle size distribution within the limits as per 1.61 (fine grade) as per SAE J726/AC fine dust.
- 7.3.2 For efficiency tests dry sodium Chloride (NaCl) particulate of 0 to 5 micrometer size 2 micrometer mean diameter) shall be added to the test dust at 90% dust and 10% NaCl mixture.
- 7.4 **Test Conditions:**
- 7.4.1 The test air flow shall be maintained constant throughout the efficiency and dust capacity tests and shall not be less than in the existing design. (Refer Appendix D).
- 7.4.2 The pulse-jet cleaning mechanism shall be activated and operated continuously, except where otherwise specified, through out of the efficiency and dust capacity tests. Individual filter elements shall be pulse cleaned using the same pulse duration as in the existing design (Refer Appendix D). The duration between pulses shall be adjusted on the test such that the cycle time to pulse all the filters shall be not less than in the existing design (Refer Appendix D). The pulse air pressure shall be maintained at a gauge pressure as detailed at Appendix D.

- 7.4.3 The test dust feed rate during the dust capacity test and the dust/NaCl mixture during the efficiency test shall be maintained constant at an inlet concentration of 0.57 g/cubic meter.
- 7.4.4 The inlet relative humidity during all tests shall be 40% and all tests shall be repeated with an air inlet relative humidity in excess of 90%.
- 7.4.5 The NaCl capture efficiency shall be based on the theoretical upstream and measured downstream NaCl concentrations. The quantity of test dust and the quantity of air sampled shall be selected to give a measured downstream sodium quantity of at least 5 times the minimum sensitivity of the sodium measuring instrument.
- 7.4.6 The type test as envisaged in this specification is mandatory.
- 7.4.7 The vendor should specify any other tests/test conditions required for the above purpose.
- 8.0 **Type Test:**
- 8.1 **Initial pressure drop.**
- 8.1.1 The initial pressure drop shall be determined, using clean filters, at 60%, 80%, 90%, 100% & 110% of the rated airflow using atmospheric dust.
- 8.1.2 The system resistance shall be graphed as a function of media velocity.
- 8.2 **Dust capacity and efficiency.**
- 8.2.1 A three phase dust capacity and efficiency test shall be conducted to demonstrate fulfillment of requirement spelt out in 5.1 above.
- Phase 1 Time taken to reach the stabilized pressure drop and achieve the minimum NaCl capture efficiency of 99.95% also particulate efficiency in clean condition shall be established during the test.
- Phase 2 a real time test of 50 hours minimum duration to demonstrate a constant system resistance (Stabilized pressure drop) under simulated dust storm conditions. Also, particulate efficiency in Stabilized condition shall be established during the test. Time for and no. of pulse cycles for each clean back (high set point to low set point) shall be recorded.
- Phase 3 a real time test to demonstrate the system ability to clean back from an abnormally high pressure drop (as might occur due to a temporary loss of pulse cleaning). Time and no. of cycles to one to stabilized form drop condition shall be recorded.
- 8.2.2 The phase 1 test shall be conducted at the rated flow rate, with test dust as defined in paragraph 7.1 on test equipment as per technical specifications at an inlet concentration of 0.57 g/cubic meter until the stabilized pressure drop is attained. The time to reach this pressure drop shall be recorded. Efficiency test shall be conducted at sufficient points during the period to determine the time and pressure drop at which the minimum NaCl capture efficiency of 99.95% as attained.

- 8.2.3 The phase 2 test shall continue on from the phase 1 test utilizing the same equipment and filter elements. Test dust as defined in paragraph 7.3 shall be fed continuously at an inlet concentration of 0.57 g/cubic meter for a minimum period of 50 hours. System pressure drop, first stage pressure drop if applicable, relative humidity, and dust feed shall be recorded hourly. NaCl capture efficiency shall be determined at the end of each 10 hour period. During this phase the measured NaCl capture efficiency shall not be less than 99.95% and the system resistance shall not show a rising pressure characteristic.
- 8.2.4 The phase 3 test shall be conducted at the end of the 50 hour period, the pulse clean mechanism shall be deactivated and test dust shall be fed continuously at 0.57 g/cubic meter until the pressure drop across the self cleaning stage reaches 2.5 KPa (10 inches water gauge). At this point NaCl capture, efficiency system pressure drop, relative humidity and dust feed shall be recorded. The dust feed shall be terminated and the pulse clean mechanism reactivated. The system shall be allowed to self clean back to, the previously determined, stabilized operating pressure drop at which point efficiencies shall be measured. The time taken to reach 2.5 KPa (10 inches water gauge) pressure differentials, the number of pulse clean cycles and the time taken to clean back to the stabilized system operating pressure shall be recorded. Particulate efficiency shall be recorded after this test.
- 8.2.5 Pressure drop across the filter at absolute humidity and maximum dust holding condition shall be recorded at rated flow.
- 8.2.6 The results of phase 1,2 and 3 tests shall be plotted on a composite graph showing system resistance in inches water gauge. NaCl capture efficiency and relative humidity as a function of time (both for RH 40% & RH > 90%).
- 8.3 **Integrity of filter elements:**
- 8.3.1 Vendor to demonstrate; by laboratory testing that filter element meet the requirements of paragraph of this specification. Filter element shall be loaded at the proposed air flow with the specified test dust upto 6.2 KPa (2.5 inches water gauge). Gravitational efficiency determinations shall be made at 3.7 Kpa (15 inches water gauge) and 6.2 KPa (25 inches water gauge) based on the cumulative amount of dust fed. Technique and procedure shall be in accordance with SAE J726C.
- 8.3.2 After the 30,000 pulse cycle test, the cartridge shall be checked for its integrity and damage.
- 8.3.3 Test shall be carried out to determine the pressure drop at which the filter cartridge media ruptures/collapses. This shall not occur below 25 inch of W.C.
- 9.0 **Further requirement for tests:**
- 9.1 Filter Paper media shall be tested for basic weight mean flow pressure, air permeability, stiffness, dry and boiled burst, heat degradation etc. as the standard practice of the manufacturer. Certificate for the same shall be furnished.
- 9.2 Minimum one cartridge per production batch for each production line shall be tested for following test as per SAE J726 or equivalent ( at 45 + 10% RH batch shall not exceed 200 cartridges.)
- 9.3 Pressure drop and dust capacity under various flow (minimum 5 readings over the entire range.)

- 9.4 Efficiency and capacity at various pressure drops i.e. from initial clean to maximum specified pressure drop.
- 9.5 Pressure collapse test to determine minimum pressure drop attained without rupture.
- 9.6 Visual and light check for integrity of the sealing and media in the cartridge.
- 10.0 **Test Report:**
- 10.1 The test report shall include, but not be limited to the following:
- 10.1.1 Sketches showing the overall test set up and details of each of the systems including make and model calibration test certificates of all measuring instruments and equipment.
- Graph of initial system resistance as a function of media velocity.
  - Composite graph of system resistance, NaCl capture efficiency.
- 10.1.2 Composite graph of system resistance, NaCl capture efficiency and relative humidity as a function of time, (both for RH 45 + 15% and RH > 90%).
- 10.1.3 Certified results of shop tests and plot of pressure drop vs flow and dust loading vs flow.
- 10.1.4 Supportive test or operating experience, if available, demonstrating minimum 2 years' operating life of filter media.
- 10.1.5 Filter media test certificate to be furnished.
- 10.2 A detailed test procedure is required to be developed by the vendor for Owner's approval.
- 11.0 **Quality Plan:**  
A detailed quality plan for reference purpose of bidder has been attached with the specification. Bidder shall have to submit QAP with the offer for approval of OTPC clearly mentioning deviation w.r.t. OTPC QAP. OTPC shall identify customer hold points (CHP) on the approved QAP i.e. checks/tests which will be carried out in presence of OTPC or their authorized representatives beyond which works shall not proceed without the consent of OTPC in writing.
- 12.0 **Acceptance Requirements:**
- 12.1 Vendor shall submit filter media material test certificates & manufacturer's certificate approving the suitability of filter media for the intended service.
- 12.2 The filter cartridges shall pass through the test measuring parameters as stipulated at 5.0 above in this specification.
- 12.3 The vendor shall not without informing Buyer in writing and receiving Buyer's permission, also in writing, alter the design, method of manufacture of change materials in any way from the original design as submitted and qualified by the testing specified, during the course of manufacture of a specific order.



12.4 Changes to filter media and major changes in the method of construction or controls shall be re qualified on the basis of all specified tests.

13.0 **Packing and Marking:**

Packing and marking shall be in accordance with the purchase order. Packing of the cartridges should be such that direct impact to the cartridges are avoided during transportation and handling. Packing shall be subject to owner's approval.

**APPENDIX-A****SITE CONDITIONS - OTPC GAS POWER PLANT AT PALATANA, TRIPURA****Ambient temperature:**

<b>Maximum / Minimum temperature :</b>	<b>37.5 °C and 7°C</b>
<b>Daily maximum mean temperature :</b>	<b>34 °C</b>
<b>Daily minimum mean temperature :</b>	<b>18 °C</b>
<b>Design temperature for electrical equipment/device/System :</b>	<b>40 °C</b>

**Rainfall:**

<b>Average annual rainfall :</b>	<b>2000 mm</b>
<b>Max. recorded in 24 Hrs :</b>	<b>164.9 mm</b>
<b>Period of Monsoon (Avg) Showers :</b>	<b>May to October</b>

<b>Relative Humidity :</b>	<b>Varies up to 100%</b>
<b>Maximum RH :</b>	<b>100%</b>
<b>Minimum RH :</b>	<b>40%</b>
<b>Mean RH :</b>	<b>77%</b>

**Winter season**

<b>December to February :</b>	<b>Heavy fog for about three months in a year.</b>
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**Seismic data: (Data from FI)**

<b>Seismic intensity :</b>	<b>As per IS-1893.</b>
<b>Zone :</b>	<b>V</b>
<b>Importance factor :</b>	<b>0.36</b>

**Wind data: (Data from FI)**

<b>Max Wind Speed :</b>	<b>55 m/s</b>
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**However vendor has to cross verify the site condition by their own arrangement before design engineering of the filter elements.**

**APPENDIX-B**

**SPECIFICATION FOR INLET AIR FILTRATION SYSTEM**

Sl.no	Description	Requirement	Reference Document / Remarks
01	Media	100% synthetic media, washable and reusable.	Either depth loading or surface loading
02	Inner & Outer Liners	Galvanized (Zinc plated) CRCS sheet to IS 513 D 1994 expanded with 72% open area. Dimensions as per drawing with tolerance +1- 1 mm	Sheet Thickness : 24 SWG Coating Thickness : 20 micron (Min) The liner joints to be spot welded.
03	End Caps	Galvanized (Zinc plated) CRCS sheet to IS 513 D 1994 Dimensions as per Drg. with tolerance +1/-1 mm Top End Open, Bottom End Closed with 1.18" Diameter Hole	Sheet Thickness : 22 SWG Coating Thickness : 10 micron End cap with filter media potted in thermosetting adhesive Dimensions as per attached drawing.
04	Gasket	Seamless Thick Neoprene rubber Thickness 12.7 mm ± 0.5 mm	Shore Hardness: 20 ± 5 Dimensions as per attached drawing.
05	Cartridge dimensions	<b>Conical:</b> 12.74" OD × 8.31" ID at small end & 17.54" OD × 13.08" ID at big end  <b>Cylindrical:</b> 12.74" OD × 8.38" ID Length: 52" (26" + 26") for both	Tolerance ± 0.125" on overall dimension. Dimensions as per attached drawing.
06	Filter Area	226 Sq. Ft	As per O&M manual
07	Minimum Adhesive Bond Strength	25 Kg on end load for 2 hours	
08	No of pleats	Cylindrical : 323 (Min.) Conical : 385 (Min.) Pleat Depth : 50 mm +1/-1 mm Pitch of pleats 40 +/-2 mm	Dimple pleated to ensure consistent pleat spacing and media utilization.
09	Weight of filters (Approx.)	6.8 KG	

Sl.no	Description	Requirement	Reference Document / Remarks
10	Permeability	14 cfm/sqft @1/2 inch WC	As per O&M manual
11	Filter cartridge temperature	200 °F max/93.3 °C max	As per O&M manual
12	Retention of filter pleats within liners	The filter media to be retained within the inner & outer liners by means of hot-melt glue or any other similar means so as to prevent excessive movement of the media caused by swelling of the fibers in humid conditions	Glue shall be of sufficient thickness to obtain proper retention of filter pleats within liners.
13	Filter Pulse Cleaning Parameters	Cycle start DP : 3 In WG /76.2 mm WC Cycle stop DP : 2.5 In WG/ 63.5 mm WC Pulse interval : 10 sec Pulse Cycle Time : 19 Minutes Compr. Air Pressure : 90- 100 Psig	Pulse cleaning filters will also be subjected to continuous pulse cleaning cycle when required.
14	Pulsation withstanding capacity of filters	Individual filter cartridges shall withstand at least 30000 pulses at mentioned pressure. These cartridges shall be designed in such a way that it withstands normal handling in transportation, storage at site, installation and service condition.	
15	Pressure drop across filter at Rated flow	Initial DP : < 24.13 mm WC Stabilized DP : 76.2 mmWC Collapse DP : 635 mm WC Alarm DP : 152.4 mm WC Shut down : 203.2 mm WC	1. Initial DP for 70, 80, 90, 100 & 110% flow condition. 2. Time taken to reach stabilized DP 3. Clean back ability from abnormal DP of 203.2 mm WC. As per ARAMCO / ASHRE 52.1 or as per EN 779: 2012
16	Gravimetric Filter Efficiency at rated flow	Clean Condition : 98.5% (Min) Stabilized Condition: 99.7% (Min)	As per ASHRE 52.1/ or as per EN 779: 2012
17	Dust Holding Capacity	Min 5.615 KG SAE	As per ASHRE 52.1/ or as per EN 779: 2012

Sl.no	Description	Requirement	Reference Document / Remarks
18	Particle Count	> 95% for particle size 0.3 to 0.5 micron > 99.6 % for 1 micron	Test as per ASHRE 52.2 / or as per EN 779: 2012
19	NaCl Capture Efficiency	>99.95 % at RH=>90%	Test as per ARAMCO/ or as per EN 779: 2012
20	NaCl capture efficiency test	As per standard	Test as per ARAMCO/ or as per EN 779: 2012
21	Integrity of Filter Element	Shaker test	Test as per ARAMCO (US Army corps Manual 136-300-178)/ / or as per EN 779: 2012
22	No. of Filters	3200 sets (1 set=1. No of Conical and 1. No of Cylindrical Filter Cartridge)	
23	Washer	Rubber coated MS washer (equal to the number of pairs of filters being ordered) to be supplied	Rubber shall be as per IS 11149 - 1984 Type -1
24	Wing Nuts	To be provided equal to the number of pairs of filters being ordered	As per image

25	Guaranteed Operating Life of Filters	<p>(a)The material supplied shall be warranted against defects in design, engineering, material, manufacturing and workmanship for a period of twelve (12) calendar months from the date of first use or eighteen (18) months from the date of receipt of last consignment of the complete LOT at Palatana Power Plant in good condition, whichever is earlier ("WARRANTY PERIOD"). Supplier shall repair/replace the defective materials free of cost, solely at the discretion of OTPC, immediately on receipt of OTPC's notice</p> <p>(b) Differential pressure (DP) of the said filtration system shall not cross 150 mm WC/5 inch WC at any weather condition during the usage time during the Guaranteed Performance Period of Twelve (12) Months of continuous operation. Once the DP reaches 150 mm WC / 6 Inch WC within the Guaranteed Performance Period ("Operating Life"), the operating life of complete filter LOT shall be deemed to cease. In such case, Supplier shall promptly refund the amount of Contract Price for the Filters calculated on pro-rata basis for the differential period of Operating Life and Guaranteed Performance Period, immediately on receipt of OTPC's notice</p>	
26	Criteria for completion of filter life	DP reaching alarm value of 150 mm WC	
27	Shelf Life	Supplier to advise	

**Note:**

1. All inspection procedures shall be As per ASHRE 52.1/ or as per EN 779: 2012 and governed by Quality Plan attached. Bidder shall bring out any deviation from Quality Plan at the time of bidding. Deviation after award shall not be entertained.
2. Bidder shall submit the measurements setup & instrument calibration report & frequency of calibration as per applicable reference standard document.
3. All measurement tolerances, as per applicable reference standards shall be indicated by the bidder.
4. All correction factors as per applicable reference standards shall be indicated by the bidder.
5. Bidder shall also submit correction factors for calculation as per applicable reference document.
6. All standards to be followed shall be as per latest revision.
7. No amount will be paid separately for test cartridges. Price quoted by bidder should be inclusive of price for test cartridges.
8. No Testing charges etc. will be paid separately. Bidders shall quote their prices accordingly.
9. Bidder shall offer 1 set of filter cartridge after manufacturing to the owner/owner's representative for dimensional and fitment checking before starting of actual production.



APPENDIX-C

**QAP FOR GAS TURBINE INLET AIR FILTER CARTRIDGES**

CLIENT : OTPC PALATANA

PO. No:

QP No. & Date:

Rev No. & Date:

SL. NO.	ITEM	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE – DOCUMENT	ACCEPTANCE NORM	FORMAT OF	AGENCY	REMARKS
<b>A. RAW MATERIAL</b>										
1	Filter media	Visual	Major	a) Basic Wt. b) Bursting strength. c) Air permeability, d) Max pore	Standard sample test	As per Tech. data sheet of media manufacturer	Specification	Media Manufacturer Test Certificate	ME DIA MFR	Inspection of filter media is to be checked by Third party before manufacturing. Also Review of test certificate & document evidence for import of media to be done by Third party. Actual production shall start after clearance from owner.
2	End Cap	Visual & Dimensional	Major	Visual & Dimensional	Sampling plan as per IS:2500 normal level-	As per approved Drawing	Approved Drawing	Internal inspection Report		Reviewed by OTPC
3	Outer Cage	Do	Major	Do	Do	Do	Do	Do		Reviewed by OTPC
4	Inner Cage	Do	Major	Do	Do	Do	Do	Do		Reviewed by OTPC
5	Twist Lock Plate	Do	Major	Do	Do	Do	Do	Do		Reviewed by OTPC
6	Gasket	Dimensional	Major	Dimensional Shore hardness	Do	Do	Do	Do		Reviewed by OTPC
<b>B. IN PROCESS INSPECTION</b>										
1.	Media pack	Filtration area Dimple formation	Major	Visual & Dimensional	Do	Do	Do	Do		Reviewed by OTPC
<b>C. SUBASSEMBLY</b>										
		Pleat distribution	Major	Visual	100%	Do	Visual	Do		Inspection by 3 <sup>rd</sup> party
		Leakage test	Major	Light test method End	25%	Do	Verification	Do		Inspection by 3 <sup>rd</sup> party
		End load test	Major	load of 20 Kg for 5	1 filter per batch	Do	Do	Do		Inspection by 3 <sup>rd</sup> party
		Outer & inner liners welding	Major	Welding check	100%	Do	As per drawing	Do		Reviewed by OTPC
		Plastisol cure	Major	Measurement	100%	Process checklist	5.3 ± 0.51 mm	Do		Reviewed by OTPC
		Height of filter element	Major	Measurement	100%	As per appd drawing	As per appd drawing	Do		Reviewed by OTPC
		Hot plate temperature	Major	Measurement	Random	Process checklist	200+30°C	Do		Reviewed by OTPC
		Spiral beading	Major	Measurement	Random	EN06.03.001 Rev 14	EN06.03.001 Rev 14	Do		Reviewed by OTPC
<b>D. FINISHED CARTRIDGE</b>										
	Type Test	Performance	Major	Pr.Drop vs Flow Capacity	1 type test for full qty. of PO	As per ARAMCO 1 <sup>st</sup> phase	As per ARAMCO 1 <sup>st</sup> phase	Test report		Witness by Third party



**QAP FOR GAS TURBINE INLET AIR FILTER CARTRIDGES**



CLIENT : OTPC PALATANA PO. No: QP No. & Date: Rev No. & Date:

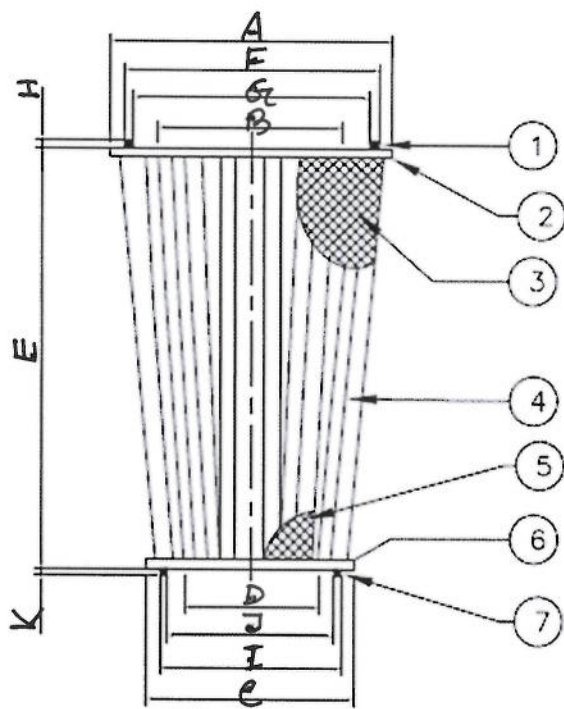
SL. NO.	ITEM	CHARACTERISTICS	CLASS	TYPE OF CHECK		QUANTUM OF CHECK	REFERENCE – DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	REMARKS
E	<b>FINISHED CARTRIDGE</b> Routine Test  Filter assy	Performance	Major	Particulate Efficiency	In clean condition	1 type test for full qty. of PO	As per buyer specification	As per buyer specification	Test report		Witness by Third party
					In stabilized DP condition		As per buyer specification	As per buyer specification			Witness by Third party
		Performance	Major	NaCl capture eff. & Particulate efficiency; NaCl capture efficiency testing required.	1 type test for full qty. of PO	As per ARAMCO 1 <sup>st</sup> phase	As per ARAMCO 1 <sup>st</sup> phase	Test report	Witness by Third party		
		Performance	Major	Most penetrating particle size efficiency (MPPS) testing	1 type test for full qty. of PO	As per EN 1822:2009 or higher version	As per EN 1822:2009 or higher version	Test report	Witness by Third party		
		Performance	Major	Real time test for 50 Hrs.	1 type test for full qty. of PO	As per ARAMCO 2 <sup>nd</sup> phase	As per ARAMCO 2 <sup>nd</sup> phase	Test report	Witness by Third party		
		Performance	Major	High Pressure Test & NaCl effect at 10 inch Pressure Drop	1 type test for full qty. of PO	As per ARAMCO 3 <sup>rd</sup> phase	As per ARAMCO 3 <sup>rd</sup> phase	Test report	Witness by Third party		
		Performance	Major	Humidity test	1 type test for full qty. of PO	As per ARAMCO 3 <sup>rd</sup> phase	As per ARAMCO 3 <sup>rd</sup> ph	Test report	Witness by Third party		
		Integrity	Major	Integrity of filter rupture/Collapse test at 25" WC-Shaker test	1 type test for full qty. of PO	As per AMARCO SAE J 726 EN 779/ASHARE- 52-92	As per AMARCO SAE J 726 EN 779/appd drwg	Test report	Witness by Third party		
		Performance	Major	Integrity test for 30000 pulses	1 type test for full qty. of PO	30000 pulses at 6-8 kgf/cm2 air pressure	30000 pulses at 6-8 kgf/cm2 air pressure	Test report	Witness by Third party		
		Performance	Major	Pressure drop vs flow & efficiency	1 test per two set	As per SAE J726/OTPC	As per SAE J726/OTPC	Test report	Witness by Third party		
		Performance	Major	Dust holding capacity and efficiency	1 test per two set	As per SAE J726/OTPC	As per SAE J726/OTPC	Test report	Witness by Third party		
		Performance	Major	Gravimetric filter efficiency	1 test per two set	As per SAE J726/OTPC	As per SAE J726/OTPC	Test report	Witness by Third party		
		Dimensional	Major	Dimensional	5% of PO qty	As per OTPC specification	As per OTPC specification	Joint inspection report	Witness by Third party		
		Appearance & cleanliness	Major	Visual	5% of PO qty	As per OTPC specification	As per OTPC specification	Joint inspection report	Witness by Third party		
		Identification marking & packing	Major	Visual	5% of PO qty	As per OTPC specification	As per OTPC specification	Joint inspection report	Witness by Third party		

**ANNEXURE TO QUALITY PLAN FOR INLET AIR FILTER FOR GAS TURBINES**

- 1.0 Material testing for the cold rolled carbon steel (CRCS) & MS sheets for chemical & mechanical property tests as per code — IS 513 & S-2061 respectively. - Customer Hold Point (**CHP**)  
If not satisfied, PMI for samples to be done.
- 2.1 Testing for the zinc coating: - Witness (**W**)  
i) Purity of zinc  
ii) Thickness of coating  
iii) Salt spray and or other corrosion test.  
Batch mill test certificate (TC) with proper co-relation mark is acceptable for serial No. i & ii for SAIL & TISCO products. In the absence of these, tests are to be arranged on identified samples.
- 3.0 Filter Media - **CHP**  
Co-related TC (S) from original manufacturer is acceptable.
- 4.0 Testing of EXPD MATL CRCA - **CHP**  
Material shall be of reputed make and tested quality. The brand is to be confirmed to OTPC prior to manufacturing of cartridges/filters. Co-related batch TC for chemical/physical properties are to be produced for OTPC verification & acceptance or else test in an approved lab. on samples identified by OTPC.
- 5.1 Silicone rubber testing as per IS-3400 and or relevant international codes.  
- Confirmation of grade of rubber.- **W**  
- Tensile, %age, elongation & breaking load/strength as per part-1.  
- Resistance of liquids (Bleed test) in HCL (33%) NaOH (40%) & DM water for 48 hours at 48 deg. C. The weight variation shall not be more than 1%. As per part-VI.  
- Shore hardness test as per Part-II.  
- Bonding/peel of test for adhesive (Test load as per Mfg.'s specification).  
- Accelerated ageing test for 5 days at 72 Deg. C as per part-IV permitted variation is +/- 10%. - **V**

**LEGEND:**

- CHP - Customer hold point, beyond which party may proceed only with OTPC permission.  
W - Witness by OTPC  
V - Verification by OTPC.



**DIMENSION**

A	445
B	334
C	327
D	212
E	660
F	403
G	373
H	12
I	263
J	239
K	12

**NOTE:-**  
TOLERANCE IN CARTRIDGE HEIGHT (E)  $\pm 2.5$  MM

**Media Details**

Sr No.	DESCRIPTION
1	TYPE OF MEDIA: 100% SYNTHETIC
2	TOTAL NO OF PLEATS: 380
3	FILTER AREA (m2): 22

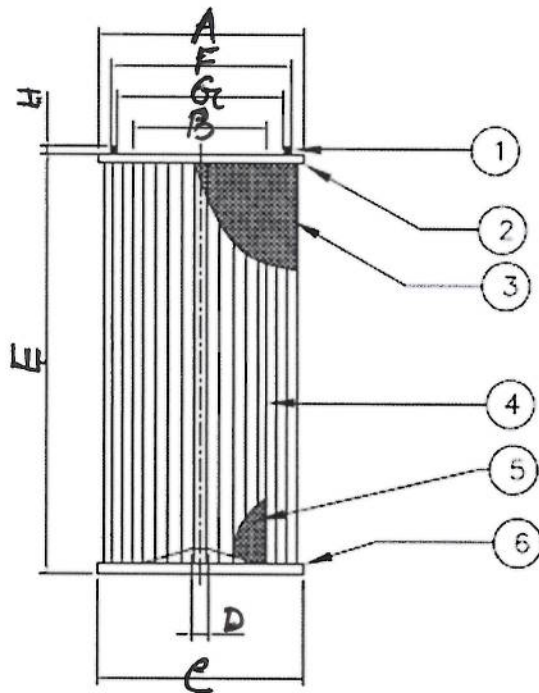
**Bill of Material**

Sr No.	ITEM DESCRIPTION	QTY	UOM
1	GASKET PU CONICAL 388 PCD	1	PCS
2	GTS UPPER CAP CONICAL (GPSP)	1	NOS
3	GTS CONICAL OUTER CAGE GPSP	1	NOS
4	PLEAT PACK	1	NOS
5	GTS CONICAL INNER CAGE GPSP	1	NOS
6	GTS UPPER CAP CYLINDRICAL (GPSP)	1	NOS
7	CONICAL PU GASKET PCD 251 MM.	1	NOS

*Blm*  
*24/04/2018*

*J*  
*24/04/2018*

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**Dimension**

A	327
B	212
C	327
D	28
E	660
F	288
G	264
H	12

**Note:-**

Tolerance in Cartridge Height (E)  $\pm$  2.5 mm

**Media Details**

Sr No.	DESCRIPTION
1	TYPE OF MEDIA: SYNTHETIC
2	TOTAL NO OF PLEATS: 315
3	FILTER AREA (m <sup>2</sup> ): 18.1

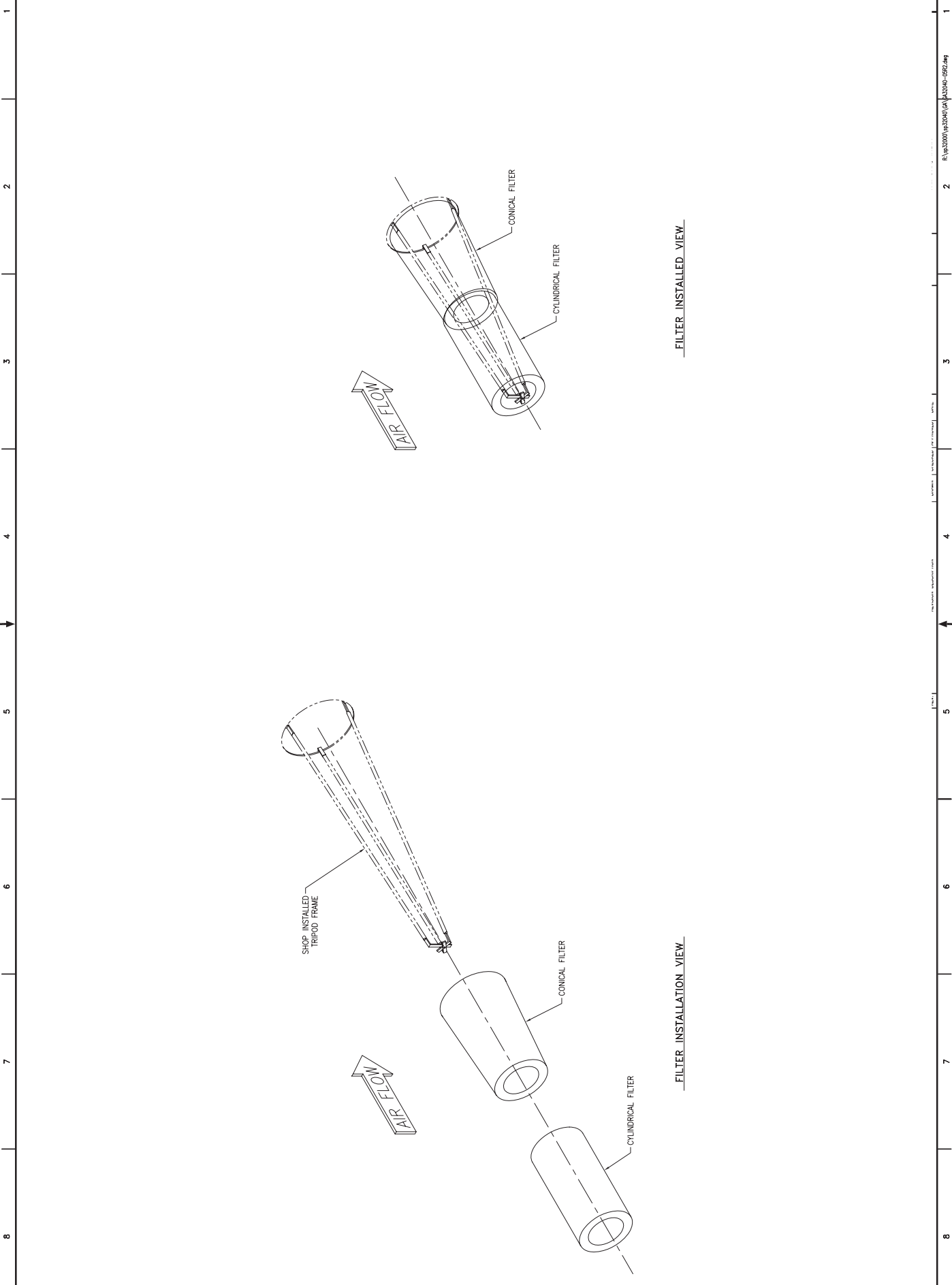
**Bill of Material**

Sr No.	ITEM DESCRIPTION	QTY	UOM
1	GASKET CYLINDRICAL	1	PCS
2	GTS UPPER CAP CYLINDRICAL (GPSP)	1	NOS
3	GTS CYLINDRICAL OUTER CAGE (GPSP)	1	NOS
4	PLEAT PACK	1	NOS
5	GTS CYLINDRICAL INNER CAGE (GPSP)	1	NOS
6	GTS BOTTOM CAP CYLINDRICAL (GPSP)	1	NOS

*Handwritten signature and date: 24/04/2018*

*Handwritten signature and date: 24/4/18*

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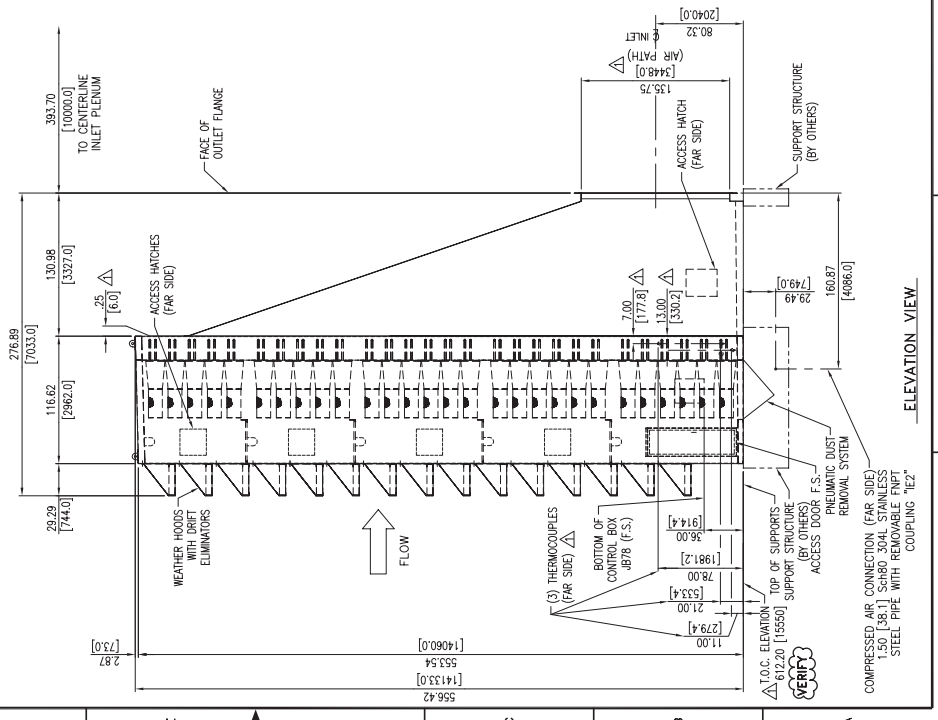
FILTER INSTALLED VIEW

FILTER INSTALLATION VIEW

**GENERAL NOTES**

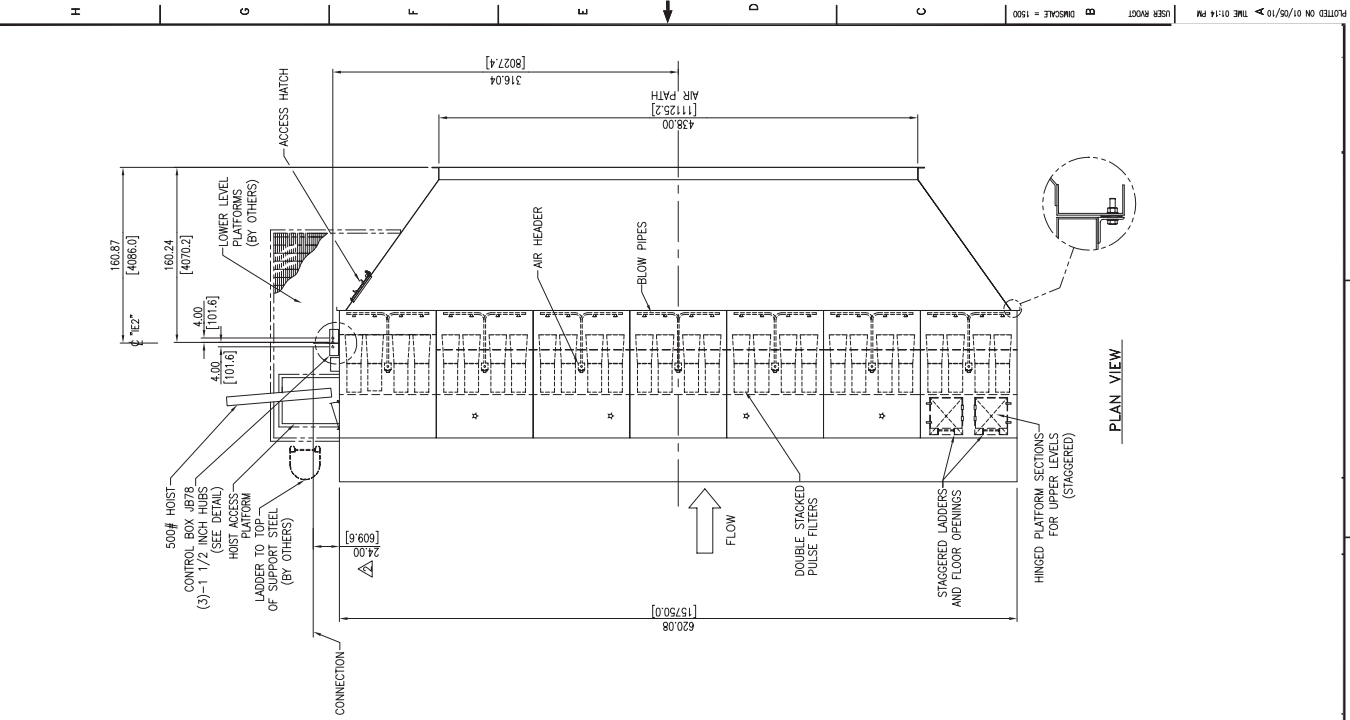
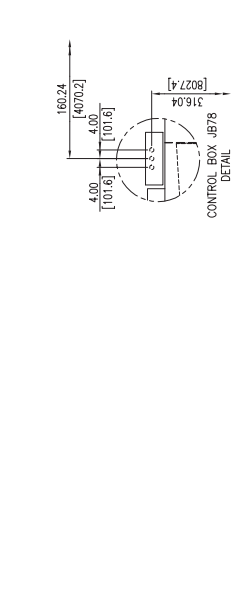
1. AIRFLOW: 1,127,763 CFM ± (5% EXTRA) 56,386 CFM ± 1,184,151 CFM
2. PULSED AIRFLOW: 1,127,763 CFM ± (5% EXTRA) 56,386 CFM ± 1,184,151 CFM
3. SYSTEM PRESSURE DROP - INITIAL CLEAN
4. MATERIALS OF CONSTRUCTION:
5. COMPRESSED AIR REQUIREMENTS
6. TEMPERATURE: 70-80 F
7. MINIMUM COMPRESSED AIR SUPPLY REQUIREMENTS @ 90-100 PSIG
8. CUSTOMER VALVES
9. AIR PER MINUTE
10. AIR PER PULSE
11. TOTAL TIME (TOTAL MINUTES)
12. MIN.
13. 3/4
14. 10
15. 13.5/718
16. 94.5
17. 19

CUSTOMER VALVES	SECONDS	STD. CUBIC FEET OF AIR SUPPLIED	MIN.
3/4	10	13.5/718	94.5
10	13.5/718	94.5	19



6. CLEANING SHALL BE PER SSPC-SP6.
7. FINISHES:
8. WELDING:
9. ELECTRICAL AND INSTRUMENTATION:
10. BOLTING AND GASKETS:
11. MATERIAL THICKNESS:
12. PULSE CLEANING SETTING:

- A. INTERIOR & EXTERIOR SURFACES SHALL HAVE:
  - ONE COAT OF ZINC RICH EPOXY PRIMER, 50 MICRONS DFT.
  - ONE COAT OF INTERMEDIATE HIGH BUILD MIO EPOXY, 125 MICRONS DFT.
  - ONE COAT OF ALIPHATIC URETHANE FINISH PAINT, 75 MICRONS DFT.
- B. INTERNAL LADDERS AND PLATFORMS ARE HOT DIPPER GALVANIZED.
- C. CHANNELS, WELDED STEEL AND ALUMINUM MATERIALS ARE FURNISHED WITHOUT ADDITIONAL FINISH.
- A. ALL SEAMS SEPARATING CLEAN AIR FROM DIRTY WILL BE SEAL WELDED.
- B. EXTERNAL WALL & ROOF STIFFENERS WILL BE SEAL WELDED.
- C. EXTERNAL FLOOR STIFFENERS WILL BE STITCH WELDED AND CAULKED WITH PAINTABLE NON-HARDENING CAULK.
- D. INTERNAL ROOF AND WALL STIFFENERS SHALL BE STITCH WELDED AND CAULKED WITH PAINTABLE NON-HARDENING CAULK.
- E. INTERNAL FLOOR STIFFENERS SHALL BE SEAL WELDED.
- F. CAULKING SHALL BE APPLIED AFTER BLAST CLEANING AND PRIMER HAVE BEEN APPLIED.
- A. (1) IP-58 ALUMINUM JUNCTION BOX FOR NON-HAZARDOUS AREA.
- B. (1) DIFFERENTIAL PRESSURE GAUGE / SWITCH 6391-1 FOR PULSE CLEANING ACTIVATION.
- C. (3) SOCKET WELDED THERMOWELLS (SHOP INSTALLED).
- D. (3) DIFFERENTIAL PRESSURE SWITCHES (FIELD TO SEND ALARM @ 6.00" WC [631T-1] WITH 100% OVERTRIP AND SHUT DOWN AT 8.00" WC).
- E. (1) DIFFERENTIAL PRESSURE TRANSMITTER WITH LOCAL DISPLAY [961T-1]
- F. (3) TYPE K THERMOCOUPLES [AT-10-1, 2 & 3] (SHIPPED LOOSE, FIELD INSTALLED).
- G. (1) PULSE TIMER/SEQUENCER [341T-1]
- H. (1) COMPRESSED AIR PRESSURE SWITCH [63CA-1]
- I. (1) LOSS OF POWER RELAY [27TF-1]
- J. (1) MANUAL CLEANING SWITCH.
- K. (1) PULSE CYCLE COUNTER.
- L. (1) CONVENIENCE OUTLET, [AR-20].
- M. (1) 500 POUND ELECTRIC MOTOR DRIVEN HOIST WITH 8 FOOT JIB CRANE, [88MH-1].
- N. (7) STANDARD PULSE HOPPERS WITH RUBBER FLAPS.
- O. (399) PULSE JET VALVES.
  - (392) FOR EXCEL FILTERS.
  - (7) FOR PNEUMATIC HOPPERS.
- P. (20) INTERNAL LIGHTS WITH FLUORESCENT LAMPS ARE PROVIDED IN THE FILTER MODULE (AL-27).
- Q. (1) LIGHTING SWITCH IN FILTER MODULE (ASM-10).
- A. 0.50 INCH [12.7mm] THICK NEOPRENE GASKET SHALL BE USED WHERE FIELD BOLTING IS UTILIZED. GASKET SHALL COMPLETELY SEAL THE PERIMETER.
- B. GASKETS ARE DOWETAILED, PRE-PUNCHED WITH MECHANICAL STOPS.
- C. ALL STRUCTURAL BOLTING ON THE DIRTY AIR SIDE OF FILTRATION SHALL BE STEEL ASTM A325 TYPE 1 WITH HARDENED WASHERS PER ASTM F436 AND NUTS PER ASTM A308. ALL BOLTING SHALL BE GALVANIZED OR ZINC COATED (GALVANIZED PER ASTM A153 CLASS C. NUTS SHALL BE HAPED OVERSIZED).
- D. ALL STRUCTURAL BOLTING HARDWARE LOCATED ON THE CLEAN AIR SIDE OF FILTRATION SHALL BE 304SS PER ASTM A193 CL2 GR88 AND SHALL BE TACK WELDED. WASHERS AND NUTS PER ASTM A194.
- E. OUTLET FLANGE SHALL HAVE 0.625 x 1.25 HORIZONTAL SLOTTED HOLES FOR 0.50 INCH BOLTS.
- A. WEATHER HOODS: 3mm
- B. PULSE MODULE: 5mm
- C. TRANSITION: 5mm
- A. PULSE CLEAN START = 3.0" W.C. / 76.2mm W.C.
- B. PULSE CLEAN STOP = 2.5" W.C. / 63.5mm W.C.





Installation with Wing Nuts:

