Based on BHEL's own experience

## VAPOUR EXHAUSTER

### 1.0 SCOPE AND APPLICATION:

This specification intended to cover design, manufacture, assembly testing & delivery of vapour exhauster, complete with motor, coupling, base plate and other accessories. The vapour exhauster is required to handle mixture of turbine oil vapours, air & $H_2$ and for creating partial vacuum in generator bearing chamber & oil tanks of Turbo-generators.

### 2.0 DESIGNATION:

The Vapour exhauster shall be designated as below: -

#### 2.1 ON DRAWINGS INDENTS:

| | | |
|---|---|---|
| (1) Material specification column | : | TG-60432 |
| (2) Description Column | : | Vapour Exhauster |
| (3) Material Code Column | : | W 96415000578 |

#### 2.2 ON ENQUIRES AND PURCHASE ORDER:-

In addition to incorporating the above details, a copy of the standard shall be enclosed along with enquiry.

### 3.0 TECHNICAL REQUIREMENTS:

#### 3.1 TECHINCAL DATA OF VAPOUR EXHAUSTER:

| | | |
|---|---|---|
| (1) Continuous discharge capacity at operating point | : | 396 $m^3$ / hr |
| (2) Normal discharge pressure at operating point | : | 96 mmWC |
| (3) Operating temp. of the medium | : | $70^0$C |
| (4) Ambient temp. | : | $50^0$C |
| (5) Speed | : | 2820rpm |



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|---|---|---|---|---|---|
| | | | | नाम NAME | दिनांक एवं हस्ताक्षर SIGNATURE & DATE |
| TSX | D.GANGWAR | | अनुवादक TRANSLATED BY | | |
| PSC Member | R.K.SHARMA | | निर्माणकर्ता WORKED BY | Kunal Mishra | 11/01/18 |
| QAX | PRETI | | जांचकर्ता CHECKED BY | Manju Azad | 11/01/18 |
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SUPERSEDES

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सामग्री सूची संख्या को अधिसूचित करता है

सामग्री सूची संख्या INVENTORY NO. 2-5-94

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### 3.2 DESIGN AND CONSTRUCTION OF VAPOUR EXHAUSTER

**3.2.1** The material of the exhauster shall be such as to resist corrosion and shall give long trouble free service.

**3.2.2** The design shall be such as to keep the friction and wear minimum caused by end thrust. Wear in mechanical seals bearings shall be minimum. The rotor of the exhauster shall be dynamically balanced as per ISO 1940, so that vibration of the exhauster is not greater than 25 micron peak to peak as per IEC 60034-14. The noise level shall not be greater than 85dB when measured at a distance of 1 meter from the base of the equipment, measurement should be done as per IEC 60034-9.

**3.2.3** Seals must comply with the following: -

(a) Easy access for maintenance work.
(b) No contamination of the medium from materials abraded from the seals.
(c) No seepage of lubricants into the flow medium.
(d) No leakage of gases outside in the atmosphere
(e) No seepage of oil toward, motor and outside along with the shaft.
(f) Shaft shall be sealed with grease lubricated axial seal as shown in the figure.

**3.2.4** Exhauster bearing shall be designed so as to ensure 50000 hours of continuous service.

**3.2.5** The exhauster shall be provided with a drain plug.

**3.2.6** Fan impeller is to be directly mounted onto rotor shaft as shown in the figure at page 8.

**3.2.7** The critical speed of the exhauster shall not lie within ± 30% of the operating speed (2820 rpm) of the exhauster.

**3.2.8** Minimum clearance between impeller & casing shall be 2mm to ensure that there is no rubbing.

**3.2.9** The construction, mounting and base frame dimensions shall be generally as per figure at page 8.

**3.2.10 Materials of Construction**:-

| | | |
|---|---|---|
| (1) Casing | : | Carbon Steel as per IS:2062 E250 BR |
| (2) Impeller | : | Carbon Steel as per IS:2062 E250 BR |
| (3) Base Frame | : | Carbon Steel as per IS:2062 E250 BR |
| (4) Sleeve | : | Brass |
| (5) 'O' ring | : | Neoprene |

### 3.3 MOTOR SPECIFICATIONS

| | | | |
|---|---|---|---|
| **3.3.1** | TYPE | : | TEFC squirrel cage induction motor to IEC 60034-1 |
| **3.3.2** | KW rating | : | 0.75kW |
| **3.3.3** | Rated voltage | : | 415 Volts, 3 phase, 50Hz |
| **3.3.4** | Type of duty | : | S1 (Continuous) as per IEC 60034-1 |
| **3.3.5** | Efficiency class | : | Refer Variant Table as below |

| **MATERIAL CODE** OF VAPOUR EXHASTER ASSEMBLY | **EFFICIENCY CLASS** OF MOTOR AS PER IEC-60034-30 | **STARTING CURRENT** (IN % OF FULL LOAD CURRENT) + 20% (Tolerance as per IEC: 60034-1) |
|---|---|---|
| **W96415000578** | IE-2 | 650 |
| **W96415003127** | IE-3 | 700 |

**3.3.6** Permissible voltage variation : ± 10%
**3.3.7** Permissible Frequency variation : ± 5%
**3.3.8** Combined voltage & frequency variation : + 10%
**3.3.9** Min. voltage required under starting : 85%
**3.3.10** Conditions to bring driven equipment to rated speed
**3.3.11** Starting Torque : Min. 1.3 times the rated torque.
**3.3.12** Breakdown torque : Min. 2 times the rated torque.
**3.3.13** Starting : DOL
**3.3.14** Acceleration time with full load connected: 3.5 + 0.5 sec.
**3.3.15** Starting duty : 3 starts spread over on hour and 2 consecutive starts from hot
**3.3.16** Condition without injurious heating to the winding.
**3.3.17** Overload capacity : Motor shall be capable of running at full load with 80% of rated
**3.3.18** Voltage for 10min. and 70% of rated voltage for 1 min.
**3.3.19** Class of insulation : 'F' with temperature limited to Class B (70 °C)
**3.3.20** Ventilation : Totally enclosed & fan cooled
**3.3.21** Enclosure protection : IP 55 as per IEC 60034-5
**3.3.22** Explosion proof : Group II T4 as per IEC 60079
**3.3.23** Bearing : as per suppliers design. Life not less than 50000hrs.
**3.3.24** Earthing : Suitable arrangement to be provided at 2 places.
**3.3.25** Terminal box : Terminal box shall be explosion proof as per Group II T4 IEC 60079.
**3.3.26** Cable gland also to be provided in terminal box for 3 core Aluminium cable.
**3.3.27** Fault level : 50 KA for 1 sec.

## 4.0 PUMP DATA SHEET (TO BE FURNISHED ALONGWITH OFFER :

**4.1** Capacity M3 / Sec. :
**4.2** Head MWC :
**4.3** Efficiency :
**4.4** Rated speed :
**4.5** Exhauster B.H.P. / kw at Rated Capacity :
**4.6** Material: Casing Impeller base Frame 'o' ring
**4.7** Type of bearing used :
**4.8** Type of coupling :
**4.9** Type of Sealing
**4.10** Suction size :
**4.11** Discharging size



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| | | | जांचकर्ता CHECKED BY | Manju Azad | 11/01/18 |

सामग्री सूची संख्या को अधिक्रमित करता है SUPERSEDES INVENTORY NO.

दिनांक एवं हस्ताक्षर SIGN & DATE 8/11/18

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**4.12** Wt. of exhauster with motors base frame :
**4.13** Wt. of exhauster :
**4.14** General assy. & cross sectionals drawing enclosed with offer :
**4.15** Capacity Vs discharge pressure curve enclosed :
**4.16** Power consumption Vs discharge pressure curve enclosed :
**4.17** Capacity Vs efficiency curve enclosed

## 5.0 MOTOR DATA SHEET (TO BE FURNISHED ALONG WITH OFFER)

**5.1** Manufacturer :
**5.2** Type :
**5.3** Frame size :
**5.4** Power absorbed by exhauster at duty point (kW) :
**5.5** Rated power (kW) :
**5.6** Duty cycle :
**5.7** Rated voltage :
**5.8** No. of phase :
**5.9** Frequency :
**5.10** Allowable voltage variation :
**5.11** Allowable frequency variation :
**5.12** Allowable voltage & frequency variation :
**5.13** Current :
**5.14** Rated speed (RPM) :
**5.15** Full load efficiency :
**5.16** Full load power factor :
**5.17** Method of starting :
**5.18** Max. starting current :
**5.19** Class of insulation :
**5.20** Starting torque :
**5.21** Max. torque :
**5.22** Safe stall time :
**a.** Under hot condition
**b.** Under cold condition
**5.23** Type of enclosure :
**5.24** Enclosure protection :
**5.25** Frequency of starting :
**5.26** Temp. rise above 500C :
**5.27** By resistance method :
By thermometer method
**5.28** Type & no. of terminals brought out :
**5.29** Type of connection during continuous running :
**5.30** Type and size of cable for when gland is provided in the terminal box. :
**5.31** Guaranteed min. voltage read at non terminals :
**5.32** System of earthing :

**5.33** Relevant standard :
**5.34** Motor GD2 Valve :
**5.35** Type of bearings (DE) :
**5.36** Type of bearings (NDE) :
**5.37** Type of lubricant :
**5.38** Frequency of lubrication :
**5.39** Wt. of motor :
**5.40** Insulation class :

## 6.0 QUALITY ASSURANCE, INSPECTION AND TESTING.

**6.1** The manufacture shall conduct all tests required to ensure that the exhauster conforms to the requirements of application codes and standards.

**6.2** The bidder shall submit the particulars of proposed shop tests along with procedures for information.

**6.3** The equipment shall be dispatched only after inspection and clearance by BHEL / owner.

**6.4** The min. tests checks to be carried out on vapour exhauster, as envisaged by BHEL are given below:-

**6.4.1** The material of Casing, Impeller, Base frame, Sleeve & O Ring shall be tested as per relevant standard for the chemical composition and mechanical properties.

**6.4.2** **TESTS DURING VARIOUS STAGE OF MANUFACTURING**

1) Check for dimension and finish of the components.
2) D.P.T on all welding as per ASME section VIII.
3) Dynamic balancing of impeller as per ISO 1940 Gr. 6.3.

**6.4.3** **FINAL TESTS**: - Following tests shall be carried out: -

1) Flow rate of air
2) Vibration test as per IEC 60034-14.
3) Noise : shall not be greater than 85dB when measured at a distance of 1 meter from the base of the equipment, measurement should be done as per IEC 60034-9
4) Speed
5) Dimensional check
6) Smooth running
7) Performance test as per ISO:5801

**6.4.4** Type & Routine tests on motor as per IEC:60034-1

**6.4.5** Vendor to furnish the test certificates for the following

1) Motor Enclosure certificate as per IP 55 as per IEC 60034-5
2) Explosion proof certificate for motor for Group II T4 as per IEC60079
3) Certificate for enclosure of Terminal box for explosion proof as per Group II T4 IEC 60079.
4) Certificate for minimum clearance of 2mm between impeller & casing.

**6.4.6** After testing the exhauster, all the surface and internal shall be thoroughly cleaned, dried and conserved. All the metallic surface except bright parts exposed to weather shall be given suitable primary coating.

## 7.0 DOCUMENTS TO BE FURNISHED AT THE TIME OF OFFER

**7.1** Assembly drawings part list, nozzle size, their coordinates base plate details etc.
**7.2** Technical data sheet of pump as per clause 4.
**7.3** Technical data sheet of motor as per clause 5.
**7.4** Performance curves.
**7.5** Quality plan in BHEL format, incorporating checks/tests at material stages, in process & final testing.
**7.6** Clause wise confirmations of specification TG60432.

## 8.0 DOCUMENT TO BE SUPPLIED

### 8.1 AFTER PLACEMENT OF ORDER

**8.1.1** G.A. drawing with parts list & material details.
**8.1.2** Final quality plan.

### 8.2 DOCUMENT FOR FINAL SUBMISSION

**8.2.1** Performance curves.
**8.2.2** Test certificates for all test checks in clause 6.4 shall be furnished.

## 9.0 CLEANING, PAINTING, CONSERVATION AND PACKING

The surface shall be cleaned and prepared for application of paint by shot blasting. The protective coating should be oil resistant. After testing the exhauster, its internals shall be thoroughly cleaned, dried and conserved before packing. The exhauster packing shall be strong enough to safeguard against any damage during transit. The exhauster shall be packed such that it is safe for at least 2 year of storage in damp atmosphere.

## 10.0 GUARANTEE

**10.1** The supplier shall guarantee trouble free and satisfactory operation of the equipment for a period of 12 months after commissioning at site or 18 months from the date of dispatch, whichever is earlier.
**10.2** The supplier shall guarantee the tested capacity head and capacity of the exhauster.
**10.3** The supplier shall repair /replace the defective parts at his own cost during the guarantee period.

## 11.0 IDENTIFICATION

A name plate of stainless steel with following information engraved on it, shall be affixed to the equipment at appropriate location –

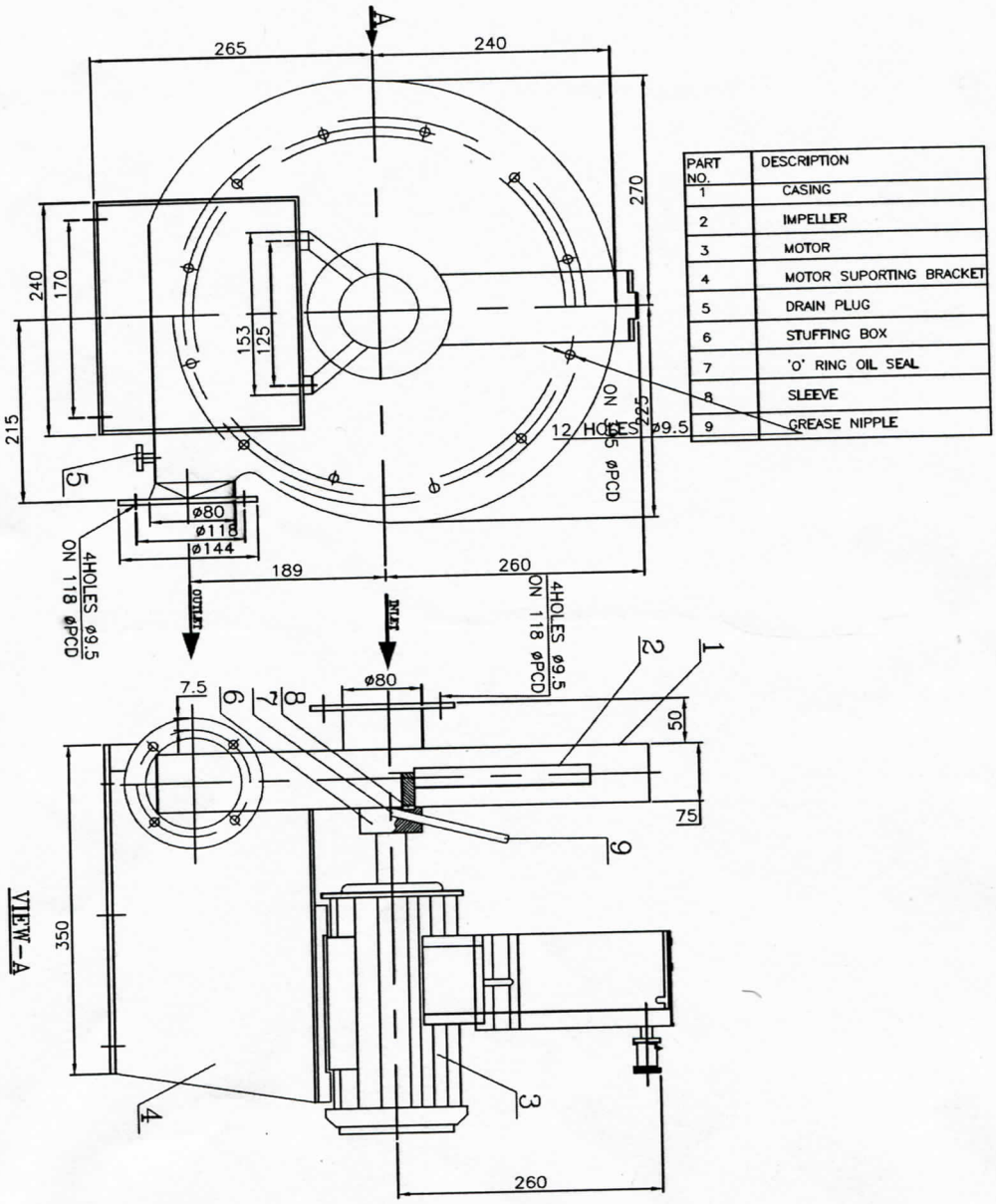
- Item description
- Manufacturer's name
- Year of manufacturing
- Sl. No.
- Main technical parameters i.e. Flow rate, Discharge pressure, Speed, Flow Medium, operating temperature, Motor KW Rating.
- BHEL specification no.
- BHEL material code.
- BHEL P.O. No.

## 12.0 GENERAL

Bidder shall furnish all the documents as per clause 7 of the specification along with offer. Any deviation shall be clearly spelled out. The offer may not be considered if all the technical particulars and information called for in the specification are not submitted along with the offer.

## 13.0 CROSS REFFERED STANDARD

ISO 1940, ISO 5801
IEC 60034-14, IEC 60034-9, IEC 60034-1, IEC 60034-5, IEC 60079
IS:2062




| PART NO. | DESCRIPTION |
|---|---|
| 1 | CASING |
| 2 | IMPELLER |
| 3 | MOTOR |
| 4 | MOTOR SUPORTING BRACKET |
| 5 | DRAIN PLUG |
| 6 | STUFFING BOX |
| 7 | 'O' RING OIL SEAL |
| 8 | SLEEVE |
| 9 | GREASE NIPPLE |

| | | | |
|---|---|---|---|
| निर्माणकर्ता WORKED BY | Kunal Mishra | Kunal | 11/01/18 |
| जांचकर्ता CHECKED BY | Manju Azad | Manju | 11/01/18 |

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