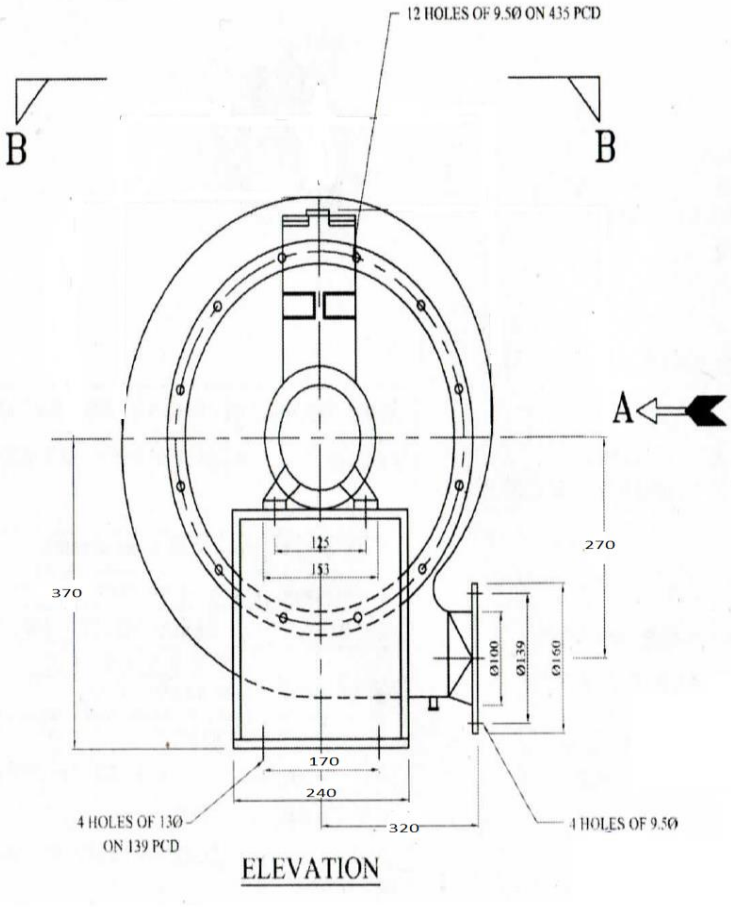
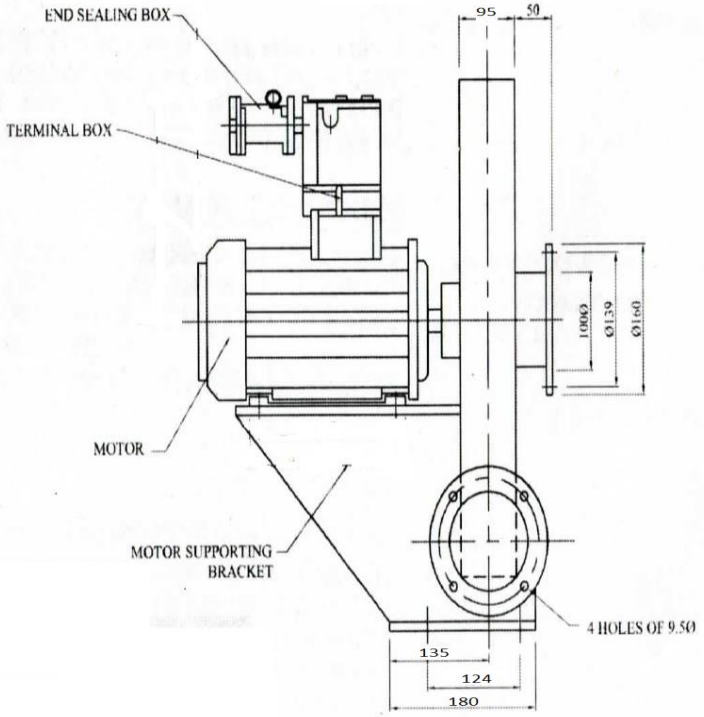
Annexure-1

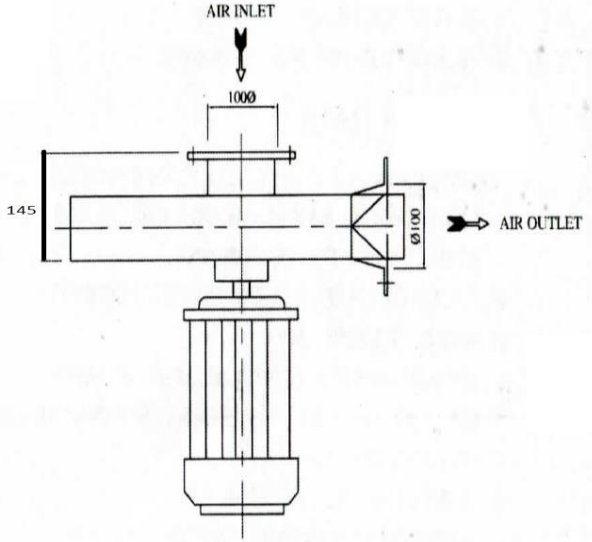
GA DRAWING TO MATCH DIMENSION FOR LUBE OIL VAPOR EXHAUSTER



ELEVATION



VIEW FROM -A



PLAN VIEW AT -BB

MANUFACTURER'S NAME AND ADDRESS			STANDARD QUALITY PLAN			TO BE FILLED BY BHEL	TO BE FILLED BY BHEL
BHEL	VENDOR'S NAME	ITEM	LUB OIL VAPOUR EXHAUSTER	QP NO.	QA/BE/QP/307		
				DATED & REV	23.12.2024 01		
		DRG. NO.	AS PER PO				
		SPEC.	ST 39004				
		REV	AS PER PO	Page 1 of 3			

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS		AGENCY			REMARKS
										M	B	N	
1	2	3	4	5	6	7	8	9	D	10			11
1.0	RAW MATERIAL												
1.1	CASING, SHAFT, IMPELLER, BLADES & BASE PLATE, SLEEVE, O-RING, SEALS	CHEMICAL, MECHANICAL PROPERTIES & SIZE	MAJOR	TEST & MEASUREMENT	100%	ORDERING SPEC. / BHEL APPD. DRG. / DATA SHEET	ORDERING SPEC. / BHEL APPD. DRG. / DATA SHEET	MTC	✓	P	V	-	NABL Lab TC
1.2	NUTS & BOLTS, LIFTING LUG & COUPLING	CHEMICAL, MECHANICAL PROPERTIES & SIZE	MAJOR	VISUAL	100%	ORDERING SPEC. / BHEL APPD. DRG. / DATA SHEET	ORDERING SPEC. / BHEL APPD. DRG. / DATA SHEET	TC	✓	P	V	-	
1.3	AC INDUCTION MOTOR (Please specify make, degree of protection and rating)	ROUTINE & TYPE TESTS CERTIFICATE INCLUDING DEGREE OF PROTECTION AND EXPLOSION PROOFNESS	MAJOR	REVIEW	100%	ORDERING SPEC. / BHEL APPD. DRG. / DATA SHEET	ORDERING SPEC. / BHEL APPD. DRG. / DATA SHEET	TC	✓	P	V	-	From BHEL Approved sources
2.0	INPROCESS INSPECTION												
2.1	ALL WELDS	QUALITY OF WELDS	MAJOR	DPT/MPT	100%	ORDERING SPEC. / BHEL APPD. DRG. / DATA SHEET	ORDERING SPEC. / BHEL APPD. DRG. / DATA SHEET	TC	✓	P	V	-	NOTE:1
2.2	IMPELLER	DIMENSIONS AFTER MACHINING	MAJOR	MEASUREMENT	100%	ORDERING SPEC. / BHEL APPD. DRG. / DATA SHEET	ORDERING SPEC. / BHEL APPD. DRG. / DATA SHEET	IR	-	P	-	-	
		DYNAMIC BALANCING OF ROTOR	MAJOR	MEASUREMENT	100%	ORDERING SPEC. / BHEL APPD. DRG. / DATA SHEET	ORDERING SPEC. / BHEL APPD. DRG. / DATA SHEET	TC	✓	P	W	-	Ensure calibration of balancing machine
2.3	ASSEMBLY OF FAN	INTERNAL CLEARANCE BETWEEN IMPELLER & CASING	MAJOR	MEASUREMENT	100%	ORDERING SPEC. / BHEL APPD. DRG. / DATA SHEET	ORDERING SPEC. / BHEL APPD. DRG. / DATA SHEET	IR	✓	P	V	-	
3.0 FINAL INSPECTION ON THE COMPLETE ASSEMBLY													
3.1		OVERALL DIMENSIONS	MAJOR	MEASUREMENT	100%	ORDERING SPEC. / BHEL APPD. DRG. / DATA SHEET	ORDERING SPEC. / BHEL APPD. DRG. / DATA SHEET	TC	✓	P	W	-	

		LEGEND:	FOR CUSTOMER USE	
MANUFACTURER/ SUBCONTRACTOR		RECORDS IDENTIFIED WITH '✓' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION. IR: INSPECTION REPORT TC: TEST CERTIFICATE COC: CERTIFICATE OF CONFIRMANCE **M**: MANUFACTURER / SUBCONTRACTOR **B**: BHEL / NOM. INSPECTION AGENCY **N**: CUSTOMER INDICATE '**P**' PERFORM '**W**' WITNESS AND '**V**' VERIFICATION		APPROVED BY
		ALL 'W' INDICATED IN COLUMN 'N' SHALL BE '**CHP**' OF CUSTOMER		

Digitally signed by RAJENDER SINGH
DN: cn=RAJENDER SINGH, o=BHEL HEEP HARIDWAR, ou=BHEL HEEP HARIDWAR, email=rajender.singh@bhel.in, c=IN
Date: 2024.12.30 09:58:48 +05'30'
Adobe Acrobat Reader version: 2024.005.20320

MANUFACTURER'S NAME AND ADDRESS			STANDARD QUALITY PLAN		TO BE FILLED BY BHEL	TO BE FILLED BY BHEL
BHEL	VENDOR'S NAME	ITEM	LUB OIL VAPOUR EXHAUSTER	QP NO.	QA/BE/QP/307	
				DATED & REV	23.12.2024 01	
		DRG. NO.	AS PER PO			
		SPEC.	ST 39004			
		REV	AS PER PO	Page 2 of 3		

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS		AGENCY			REMARKS
										M	B	N	
1	2	3	4	5	6	7	8	9	D	10			11
3.2		ONLINE GREASING FACILITY FOR MOTOR	MAJOR	VISUAL	100%	ORDERING SPEC. / BHEL APPD. DRG. / DATA SHEET	ORDERING SPEC. / BHEL APPD. DRG. / DATA SHEET	TC	✓	P	W		
3.3		SEALS AS PER CLAUSE 6.4 OF SPEC ST39004	Major	Visual	100%	ORDERING SPEC. / BHEL APPD. DRG. / DATA SHEET	ORDERING SPEC. / BHEL APPD. DRG. / DATA SHEET	TC	✓	P	W		
3.4		PERFORMANCE (INCLUDING DISCHARGE V/S PRESSURE & POWER CONSUMPTION, EFFICIENCY) & STRIP TEST	MAJOR	PERFORMANCE	100%	ORDERING SPEC. / BHEL APPD. DRG. / DATA SHEET	ORDERING SPEC. / BHEL APPD. DRG. / DATA SHEET	TC	✓	P	W	-	
3.5		FAN SPEED AT 80% OF RATED VOLTAGE	MAJOR	ELECTRICAL	100%	ORDERING SPEC. / BHEL APPD. DRG. / DATA SHEET	ORDERING SPEC. / BHEL APPD. DRG. / DATA SHEET	TC	✓	P	W	-	
3.6		FAN SPEED, SMOOTH RUNNING, DIRECTION OF ROTATION	MAJOR	VISUAL	100%	ORDERING SPEC. / BHEL APPD. DRG. / DATA SHEET	ORDERING SPEC. / BHEL APPD. DRG. / DATA SHEET	IR	✓	P	W	-	
3.7		NOISE LEVEL	MAJOR	MEASUREMENT	100%	ORDERING SPEC. / BHEL APPD. DRG. / DATA SHEET	ORDERING SPEC. / BHEL APPD. DRG. / DATA SHEET	IR	✓	P	W	-	
3.8		VIBRATION	MAJOR	MEASUREMENT	100%	ORDERING SPEC. / BHEL APPD. DRG. / DATA SHEET	ORDERING SPEC. / BHEL APPD. DRG. / DATA SHEET	IR	✓	P	W	-	
3.9		CLEANING, PRESERVATION, PACKING & PAINTING INCLUDING PAINT THICKNESS (DFT)	MAJOR	VISUAL & MEASUREMENT	100%	ORDERING SPEC. / BHEL APPD. DRG. / DATA SHEET	ORDERING SPEC. / BHEL APPD. DRG. / DATA SHEET	IR/TC		P	-	-	
3.10		COMPLIANCE OF TECHNICAL REQUIREMENTS & COMPLETION OF DOCUMENTS	MAJOR	--	100%	ORDERING SPEC. / BHEL APPD. DRG. & DATA SHEET	ORDERING SPEC. / BHEL APPD. DRG. & DATA SHEET	COC		P	V	-	

		LEGEND:	FOR CUSTOMER USE	
MANUFACTURER/ SUBCONTRACTOR		RECORDS IDENTIFIED WITH '✓' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION. IR: INSPECTION REPORT TC: TEST CERTIFICATE COC: CERTIFICATE OF CONFIRMANCE **M**: MANUFACTURER / SUBCONTRACTOR **B**: BHEL / NOM. INSPECTION AGENCY **N**: CUSTOMER INDICATE '**P**' PERFORM '**W**' WITNESS AND '**V**' VERIFICATION		APPROVED BY
		ALL 'W' INDICATED IN COLUMN 'N' SHALL BE '**CHP**' OF CUSTOMER		

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Date: 2024.12.30 09:59:03 +05'30'
Adobe Acrobat Reader version: 2024.005.20320

MANUFACTURER'S NAME AND ADDRESS			STANDARD QUALITY PLAN			TO BE FILLED BY BHEL	TO BE FILLED BY BHEL
BHEL	VENDOR'S NAME	ITEM	LUB OIL VAPOUR EXHAUSTER	QP NO.	QA/BE/QP/307		
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		REV	AS PER PO		Page 3 of 3		

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS		AGENCY			REMARKS
										M	B	N	
1	2	3	4	5	6	7	8	9	D	10			11
4.0	PACKING												
4.1		SOUNDNESS OF PACKING AGAINST TRANSIT DAMAGE	MAJOR	PHYSICAL	100%	ORDERING SPEC. / BHEL APPD. DRG. / DATA SHEET	ORDERING SPEC. / BHEL APPD. DRG. / DATA SHEET	INTERNAL RECORDS		P	-	-	

NOTE 1: WELDING TO BE DONE BY QUALIFIED WELDER AS PER ASME IX WPS AND PQR TO BE CHECKED BY INSPECTING AGENCY.

NOTE 2: STRIP TEST SHALL BE CARRIED OUT IF ABNORMAL SOUND OBSERVED DURING PERFORMANCE TEST.

NOTE 3: ALL PAGES OF THE INSPECTION DOCUMENTS SHALL BE NUMBERED IN CHRONOLOGY WITH THE QAP CLAUSES, DULY MENTIONING THE CORRESPONDING QAP CLAUSE NO. AT THE TOP OF EACH PAGE.

NOTE 4: ONE 'INDEX' PAGE CONTAINING THE DOCUMENT DESCRIPTIONS, THEIR PAGE NO'S & QAP CL NO. SHALL BE ATTACHED UPFRONT THE INSPECTION DOCUMENTS.

NOTE 5: PAINTING CAN BE DONE ONLY AFTER INSPECTION CLEARANCE, AS PER CUSTOMER'S /BHEL APPROVED PAINT SPECIFICATION / SCHEDULE (IF REQUIRED). OTHERWISE MANUFACTURER'S STANDARD SHALL BE FOLLOWED.

NOTE 6: FOR ANY SPARES ITEM, APART FROM 'VISUAL INSPECTION' THE 'INTERCHANGEABILITY FITMENT CERTIFICATE' OR 'MATERIAL TC' ARE TO BE SUBMITTED, WITH SPECIFIC MENTIONING OF THE ' PART NO/ ITEM NO OF THE APPROVED GA/ X-SEC DRG.".

		LEGEND:	FOR CUSTOMER USE	
MANUFACTURER/ SUBCONTRACTOR		RECORDS IDENTIFIED WITH '✔' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION. IR: INSPECTION REPORT TC: TEST CERTIFICATE COC: CERTIFICATE OF CONFIRMANCE **M**: MANUFACTURER / SUBCONTRACTOR **B**: BHEL / NOM. INSPECTION AGENCY **N**: CUSTOMER INDICATE '**P**' PERFORM '**W**' WITNESS AND '**V**' VERIFICATION		APPROVED BY
		ALL 'W' INDICATED IN COLUMN 'N' SHALL BE '**CHP**' OF CUSTOMER		

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Date: 2024.12.30 09:59:35 +05'30'
Adobe Acrobat Reader version: 2024.005.20320

PRE-QUALIFICATION REQUIREMENT
Lube Oil /Control Fluid Vapour Exhauster

DOCUMENT NO.
TL/OVE/PQR/20242721
Rev:00 Dt:13.12.24

Description: - Oil Vapor exhauster handles oil fumes generated during the running of the turbine. It shall also maintain a partial vacuum in the main oil tank and turbine bearing pedestal etc. The fumes to be handled by the exhauster contain free droplets of oil. Viscosity grade of the oil is ISO VG046.

Control fluid vapour exhauster is to handle the control fluid fumes generated during running of the turbine. It shall also maintain a partial vacuum in the tank. The fumes to be handled by the exhauster shall contain free droplets of control fluid.

The vapour exhauster/CF Vapor Exhauster used in system is complete assembly of Fan, motor, coupling, base plate and other accessories. The vapour exhauster/CF Vapor Exhauster should be of very reliable and proven design to maintain the required parameters to meet system requirements under all conditions.

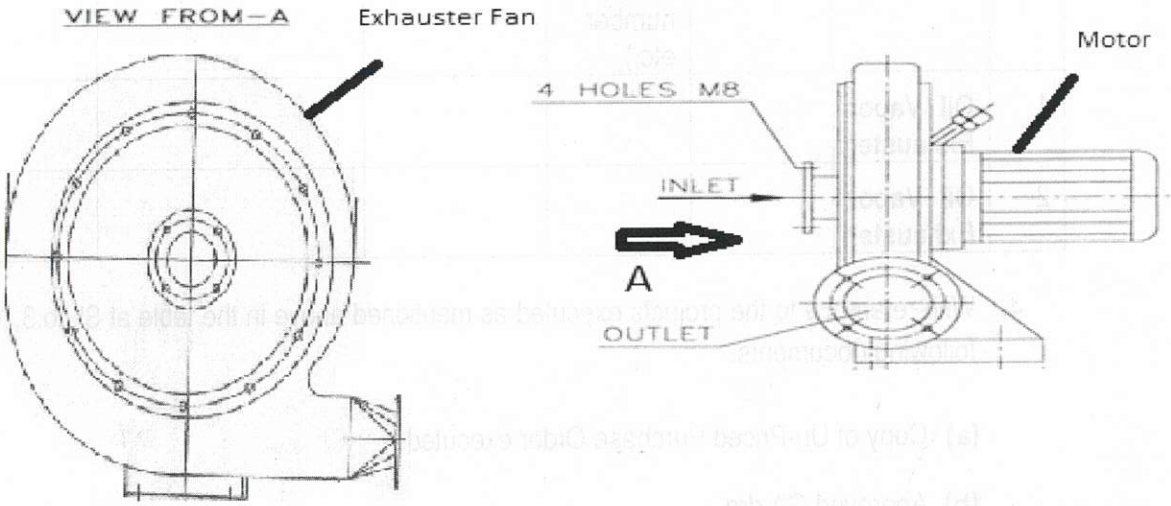


Figure 1

Acceptance Criteria: -

1. Vendor or its principal should have manufactured, tested and supplied at least 2 nos. Oil vapor exhausters Fan along with electric motor in last 10 years from the date of issuance of enquiry (i.e. P.O. on or after 01.12.2014) with minimum following details – Yes/**No**.

Sl No.	Medium	Parameter	Value Range
1.	Lube oil/Control Fluid	Continuous discharge capacity at operating point	0.05 to 0.20 m3/sec
2.		Nominal discharge pressure at operating point	Minimum220 mmWC

Deptt	Worked By	Checked By	Approved By
STE	H Gupta 13/12/24	HSDOGRA 14.12.24	ANUJ JAIN 16/12/24
CIE	L K MISHRA 17/12/24	SATISH KUMAR 17/12/24	VINOD KUMAR 18/12/24

2. Vendor (Main pump supplier) or Sub vendor (Motor supplier) should have commissioned the Exhauster Fan with AC motor (squirrel cage induction motor suitable for direct-on-line starting with continuous duty type (S1)) of 415V-AC, (+/-10%), 50Hz (+/-5%) & absolute sum variation 10% with starting current limited to 600% + (tolerances) as per IS: 12615-2011/ IEC 60034... **Yes/No.**

3. In support of Clause No.1, vendor shall furnish their credential list, as per the following format.

S. No.	Detail of Item supplied	Name & address of customer	Contact Details of the customer (email & phone number etc.)	Purchase order reference no. and issue date	Continuous discharge capacity (m3/sec)	Discharge pressure (mmWC)	Type & rating of motor used
1	**Oil Vapor Exhauster**						
2	**Oil Vapor Exhauster**						

4. With reference to the projects executed as mentioned above in the table at Sl.no.3, Vendor to furnish following documents:

(a) Copy of Un-Priced Purchase Order executed.

(b) Approved GA drg.

(c) Unpriced dispatch documents e.g .LR, SRV, Invoice etc.

(d) Motor data sheet, wiring diagram, motor characteristics curve and GA drawing.

Note - BHEL reserves the right to verify information submitted by vendor. In case the information is found to be false / incorrect, the offer shall be rejected.

----End of PQR----

Deptt	Worked By	Checked By	Approved By
STE	H Gupta	HSDOGRA 14.12.24	ANUJ JAIN 16/12/24
CIE	L K MISHRA 17/12/24	SATISH KUMAR 17/12/24	VINOD KUMAR 18/12/24

TECHNICAL SPECIFICATION FOR OIL VAPOUR EXHAUSTER

1.0 **INTENT OF SPECIFICATION: -** This specification is intended to cover design, manufacture, assembly testing and supply of oil vapour exhauster complete with foundation base plate, anchor bolts, lifting lugs, coupling and other accessories including motor. The exhausters should be suitable for continuous operation at an ambient temperature of 50˚C & 90% humidity.

2.0 **FUNCTION: -** Oil vapour exhauster handles oil fumes generated during the running of the turbine. It shall also maintain a partial vacuum in the main oil tank and turbine bearing pedestals etc. The fumes to be handled by the exhauster contain free droplets of oil.

3.0 **OIL SPECIFICATION: -** Viscosity grade of the oil is ISO VG 46. The equivalent grades of various oil suppliers are Servo prime -46 of M/s IOC and Turbinol-47 of M/s Hindustan Petroleum Corporation Ltd.

Kinematic viscosity at 65˚C/20˚C	: 16 Cs/100 Cs
Specific gravity at 65˚C	: 0.8488
Flash point	: 200˚ C (min.)
Operational temperature	: 65˚C
Pour point	: -6.6˚ C (max.)

4.0 **DATA SHEET OF OIL VAPOUR EXHAUSTER:**

Type	: Centrifugal
Cont. discharge capacity	: 0.11 m^3/sec.
Normal discharge pressure	: 220mmWC
Design temperature	: 100˚C
Operating temperature	: 65˚C
Efficiency of exhauster	: Min. 40%

5.0 **MOTOR: -** A suitable motor conforming to the exhauster requirement shall be supplied. The Motor shall also meet the following requirements broadly. The motor shall conform to IS : 4722, IS : 325, IS-: 2223, IS : 4029 , IS : 4691, IS : 2148 and IS : 12615-2011 or equivalent, BS : Specification. The motor shall meet all Indian statutory requirements.

5.1 **Application:** To drive Oil Vapour Exhauster.

5.2 **Location:** Turbine oil room (indoor).

5.3 **Type of motor:** Squirrel cage, induction motor.

5.4 **KW Rating:** It shall have at least 25% and max. 40% reserve capacity over required power to drive the exhauster when it is discharging max. quantity.

				नाम NAME	दिनांक एवं हस्ताक्षर SIGNATURE & DATE
TSX	DEEPAK	Deepakkey 22/9/15			
MEMBER PSC	R.PANJA	Rpanja 24-9-15	अनुवादक TRANSLATED BY	-	
QAX	VIBHUTI SHAH	Vibhuti 22/9/15	निर्माणकर्ता WORKED BY	VIVEK RAWAT	Vivek 22/9/15
CIE	NIRBHAY KUMAR	Nirbhay Kumar 22/9/15	जांचकर्ता CHECKED BY	P.KUMAR	22/9/15
सहमत विभाग AGREED DEPTT.	नाम NAME	दिनांक एवं हस्ताक्षर DATE & SIGNATURE	पर्यवेक्षणकर्ता SUPERVISED BY	ANUJ JAIN	22/9/15

REAFFIRMED

	WORKED BY	25/02/20
REV.NO. 06	CHECKED BY	25/2/20
Dt. 25/02/20	C/A NO.	STE-20-20

स्वीकृति APPROVED : (R PANJA) AGM Rpanja 24-09-15

GP No 2.03

निर्माण PREPARED : PED

जारी ISSUED : TSX

दिनांक DATE: 24.06.80

हस्ताक्षर एवं दिनांक SIGN & DATE 24/9/15

सामग्री सूची संख्या INVENTORY NO. 2-5135

5.5 KW actually required by driven equipment under specified operation/startup conditions at 50°c ambient. : capacity of the exhauster

5.6 Rated voltage: 415 V

5.7 Frequency: 50 Hz

5.8 Permissible voltage and frequency variation under normal running condition : ± 10% Volt.
: ± 5% Frequency

5.9 Combined variation : 10% (sum of absol. value)

5.10 Min. voltage required under starting conditions to bring driven equipment up to rated speed. : 80% rated

5.11 No. of phases : 3ø

5.12 Type of duty : Continuous

5.13 Starting current : Not to exceed 600% of I-rated.

5.14 Starting torque : 1.3 (min.)of rated torque

5.15 Break down torque : Two times (min.) of rated value.

5.16 Class of insulation of winding : Class-B, fungus resistant tropicalized as per IS: 3202.

5.17 **Starting data :-**

5.17.1 Starting : Direct on line

5.17.2 Acceleration time with full load connected : 3.5 ± 0.5 secs.

5.17.3 Permissible starting duty cycle, no. of starts : 3 Starts spread over an hour
2 Consecutive starts from hot condition without any injurious heating to the winding

5.17.4 Overload (% of full load) that can be carried by motor without impairing over all performance and period for which this over load is applicable. : Motor shall be capable of running at full load with 80% of rated voltage for 5.0 minutes and 70% of rated voltage for 1 sec.

5.17.5 Locked rotor with stand time under hot condition at rated voltage shall be at least 2.5 sec. more than starting time.

5.18 **Mechanical construction ;-**

5.18.1 Shaft disposition mounting : Horizontal / flange mounted.

5.18.2 Method of connections to driven equipment : Flange flexible coupling Directly mounted on the motor shaft.

5.18.3 Direction of rotation and corresponding Terminal designation : To suit exhauster

5.18.4 Efficiency of the motor shall be as per IS: 12615-2011.

5.18.5 Enclosure and ventilation: Totally enclosed fan cooled explosion proof as per IS: 2148.

5.18.6 Bearing: As per supplier's design, life not less than 30,000 hrs.

5.18.7 Grounding device: Suitable arrangement shall be provided for earthing the motor at two separate and distinct connection points. Design of earthing conductor shall be as per IS: 4722-1992.

5.18.8 Terminal connectors for stator: 3 terminals shall be connected externally in the terminal box. heads type and number.

5.19 Terminal box: -To be provided with double compression cable gland for Al cable.
- Fault level for terminal box shall be 50KA for 0.25 sec.
- It shall be explosion proof

5.20 **Special requirements:**

5.20.1 The motor shall be suitable to operate in environment of oil fumes.

5.20.2 The motor shall be suitable for rewinding.

5.20.3 The motor shall have on line greasing facility.

5.20.4 The motor construction shall be suitable for easy disassembly and reassembly.

5.21 Documents to be supplied: - Motor data sheets with G. A. drgs. and Terminal details shall be furnished in 05 sets after award of contract/placement of order for BHEL approval.

5.21.1 Type and frame size

5.21.2 Starting time at
i) With 100% voltage at terminal
ii) With 85% voltage at terminal

5.21.3 Safe stall time at 100% rated voltage under hot condition.

5.21.4 Motor GD² value.

5.21.5 Weight of motor

5.21.6 I) Type and routine test certificates as per IS: 4722.
II) In addition to type and routine test as per IS: 4722, following test shall also be carried out:-
- Degree of protection test as type test. (In case test is already carried out and is not more than five years old then only Test Certificates to be furnished).

6.0 DESIGN & CONSTRUCTION OF OIL VAPOUR EXHAUSTER:

6.1 All materials used in the construction of the exhauster shall be selected from the range of materials most appropriately suitable for the purpose and service conditions. The bidder shall furnish along with the bid the material specification for all the components to BHEL for their review and acceptance by BHEL/Owner. BHEL/Owner reserves the right to ask for changes in material.

6.2 The supplier shall also furnish the method and frequency of lubrication of the bearings and quantity and type of lubricant required for normal operation.

6.3 The design shall be such as to keep the friction loss and wear caused by end thrust, wear in mechanical seals and bearings to the minimum. It should ensure long and trouble free service. The rotor of the exhauster should be balanced dynamically so that the vibration of the exhauster is not greater than 25µm peak to peak in accordance with IS: 12075. The noise level should not be greater than 85 dBA when measured at a distance of 1.5 meters above floor level and one meter horizontally from the base of the equipment.

6.4 Seals must comply with the following properties :-

a) Ready access and amenability for maintenance work.
b) No contamination of the medium from material abraded from the seals.
c) No seepage of lubricants into the flow medium.
d) No leakage of gases (oil fumes) outside in the atmosphere.
e) No seepage of oil towards motor and outside along with the shaft.

6.5 At suitable points on the components erection eyes or lifting hooks shall be fitted for transport and erection. Their locations must be shown on the dimensional drawing.

6.6 Exhauster bearings shall be designed so as to assure 50,000 hours continuous service for friction bearings and 25,000 hours for ball and roller bearings.

6.7 The mechanical design shall allow easy access to the parts for maintenance work to be carried out.

6.8 The exhauster shall be provided with drainage devices.

6.9 All system parts shall be of oil tight construction. Compression-type fittings are not permissible.

6.10 For exhauster running at sub critical speeds, it shall be demonstrated that the critical speed lies above the maximum speed attainable during operation. For exhauster running at super critical speeds, it shall be demonstrated that there is a difference of sufficient magnitude (not less than 15%) between the operating speed and the bordering critical speeds. Allowance shall be made for the type of coupling between the exhauster and motor when calculating the critical bending speed.

6.11 **COUPLING:-** Suitable coupling with guards shall be provided for coupling exhauster with motor and shall be designed to facilitate easy alignment. One set of coupling pins/bolts shall be supplied in spare. Common shaft for exhauster and motor shall be preferred.

6.12 **FOUNDATION: -** The exhauster shall be mounted on the oil tank top. Frame of exhauster shall be sturdy to limit the vibration level as mentioned in the clause 6.3. For mounting Dimensions. Refer sketch at Annexure -3 or Annexure -4.

6.13 **ORIENTATION:-** Orientation of motor w.r.t. inlet/outlet connections shall be as per Annexure-3 for var.01 and Annexure -4 for variant 02.

6.14 **SPECIAL TOOLS & TACKLES:-** One set of tools required for erection, operation and maintenance of the sets shall be supplied together with each set comprising of two numbers of exhauster with motor. List of these tools shall be submitted along with the offer.

7.0 **QUALITY ASSURANCE, INSPECTION AND TESTING :-**

a) The manufacturer shall conduct all tests required to ensure all the component parts of the oil vapour exhauster offered confirm to the requirements of applicable codes and standards.

b) The bidder shall submit along with his offer quality plan in the BHEL format /customer format as required.

7.1 The material shall be dispatched only after inspection and clearance of material by BHEL / Owner and approval of test certificates by BHEL/Owner.

7.2 The minimum tests/checks to be carried out on oil vapour exhauster as envisaged by BHEL are given below. This is however not intended to form a comprehensive testing programme as it is suppliers responsibility to prepare the detailed quality plan, which should also include tests/ checks carried out by supplier as a part of their normal practice. This quality plan is subject to the approval of BHEL/ its customer and BHEL/ its customer reserves the right to ask for any more checks at the time of quality plan finalization.

7.2.1 Testing of materials :- The material of each component shall be tested as per relevant specification for its chemical composition and mechanical properties Viz YS, TS, % age elongation shall be carried out.

7.2.2 Following tests shall be carried out during various stages of manufacture at manufacturer s' works.

a) Check for dimensions of all the component parts including finish.

b) Non-destructive Examination –DPT/MPT for welds to ensure freedom from subsurface defects.

c) Dynamic balancing of rotor as per ISO: 1940 or equivalent, Gr. =6.3.

d) Check for direction of rotation of exhauster and its working as per clause 6.10 of spec.

e) Performance testing e.g. discharge V/S pressure, power consumption.

f) Noise as per clause 6.3

g) Vibration as per clause 6.3

7.2.3 Test certificates indicating the actual test results of material testing , NDT, dynamic balancing, performance test, strip down examination shall be furnished.

8.0 **DOCUMENT TO BE SUPPLIED AFTER THE PLACEMENT OF ORDER**:- These shall be supplied in 10 copies each or two copies and a set of reproducible.

1) Contractual drawings i.e. pre approval drgs /documents in final shape after incorporating BHEL's comments if there are any. — 8 weeks

2) O & M manual — 12 weeks

9.0 **PRE-APPROVAL DOCUMENTS AT THE TIME OF OFFER :-** (4 Sets)

1) Assembly drawing with part lists, inlet/outlet connection sizes and their coordinates, base plate details and cross sectional arrangement along with static and dynamic loading.

2) Calculations with necessary drawings (Torque/speed characteristics etc.), power requirement.

3) Quality plan in the specified format.

4) Filled in Annexure-1 & Annexure-2

5) The supplier shall quote item wise price of recommended spares for 3 years and 5 years respectively.

9.1 Examination of the pre approval documents by BHEL shall not release the manufacturer and his subcontractors of their responsibilities.

9.2 The pre approval documents shall form the basis for the order. No changes shall be made without approval from BHEL.

10.0 **NAME PLATE IDENTIFICATION MARKS SHOULD BE AS FOLLOWS:-**

1) Type/ Designation
2) Manufacturer
3) Year of Manufacturing
4) Purchaser's order no.
5) Volumetric flow (M^3/S)
6) Discharge pressure (MM WC)
7) Operating temperature (˚c)
8) Speed
9) Flow medium

11.0 **CLEANING, PAINTING, CONSERVATION & PACKING:-** The surface shall be cleaned & prepared for the application of the coatings by blasting with non-silicatic abrasive agents. The protective coating should be oil resistant to prevent contamination of oil specified & to prevent the deterioration of the coating itself. The supplier shall give exact and precise details about the measures envisaged by him for surface protection, which may be commented by BHEL.

After testing the exhauster, its internals shall be thoroughly cleaned, dried and conserved before packing it. The exhauster packing shall be sufficiently strong to safeguard against any damage during transit. It should be packed such that it is safe at least for 2 years in a very damp atmosphere. Instructions should be issued
Regarding reconservation, deconservation and storage of package.

12.0 **GENERAL:-** The tenderer can make suitable offers even if there are minor deviations which do not affect the efficient functioning of the equipment. However, the deviations must be clearly spelt out. Supplier shall also fill in the blank data sheet (Annexure-1) and submit the same along with the offer. The offer may not be considered if all the technical particulars and information called for in the specifications are not submitted along with the offer.

13.0 **GUARANTEE:-**

13.1 The supplier shall guarantee trouble free and satisfactory operation of the equipment for a period of 18 months after delivery or 12 months after commissioning whichever is earlier.

13.2 The supplier shall guarantee the capacity, head and efficiency of the exhauster as per the tested characteristics with oil fumes.

13.3 If during erection at site any deficiency in a part is detected, BHEL site representative shall prepare the assessment report and a copy of the same shall be forwarded to the supplier. The supplier shall replace/rectify the concerned items free of charge. The supplier if he so desires may depute his representatives to site at his own cost otherwise the finding of BHEL representative shall be final and binding on the supplier.

13.4 The supplier shall repair/replace the defective parts at his own cost during the guarantee period.

ANNEXURE-1

DATA TO BE FURNISHED BY BIDDER ALONG WITH OFFER

1.0 Equipment and Services offered :-

Please state whether the following equipment service as specified in the data sheets are offered or not.

1.1	Exhauster as per specification	Yes/No
1.2	Motor/Make	M/s……
1.3	Necessary instruments, Test connections	Yes/No
1.4	Base plate as per Annexure-3/4	Yes/No
1.5	Companion flanges	Yes/No
1.6	Maintenance and special erection tools	Yes/No
1.7	No. of exhausters offered	Nos.

2.0 Design and performance :-

2.1	Designed capacity of each exhauster	m^3/sec
2.2	Normal discharge pressure	
2.3	Efficiency	
2.4	Rated speed	
2.5	Performance guaranteed when installed as per given arrangement	Yes/No
2.6	Exhauster b. h. p. / KW at rated capacity	

3.0 Material of construction

3.1 Casing
3.2 Rotor and blades
3.3 Base plate
3.4 Wearing rings
3.5 Type of bearings used
3.6 Type of coupling
3.7 Type Of Packing

4.0 **Connections**:-

4.1 Suction size

4.2 Discharge size

5.0 **Drawings**: - General arrangement and sectional drgs. Enclosed with offer Yes/No

6.0 **Weight schedule**:-

6.1 Weight of exhauster

6.2 Weight of motor

6.3 Weight of exhauster with motor and base frame

7.0 **Characteristic curves** :-

7.1 Power consumption / Discharge pressure

7.2 Discharge quantity / pressure

7.3 Discharge / efficiency

8.0 Any deviation taken against specification Yes/No

9.0 Deviations taken as mentioned here

ANNEXURE-2

MOTOR DATA SHEET TO BE FURNISHED AFTER PLACEMENT OF PO FOR APPROVAL

1. GENERAL

i) Vendor document no. and revision no./date :----------

ii) Project :----------

iii) Customer :----------

iv) BHEL- P.O. no. and date :----------

v) Manufacturer :----------

vi) Equipment driven by motor :----------

vii) Motor type :----------

2. DESIGN AND PERFORMANCE DATA

i) Frame size :----------

ii) Type of duty :----------

iii) Type of enclosure :----------

iv) Type of cooling (IC) :----------

v) Applicable standard to which motor conforms :----------

vi) Enclosure degree of protection (IP) :----------

vii) Type of mounting :----------

viii) Direction of rotation as viewed from non-driving end :----------

ix) KW rating at 50^0c of ambient temp. :----------

x) Rated voltage (volts) :----------

xi) Rated frequency (Hz) :----------

xii) Permissible variation of :
a) Voltage (Volts) :----------
b) Frequency (Hz) :----------
c) Combind voltage and frequency (absolute value) :----------

xiii) Minimum permissible starting voltage (volts) :----------

xiv) Rated speed at rated voltage and frequency (RPM) :----------

xv) At rated voltage and frequency:

a. Full load current :----------
b. No load current :----------

xvi) Power factor at :
a. 100% load
b. 75% load

xvii) Efficiency at rated voltage and frequency at

a. 100% load :----------

b. 75% load :----------

xviii) Starting current (amps) at

a. 100% voltage :----------

b. 80% voltage :----------

xix) Starting time at 100% and 80% of rated voltage :----------

xx) Safe stall time with 110% of rated voltage :

a. from hot condition :----------

b. from cold condition :----------

xxi) Torques :
a. starting (Kg-meter) at 80% voltage :----------

b. pull up (Kg-meter) :----------

c. pull out (Kg-meter) :----------

d. rated torque (Kg-meter) :----------

xxii) Stator winding resistance per phase (ohms) :----------

xxiii) Flywheel moment (GD^2) of motor (Kg-m^2) :----------

3. CONSTRUCTIONAL FEATURE :

i) STATOR WINDING INSULATION:

a. Class :----------

b. Tropicalised (yes / no) :----------

c. Temperature rise over specified ambient of 50^0c, max 70^0c (yes / no) :----------

d. Method of temp. measurement :----------

e. Stator winding connection :----------

f. Number of terminals brought out :----------

ii) FOR SPACE HEATER:

a. Type of terminal box and degree of protection :----------

b. No. of space heaters :----------

c. Location :----------

d. Rated voltage & power :----------

e. Double compression cable glands with lugs provided (yes / no) :----------

f. Suitable for cable size :----------

iii) FOR MAIN TERMINAL BOX :

a. Type of terminal box & degree of protection :----------

b. Double compression cable glands & lugs provided (yes / no) :----------

c. Suitable for cable size :----------

d. Terminal box capable of being rotated through 180^0 in steps of 90^0 (yes / no) :----------

e. Fault level (KA, sec.) :----------

iv) BEARINGS :

a. Type (at DE / NDE) :----------

b. Make :----------

c. Recommended lubricant :----------

d. Life :----------

v) STARTING SUITABLE FOR :

a. DOL only (yes / no) :----------

b. DOL as well as star-delta (yes / no) :----------

vi) TOTAL WEIGHT OF MOTOR (KG): :----------

4. i) Noise level : :----------

ii) Vibration level : :----------

iii) Paint materials, thickness, color : :----------

Note : Supplier / vendor shall get the confirmation about paint from BHEL before manufacturing of motor.

5. **DOCUMENTS :**

i) Motor GA / dimensional drawings including terminal boxes drg.no. :- ----------

ii) CURVES AT RATED VOLTAGE :

a. Starting current –vs- time curve drg. no. :- ----------

b. Speed –vs- starting time curve drg.no. :- ----------

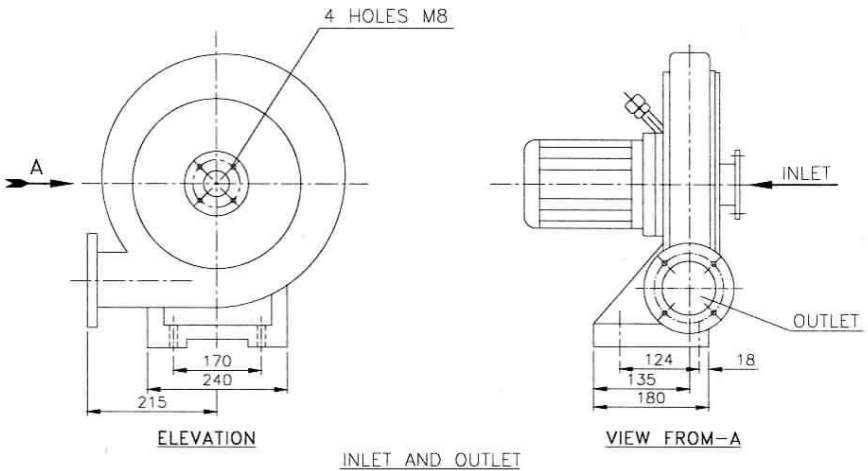
c. Torque –vs- speed curve drg.no. :- ----------

d. Speed –vs- current curve drg.no. :- ----------

e. Thermal withstand curve for hot and cold conditions. : drg. no. :----------

CROSS REFERRED STANDARDS:- ISO VG 46
IS : 4722, IS : 325, IS: 2223, IS: 4029, IS: 4691
IS : 2148, IS : 3202, IS : 12075, ISO: 1940, IS: 12615-2011

ANNEXURE-3



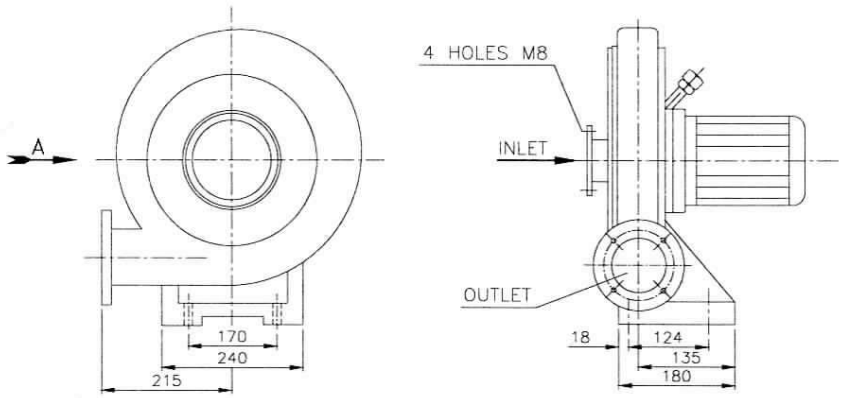
INLET AND OUTLET

CONNECTION NB100
OUT SIDE DIA 165
BOLT CIRCLE DIA 139

VAR. 01

हस्ताक्षर एवं दिनांक SIGN & DATE					
सामग्री सूची संख्या INVENTORY NO.	REV. NO.		निर्माणकर्ता WORKED BY	V. RAWAT	22/09/15
P. 5185	06		जांचकर्ता CHECKED BY	P.KUMAR	22/9/15

ANNEXURE-4



INLET AND OUTLET

CONNECTION NB100
OUT SIDE DIA 165
BOLT CIRCLE DIA 139

VAR.02