SPECIFICATION FOR TECHNICAL DELIVERY CONDITIONS FOR SCANNER AIR FANS

1. The specification Contains :
   Part I - TDC for Scanner air fans.
   Part II A - Vendor check list
   Part II B - Special contract requirements.
2. If the requirement of part II B is differing with part I. The requirement of part II B will be mandatory.
   Vendor should fill up the Part II after studying Part I and submit along with offer.
3. Vendor offer is liable to be rejected if part II is not filled up and submitted with offer or incomplete submission.
4. Vendor should fill up the Part I datasheet if any after placement of order and submit for approval.

PREPARED BY:	CHECKED BY:	APPROVED BY :	DATE:
K.B.Choudhury	S.K.Santhanam	K.P.A.Jaffer Ali	30.04.1997

REV No.	DETAILS	REVISED BY	APPROVED BY	DATE

PART - I: TECHNICAL DELIVERY CONDITIONS FOR SCANNER AIR FANS

1.0 **SCOPE** This technical delivery conditions specifies the design, construction and testing requirements of centrifugal fans.

2.0 **APPLICABLE STDS:** BS 848 part I: methods of testing performance, IS 4894: specification for centrifugal fans. ISO 1940: balance quality of rotating rigid bodies. In case of any information not specified in the TDC the above standards will be binding.

3.0 **DESIGN AND CONSTRUCTIONAL REQUIREMENTS:**

3.1 TYPE: Radial, backward curved blade type; directly coupled to the motor and mounted on a common frame; designed for continuous duty. Fan will be mounted on ground or on structural floor as indicated in the vendor enquiry datasheet.

3.2 FAN SUCTION: Shall be side axial with transition piece.

3.3 FAN DISCHARGE: Shall be vertically upwards with transition piece.

3.4 The transition pieces shall be less than 500 mm length. The taper angle shall not exceed 15 degrees to give smooth transition. The suction and discharge ends shall be provided with flanges and counter flanges to match with the pipe sizes specified.

3.5 FAN REGULATION:

Flow and pressure are regulated by inlet and outlet dampers arranged by purchaser, if necessary.

3.6 MOTOR CAPACITY:

Shall be 20% more than the BHP required by the fan. Motor shall be of reputed make and conform to the attached LT motor specification.

3.6.1 The starting current of the motor shall not exceed the value indicated in the LT motor specification when started with fan inlet and outlet dampers fully open.

3.6.2 The starting time for the fan assy. to reach the full load current shall not exceed the value indicated in LT motor specification, when input/output dampers are open.

3.7 FAN IMPELLER:

The fan impeller shall be directly mounted on the shaft with the impeller hub keyed to the shaft and axially bolted to motor shaft to prevent axial movement of impeller. The material shall be IS 2002 or better & thickness of impeller shroud shall not be less than 3 mm. The shaft shall be fully enclosed in the impeller hub. RPM shall be as required to the Vendor checklist.

3.8 CASING:

Shall be of single construction suitably stiffened for minimum vibration. Inspection door and drain plug shall be provided. Efficient clearance shall be given between impeller and suction mouth. A stainless steel flow direction arrow plate shall be fixed permanently on the casing. Minimum casing thickness shall be 3 mm.

3.9 The static and dynamic balancing tests shall be done as per ISO 1940. The residual balance shall be limited to the group C 6.3 of ISO-1940. The ωe shall be less than 6.3 mm/e, where e = permissible residual unbalance and ω is the angular velocity. The above testing shall be made with all the vibration pads mounted under the frame.

3.10 Necessary vibration pads with bolts shall be provided in case of fans to be mounted on steel structure. In case of ground mounted fans necessary foundation bolts, nuts and washers shall be provided.

3.11 The bearings shall be provided with facility for greasing.

PART - I: TECHNICAL DELIVERY CONDITIONS FOR SCANNER AIR FANS

4.0 INSPECTION AND TESTING:

All fans to be inspected by the purchaser at the manufacturer's works for its constructional and dimensional details. The following tests are to be done by the manufacturers witnessed by purchaser.

4.1 Performance test on one fan in each type as per BS 848 part I or IS 4894/1968. However the tolerance on pressure, capacity and power absorbed shall be as per BS 848 part I class C only.
The following is the variations permitted when tested at rated pressure:
Inlet volume of flow - 7.5%
Power input + 15%

4.2 Vibration measurement, when mounted on vibration isolation pads.

4.3 Continuous running test for 4 Hrs. (Temperature rise on bearings)

4.4 Starting current when started with no inlet and outlet dampers or the inlet and outlet dampers completely open.

4.5 Starting time.

4.6 MPI / LPI test for all impeller welds.
MPI / LPI shaft < 2.5″ & UT for ≥2.5 ″

5.0 Documents shall be supplied in triplicate of the following:

5.1 The filled in technical data sheet:

5.2 Fan operating characteristics.

5.3 Assy. Drg. of motor and fan with transition piece, foundation details and materiel specifications.

5.4 Test certificates as mentioned under section 4.

5.5 Erection, operating and instruction manuals with trouble shooting guide & spares identification drawings.

5.6 Material test certificates for impeller and shaft.

5.7 Test certificates and characteristics as called for under LT motor specification.

6.0 GUARANTEE:

The equipment shall be guaranteed against manufacturing defects.
The performance guarantee shall be for a period of 12 months from the date of commissioning or 18 months from the date of delivery of equipment which ever earlier.

7.0 PAINTING:

Casing, impeller are Epoxy paint to system II
Bearings, shaft, parts with running clearances are rust preventive oil.

8.0 PACKING:

8.1 The fan & motor shall be packed in assembled condition. All components shall be identifiable with Packing lists with BHEL material codes mentioned.

8.2 All opening shall be covered with blanks and the total assembly is to be covered with rain proof sheet to Avoid water entry in motor winding and fan and packed firmly in wooden box.

9.0 ENCLOSURES:

1. Vendor check list for the fan.
2. LT Motor specification.

TECHNICAL DATA SHEET FOR CENTRIFUGAL FAN

1.TYPE :		RADIAL, BACKWARD CURVED BLADE, SINGLE SUCTION		
2.MAKE & MODEL No.		DUTY : CONTINUOUS		
3.MOUNTING		ON STRUCTURAL STEEL FLOOR		
4.MEDIUM TO BE HANDLED		DUST LADEN AIR		
5. MAX. DUST CONCENTRATION	mg/ cum	300		
6.AMBIENT CONDITION	mm Hg/ ^{0}C	760 mm Hg & 50	AIR DENSITY: 1.09 kg/cu.m	
7.OPERATING CONDITIONS		NORMAL	TEST BLOCK	
7.1 CAPACITY :	Cum/ Hr	4000		
7.2 PRESSURE DEVELOPED :	mmwc	250		
7.3 AIR TEMPERATURE :	^{0}C	50		
7.4 SUCTION PRESSURE :	mmwc	0 to 260		
7.5 POWER CONSUMPTION :	kW			
7.6 FAN SPEED :	Rpm	3000		
7.7 DIRECTION OF ROTATION :		CLOCK / ANTI CLOCKWISE SEEN FROM DRIVE END		
7.8 FAN MOVEMENT OF INERTIA (GD^2) :	Kgm^2			
7.9 FAN STARTING TORQUE :	Kgm			
7.10 FAN FULL LOAD TORQUE :	Kgm			
7.11 EFFICIENCY OF FAN : STATIC/TOTAL %				
7.12 MOTOR RATING :		KW, 415V AC, 3Ø, 50Hz	KW, 220V DC	
7.13 MAKE / FRAME SIZE:				
7.14 MOTOR DATA SHEET No.				
7.15 FAN STARTING TIME:				
7.16 FIRST CRITICAL SPEED :	Rpm	> 150% OF NORMAL SPEED		
7.17 VIBRATION LEVEL AT CASING:				
7.18 NOISE LEVEL :	dB	< 85 AT 1 M DISTANCE		
8.0 CONSTRUCTIONAL DETAILS :		MATERIAL	SIZE	
8.1 SPIRAL CASING SIDE WALL ;				
8.2 SPIRAL CASING PERIPHERAL WALL ;				
8.3 IMPELLER BLADE :				
8.4 IMPELLER BACK PLATE:				
8.5 IMPELLER COVER PLATE:				
8.6 IMPELLER HUB :				
8.7 SHAFT :				
8.8 BEARING MAKE & TYPE No. :				
8.9 SEAL TYPE :				
8.10 VIBRATION PADS PROVIDED :		YES / NO	NOS OFF / ASSY.	
8.11 BALANCING : STATIC & DYNAMIC BALANCED TO		C 6.3 OF ISO: 1940		
8.12 BASE FRAME PROVIDED :		YES / NO		
8.13 WEIGHT PER ASSY. :	Kg			
8.14 SUPPLIERS DRG No.:				
9.0 LUBRICANT TO BE USED :				
9.1 FREQUENCY OF LUB. & QTY. :				
10.0 O & M MANUAL REFERENCE:				
11.1 FAN INLET TRANSITION PIECE TO MATCH PIPE		OD X T : 323.9 X 6.4 mm		
11.2 FAN OUTLET TRANSITION PIECE TO MATCH PIPE		OD X T : 323.9 X 6.4 mm		

PREPARED BY (VENDOR)		DATE	APPROVED BY (BHEL)		DATE

PART - II: VENDOR CHECK LIST FOR CENTRIFUGAL FANS

BHEL MATERIAL CODE: L143014320001001 – 008 **ENQUIRY No.:**

IIA	BHEL SPECIFICATION		VENDOR CONFIRMATION	
1.Type	Radial, backward curved blade/Single Suction.			
2.Make & Model no.	Vendor to state			
3. Applicable Std	BS: 848 / IS: 4894 / ISO :1940			
4. Suction / Discharge	Side duct / Vertical Duct			
4.1 Fan recirculation	By inlet / outlet dampers			
4.2 Transition piece for	Inlet / outlet			
5.Duty	Continuous			
6. Mounting	On structured steel floor			
7. Medium to be handed	Dust laden air			
8. Max.Dust concentration	300 Mg/Cum			
9. Ambient condition	760 mm Hg and 50 ^{0}C, Air Density : 1.09 kg/m^3			
10. Operating conditions	Normal	Test Block	Normal	Test Block
10.1 Capacity	4000 Cum/HR	Cum/HR	Cum/HR	Cum/HR
10.2 Pressure developed	250 mmWC	mmWC	mmWC	mmWC
10.3 Air Temperature	50 ^{o}C	^{o} C	^{o} C	^{o} C
10.4 Suction Pressure	0 to 260 mmWC	mmWC	mmWC	mmWC
10.5 Power Consumption	KW	KW	KW	KW
10.6 Fan Speed	3000 RPM			
10.7 Direction of Rotation	Clock/Anticlock wise seen from drive end			
10.8 Fan moment of inertia	Kgm^2 Vendor to provide			
10.9 Fan Starting Torque	Kgm - Vendor to provide			
10.10 Fan Full load Torque	Kgm - Vendor to provide			
10.11 Efficiency of Fan	% - Vendor to provide			
10.12 Motor Rating	KW, - Vendor to provide			
(Min.120% of Clause 10.5)	415 Volts AC, 3 Φ, 50 Hz			
	220 Volts DC			
10.13 First Critical speed	RPM > 150% of normal speed			
10.14 Vibration level at casing	< 4.5 mm/sec as per ISO 10816			
10.15 Noise level	dB < 85 at 1 M distance			
11.0 Constructional Details	Materials	Size	Materials	Size
11.1 Spiral Casing side wall		min. 3.0 mm		
11.2 Spiral casing peripheral wall		min. 3.0 mm		
11.3 Impeller Blade		min. 3.0 mm		
11.4 Impeller Cover plate		min. 5.0 mm		
11.5 Impeller Shroud		min.3.0 mm		
11.6 Impeller Hub				
11.7 Transition piece	IS 2062	min. 6 mm		
11.8 Bearing Make & Type No.	Vendor to provide			

BHEL			**VENDOR**		
PREPARED	APPROVED	DATE	PREPARED	APPROVED	DATE
Sairam N	Gangadhar MCHS	10.6.19			

PART - II VENDOR CHECK LIST FOR CENTRIFUGAL FANS

BHEL MATERIAL CODE: L143014320001001 – 008 **ENQUIRY No.:**

IIA	BHEL REQUIREMENTS		VENDOR CONFIRMATION
11.9 Seal Type	Vendor to provide		
11.10 Vibration Pads Provided	Yes / No	Nos Off / Assy	
11.11 Balancing	C 6.3 ISO : 1940		
11.12 Base frame Provided	Yes	No	
11.13 Weight per Assy.	Kg		
11.14 Suppliers Drg. No.	Vendor to provide		
12.0 Lubricant to be Used	Vendor to provide		
12.1 Frequency of Lub. & Qty.	Vendor to provide		
13.0 Inspection & Testing	Performance test		
	Vibration test		
	Running test		
14.0 Painting	As required in spec.		
15.0 Packing	As required in spec.		
16. LT motor Spec.			
17.0 Documents	As required in spec.		
18.0 Guarantee	As required in spec.		

IIB	SPECIAL CONTRACT REQUIREMENT, IF ANY	
	- Inlet & Outlet transition shall match OD 323.9 X 6.4 mm thick. - Inlet and outlet ends of the fan shall be provided with flanges and counter-flanges along with necessary fasteners. (USE AN ANNEXURE IF THIS SPACE IS INADEQUATE)	

BHEL			**VENDOR**		
PREPARED	APPROVED	DATE	PREPARED	APPROVED	DATE
Sairam N	Gangadhar MCHS	10.6.19			

BHARAT HEAVY ELECTRICALS LIMITED

HIGH PRESSURE BOILER PLANT, TIRUCHIRAPALLI-620 014

CONTROLS & INSTRUMENTATION/FB

TECHNICAL SPECIFICATION OF

LT AC MOTORS (SAFE AREA)

SPECIFICATION REFERENCE – TCI : 140, Rev. 13

Revision History

Rev. No.	Date	Description	Prepared & Reviewed	Approved
01 -12		Earlier Revisions	-Sd-	-Sd-
13	05-03-22	General Revisit	M. Muruga Jothi	D. Kavitha 8/3/2022

Sl. No.	Description	Requirement
1	Site Conditions :-	
	Altitude above MSL	500 meters
	Ambient temperature	50° C
	Relative Humidity	100 %
	Atmosphere	Tropical, dusty, salty, corrosive and highly polluted environment.
2	Motor type	Squirrel cage type induction motor suitable for direct on line starting through any type of breaker.
3	Applicable Standards	IS-325, IS 12615, IS/IEC-60034, IS-12065, IS-12075, IS 15999, IS/IEC-60529, IS 4029, IS-1231, IS-6362, IS-2253. (Latest version of relevant standards shall be referred).
4	Type of Enclosure and degree of protection	Totally Enclosed Fan Cooled (TEFC), IP-55 as per IS/IEC-60529
5	Duty Cycle	Continuous, S1
6	Energy Efficiency Class	IE2/IE-3 as per IS-12615/IEC 60034-30. Refer project specific transmittal furnished along with enquiry for applicable energy efficiency class.
7	Rated Voltage & Tolerance	415 V AC, 3 Phase, ± 10 %.
8	Rated Frequency & Tolerance	50 Hz, ± 5 %
9	Combined voltage & frequency tolerance	10 % (absolute sum)
10	General Requirements	a. All motors shall be so designed that maximum inrush currents, locked rotor and pull out torque, developed at the extreme voltage and frequency variations do not endanger the motor and driven equipment. b. Motor shall be designed to keep the torsional and rotational natural frequencies of vibration, at least 25 percent above the motor rated speed ranges to avoid resonant vibration over the operating speed range of the motor and driven equipment.

Sl. No.	Description	Requirement
		c. Maximum continuous rating (MCR) of the motor shall have at least 15 % margin over the maximum load demand of the driven equipment including voltage and frequency variation. (Applicable only if vendor supplies motor along with the driven equipment or load).
11	Torque requirements	Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% of motor full load torque. Pull Out torque at rated voltage shall not be less than 205 % of full load torque.
12	Requirements during Starting & Running	• Motor shall start with rated load and accelerate to full speed with 80 % rated voltage at motor terminals • The motor shall be capable of withstanding the stresses imposed if started at 110 % rated voltage. • The motor shall be capable of operating satisfactorily at full load for 5 minutes without injurious heating with 75 % rated voltage at motor terminals.
13	Momentary Overload withstanding capability	The motor shall be designed to withstand momentary over-load of 60% of full load torque for 15 seconds without any damage.
14	Momentary Over speed Withstanding capability	The motor shall be designed to withstand 120 % of rated speed for 2 minutes without any mechanical damage.
15	Hot thermal withstand curve	Margin of at least 10% over the full load current
16	Class of Insulation	Class-F insulation with temperature rise limited to Class-B. Temperature rise of the motor shall be limited to 70° C (by resistance method) over an ambient temperature of 50° C.
17	Stress withstanding capability during Bus Transfer	The motor may be subjected to sudden application of 150 % rated voltage during bus transfer, due to the phase difference between the incoming voltage and motor residual voltage.
18	Capacity to restart for rated voltage	a. Two successive starts from cold condition. b. Three equally spread starts per hour. c. Two hot starts in succession, with motor initially running at normal temperature.

Sl. No.	Description	Requirement
19	Starting Current	The starting current (% of FLC) shall be limited as per the standard IS-12615.
20	Locked Rotor Condition	The ratio of Locked Rotor KVA at rated voltage to rated KW shall not exceed as indicated below (without any further tolerance) For Motor rating from 50 KW and up to 110 KW: 11
21	Locked Rotor with-stand time	For motor with starting time up to 20 seconds at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 seconds more than starting time.
		For motor with starting time more than 20 seconds but not exceeding 45 seconds at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 seconds more than the starting time.
		For motor with starting time more than 45 seconds at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be 10% more than the starting time
		Vendor to provide Speed switches mounted on the motor shaft in case the above requirement is not met with.
22	Type of balancing of rotor	Dynamic balancing
23	Method of cooling	IC-0411 as per IS-6362
24	Direction of cooling air flow	NDE side to DE Side
25	Winding wire	Enameled Copper Wire, Grade-2, as per IS-13730, Part-3. Windings shall be non-hygroscopic, oil resistant and flame resistant.
26	Treatment on Winding Insulation	Winding Insulation shall be given tropical and fungicidal treatment for operation of motor in hot, humid & tropical climate.

Sl. No.	Description	Requirement
27	Bearing	Deep Groove Ball Bearing or Roller bearing as per the motor design, properly sealed to protect against the ingress of dust and water. Lubrication : Grease.
28	Noise level	Noise level shall be limited to 85 dB at 1 meter distance.
29	Vibration level	The peak amplitude of vibration shall be as per IS-12075 (Limits of Severity-Normal grade shall be followed).
30	Shaft extension	Motor shall be provided with key slotted bare shaft extension, with key at the drive end.
31	Terminal box	Weather proof terminal box shall be provided. The terminal box shall be capable of being turned through 360° in steps of 180° or 90°. Shall meet IP 55 protection class requirements as per IS 60529. Minimum Distance between center of the terminal stud & the gland plate and Minimum inter-phase/phase-earth air clearance shall be provided as per IS/IEC standards. Refer Project Specific transmittal for project specific requirements of dimensions. Terminal box shall have adequate space to terminate the Power cable applicable to the motor by using suitable lugs. Connection diagram shall be marked inside the terminal box. The terminal box shall be capable of withstanding a fault level of 50 kA rms for 1 second (Voltage : 415 V) at the terminals.
32	Cable Entries, Cable Glands & Lugs	Cable entries, Cable glands and Lugs shall be provided suitable for the power cable size, which will be indicated after PO placement during datasheet approval. Tentative sizes are indicated in the project specific transmittal. Double Compression type, brass with nickel plated, weather proof cable glands shall be provided – Quantity to be matched with the number of entries. 6 Nos. of Tinned Copper Lugs shall be provided.
33	Terminals	Separate Terminals for Space heaters and Windings with suitable connecting links shall be supplied.

Sl. No.	Description	Requirement
34	Earthing provisions	Earthing provisions shall be provided on motor body (2 nos. at opposite locations) and in terminal boxes as per the standard.
35	Space heater for motors rated 30 KW and above	Separate space heater suitable for 240 V AC, Single Phase supply shall be provided.
36	Lifting device	Eye bolt.
37	Project specific requirements	Vendor to take care of the project specific requirements indicated in the annexure - “Project specific transmittal”.
38	Name Plates	Motor shall have name plate as per relevant IS and in addition, Manufacture’s name, frame size, Energy Efficiency class, Insulation class, Bearing details, year of manufacture shall also be indicated.
39	Type test reports	Type test reports shall be produced for the following tests as per the requirements spelt in the standards, • Measurement of resistance of windings of stator. • No load test at rated voltage to determine input current power and speed • Full load test to determine efficiency, power factor and slip. • Temperature rise test. • Momentary excess torque test. • High voltage test. • Test for vibration severity of motor. • Test for noise levels of motor. • Test for degree of protection. • Over speed test. • Energy Efficiency test. In case the vendor is not able to submit report of the type test(s) conducted within last 5 years from the date of bid opening, or in case the type test report(s) are not found to be meeting the specification requirements, the vendor shall conduct all such tests either in an independent laboratory or at manufacturer’s works in presence of Owner’s representative under this contract, free of cost to the Owner and submit the reports for approval.

Sl. No.	Description	Requirement
40	Confirmation and Documents to be submitted by the vendor, during Purchase Enquiry.	Vendor to indicate the references of the technical specification, project specific annexure and indicate "No Deviation" in the Sub-Delivery Enquiry deviation form. Any deviation shall only be indicated in the Sub-Delivery Enquiry deviation form. Deviations indicated elsewhere in the offer will not be considered.
41	Documents to be submitted by the vendor for approval by BHEL/Customer, after placement of purchase order.	3 Sets of the following: - a. Final technical Data sheet as per the format submitted by BHEL. b. Motor GA drawing indicating details of foundation, shaft dimensions and terminal box arrangement with complete dimensions. c. Motor Characteristic curves (Torque Vs. Speed, Current Vs. Speed, Speed Vs. time, Current Vs. time, Efficiency and PF Vs. load, Thermal withstand characteristic) d. O & M manuals.
42	Packing	The packing shall be suitable for safe transport, safe delivery at site and shall avoid damages due to environmental conditions during storage at site.
43	Painting	Paint shade shall be as per the purchase enquiry. The finish shall be corrosion resistant, epoxy based paint.

Taking care of the above indicated technical requirements in full, vendor to submit Sub-delivery enquiry deviation (SDED) format sent along with the purchase enquiry, without any deviations. Any deviation/clarification in the technical requirements has to be indicated only in the SDED format. Other than the SDED format, hidden deviations indicated elsewhere in the offer will not be considered.

BHARAT HEAVY ELECTRICALS LIMITED

HIGH PRESSURE BOILER PLANT, TIRUCHIRAPALLI-620 014

CONTROLS & INSTRUMENTATION/FB

TECHNICAL SPECIFICATION FOR DC MOTORS (NON FLAME PROOF)

SPECIFICATION REFERENCE – TDC: 223/DC MOTOR

Revision History

Rev. No.	Date	Description	Prepared	Reviewed	Approved
05	12-06-2019	Initial revision	-Sd-	-sd-	-sd-

Sl. No.	Characteristics	Requirement
1	Site Conditions :-	
	Altitude above MSL	50 metre
	Ambient temperature	50° C
	Relative Humidity	100 %
	Atmosphere	Tropical, dusty, salty, corrosive and highly polluted
2	General Description	DC Shunt Motor. Maximum continuous rating (MCR) shall have at least 10 % margin over maximum load demand including voltage variation, temperature rise and other variations.
3	Applicable Standards	IEC-60034 (part 1,2,5,6,7,8,9,11,14,30), IEC 60072, IEC-60079, IEC-60529 etc. (Latest version of relevant standards shall be referred). For all the requirements, international standards IEC/ISO shall be followed.
4	Application	Scanner Air fan
5	Constructional Features	Poles and armature shall have fully laminated construction with low loss silicon steel sheet. Yoke shall be made of cast steel or thick rolled steel plates and shaft shall be forged from special high tensile steel (Solid Yoke).
6	Brushes	a) The brushes shall be of graphite of high quality and the pressure on the brush shall be adjustable, if necessary b) The brush holder shall be of non-ferrous material and constructed to maintain constant pressure, regardless of wear and tear and to ensure sparkless commutation at top speeds and during over load. c) Provision shall be made available for maintenance of brushes. d) Motor shall have double shaft extension for mounting brakes and tachometers on the non- driving end.
7	Duty Cycle	Continuous, S1
8	Rated Voltage & Tolerance	220V DC -15% to +10%
9	Method of motor starting	3 step resistance cutting method is adopted for motor starting. The external resistors are placed in series to the armature resistance and are cut off in steps through control circuit. Starter Box will be supplied by BHEL. AS per the fan starting time, vendor to calculate the starting resistance values and shall furnish to BHEL.
10	Capacity to restart	3 starts spread over an hour and 2 consecutive hot starts

Sl. No.	Characteristics	Requirement
11	Type of balancing of rotor	Dynamic balancing
12	Enclosure protection & Method of cooling	IP 55 as per IEC 60529 and IC-0411 as per IEC 60034 - 6
13	Direction of cooling air	NDE side to DE Side
14	Winding wire	Enameled Copper Wire, Grade-2, as per IEC 60317. Windings shall be non-hygroscopic, oil resistant and flame resistant.
15	Winding Treatment	Winding Insulation shall be given tropical and fungicidal treatment for operation of motor in hot, humid & tropical climate.
16	Class of Insulation	Class-F insulation with temperature rise limited to Class-B. Temperature rise of the motor shall be limited to 70° C (by resistance method) over an ambient temperature.
17	Starting Current	180% of Full Load Current.
18	Shaft extension	Motor shall be provided with key slotted bare shaft extension with key at the drive end
19	Terminal box	Weather proof IP 55 as per IEC-60529, capable of being turned through 360° in steps of 90°.
20	Size of Terminal box	Size of Terminal box shall have adequate space which shall be suitable to terminate the Power cable applicable to the motor by using the suitable crimping lugs. The power cable size is indicated in project specific transmittal.
21	Terminals	Separate Terminals for Windings and Space heaters. Stud type terminals with plain washers, spring washers & check nuts Solder type/Crimping type Crimping lugs shall also be supplied for connecting the power cable and cable for space heaters, if applicable.
22	Earthing terminals	1 Number External and 1 Number inside the terminal box
23	Lifting device	Eye bolt
24	Noise level	Noise level shall be limited to 85 dB at 1 metre distance as per IEC 60034 - 9.
25	Vibration level	The peak amplitude of vibration shall be as per IEC 60034 - 14 (Limits of Severity-Normal grade shall be followed).
26	Over speed	a) 20% above rated maximum field working speed in both direction of rotation without any mechanical damage to the rotor. b) Provision shall be available for measuring the speed of motor, while the motor is running.

Sl. No.	Characteristics	Requirement
27	Painting	Paint shade shall be as per the purchase enquiry. The finish shall be corrosion resistant, epoxy based paint.
28	Inspection & Testing	Motors up to 30 KW- Inspection by Vendor meeting IEC standard requirements, as applicable. Routine & type test reports shall be submitted for review and acceptance by BHEL. In case the vendor is not able to submit report of the type test(s) conducted within last 5 years from the date of bid opening, or in case the type test report(s) are not found to be meeting the specification requirements, the vendor shall conduct all such tests either in an independent laboratory or at manufacturer's works in presence of Owner's representative under this contract free of cost to the Owner and submit the reports for approval.
29	Documents (along with offer)	a. Vendor to indicate the references of technical specification and project specific annexure and indicate "No Deviation" in the Sub-delivery Enquiry deviation form. Any deviation shall only be indicated in the Sub-delivery Enquiry deviation form. Deviations indicated elsewhere in the offer shall not considered. b. Motor GA drawing indicating foundation, shaft details and terminal box arrangement with complete dimensions.
30	Documents for approval by BHEL/Customer (after placement of purchase order)	a. Final technical Data sheet as per the format submitted by BHEL. b. Motor GA drawing indicating foundation, shaft details and terminal box arrangement with complete dimensions. c. Motor Characteristic curves (Torque Vs. Speed, Current Vs. Speed, Speed Vs. time, Current Vs. time, Efficiency and PF Vs. load, Thermal withstand characteristic) d. O & M manuals
31	Packing	The packing shall be as per manufacturers standard meeting the Transport, environment and Storage hazards

Note :-

Vendor to indicate "Yes" or "Confirmed" in the Vendor's Compliance column for all the clauses and submit along with the offer.

Controls & Instrumentation/Fossil Boilers
Project Specific Transmittal for LT AC motors and DC motors

Ref. : TR:LT AC-DC MOTOR:1430 - 1431

Project Details:

Project/Rating : IEL Jamshedpur
Customer Number : 1430 - 1431

Project Specific Features: -

The following project specific features have to be referred along with the technical specification of the motors. Applicable requirements in the following project specific list, will supersede the respective clauses of the technical specification

- Motor shall be suitable for working for variations in the power supply voltage (415 V) and frequency as follows,
  - Terminal voltage variation within +10 to -15%.
  - Frequency variation + 6%.
- Hot thermal withstand curve shall have a margin of at least 10% over the full load current of the motor to permit relay setting utilising motor rated capacity.
- Energy efficient level: IE3 as per IS 12615 – 2018 (For LT AC Motors)
- For Motors up to 75 KW rating, it shall be suitable for, Atleast four (4) cold starts or three (3) hot starts equally spread over an hour.
- Salient Constructional Features:
  Shall be of Grey iron casting as per IS:210 with integrally cast motor feet with the stator. The motor body shall be designed to prevent breakage or other failures due to vibrations normally encountered in heavy industries, having weather proof construction, suitable for operating in the humid atmosphere and having drain plugs. Form of construction in IM designation shall be IM 1001 or IM 1002 based on mounting of accessories. Normally, horizontal foot mounting is preferred with standard shaft.
- Paint Shade: Light grey shade 631 as per IS: 5 or RAL 7030 (grey).

Table - 1, Power cable size for LT AC motors: -

Vendor to provide the cable entry and supply cable-glands, lugs as per the technical specification requirement and suitable for the power cable sizes as indicated below. The cable sizes indicated below are tentative. The actual power cable size based on the run length will be intimated during technical evaluation stage.

Sl. No.	From (KW)	To (KW)	Power Cable size in sq. mm. (#)
1.	0.01	3.70	3C-2.5mm^2(CU)
2.	3.8	11	3C-10mm^2(AL)/ 3C-25mm^2(AL)

3.	11.1	22	3C-25mm^2(AL)/ 3C-50mm^2(AL)

Table-2 Applicable for LT AC motors :-

Minimum inter-phase and phase-earth air clearance for LT AC motors with lugs installed shall be as follow

Sl. No.	Motor MCR in KW	Clearance (in mm)
1	Up to 110 KW	10

Table-3 (Power cable size for DC motors) :-

Vendor to provide the cable entry and supply cable-glands, lugs as per the technical specification requirement and suitable for the power cable sizes as indicated below. The cable sizes indicated below are tentative. The actual power cable size based on the run length will be intimated during technical evaluation stage.

Sl. No.	Full Load current (Amp)	Power Cable, Armoured, Aluminium Conductor
1.	16 - 35	2C-50mm^2 (AL)
2.	35 - 50	2C-95mm^2 (AL)
3.	63 - 100	2R-2C-95mm^2 (AL)

STANDARD QUALITY PLAN FOR SCANNER AIR FANS WITH ACCESSORIES

Prepared By **Quality Assurance**	ABDUR RAHMAN SULTAN	11.05.2016

Reviewed by	Signature
Quality Assurance (VENKANNA RUPANI)	11/05/2016
Engineering (M. THANDAPANI)	11/05/16.
Materials Management / BOI (P.R. SOWMYA)	11/05/16
Quality Control (R. DHARMAR)	11/05/16

Rev No	Date	Approved by	Signature
00	11/05/2016	AGM / QA & BE	11/05/16

Record of Revisions

Rev No	Details of Revision	Remarks
00	Fresh Issue	

MANUFACTURER'S NAME & ADDRESS: BHEL: TIRUCHIRAPPALLI APPROVED SUPPLIERS	**STANDARD QUALITY PLAN** **PRODUCT: SCANNER AIR FANS WITH ACCESSORIES** **SUB-SYSTEM : Steam Generator and Auxiliaries**	**QWI NO:SQP:SD:16** **REV NO: 00 DATE: 11/05/2016** **PAGE: 2 OF 4**

SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
											M	C	N	
1	2	3	4	5	M	C/N	7	8	9	D*	** 10			11
1.0	**RAW MATERIALS**													
1.1	Raw material sheets / Plates for casing & Impeller	Chemical, Mech. Properties surface defect.	A	TC Review & Visual	Sample/Heat test 100%		BHEL Approved Drawing	BHEL Approved Drawing	MTC	√	P	V	V	See note-1
1.2	Hub	Chemical, Mech. Properties	A	TC Review	Sample/Heat test		BHEL Approved Drawing	BHEL Approved Drawing	MTC	√	P	V	V	See note-2
		Internal soundness	A	UT*	100%		ASME V /ASTM A388 Freq. 2-4MHz	See note-3	MTC/IR	√	P	V	V	*For dia. more than 40mm
1.3	AC motor / DC motor	MAKE/TYPE/ RATING	A	TC Review	100%		BHEL Approved Drawing / Datasheet	BHEL Approved Datasheet	MTC	√	P	V	V	
		Routine test	A	Measurement	See note-4		IS:325-1996/ IS:4722-2001	IS:325-1996/ IS:4722-2001	MTC	√	W*	V	V	*See Note-10
2.0	**INPROCESS CONTROLS**													
2.1	Welding Qualifications	Procedures Qualification	B	Review of Documents	100%		ASME Sec IX / AWS D 1.1		WPS & PQR	√	P	V	V	See Note-5
		Personnel Qualification	B						WQR	√	P	V	V	
2.2	Casing Fabrication Welding	Dimensional conformity	B	Measurement	100%		BHEL Approved Drawing		Log		P	-	-	
		Surface defects	B	Visual	100%		No defects	See note-6	Log		P	-	-	
		Surface quality	B	NDE-LPI	20%		ASME-E-165	No defects*	IR	√	P	V	V	*See note-6
2.3	Impeller Fabrication Welding	Dimensional conformity	B	Measurement	100%		Manufacturer's drawing		Log		P	-	-	
		Surface defects	B	Visual	100%		No defects	See note-6	Log	√	P	V	-	
		Surface quality	B	NDE-LPI	20%		ASME-E-165	No defects*	IR	√	P	V	V	*See note-6
	Machining of HUB	Dimensional	B	Measurement	100%		Manufacturer's drawing		Log		P	-	-	
2.4	Static & Dynamic balancing of impeller	Amount of unbalancing	A	Balancing	100%		ISO: 1940-1	ISO: 1940 Balancing GR.6.3	IR	√	P	W	V	
2.5	Assembly	Completeness dimensional	B	Visual Measurement	100%		BHEL Approved Drawing		IR	√	P	V	V	

LEGEND: * RECORDS IDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY INCLUDED BY THE SUPPLIER IN QA DOCUMENTATION;
**** M:** MANUFACTURER, **C:** BHEL QC/BHEL AIA, **N**: CUSTOMER; **P:** PERFORM. **W**: WITNESS, **V:** VERIFICATION; **CLASS** : A - CRITICAL ; B - MAJOR ; C – MINOR;
MTC- Manufacturer's Test Certificate; IR- Inspection/Test Report; COC: Certificate of Compliance; (R): Routine test; (T)/(Ts): Type test.

बी एच ई एल BHEL	MANUFACTURER'S NAME & ADDRESS: BHEL: TIRUCHIRAPPALLI APPROVED SUPPLIERS	STANDARD QUALITY PLAN PRODUCT: SCANNER AIR FANS WITH ACCESSORIES SUB-SYSTEM : Steam Generator and Auxiliaries	QWI NO:SQP:SD:16 REV NO: 00 DATE: 11/05/2016 PAGE: 3 OF 4

SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
											M	C	N	
1	2	3	4	5	M	C/N	7	8	9	D*	** 10			11
3.0	**Final Inspection: - See Note 11.**													
3.1	Fan Assembly	1. Performance test 2. Capacity, S.P., 3. Power consumption, 4. Speed, 5. Efficiency, 6. Bearing temp rise (For 8 hr. or till establishing the bearing temp.)	A	Performance Test for each size & type of fan (See note-7) (See note-8)	1 unit of each size/ type		BHEL Approved Drawing / IS: 4894-1987 BHEL Appd. Data sheet	BHEL Approved Drawing & Tolerance as per IS: 4894-1987/ BHEL Appd. Data sheet	IR*	√	P	W	V	*Performance test result with curve.
		7.Run test a) Vibration b) Noise level c) Current Drawn	B	Routine test	100%			a) 6.3 mm/sec (Max) b) 85 dBA (Max) at 1.0 Mtr. Dist. c) BHEL Appd datasheet	IR	√	P	W	V	
3.2	Other Accessories like transition pieces, anti-vibration pads, foundation/ fixing bolts, vibration isolators, etc.	Surface Finish & Dimensional	B	Visual & Measurement	100%		BHEL Approved Drawing		IR	√	P	W	V	
3.3	Surface Preparation & Protection	Cleaning & Painting-Color & Shade, DFT	B	Visual & Measurement	100%		One coat of IS:12744 primer & 2 coats of IS 2932 dark admiralty gray total DFT equal to 65 micron (min)		IR	√	P	V	-	
3.4	Marking	Name Plate	B	Visual	100%		BHEL Approved Drawing				P	V	-	
3.5	Packing	Tightness & Stability	B	Visual	100%		BHEL Specn.		Packing Slip		P	V	-	
3.6	Document Review	Verification	B	Review	As noted in Column "D"						P	V	V	

LEGEND: * RECORDS IDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY INCLUDED BY THE SUPPLIER IN QA DOCUMENTATION;
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MTC- Manufacturer's Test Certificate; IR- Inspection/Test Report; COC: Certificate of Compliance; (R): Routine test; (T)/(Ts): Type test.

बी एच ई एल BHEL	MANUFACTURER'S NAME & ADDRESS: BHEL: TIRUCHIRAPPALLI APPROVED SUPPLIERS	**STANDARD QUALITY PLAN** **PRODUCT: SCANNER AIR FANS WITH ACCESSORIES** **SUB-SYSTEM : Steam Generator and Auxiliaries**	**QWI NO:SQP:SD:16** **REV NO: 00 DATE: 11/05/2016** **PAGE: 4 OF 4**

SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
											M	C	N	
1	2	3	4	5	M	C/N	7	8	9	D*	** 10			11

Notes:

1) For Plates/ Sheets, in case Mfr's TC is not available, one sample from plate of each heat shall be tested at approved lab by Vendor & TC shall be submitted to BHEL for review.
2) For Hub, in absence of correlated TC, one sample from each bar shall be tested by Vendor & TC shall be submitted to BHEL for review.
3) The defect echo height more than 20% of FSH when back wall echo initially set to 100% (FSH) in sound area of material shall be unacceptable. Also, fall in back wall echo to less than 80% of FSH when back wall echo initially set to 100% (FSH) shall not be acceptable. For other defects which are acceptable as scanned above.: Total number of defects permissible are five in one meter long & distance between two defects shall not be less than 3 times the dia. of probe.
4) Type test certificate for similar motor rating & frame size from same manufacturer is to be submitted to BHEL for verification.
5) Only qualified welders as per ASME Section IX/AWS D1.1 are engaged and approved consumables are to be used. Records to be shown for verification. WPS shall be approved by BHEL.
6) No defects like pin hole, under cut, linear indication.
7) "AC Motor FAN" shall be tested with actual job motor.
8) "DC Motor FAN" shall be tested with equivalent AC motor.
9) **Motors:**
   a) **For motors less than 30KW:** Acceptance of motor less than 30KW is based on supplier confirming as follows:
   "It is hereby confirmed that the above mentioned motor(s) was /were manufactured taking care of BHEL specific requirements regarding ambient temperature, voltage and frequency variation , hot start, pull out torque, starting KVA / KW, temperature rise, distance between centre of the stud and gland plate, space heater and tested in accordance with approved drawing / data sheet".

   b) **For motors of 30KW and above:** Acceptance of motor rating between 30KW and 50KW is based on BHEL review of routine test inspections. Report as per IS:325 witnessed by supplier with confirmation as follows:
   "It is hereby confirmed that the above mentioned motor(s) was /were manufactured taking care of BHEL specific requirements regarding ambient temperature, voltage and frequency variation , hot start, pull out torque, starting KVA / KW, temperature rise, distance between centre of the stud and gland plate, space heater and tested in accordance with approved drawing / data sheet".
10) **For Customer inspection, if applicable, the stages indicated under Column N shall be followed with specific approval of BHEL/Customer for Witness/Verification by Customer.**

Technical Pre-Qualification Requirement for Scanner Air Fan & Motor assembly.

1. The vendor shall be an established Centrifugal fan (radial backward curved) supplier having adequate Engineering, Manufacturing, testing and servicing facilities for fan and shall furnish technical backup documents in proof of the above requirements.
2. The Scanner Air Fan & Motor assembly offered shall be from the existing regular manufacturing range of the supplier.
3. The vendor shall have experience of having supplied Centrifugal Fan of radial backward curved type with AC/DC motor assembly & shall be capable of handling the dust-laden air, designed for developing head and capacity as per the technical specification for boiler/refinery or application of similar severity. The supplied fan & motor shall be in operation for at least one year as on the date of enquiry.
4. As proof of above pre-qualifying requirement points, vendor should submit :
   a. The product catalogue and general reference list for the fan & motor assembly indicating Application, Capacity, Head, Type of Fan, Customer Name, Purchase order date along with offer.
   b. Minimum ONE end user certificate for the satisfactory operational performance of their supplied Scanner Air Fan & Motor assembly meeting the minimum pre-qualifying requirements stated above.

      OR

      Minimum Two past purchase orders of similar Scanner Air Fan & Motor assembly meeting the minimum pre-qualifying requirements stated above.
   c. Vendor to attach the corresponding data sheets/ technical documents of the Scanner Air Fan & Motor assembly supplied as per P.O / End user certificate (submitted vide point 4.b) for our review.
5. In case of ordering, the Vendor shall have the responsibility for the followings and same to be confirmed point wise.
   i) Vendor should have the component replacement responsibility in case of defect / failure.
   ii) Experts from Vendor's side shall assist in commissioning activities at site, if required.
   iii) Vendor should ensure the product performance during erection & commissioning.

6. DOCUMENT SUBMISSION CHECKLIST FOR THE VENDOR TO MEET PQR

Clause	Documents acceptable	Check list
1	i) ISO or Other third Party certification about the engineering, manufacturing, testing and servicing facilities in the name of supplier/OEM as applicable. The certificate shall be specific for the product quoted by the vendor. (OR) ii) List of manufacturing, testing and servicing facilities available (like machinery/equipment) in the letterhead of supplier/OEM as applicable.	☐
2	Supply reference list with details of PO, PO date, customer name, application severity/type in the form of a table	☐
3	Product Catalogue in the name of supplier/OEM as applicable	☐
4	Min. one end user certificate (or) Two POs in the name of supplier/OEM as applicable	☐
5	Signed copy of this technical PQR document	☐

Vendor signature and seal with Date