PEM :: C&I

STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.:	**PE-QP-999-145-I056**
VOLUME	IIB
SECTION	D
REV. NO.	01 DATE: 22-02-2008
SHEET	5 OF 7

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency $ P	Agency $ W	Agency $ V	Remarks
10.	Panel Wiring	1. Wiring Layout	MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	---	
		2. Wiring Termination (Crimped Lugs)	MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	---	
		3. Ferrule numbers	MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	---	
		4. Colour of wiring	MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	1	
		5. Size of Conductor	MA	Measurement	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	1	
11.	Component Mounting	1. Correct components	MA	Visual	100%	Approved drgs., Specs. & BOM	Approved drgs., Specs. & BOM	Log Book	2	---	---	
		2. Fixing	MA	Visual	100%	Approved drgs., Specs. & BOM	Approved drgs., Specs. & BOM	Log Book	2	---	---	
	FINAL											
12.	Final Inspection	1. Workmanship	MA	Visual	100%	Factory Standard	Factory Standard	Inspection Report	2	1	1	At Random by BHEL, based on 100 % internal test reports by Mfr.
		2. Component layout (neatness, accessibility & safety) Mounting / Proper fixing of all components	MA	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	
		3. Components identification Marking / Name plates	MA	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	

LEGEND: * CR - Critical characteristics; MA - Major characteristics; MI - Minor characteristics

$ P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test.

1 - BHEL; 2 - Vendor; 3 - Sub-vendor

PEM :: C&I

STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.:	**PE-QP-999-145-I056**
VOLUME	IIB
SECTION	D
REV. NO.	01 DATE: 22-02-2008
SHEET	6 OF 7

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency $ P	Agency $ W	Agency $ V	Remarks
		5. Dimensions	MA	Measurement	100%	BHEL approved drg. / Spec., BOM	BHEL approved drg. / Spec., BOM	Inspection Report	2	1	1	At Random by BHEL, based on 100 % internal test reports by Mfr.
		6. Door functioning	MA	Functional	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	
		7. Paint Shade	CR	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	
		8. Paint Thickness	CR	Measurement	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	
		9. Workmanship of Gaskets	MA	Visual	100%	Factory Standard	Factory Standard	Inspection Report	2	1	1	
		10. Wiring Layout	MA	Visual	100%	BHEL approved drg.	BHEL approved drg.	Inspection Report	2	1	1	
		11. Wire Termination	MA	Pulling manually	Sample	-----	Firm termination	Inspection Report	2	1	1	
		12. Continuity	MA	Electrical	100%	-----	Continuity OK	Inspection Report	2	1	1	

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PEM :: C&I

STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.:	**PE-QP-999-145-I056**
VOLUME	IIB
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REV. NO.	01 DATE: 22-02-2008
SHEET	7 OF 7

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency $			Remarks
									P	W	V	
13.	TYPE TEST	Degree of Protection	CR	Mech. Protection	Sample	BHEL approved spec., drg relevant IEC-60947, IEC-60079	BHEL approved spec., drg relevant IEC-60947, IEC-60079	Type Test Certificate	3	---	1	
14	ROUTINE TEST	IR before & after HV Test	CR	Electrical	100%	BHEL approved spec., drg., BOM & relevant standard	BHEL approved spec., drg., BOM & relevant standard	Test Report	2	1	1	
15	FUCTIONAL TEST	1. Control Logic Operation	CR	Electrical	100%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1	
		2. Instrument Calibratio	CR	Electrical	10%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1	
		3. Temperature rise	CR	Electrical	100%	BHEL approved spec/drg. & relevant standard	BHEL approved spec/drg & relevant standard	Inspection Report	2	1	1	

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CABLE BOQ

CABLE SIZES TO BE USED	
Sl no.	Cable Type
	G-TYPE
1	2P X 0.5 sqmm
2	4P X 0.5 sq mm
3	8P X 0.5 sqmm
4	12P X 0.5 sqmm
5	2P X 1.5 sqmm
	F-TYPE
1	4P X 0.5 sqmm
2	8P X 0.5 sqmm
3	12P X 0.5 sqmm
4	20P X 0.5 sqmm
	CONTROL CABLE
1	3C X 2.5 sqmm
2	5C x 2.5 sq mm
3	12C x 2.5 sqmm

KKS PHILOSOPHY

KKS NUMBERING PHILOSOPHY

For identifying (tagging) an instrument / equipment in Power plant KKS numbering scheme is used. The purpose is to assign a unique number to every equipment in the power plant. For C&I equipment unique number are to be provided up to the signal level so that a unique number Input / Output exist in DCS for every signal.

Normally KKS number is a 10 digit alpha-numeric code and is typically split into the following:

X	X	X	A A Y			Y B B	B		

First three digits indicate the Sub-System. The Code for the major system are given as per **Annexure-**1.

Fourth and Fifth digits are the **Numerical Keys at System Code Level** and used to distinguish between main systems having same Alpha Codes.

Sixth and Seventh digits are the **Equipment / Apparatus / Measuring Circuit Code**. The code of various Equipment / Apparatus / Measuring Circuit is shown in **Annexure-2**

Eight, Nine and tenth digits are the **Numerical Keys at Equipment / Apparatus / Measuring Circuit Code** and used to distinguish between various instruments in the same sub-group. Numerical keys at System / Equipment / Apparatus / Measuring Circuit is shown in **Annexure-3**.

ANNEXURE-1

List of System / Sub-System Codes used in Power Plant:

1) Compressed air system : QEA, QEC
2) Ventilation System : SAA TO SAZ
3) Fire Detection & Protection System + Fire Water pumps : SGM, SGN, SGO, SGP
4) Sewage Treatment : SJA TO SJZ
5) Pre-treatment Plant : GBI, GBM, GBV
6) RO DM Plant : GCI, GCM, GBV
7) AC SYSTEM : QKA,QKB TO QKZ

ANNEXURE-2

Standard Equipment Codes:

AA	Valves including drives, also hand operated
AB	Seclusions, Lock, Gates, Doors
AC	Heat Exchanger
AE	Turning, Driving, Lifting equipment
AF	Continuous conveyors, Feeders
AG	Generator Units
AH	Heating and Cooling Units
AK	Pressing and Packaging equipment
AM	Mixer, Stirrer
AN	Blower, Air Pumps / Fans, Compressor Units
AP	Pump Units
AT	Purification, Drying, Filter
AV	Combustion Equipment e.g. grates

Standard Apparatus Codes:

BB	Vessels and Tank
BF	Foundation
BG	Boiler Heating Surfaces
BN	Injector, Ejector
BP	Flow and throughput limitation equipment (Orifice)
BQ	Holders, Carrying Equipment, Support
BR	Piping, Ducts, Chutes, Compensator
BS	Sound Absorber
BU	Insulations, Sheatings

Standard Measuring Circuits Codes:

CD	Density
CE	Electrical Quantities
CF	Flow, throughput
CG	Distance, Length, Position
CK	Time
CL	Level
CM	Humidity
CQ	Analysis (SWAS)
CS	Speed, Velocity, Frequency
CT	Temperature
CY	Vibration, Expansion

ANNEXURE-3

Numerical Keys

A) Numerical Keys at System Code Level

i) Use 10, 20, 30, ……. To distinguish between main systems having same Alpha Codes. Examples:

a) Main Steam (Left) and Main Steam (Right)

b) BFP – A/B/C

c) ID Fan – A/B, FD Fan A/B, AH – A/B

ii) For branch off from main system path having code say 10, keep the same alpha code and use 11, 12, 13 etc. Similarly for other branch off from main system path having code say 20, keep the same alpha code and use 21, 22, 23 etc and shall carry on further in the same way.

iii) If the branch off from main system / sub system path is used for some other system, where different alpha codes can be applied, then in that case the said branch line will be designated by the alpha codes of the system to which it is providing the input.

B) Numerical keys at Equipment Code level:

There are three numerical keys available for each type of equipment code. Following has been agreed upon considering present practice, better flexibility and ease in sorting.

i) Valves and Dampers --- *Equipment Code – AA*

N1 N2 N3

Motorised *(on/off duty)*	-	*0*	*01 to 50*
Motorised (inching duty)	-	*0*	*51 to 99*
Pneumatic (Control)	-	*1*	*01 to 50*
Motorised (thyrestor Control)	-	*1*	*51 to 99*
Sol. Operated	-	2	01 to 99
(Open / Close duty (Valves, NRVs, Gate)			
Hydraulic	-	3	01 to 99
NRV (Without actuation)	-	4	01 to 99
Manual	-	5	01 to 99
Manual	-	6	01 to 99
Relief & Safety Valves	-	7	01 to 99
Reserve	-	8	01 to 99
Reserve	-	9	01 to 99

ii) Field Instruments

Field Transmitters & Analog Signals	-	0	01 to 99
Field Switches & Binary Signals	-	1	00 to 99
PG Test Point	-	4	00 to 99
Gauges	-	5	00 to 99
Automatic Turbine Tester (ATT)-HWR	-	2	00 to 99
(Reserved for protection Signals used by Hardwar)			

Example of Numerical Key Usage:

In line with the philosophy adopted for Valves / Dampers /instruments etc. pumps and fans in the main systems (having different system code) can be numbered as AP/N100 and as AP/N101, 102, ……. Where system code is same.

LIST OF DELIVERABLES

LIST OF VENDOR DELIVERABLES FOR C&I FOR AC SYSTEM		
BHADRADRI FGD (4X270 MW		
DOCUMENT NUMBER:		
Sl.No.	**DRAWING NO.**	**DRAWING/DOCUMENT TITLE**
1	PE-V9-439-553-I901	INSTRUMENT DATA SHEETS
2	PE-V9-439-553-I902	INSTRUMENT SCHEDULE
3	PE-V9-439-553-I903	INSTRUMENT INSTALLATION/ HOOK UP DRAWINGS
4	PE-V9-439-553-I904	INSTRUMENT QP/CHECK LIST
5	PE-V9-439-553-I905	CONTROL & OPERATIONAL WRITE-UP FOR THE SYSTEM
6	PE-V9-439-553-I906	CONTROL SCHEMES/LOGIC DIAGRAM (TO BE IMPLEMENTED IN DCS)
7	PE-V9-439-553-I907	FIELD JB TERMINATIONS /GROUPING DOCUMENT
8	PE-V9-439-553-I908	DCS INPUT / OUTPUT LIST (ANALOG & BINARY)
9	PE-V9-439-553-I909	ANNUNCIATION & SOE LIST
10	PE-V9-439-553-I910	PROCESS GRAPHIC MANUSCRIPTS FOR DDCMIS
11	PE-V9-439-553-I911	CABLE SCHEDULE & INTERCONNECTION
12	PE-V9-439-553-I912	LOCAL CONTROL PANEL DATA SHEET & WIRING DIAGRAM
13	PE-V9-439-553-I913	PANEL LAYOUT & EXTERNAL/INTERNAL GA DRAWING
14	PE-V9-439-553-I914	LIST OF SIGNAL EXCHANGE WITH DDCMIS (BOTH HARDWIRED & SERIAL INTERFACE)
15	PE-V9-439-553-I915	QUALITY PLAN

NOTES:

1. ANY OTHER DOCUMENT DECIDED DURING DETAILED ENGINEERING SHALL BE PROVIDED BY BIDDER WITHOUT ANY COMMERCIAL/TECHNICAL IMPLICATION.

2. CONTRACTOR TO SUBMIT REUSABLE DATABASE FORMATS IN BHEL/CUSTOMER APPROVED FORMATS LIKE MS EXCEL,MS ACCESS OF DOCUMENTS LIKE INSTRUMENT SCHEDULE, I/O LIST, DRIVE LIST,FIELD JB TERMINATIONS, CABLE SCHEDULE & INTERCONNECTION, etc. SOFT COPY OF FORMATS SHALL BE PROVIDED BIDDERS. TO SUCCESSFUL.

C&I MANDATORY SPARES LIST FOR AUXILIARY PACKAGE

C&I MANDATORY SPARES ANNEXURE - II		Doc No:	PE-PF-440-571-13000-A-A001
		Rev No:	0
		Date of issue	07.10.2023
NAME OF PROJECT:		**4X270 MW BHADRADRI FGD THERMAL POWER PROJECT**	
NAME OF PACKAGE:		**HVAC FOR FGD**	
TECHNICAL SPECIFICATION No:		**PE-TS-440-571-13000-A-A001**	
SL NO	**DESCRIPTION**	**Qty**	**AMOUNT (Ex-Works)**
A	**AIR CONDITIONING**		
1.00	**Mandatory Spares for Temperature Elements and Thermowells**	**As applicable**	
1.10	Thermocouple / RTD elements (10% of each type, rating and immersion length. Minimum 5 nos..)	10% of each type, rating and immersion length. **Minimum 5 nos.**	
1.20	Thermowells for each type of temperature sensors (10% of each type, rating and immersion length. Minimum 5 nos.)	10% of each type, rating and immersion length. **Minimum 5 nos.**	
2.00	**Mandatory Spares for Electronic Transmitters (for pressure, DP, Flow, level, Temperature) and Electrical Transducers.**		
2.10	Transmitters and Electrical Transducers (10% of total or atleast two (whichever is higher) for each type along with accessories.)	10% of total or atleast two (whichever is higher) for each type along with accessories.	
3.00	**Mandatory spares for local gauges/switch (for Pressure, DP, Temperature, Flow, level , etc.)**		
3.10	Local gauges/ Switch (for Pressure, DP, Temperature, Flow, level , etc.) (10% of total or atleast two (whichever is higher) for each type along with accessories.)	10% of total or atleast two (whichever is higher) for each type along with accessories.	

NOTES

1	Mandatory spares listed above is bare minimum requirement. In case any additional mandatory spares requirement is covered elsewhere in the tender specification apart from specified above, same shall be deemed to have been covered in bidders scope of supply.
2	Unless stated otherwise, a "set" or "Lot" means items required for complete replacement in one equipment of each type / size/ range.
3	Wherever quantity has been specified as percentage (%), it shall mean percentage (%) of the population of the item required for one unit of 270 MW in the station (project), unless specified otherwise.
4	In case of Bought Out items, itemised spares list may be vendor specific and may differ from the list of spares mentioned above. In such cases, The quoted price shall be considered for applicable items only without any change in the contract price.
5	All Spares shall be supplied as per the requirement of the specifications. In case any spare indicated in the specification is “not applicable” for particular equipment, then suitable applicable alternate spare has been offered / shall be supplied by the bidder without any financial implication."
6	Bidder to write “Quoted / Not Applicable” against all items. Any item which is quoted as “not applicable” by the bidder in the above list and is found to be “applicable” at a later date shall be supplied by the bidder without any commercial and delivery implication.
7	For quantities indicated in percentage, fractions are to be rounded-off to next higher integer.
8	Any cell left blank in the unpriced schedule shall be treated as “Quoted” and is included in total price.
9	Bidder to note that even though there may be some spares which are repetitive at various sl.no mentioned above, bidder to ensure that prices are quoted against each sl.no. In case any cell is left blank in the unpriced schedule shall be treated as "quoted" and included in total price.

	Name	**Designation**	**Signature**

SECTION: I

SUB-SECTION: C6

LIST OF ANNEXURES- I, II, III, IV

SECTION-I

SUB SECTION C6

ANNEXURE-I

LIST OF MAKES OF SUB-VENDOR ITEMS

SLNo	ITEM	VENDOR
1	PRECISION PACKAGE UNITS	STULZ
		UNIFLAIR
		EMERSON PROCESS MANAGEMENT (ROSEMOUNT)
		BLUEBOX
		CLIMADENTA
2	SPLIT AIR CONDITIONER	VOLTAS
		BLUE STAR
		CARRIER
		HITACHI-HIREL
		LG
3	AIR WASHER & UAF*	HYDERABAD POLUTION CONTROL
		SK SYSTEM
		ADVANCE VENTILATION
		DRAFT AIR
		BLUE STAR
		VOLTAS
		STERLING WILSON
		ROOTS COOLING SYSTEM
		C DOCTOR
		TAP
		PACK PLAST
		INDUSTRIAL PROJECTS AND PRODUCTS
4	CENTRIFUGAL FAN	FLAKT
		KRUGER
		DRAFT AIR
		HYDERABAD POLUTION CONTROL
		ADVANCE VENTILATION
		PATEL AIR
		NICOTRA
		SK SYSTEM
		MARATHON
		CB DOCTOR
		SARLA
		COMEFRI
5	FRESH AIR/ SUPPLY/ EXHAUST/ RE UNIT FANS / PROPELLAR	HYDERABAD POLUTION CONTROL
		SK SYSTEM
		ADVANCE VENTILATION
		KRUGER
		NICOTRA

		MARATHON
		FLAKT
		CB DOCTOR
		SARLA (SITAL)
		PATEL AIR
		KHAITAN
6	PUMPS	BEST & CROMPTON
		JYOTI
		SAM TURBO
		KBL
		KSB
		M&P
		VOLTAS
		BEACON-WEIR
		WORTHINGTON
		FLOWMORE
		SULZER PUMPS INDIA LTD.
		BHARAT PUMPS & COMPRESSORS LTD
		FLOWSERVE INDIA CONTROL PVT LTD
		V-FLOW PUMPS & SYSTEMS CO
		KISHORE PUMPS
7	LV MOTORS (FLAME PROOF)	SIEMENS
		ABB
		CGL
		MARATHON
		KEC
		BHARAT BIJLEE
		BHARAT ELECTRIC
		NGEF
		JYOTI
		LHP
8	LV MOTORS (NON-FLAME PROOF)	SIEMENS
		ABB
		CGL
		MARATHON
		KEC
		BHARAT BIJLEE
		NGEF
		JYOTI
		LHP
		BHARAT ELECTRIC
9	AIR FILTER	PUROLATOR

		FMI
		ANFILCO
		TENACITY
		JOHN FOWLER
		SPECTRUM
		AIR TECH
		PUROMATIC
10	INSULTATION MATERIAL	BEARDSHEL
		K-FLEX
		PARAMONT
		ARMAFLEX
		SUPREME
		LLOYDS
		UP TWIGA
		AEROCELL
11	BALANCING VALVE	ADVANCE
12	BUTTERFLY VALVES	ADVANCE
		AUDCO
		FOURESS ENGG
		INTER VALVE
		BDK
		WEIR BDK
		TYCO
		CRANE PROCESS
		KEYSTONE
		FLUIDLINE
		INSTRUMENTATION LTD
		R AND D MULTIPLES (METAL CAST) PVT LTD
		SURYA VALVES AND INSTRUMENTS MFG CO
		PENTAIR VALVES AND CONTROLS INDIA PRIVATE LIMITED
		UPADHAYA VALVES MANUFACTURERS PRIVATE LIMITED
		VENUS PUMPS AND ENGG. WORKS
13	NON-RETURN VALVE	LEADER VALVES
		H SARKAR
		FLUIDLINE
		HI-TECH
		CRESCENT VALVES
		A V VALVES

		BANKIM
		SHIVADURGA
		SURYA VALVES AND INSTRUMENT MANUFACTURING
		ATAM VALVES
		GM DAULI & SONS
		KBL
		VENUS PUMPS AND ENGINEERING WORKS
14	STEEL GATE/GLOBE/NR VALVES (WATER SYSTEM)	CRESCENT VALVES
		BDK
		AUDCO
		FOURESS ENGG
		KIRLOSKAR BROTHERS LTD.
		SANT VALVES
		BOMBAY METAL & ALLOYS
		BANKIM
		LEADER VALVES
		H SARKAR
		AV VALVES
		VENUS PUMPS
		FLUIDLINE
		HI –TECH
		SHIVADURGA
		SURYA VALVES AND INSTRUMENT MANUFACTURING
		ATAM VALVES
		GM DAULI & SONS
		KBL
15	4 WAY MIXING VALVE WITH ACTUATING MOTOR	SIEMENS BUILDING TECHNOLOGY
		JOHNSON
		BELIMO
		HONEYWELL AUTOMATION
		RAPID CONTROL
		ALC
16	BUTTERFLY VALVE (MOTORIZED)	ANERGY
		ADVANCE
		BELIMO
		JOHNSON
		HONEYWELL AUTOMATION
		SIEMENS
		LEADER

		H.SARKAR
		FLUID LINE
		A V VALVES
		BANKIM & COMPANY
		SURYA VALVES AND INSTRUMENT MANUFACTURING
		ATAM VALVES
		GM DAULI & SONS
		KBL
		VENUS PUMPS AND ENGINEERING WORKS
17	ACTUATOR FOR MOTORIZED BUTTERFLY VALVE	SIEMENS BUILDING TECHNOLOGY
		JOHNSON
		BELIMO
		HONEYWELL
		RAPID CONTROL
		ALC
		AUMA
		LIMITORQUE
18	Y / POT STRAINER	MULTITEX
		GREAVES COTTON
		JAYPEE
		SANT VALVES
		OTOKLIN
		GRAND PRIX
		GUJARAT OTOLIFT
		DS ENGG
		SAROJINI ENTERPRISE
		BHATIA ENGINEERING
		FILTERATION ENGINEERS INDIA PVT LTD
		SUNGOV ENGINEERING
19	Pipes (MS/GI) - ERW	SURYA ROSHNI
20	Pipes (MS/GI) - ERW	TISCO
		DADU PIPES
		INDUS TUBES
		WELSPUN
		TATA
		BST
		JINDAL
		SAIL
		PSL
		LALIT PROFILE

		SAMSHI PIPE INDUSTRIES
		S MUKUT PIPES
		MANN INDUSTRIES
		SURENDRA ENGINEERING
		PRATIBHA PIPES AND STRUCTURES PVT LTD
		JCO GAS PIPES
		NUKAT TANK AND VESSELS
		GOODLUCK TUBES
		ADVANCE STEEL TUBES
		BIHAR TUBES
		HITECH PIPES
		RATNAMANI
		MAHARASHTRA SEAMLESS
21	PIPING - CS SEAMLESS (ASTM A 106)	ISMT
		MAHARASTRA SEAMLESS
22	GI SHEETS FOR DUCTING	TISCO
		INDIAN IRON & STEEL CO
		RASHTRIYA ISPAT NIGAM LIMITED
		ESSAR
		ISPAT INDUSTRIES
		JSW
		LLOYDS
		BHUSHAN STEELS
		TATA
		SAIL
		JINDAL
23	FIRE DAMPER	TSC
		CARRYAIRE
		RAVISTAR (SYSTEM AIR)
24	GRILL/DIFFUSER/VOLUME CONTROL DAMPER	AIR FLOW
		TSC
		AIR MASTER
		CARRYAIRE
		RAVISTAR (SYSTEM AIR)
25	STRIP HEATER	ESCORTS
		RACOLDS
		DASPASS
		ALCO
		HEATCO
		HOTSET
26	PAN HUMIDIFIER	RAPID COOL

		HOTSET
		ALCO
27	RELIEF / PURGE VALVE	BRASSOMATIC
28	THERMOSTATS	HONEYWELL AUTOMATION
		RANCO
		PENN
		DANFOSS
		INDFOSS
		JHONSON CONTROL
		RANUTROL
29	HUMID STAT	JHONSON CONTROL
		HONEYWELL AUTOMATION
		PENN
30	ANTI FREEZE THERMOSTAT	RANCO
		HONEYWELL AUTOMATION
		PENN
		DANFOSS
		INDFOSS
31	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	GENERAL INSTRUMENT CONSORTIUM
		BELLS CONTROLS LTD
		H. GURU IND
		WAAREE INSTRUMENTS
		H. GURU INST
		FORBES MARSHALL
		MANOMETER INDIA
		A. N INSTRUMENT
		GAUGES BOURDON
		GLUCK INDIA
		WIKA.
		ASHCROFT INDIA PVT LTD.
		BAUMER TECHNOLOGIES INDIA PVT. LTD.
		PRECISION MASS PRODUCTS
		BOSE PANDA INSTRUMENTS PVT.LTD.
32	TEMPERATURE GAUGE	H. GURU IND
		H. GURU INST
		FORBES MARSHALL
		DETRIVE INST & ELECTRONICS
		PYRO ELECTRIC
		TOSHNIWAL
		BROSS
		WAREE INSTRUMENTS
		A. N INSTRUMENT

		GOA INSTRUMENTS
		WIKA
		ASHCROFT INDIA PVT LTD.
		H. GURU IND
		BAUMER TECHNOLOGIES INDIA PVT. LTD.
		GOA THERMOSTATIC
		GAUGES BOURDON
		BUDENBERG GAUGE
		PRECISION MASS PRODUCTS
33	LEVEL INDICATOR	GENERAL INSTRUMENT CONSORTIUM
		CHEMTROL
		SBEM
		AUTOMAT MUMBAI
		SIGMA
		TOSHNIWAL
		TECHNOMATIC
		TELACO
		LEVCON
		D K INSTRUMENTS
		PUNE TECHTROL
		FLOW STAR
		BLISS ANAND
34	PRESSURE/ DP/ VACUUM/ TEMPERATURE SWITCH	BELLS CONTROLS LTD
		DANFOSS
		DK INSTRUMENTS
		DRESSER
		SOR INC
		VASU
		SWITZER INSTRUMENT LTD.
		INDFOSS
		TRAFAG
		GIC
		ASHCROFT INDIA PVT LTD.
		KASTURBA UDYOG
		BARKSDALE GMBH
		PRECISION MASS PRODUCTS
		MITTAL REFRIGERATION
35	TEMPERATURE SWITCH	INDFOSS
		SIEMENS
		DANFOSS
		DK INSTRUMENTS
		SOR INC

		VASU
		DRESSER
		TOSHNIWAL
		SWITZER INSTRUMENT LTD.
36	FLOW SWITCH	SWITZER INSTRUMENT LTD.
		LEVCON
		DK INSTRUMENTS
		SBEM
		V AUTOMAT
		SIEMENS
37	LEVEL SWITCH-FLOAT TYPE	SBEM
		BLISS ANAND
		HI-TECH
		RAMAN INST
		SIGMA
		SOR INC
		WAREE INST
		LEVCON
		DK INSTRUMENTS
		V AUTOMAT
		CHEMTROL
		SIEMENS
		FLOW STAR
		TRAC
		FLOW TECH
		NIVO CONTROLS
		PUNE TECHTROL
		SAPCON INSTRUMENT
		BAUMER TECHNOLOGIES INDIA PVT. LTD.
		GIC
38	LEVEL SWITCH-CAPACITANCE TYPE	SBEM
		BLISS ANAND
		HI-TECH
		RAMAN INST
		SIGMA
		SOR INC
		WAREE INST
		LEVCON
		DK INSTRUMENTS
		V AUTOMAT
		CHEMTROL
		SIEMENS

		FLOW STAR
		TRAC
		FLOW TECH
		NIVO CONTROLS
		PUNE TECHTROL
		SAPCON INSTRUMENT
		BAUMER TECHNOLOGIES INDIA PVT. LTD.
		GIC
39	FLOW TRANSMITTERS	SBEM
		TAYLOR
		ABB
		BRISTOL BABCOCK
		BIRLA KENT TAYLOR
		BLISS ANAND
		SMART INST
		V AUTOMAT
		FISHER-ROSEMOUNT
		SIEMENS
		TATA HONEYWELL
		PUNE TECHTROL
		NIVO CONTROLS
		PANAM ENGINEERS
		EMERSON PROCESS MANAGEMENT (ROSEMOUNT)
		MOORE
		TOSHNIWAL
		YOKOGAWA
		E&H
		ABB
40	PRESSURE/ DIFF. PRESSURE TRANSMITTER	SBEM
		TAYLOR
		ABB
		BRISTOL BABCOCK
		BIRLA KENT TAYLOR
		BLISS ANAND
		SMART INST
		V AUTOMAT
		FISHER-ROSEMOUNT
		SIEMENS
		TATA HONEYWELL
		PUNE TECHTROL
		NIVO CONTROLS

		PANAM ENGINEERS
		EMERSON PROCESS MANAGEMENT (ROSEMOUNT)
		MOORE
		TOSHNIWAL
		YOKOGAWA
		E&H
		ABB
41	SIGHT FLOW INDICATORS	SIGMA
		LEVCON
		V AUTOMAT
		TELLACE
		EUREKA INDUSTRIAL EQUIPMENTS PVT.LTD.
		TATA HONEYWELL
		BLISS ANAND
		SCIENTIFIC DEVICES
		BK EQUIPMENTS
		INSTRUMENTATION ENGINEERS
42	FLOW ELEMENT - ORIFICE	BRISTOL BABCOCK
		BALIGA LIGHTING EQPT PVT LTD
		LIGHTING EQUIP
		ENGINEERING SPECIALITIES
		IL
		MINCO
		MICRO PRECISION
		STAR-MECH CONTROLS (I) PVT.LTD.
43	TEMPERATURE ELEMENT	GENERAL INSTRUMENT CONSORTIUM
		PYRO ELECTRIC
		WAAREE INSTRUMENTS
		DETRIVE INST & ELECTRONICS
		TOSHNIWAL
		GOA INSTRUMENTS
		GAUGES BOURDON
		TECHNO INSTRUMENTS
		TEMPSENS INSTRUMENTS
		THERMAL INSTRUMENTS
		TM TECNOMATIC SPA
		BAUMER TECHNOLOGIES INDIA PVT. LTD.
44	FLOW METER	EUREKA INDUSTRIAL EQUIPMENTS PVT.LTD.
		INSTRUMENTATION ENGINEERS

		PLACKA
		TRAC
		FLOW STAR
		SCIENTIFIC DEVICES
45	RH SENSOR/TEMP SENSOR	HONEYWELL AUTOMATION
		JOHNSON
		SIEMENS
		GENERAL INSTRUMENT CONSORTIUM
46	PLC BASED PANEL	SIEMENS
		SCHNEIDER
		ROCKWELL AUTOMATION
		GE INTELLIGENT
		HONEYWELL AUTOMATION
		ABB
		MITSUBISHI ELECTRIC
47	OWS/PC	HP
		COMPAQ
		DELL
		HCL
		IBM
		LENOVO
48	PRINTER	HP
		CANNON
		EPSON
		XEROX
		IBM
		LEXMARK
49	UPS	HITACHI-HIREL
		APC
		DELTA
		EMERSON PROCESS MANAGEMENT (ROSEMOUNT)
		DB POWER
		APLAB
50	FIBRE OPTIC CABLE	BIRLA ERICSSON
		FINOLEX
		AKSH FIBRE
51	ANNUNCIATOR	ICC
		PECON
		PROCON
52	LT ADAPTER BOX FOR AL TO CU CABLE CONVERTOR	CONTROL DEVICE
		SYSTEM POWER CONTROL

		JACKSON ENGINNEERS
		UNILEC
		ELECTRIC ALLIED PRODUCT
53	METERING PUMPS	SHAPO TOOLS
		VK PUMPS
54	WATER SOFTENING PLANT	THERMAX
		ION EXCHANGE
		DOSI ION
55	PRESSURE/ DIFF. PRESSURE TRANSMITTER	ABB
		ENDRESS+HAUSER (INDIA)
		MOORE
		SIEMENS
		SMART INST
		SBEM
		TOSHNIWAL
		V AUTOMAT
		EMERSON PROCESS MANAGEMENT (ROSEMOUNT)
		YOKOGAWA
		HONEYWELL AUTOMATION
		FUJI
56	TEMPERATURE TRANSMITTERS	ABB
		ENDRESS+HAUSER (INDIA)
		MOORE
		SIEMENS
		SMART INST
		SBEM
		TOSHNIWAL
		V AUTOMAT
		EMERSON PROCESS MANAGEMENT (ROSEMOUNT)
		YOKOGAWA
		HONEYWELL AUTOMATION
57	ROTAMETER	CHEMTROLS SAMIL (INDIA) PVT LTD.
		EUREKA INDUSTRIAL EQUIPMENTS PVT.LTD.
		IL
		TRANSDUCERS AND CONTROL
58	BATTERY CHARGER	AMARA RAJA POWER SYSTEMS LIMITED
		CHHABI ELECTRICALS PVT.LTD.
		DUBAS ENGG
		HBL POWER SYSTEM

		STATCON POWER CONTROLS LTD
		CALDYNE
59	DC LEAD ACID/NI-CD BATTERY	HBL POWER SYSTEM
		AMCO SAFT INDIA LTD
		SAFT

NOTES:

1. *Designed by Hyderabad Pollution Control / SK System/ Advance ventilation / Draft air/Blue star/ Voltas/ Sterling wilson/Roots cooling system/ C doctor/ Tap/ Pack plast/ industrial projects and products & fabricated by their approved fabricator.

2. The sub vendor list above is indicative only and is subject to BHEL and customer approval during detailed engineering stage without any commercial & delivery implication to BHEL. Bidder to propose sub vendor within 4 weeks of placement of LOI. Thereafter no request for additional sub-vendor shall be entertained.

3. The inspection category will be intimated after award of contract by BHEL/Customer. However, the same will be adhered by the bidder without any commercial and delivery implication to BHEL/ Customer.

4. Please also refer respective sections for Electrical and C&I list of make.

SECTION-I
SUB SECTION –C6

ANNEXURE-II

MANDATORY SPARE LIST
(REFER SUGGESTIVE PRICE FORMAT)

SECTION-I

SUB-SECTION-C6

ANNEXURE-III

LIST OF TOOLS & TACKLES
AND
LIST OF COMMISSIONING SPARES
(REFER SUGGESTIVE PRICE FORMAT)

SECTION-I

SUB-SECTION-C6

ANNEXURE-IV

DRAWING / DOCUMENT SUBMISSION PROCEDURE

DISTRIBUTION SCHEDULE

S. No	Description	TSGENCO								CONSULTANT			Equipment Vendor	Remarks
		Director Projects	Director Technical	CE/Civil Thermal Projects Hyd.	CE/ TPC-I, Hyd	CE/ O&M/ KTPS	SE/ Civil KTPS	SE/E&M / KTPS	DE Constr. KTPS	Kolkata	HYD	KTPS		
A	**Letter Of Intent or Contract Documents**	1	1	1	S	1	2	2	1	1	1	1	2	
B	**Vendor Drawings**													
1.	Preliminary	1	1	1	2	1	1	2	2	12	1	-	S	
2.	Return preliminary with comments	-	-	1	2	1	1	1	1	S	1	-	1	
3.	Final and any revision thereof													
	a. Civil	1	1	6+1T	1	1	6+1T	1	-	2+1T	1	1	S	
	b. E&M	1	1	1	6+1T	1	1	6+1T	1	2+1T	1	1	S	
C.	**Design Drawings**													
1.	Preliminary													
	a. Civil	1	1	2	1	1	2	1	1	4	1	1	S	
	b. E&M	1	1	1	2	1	1	2	1	4	1	1	S	
2.	Released for construction													
	a. Civil	1	1	2	1	1	6	1	1	1	1	2	S	
	b. E&M	1	1	1	1	2	1	6	1	1	1	2	S	
3.	Return marked 'As built'													
	a. Civil	-	-	1	-	-	1	-	-	1	1	S	1	
	b. E&M	-	-	-	1	-	-	1	1	1	1	S	1	
4.	As built drawings													
	a. Civil	-	-	1+1T	-	2+1T	5+1T	-	1	1+1T	-	1	S	
	b. E&M	-	-	1	2+1T	2+1T	-	5+1T	1+1T	1+1T	-	1	S	

S. No	Description	TSGENCO								CONSULTANT			Equipment Vendor	Remarks
		Director Projects	Director Technical	CE/Civil Thermal Projects Hyd.	CE/ TPC-I, Hyd	CE/ O&M/ KTPS	SE/ Civil KTPS	SE/E&M / KTPS	DE Constr. KTPS	Kolkata	HYD	KTPS		
D	Progress Report Monthly													
1.	Equipment vendor	1	1	1	2	1	1	2	1	1	1	1	S	
2.	M/s DCPL, Kolkata	1	1	2	2	1	1	2	1	S	1	1	Nil	
E	Test & Inspection Reports													
1.	Equipment manufacturer													
	a. Civil	1	1	1	2	1	1	1	-	11	1	1	S	
s	b. E&M	1	1	-	2	1	-	1	1	11	1	1	S	
2.	M/s DCPL, Kolkata	1	1	-	2	1	-	1	1	S	-	1	-	
F	Instruction Manuals/Data Books													
1.	Equipment manufacturer													
	a. Civil	1	1	1+1T	1	1	6+1T	1	1	2+1T	1	1	S	
	b. E&M	1	1	-	3+1T	1	-	6+1T	2	3+1T	1	1	S	
2.	M/s DCPL, Kolkata	1	1	-	10+1T	1	-	15+1T	-	S	1	1	Nil	
G	M/s DCPL, Kolkata Criteria	1	1	1	8+1T	1	1	2	1	1	1	1	S	
H	Design Calculations	1	1	1	8+1T	1	1	2	1	1	1	1	S	
I	Final consulting Engineering Report	1	1	1	10	1	1	2	1	S	1	1	Nil	

S – Source, T – Transparency & Soft Copy on CD,

Director, Technical, Hyd	:	Director/ Technical, TSGENCO, Vidyut Soudha, Hyderabad – 500 082
CE/ Civil, Hyd	:	Chief Engineer/Civil, Thermal Projects, TSGENCO, Vidyut Soudha, Hyderabad – 500 082
CE/ TPC-I, Hyd	:	Chief Engineer/TPC, TSGENCO, Vidyut Soudha, Hyderabad – 500 082
CE/ O&M/ KTPS	:	Chief Engineer(O&M), KTPS, Kothagudem, Telangana
SE/Civil, KTPS	:	Superintending Engineer (Civil), KTPS, Kothagudem, Telangana
SE/E&M, KTPS	:	Superintending Engineer (E&M), KTPS, Kothagudem, Telangana
DE/Constr./ KTPS	:	Divisional Enginer/Constrcution, KTPS, Kothagudem, Telangana
M/s DCPL, Kolkata	:	M/s DCPL, Kolkata.
M/s DCPL, Hyd	:	M/s DCPL, Hyderabad.
M/s DCPL, KTPS	:	M/s DCPL, KTPS, Kothagudem, Telangana

SECTION-II

SUB-SECTION-D

ANNEXURE-I

FORMAT FOR OPERATION AND MAINTENANCE MANUAL

Project name :
Project number :
Package Name :
PO reference :
Document number :
Revision number :

Sl.no. & Sections	Description	Tick (√)if included in Manual			Remarks
		Yes	No	Not Applicable	
1.	**COVER PAGE**				
1.1	Project Name				
1.2	Customer/consultant Name				
1.3	Name of Package				
1.4	Supplier details with phone, FAX ,email address , Emergency Contact number				
1.5	Name and sign of prepared by , checked by & approved by				
1.6	Revision history with approval Details				
2.0	**INDEX**				
2.1	showing the sections & related page nos All the pages should be numbered section wise				
3.0	**DESCRIPTION OF PLANT/SYSTEM**				
3.1	Description /write up of operating principle of system equipment/ associated sub-systems & accessories/controls system , operating conditions, performance parameters under normal , start up and special cases				
3.2	Equipment list and basic parameter with Tag numbers				
3.3	Data sheets approved by Customer/for information and catalogues provided by original manufacturer				
3.4	Associated other packages and Interface /terminal points				
3.5	P&ID & Process Diagrams				
3.6	GA Layout drawings, As-built drawings , Actual photograph of items/system (Drawings of A2 & bigger sizes are to be attached in the last)				
3.7	Single line/wiring diagrams				
3.8	Control philosophy /control write-ups				

Sl.no. & Sections	Description	Tick (√)if included in Manual			Remarks
		Yes	No	Not Applicable	
4.0	**COMMISSIONING ACTIVITIES (IF NOT COVERED IN SEPARATE DOCUMENT I.E. ERECTION MANUAL, COMMISSIONING MANUAL)**				
4.1	Pre-Commissioning Checks				
4.2	handling of items at site				
4.3	Storage at site				
4.4	Unpacking & Installation procedure				
5.0	**OPERATION GUIDELINES FOR PLANT PERSONAL/USER/OPERATOR**				
5. 1	Interlock & Protection logic along with the limiting values of protection settings for the equipment along with brief philosophy behind the logic, drawings etc. to be provided.				
5. 2	Start up, normal operation and shut down procedure for equipments along with the associated systems in step by step mode. Valve sequence chart, step list, interlocks etc. with Equipment isolating procedures to be mentioned.				
5. 3	Do's & Don't of the equipments.				
5. 4	Safety precautions to be taken during normal operation. Safety symbols, Emergency instructions on total power failure condition/lubrication failure/any other condition				
5. 5	Parameters to be monitored with normal values and limiting values				
5. 6	Trouble shooting with causes and remedial measures				
5. 7	Routine operational checks, recommended logs & records				
5. 8	Changeover schedule if more than one auxiliary for the same purpose is given				
5. 9	Painting requirement and schedule				
5. 10	Inspection, repair , Testing and calibration procedures				
6.0	**MAINTENANCE GUIDELINES FOR PLANT PERSONAL**				

Sl.no. & Sections	Description	Tick (√)if included in Manual			Remarks
		Yes	No	Not Applicable	
6.1	List of Special Tools and Tackles required for Overhaul/Trouble shooting including special testing equipment required for calibration etc.				
6.2	Stepwise dismantling and re-assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained, clearances etc. to be mentioned. Tolerances for fitment of various components to be given.				
6.3	Preventive Maintenance & Overhauling schedules linked with running hours/calendar period along with checks to be given				
6.4	Long term maintenance schedules especially for structural, foundations etc.				
6.5	Consumable list along with the estimated quantity required during commissioning, normal running and during maintenance like Preventive Maintenances and Overhaul. Storage/handling requirement of consumables/self-life.				
6.6	List of lubricants with their Indian equivalent, Lubrication Schedule, Quantity required for each equipment for complete replacement is to be given				
6.7	List of vendors & Sub-vendors with their latest addresses, service centres ,Telephone Nos., Fax Nos., Mobile Nos., e-mail IDs etc.				
6.8	List of mandatory and recommended spare parts list				
6.9	Tentative Lead time required for ordering of spares from the equipment supplier				
6.10	Guarantee and warranty clauses				
7.0	**Statutory and other specific requirements considerations.**				
8.0	**List of reference documents**				
9.0	**Binding as per requirement**				

SECTION-II

SUB-SECTION-D

ANNEXURE-II

SITE STORAGE AND PRESERVATION

SITE STORAGE AND PRESERVATION GUIDELINES

FOR

MECHNANICAL BOPs

(Doc No: PE-DC-SSG-A001 REV.00)

PROJECT ENGINEERING MANAGEMENT, POWER SECTOR

BHARAT HEAVY ELECTRICALS LIMITED-NOIDA

CONTENT

1. SCOPE OF THE DOCUMENT

This guideline is prepared in intent to provide proper site storage and preservation of the Mechanical, Electrical and C & I items / equipment supplied under various bought out packages/items. This storage procedure shall be followed at different power plant sites by concerned agency for storage and preservation from the date of equipment received at site until the same are erected and handed over to the customer.

2. PURPOSE OF STORAGE & PRESERVATION

Many of the items may be required to be kept in stores for long period. It shall therefore be essential that proper methods of storage and preservation be applied so that items do not deteriorate, loose some of their properties and become unusable due to atmospheric conditions and biological elements.

3. MEASURES TO BE TAKEN FOR STORAGE, HANDLING & PRESERVATION

a) GENERAL STORAGE REQUIREMENTS

1. To the extent feasible, materials should be stored near the point of erection. The storage areas should have adequate unloading and handling facilities with adequate passage space for movement of material handling equipment such as cranes, fork lift trucks, etc. The storage of materials shall be properly planned to minimise time loss during retrieval of items required for erection.
2. The outdoor storage areas as well as semi-closed stores shall be provided with adequate drainage facilities to prevent water logging. Adequacy of these facilities shall be checked prior to monsoon.
3. The storage sheds shall be built in conformity with fire safety requirements. The stores shall be provided with adequate lights and fire extinguishers. ‘No smoking’ signs shall be placed at strategic locations. Safety precautions shall be strictly enforced.
4. Adequate lighting facility shall be provided in storage areas and storage sheds and security personnel positioned to ensure enforcement of security measures to prevent theft and loss of materials.
5. Adequate number of competent stores personnel and security staff shall be deployed to efficiently store and maintain the equipment / material.
7. The equipment shall be stored in an orderly manner, preserving their identification slips, tags and instruction booklets, etc., required during erection. The storage of materials shall be equipment-wise. Loose parts shall be stored in sheds on racks,

preserving the identification marks and tags in good condition. The group codes shall be displayed on the racks

6. At no time shall any materials be stored directly on ground. All materials shall be stored minimum 200 mm above the ground preferably on wooden sleepers

b) GENERAL PRESERVATION REQUIREMENTS

1. All special measures to prevent corrosion shall be taken like keeping material in dry condition, avoiding the equipment coming in contact with corrosive fluid like water, acid etc.
2. Materials which carry protective coating shall not be wrapped in paper, cloth, etc., as these are liable to absorb and retain moisture. The material shall be inspected and in case of signs of wear or damages to protective coating, that portion shall be cleaned with approved solution and coated with an approved protective paint. Complete record of all such observations and protective measures taken shall be maintained.
3. Generally equipment supplied at site are properly greased or rust protective oil is applied on machined/ fabricated components. However periodic inspection shall be carried out to ensure that protection offered is intact.
4. While handling the equipment, no dragging on the ground is permitted. Avoid using wire rope for lifting coated components. Use polyester slings (if possible) otherwise protective material (e.g. clothes, wood block etc.) should be used while handling the components with rope / slings
5. For Equipment supplied with finished paint, touch paint shall be done in case any surface paint gets peeled off during handling. Otherwise such surfaces shall necessarily be wrapped with polythene to avoid any corrosion. Further for equipment wherein finish coat is to be applied at site, site to ensure that equipment is received with primer coat applied.
6. It shall be ensured by periodic inspection that plastic inserts are intact in tapped holes, wherever applicable.
7. Pipes shall be blown with air periodically and it shall be ensured that there is no obstruction.
8. Silica gel or approved equivalent moisture absorbing material in small cotton bags shall be placed and tied at various points on the equipment, wherever necessary.
9. Heavy rotating parts in assembled conditions shall be periodically rotated to prevent corrosion/jamming due to prolonged storage.

10. All the electrical equipment such as motors, generators, etc. shall be tested for insulation resistance at least once in three months and a record of such measured insulation values shall be maintained.

11. Following preservatives/preservation methods can be used depending upon type of equipment

    a. Rust preventive fluid (RPF)

    b. Rust protective paints

    c. Tarpaulin covers, in case of outdoor storage

    d. De-oxy aluminate for weld-ments

c) GENERAL INSPECTION REQUIREMENTS

1. Period inspection of materials with specific reference to –

    - Ingress of moisture and corrosion damages.
    - Damage to protective coating.
    - Open ends in pipes, vessels and equipment -
        - In case any open ends are noticed, same shall be capped.

2. Any damages to equipment / materials.

    - In case of any damages, these shall be promptly notified and in all cases, the repairs / rectification shall be carried out.
    - Any items found damaged or not suitable as per project requirements shall be removed from site. If required to store temporarily, they shall be clearly marked and stored separately to prevent any inadvertent use.

4. TYPE OF STORAGE FOR VARIOUS EQUIPMENT

The types of storage are broadly classified under the following heads:

i **Closed storage with dry and dust free atmosphere**. (C)

The closed shed can be constructed by using cold-rolled / tubular components for structure and corrugated asbestos sheets / galvanised iron sheets for roofing. Brick walls / asbestos sheets can be used to cover all the sides. The floor of the shed can be finished with plain cement concrete suitably glazed. The shed shall be provided with proper ventilation and illumination.

ii **Semi-closed storage**. (S)

The semi closed shed can be constructed by using cold-rolled / tubular components for structure and corrugated / asbestos sheets for roofing. The floor shall be brick paved. If required a small portion of sides can be covered to protect components from rainwater splashing onto the components.

iii Open storage (O)

The open yard shall be levelled, well consolidated to achieve raised ground with the provision of feeder roads for crane approach along with access roads running all sides. One part of the open yard shall be stone pitched, levelled and consolidated with raised ground suitable for storing / stacking heavier and critical components with due space to handle them by cranes etc . Adequate number of sleepers, concrete block etc. to be provided to make raised platforms to stack critical materials.

A separate yard to be identified as “scrap yard” slightly away from main open yard to store wooden/steel scraps, which are to be disposed off. This is required to avoid mix up with regular components as well as to avoid fire hazard.

Some of the components, which are having both machined & un-machined surfaces and are bulky, shall be stored in open storage area on a raised ground and suitably covered with water proof / fire retardant tarpaulin.

The equipment listed below shall be stored and inspected as per requirement mentioned in the table below.

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
Raw material /mechanical items like pipes, plates, structure sections etc.)				
1.	Steel pipes (lined/unlined)	S	Damage , paint, corrosion, rubber lining peeling	Provide end cap
2.	MS Plates	S	Damage, paint, corrosion	
3.	SS Plates	S	Damage	
4.	Non-metallic pipes	S	Damage, cracks	Provide end cap
5.	Stainless steel pipes	S	Damage ,	Provide end cap
6.	MS sections, beams	S	Damage, paint, corrosion	
7.	Cable trays	S	Damage, condition of preservations	
8.	Insulation sheets	S	Damage	
9.	Insulation	C	Damage, packing	
10.	Hangers Rods	S	Damage, paint, packing	
11.	Tubes	S	Damage, paint , packing	Provide end cap
12.	Hume pipes	O	Damage	
13.	Castings	O	Damage, paint, corrosion	
Fabricated mechanical items (pressure vessels, tanks etc.)				
14.	Pressure vessels (unlined)	O	Damage, paint, corrosion,	Covered nozzles
15.	Atmospheric storage tanks (unlined)	O	Damage, paint, corrosion	Covered nozzles

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
16.	Pressure vessels (lined)	S	Damage, paint, corrosion, rubber lining	
17.	Atmospheric storage tanks(lined)	S	Damage, paint, corrosion, rubber lining	
18.	Support structures	O	Damage , paint, corrosion	
19.	Flanges	C	Damage , paint, corrosion	
20.	Fabricated pipes	S	Damage , paint, corrosion	Provide end cap
21.	Vessels internals	C	Damage , paint, corrosion ,packing	
22.	Grills	S	Damage , paint, corrosion	
23.	Angles	S	Damage , paint, corrosion	
24.	Bridge mechanism/clarifier mechanism	O	Damage , paint, corrosion	
25.	Cranes, rails	S	Damage , paint, corrosion	
26.	Stair cases	O	Damage , paint, corrosion	
27.	Ladders/handrails	O	Damage , paint, corrosion	
28.	Fabricated ducts	S	Damage , paint, corrosion	
29.	Isolation Gates	O	Damage , paint, corrosion	
30.	Fabricated boxes/panels	S	Damage , paint, corrosion	
Mechanical components like valves, fittings, cables glands, spares etc.)				
31.	Valves	S	Damage , packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
32.	Fittings	S	Damage , packing	Provide end cap
33.	Cable glands	C	Damage , packing	
34.	Tools & tackles	C	Damage , packing	
35.	Nut , bolts, washers,	C	Damage , packing	
36.	Gasket & Packings	C	Damage , packing	
37.	Copper tubes	C	Damage , packing, corrosion	Provide end cap
38.	SS tubing	C	Damage , packing	Provide end cap
Rotating assemblies (pumps, blowers, stirrers, fans, compressors etc.)				
39.	Pumps	S	Damage , packing, corrosion	Shaft rotation
40.	Blowers/Compressors	S	Damage , packing, corrosion	Shaft rotation
41.	Agitators/stirrers/radial launders	C	Damage , packing, corrosion	Shaft rotation
42.	Rollers for chlorine tonner mounting	C	Damage , packing, corrosion	
43.	Centrifuge	S	Damage , packing,	
44.	Gear box	C	Damage , packing, corrosion	
45.	Bearings	C	Damage , packing, corrosion	
46.	Fans	S	Damage , packing, corrosion	
47.	Dosing skids	S	Damage , packing, corrosion	
48.	Pump assemblies	S	Damage , packing, corrosion	
49.	Air washers(INTERNALS)	S	Damage , packing	
50.	Air conditioners (split)	C	Damage , packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
51.	Elevators(CONTAINERIZED)	O	Damage , packing, corrosion	
52.	Chillers/VA machines	S	Damage , packing	
53.	Air handling Unit/Package unit	S	Damage , packing	
54.	Chlorinators & Evaporators	C	Damage , packing	
55.	Ejectors	C	Damage , packing	
56.	Electrolyser	C	Damage , packing	
Miscellaneous items like chain pulley blocks, hoists etc.				
57.	Chain pulley blocks	S	Damage, Packing	
58.	Electric hoists	S	Damage, Packing	
59.	Fire extinguishers	C	Damage, expiry date	
60.	Fork Lift Truck	S	Damage, Packing	
61.	Hydraulic Mobile Crane	O	Damage, Packing	
62.	Mobile Pick Up & Carry Crane	O	Damage, Packing	
63.	Motor boats	O	Damage, Packing	
64.	Safety showers	S	Damage, Packing	
65.	Diffusers/dampers	S	Damage, Packing	
Chemicals and consumables (acid, alkali, paints, oils, reagents and special chemicals)				
66.	Hydro Chloric Acid (HCl)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical
67.	Sulphuric acid (H_2SO_4)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
68.	Sodium hydroxide (NaOH)	Store in canes/ storage tank in dyke area	Date of production/ leakage/ fumes/ breather	hazardous chemical ,breather to be checked for air ingress
69.	Sodium hypo chlorite	To be stored under shed	Date of production/ leakage/ fumes	hazardous chemical ,self-life normally 15-30 days after which strength of chemical decays
70.	Ammonia	S	Date of production/ leakage/ fumes	Store in closed storage tanks, hazardous chemical
71.	CW treatment chemicals	S	Date of production , Self-life	Store in closed canes
72.	RO/UF cleaning chemicals	S	Date of production , Self-life	Store in closed canes
73.	Lime	C	Damage to packing , seepage	Prevent moisture, rain
74.	Alum bricks	C	Damage to packing	Prevent moisture, rain
75.	Poly electrolyte	S		Store in closed storage tanks
76.	Laboratory chemicals(powder)	C	Damage, Packing self-life	
77.	Laboratory chemicals(liquid)	C	Damage, Packing self-life	
78.	Lubrication oils	C	Leakage	
79.	Paints	S	Leakage ,air tightness	
80.	Sand	O	Damage of packing	No hooks
81.	Salt (NaCl)	C	Damage of packing, water ingress	Prevent moisture, rain
82.	Anthracite	S	Damage of packing	
83.	Activated carbon	S	Damage of packing	

Sl. No.	**Description of the equipment**	**Type of Storage**	**Check for**	**Remarks**
84.	Thermal insulation	S	Damage of packing	
85.	Cement	C	Damage of packing	Prevent moisture, rain
86.	Gravels	O	Damage of packing	
87.	ION exchange resins	C	Damage , packing	Refer manufacturer guidelines
88.	RO membranes	C	Damage , packing	Refer manufacturer guidelines
89.	UF membranes	C	Damage , packing	Refer manufacturer guidelines
90.	Cleaning chemicals	C	Damage , packing	Refer manufacturer guidelines
91.	Chemicals for analysers/calibration	C	Damage , packing	Refer manufacturer guidelines
Electrical and C & I items (motors, cables etc.)				
92.	Motors	C	Damage , packing	
93.	Cable drums	O	Damage	
94.	Control Panel /control desk, UPS ,JB	S	Damage, Packing	
95.	Instruments(gauges/analysers)	C	Damage	
Special items		As per Manufacturer's item, like Hydrogen cylinders, Ozonator, Analyser, Chlorine dioxide generators etc.		

5. CONCLUSION

Concerned storage agency at site should make sure that loss in equipment performance and wear & tear are minimised through proper storage and preservation. The above are broad guidelines and cover major equipment / materials. However specific storage practices shall be followed as per manufacturer recommendation. All the necessary measures even in addition to the ones mentioned above, if found necessary, should be taken to achieve the objective.

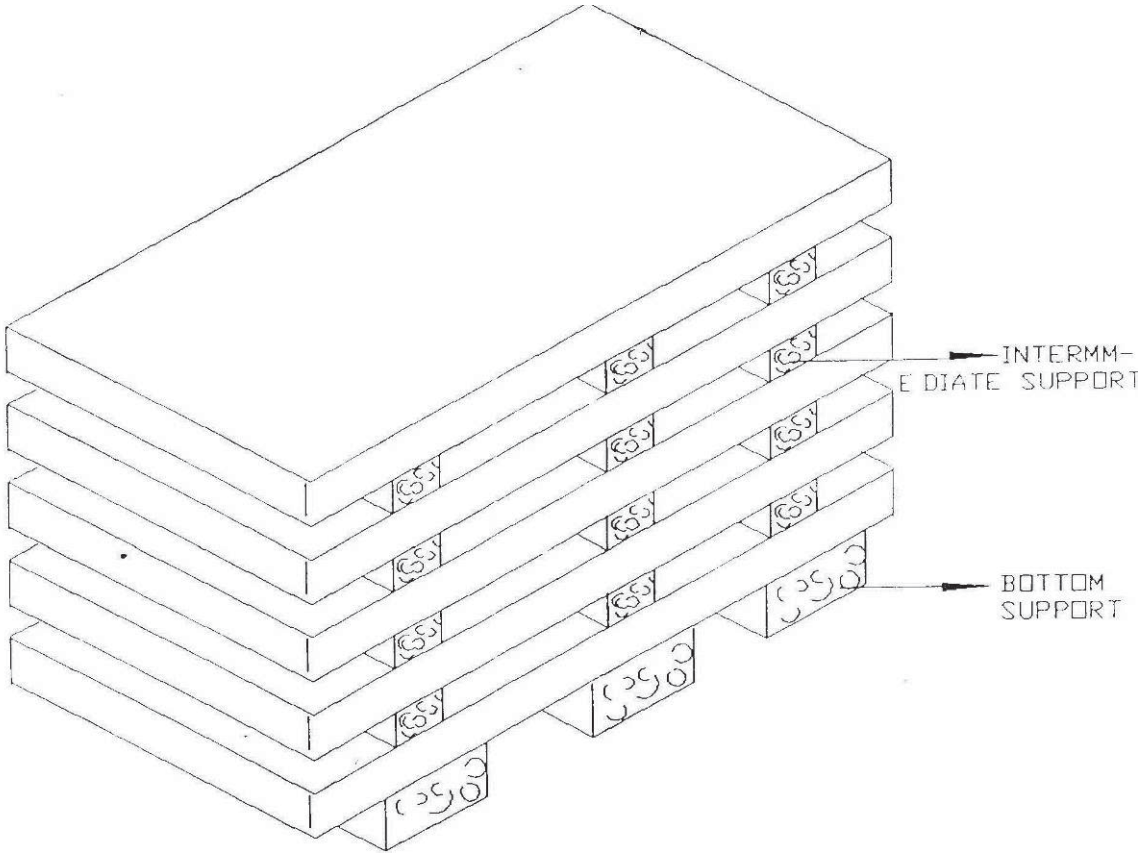


Figure – 1 – PLATE STACKING ARRANGEMENT

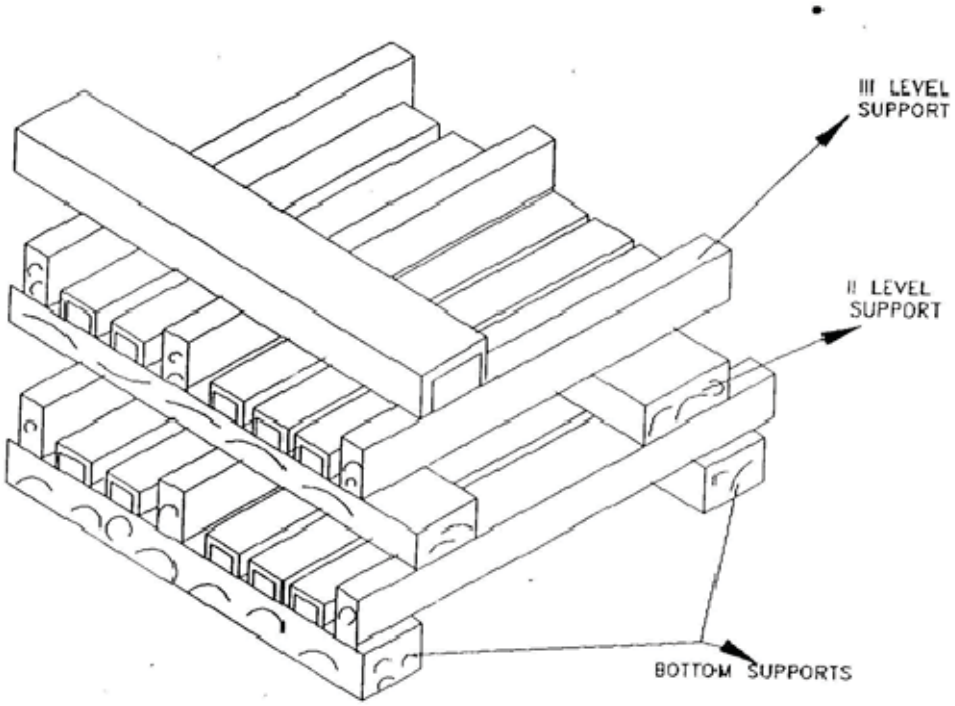


Figure – 2 – STRUCTURAL STEEL STACKING ARRANGEMENT

SECTION-II

SUB SECTION-D

ANNEXURE- III

INSPECTION AND TESTING DETAILS

1.01.00 Inspection and Tests during Manufacture.

1.01.01 The method and techniques to be used by the Bidder for the control of quality during manufacture of all plant and equipment shall be agreed with the Owner.

1.01.02 The Owner's general requirements with respect to quality control and the required shop tests are set out elsewhere in this specification.

1.01.03 Before any item of plant or equipment leaves its place of manufacture the Owner shall be given the option of witnessing inspections and tests for compliance with the specification and related standards.

1.01.04 Advance notice shall be given to the Owner as agreed in the Contract, prior to the stage of manufacture being reached, and the piece of plant must be held at this stage until the Owner has inspected the piece, or has advised in writing that inspection is waived. If having consulted the Owner and given reasonable notice in writing of the date on which the piece of plant will be available for inspection, the Owner does not attend the Bidder may proceed with manufacture having forwarded to the Owner duly certified copies of his own inspection and test results.

The owner's representative shall have at all reasonable times access to bidder's or his sub-vendor's premises and shall have power to inspect/ examine materials and workmanship or equipment under manufacture.

The Bidder shall forthwith forward to the engineer duly certified copies of the Test Certificates in six copies (one to the Purchaser and five to the Consulting Engineer) for approval. Further nine (9) copies of Shop Test Certificates shall be bound with Instruction Manuals referred to elsewhere.

For electrical equipment, routine tests as per relevant IS spec are to be carried out on all equipment. Type tests are also to be carried out on selected equipment as detailed in the specs of concerned electrical equipment.

1.01.05 Under no circumstances any repair or welding of castings be carried out without the consent of the Engineer. Proof of the effectiveness of each repair by radiographic and/or other non-destructive testing technique, shall be provided to the Engineer.

1.01.06 All the individual and assembled rotating parts shall be statically and dynamically balanced in the works.
Where accurate alignment is necessary for component parts of machinery normally assembled on site, the Bidder shall allow for trial assembly prior to despatch from place of manufacture.

1.01.07 All materials used for the manufacture of equipment covered under this specification shall be of tested quality. Relevant test certificates shall be made available to the Purchaser. The certificates shall include tests for mechanical properties and chemical analysis of representative material. Equipment or parts coming under any statutory

Regulations shall be certified by a Competent Authority under the regulations in the specified format.

1.01.08 All pressure parts connected to pumping main shall be subjected to hydraulic testing at a pressure of 150% of shut-off head for a period not less than one hour. Other parts shall be tested for one and half times the maximum operating pressure, for a period not less than one hour.

1.01.09 All necessary non-destructive examinations shall be performed to meet the applicable code requirements.

1.01.10 All welding procedures adopted for performing welding work shall be qualified in accordance with the requirements of Section-IX of ASME code or IBR as applicable. All welded joints for pressure parts shall be tested by liquid penetrant examination according to the method outlined in ASME Boiler and Pressure Vessel code. Radiography, magnetic particle examination magnuflux and ultrasonic testing shall be employed wherever necessary/ recommended by the applicable code. At least 10% of all major but welding joints shall be radiographed unless otherwise stipulated.

Statutory payments in respect of IBR approvals including inspection shall be made by the bidder. Bidder's scope shall include to preparation of all necessary documents, co-ordination and follow-up for above approval. Owner shall only forward assistance/endorsement of documents /design /drawings /reports/records to be submitted for approval as stipulated/ required by Statutory Authorities till registration of the unit and clearance for commercial operation.

1.02.00 Performance Tests at Site

1.02.01 The full requirements for testing the system shall be agreed between the Owner and the Bidder prior to Award of Contract. The completely erected System shall be tested by the Bidder on site under normal operating conditions. The Bidder shall also ensure the correct performance of the System under abnormal conditions, i.e. the correct working of the various emergency and safety devices, interlocks, etc.

1.02.02 The Bidder shall provide complete details of his normal procedures for testing, for the quality of erection and for the performance of the erected plant. These tests shall include site pressure test on all erected pipe work to demonstrate the quality of the piping and the adequacy of joints made at site.

1.02.03 The Bidder shall furnish the quality procedures to be adopted for assuring quality from the receipt of material at site, during storage, erection, pre-commissioning to tests on completion and commissioning of the complete system/equipment.

1.03.00 For details of specific tests required on individual equipment refer to respective section of this specification.

All Statutory testing / clearance is in Bidder's scope including payment of all fees, etc. as required

QAP FORMAT

BHARAT HEAVY ELECTRICALS LIMITED

CORPORATE QUALITY ASSURANCE

PROJECT: SYSTEM :

VENDOR : ITEM :

SL NO	COMPONENT /OPERATION OPERATIONS	CHARACTERISTICS CHECKED	CATEGORY	TYPE /METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11

Legend: 1. BHEL 2. Vendor 3. Sub-Vendor

QP No	CQS/SQP/31	Signature	Date			
	Rev		Name			
Page No	1 of 1		Party	Customer/Consultant	Bhel	Vendor

SECTION: III

SUB SECTION: 1

LIST OF DOCUMENTS TO BE SUBMITTED WITH BID

LIST OF DOCUMENTS TO BE SUBMITTED WITH BID

BIDDER SHOULD SUBMIT THE SIGNED AND STAMPED COPY OF THE FOLLOWING DOCUMENTS:

1. Compliance cum confirmation certificate
2. No Deviation Certificate mentioning “NIL DEVIATION”
3. Guaranteed Power Consumption (In the format attached in the spec mentioning KW rating).
4. Unpriced copy of the Price format (mentioning quoted against each item in every cell)
5. Pre-Bid Clarification / Corrigendum / Amendments

Offer will be considered as incomplete in absence of any of the above documents. Bidder to ensure that all above documents are available in their offer, failing to which bidder offer is liable to be rejected.

Any other document apart from above submitted along with bid will not be taken cognizance off and will not make any part of the contract and accordingly will not be considered for bid evaluation.

COMPLIANCE CUM CONFIRMATION CERTIFICATE

The bidder shall confirm compliance with following by signing / stamping this compliance certificate (every sheet) and furnish same with the offer.

a) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions, other than those mentioned under "exclusion and those resolved as per 'Schedule of Deviations', with regard to same.

b) There are no other deviations w.r.t. specifications other than those furnished in the 'Schedule of Deviations'. Any other deviation, stated or implied, taken elsewhere in the offer stands withdrawn unless specifically brought out in the 'Schedule of Deviations'

c) Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL / CUSTOMER approval & customer hold points for inspection / testing shall be marked in the QP at the contract stage. Inspection / testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. This is within the contracted price without any extra implications to BHEL after award of the contract.

d) All drawings/ data-sheets / calculations etc. submitted along with the offer shall not be taken cognizance off.

e) The offered materials shall be either equivalent or superior to those specified in the specification & shall meet the specified / intended duty requirements. In case the material specified in the specifications is not compatible for intended duty requirements then same shall be resolved by the bidder with BHEL during the pre-bid discussions, otherwise BHEL / Customer's decision shall be binding on the bidder whenever the deficiency is pointed out.

For components where materials are not specified, same shall be suitable for intended duty, all materials shall be subject to approval in the event of order.

f) The commissioning spares shall be supplied on 'As Required Basis' & prices for same included in the base price itself.

g) All sub vendors shall be subject to BHEL / CUSTOMER approval in the event of order.

h) Guarantee for plant/equipment shall be as per relevant clause of GCC / SCC / Other Commercial Terms & Conditions

i) In the event of order, all the material required for completing the job at site shall be supplied by the bidder within the ordered price even if the same are additional to approved billing break up, approved drawing or approved Bill of quantities within the scope of work as tender specification. This clause will apply in case during site

commissioning, additional requirements emerges due to customer and / or consultant's comments. No extra claims shall be put on this account

j) Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL's / Customer's / Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.

k) As built drawings shall be submitted as and when required during the project execution.

l) The bidder has not tempered with this compliance cum confirmation certificate and if at any stage any tempering in the signed copy of this document is noticed then same shall be treated as breach of contract and suitable actions shall be taken against the bidder.

m) Successful bidder shall furnish detailed erection manual for each of the equipment supplied under this contract at least 3 months before the scheduled erection of the concerned equipment / component or along with supply of concerned equipment / component whichever is earlier.

n) Document approval by customer under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and require written approval. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to customer for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.

o) In case vendor submits revised drawing after approval of the corresponding drawing, any delay in approval of revised drawing shall be to vendor's account and shall not be used as a reason for extension in contract completion.

PRE-BID CLARIFICATION SCHEDULE

S. NO.	SECTION/CLAUSE/PAGE NO.	STATEMENT OF THE REFERRED CLAUSE	CLARIFICATION REQUIRED

The bidder hereby clarifies that above mentioned are the only clarifications required on the technical specification for the subject package.

Signature: _____

Name: _____

Designation: _____

Company: _____

Date: _____

Company Seal

SECTION: III

SUB SECTION: 4

NO DEVIATION CERTIFICATE

SL NO	VOULME/ SECTION	PAGE NO.	CLAUSE NO.	TECHNICAL SPECIFICATION/ TENDER DOCUMENT	COMPLETE DESCRIPTION OF DEVIATION	COST OF WITHDRAWAL OF DEVIATION	REFERENCE OF PRICE SCHEDULE ON WHICH COST OF WITHDRAWAL OF DEVIATION IS APPLICABLE	NATURE OF COST OF WITHDRAWAL OF DEVIATION (POSITIVE/ NEGATIVE)	REASON FOR QUOTING DEVIATION
TECHNICAL DEVIATIONS									
COMMERCIAL DEVIATIONS									
PARTICULARS OF BIDDERS/ AUTHORISED REPRESENTATIVE									
NAME				**DESIGNATIONS**		**SIGN & DATE**			

NOTES:

1. Cost of withdrawal of deviation will be applicable on the basic price (i.e. excluding taxes, duties & freight) only.
2. All the bidders have to list out all of their Technical & Commercial Deviations (if any) in detail in the above format.
3. Any deviation not mentioned above and shown separately or found hidden in offer, will not be taken cognizance of.
4. Bidder shall submit duly filled unpriced copy of above format indicating "quoted" in "cost of withdrawal of deviation" column of the schedule above along with their Techno-commercial offer, wherever applicable. In absence of same, such deviation (s) shall not be considered and offer shall be considered in total compliance to NIT.
5. Bidder shall furnish price copy of above format along with price bid.
6. The final decision of acceptance/ rejection of the deviations quoted by the bidder shall be at discretion of the Purchaser.
7. Bidders to note that any deviation (technical / commercial) not listed in above and asked after Part I opening shall not be considered.
8. For deviations w.r.t. Credit period, Liquidated damages, Firm prices if a bidder chooses not to give any cost of withdrawal of deviation loading as per above, will apply. For any other deviation mentioned in un-priced copy of this format submitted with Part-I bid but not mentioned in priced copy of this format submitted with Priced bid, the cost of withdrawal of deviation shall be taken as NIL.
9. Any deviation mentioned in priced copy of this format, but not mentioned in the un-priced copy, shall not

be considered.
10. All techno-commercial terms and conditions of NIT shall be deemed to have been accepted by the bidder, other than those listed in unpriced copy of this format.
11. Cost of withdrawal is to be given separately for each deviation. In no event bidder should club cost of withdrawal of more than one deviation else cost of withdrawal of such deviations which have been clubbed together shall be considered as NIL.
12. In case nature of cost of withdrawal (positive/negative) is not specified it shall be assumed as positive.
13. In case of discrepancy in the nature of impact (positive/ negative), positive will be considered for evaluation and negative for ordering.

SECTION: III

SUB SECTION: 5

GUARANTEED POWER CONSUMPTION (GPC)

4x270 MW BHADRADRI FGD TPS						
HVAC SYSTEM						
GUARANTEED POWER CONSUMPTION FIGURES						
S.NO.	DESCRIPTION OF EQUIPMENT	NO OF EQUIPMENT		TOTAL GUARANTEED POWER CONSUMPTION FOR EACH EQUIPMENT AT MOTOR INPUT TERMINAL AND CONTROL PANEL (IN KW)	DUTY FACTOR	TOTAL KW
		WORKING	STANDBY			
		3A	3B	4	5	6=3Ax4x5
A	**AIR CONDITIONING SYSTEM FOR FGD BUILDING**					
i	Precision AC for FGD Control room	4	2		1	
ii	Fresh air fans for above PAC room.	1	0		1	
B	**VENTILATION SYSTEM FOR FGD BUILDING**					
i	Centrifugal Fan of cap. 1,10,000 CMH at 65 mmwc static pr for air washers.	1	0		1	
ii	Pumps for circulation of water in spray chamber of above air washer	1	1		1	
				TOTAL (KW)		

Note:

Estimated power consumption (EPC) figure for the system (for working drives only) has been considered as **135 KW**. So long bidder's quoted guaranteed power consumption (GPC) above remains within this EPC, there will be no technical loading of bid on power consumption for evaluation. However, if bidder's quoted GPC exceeds EPC, there shall be technical loading of bid for evaluation **@ Rs 2,52,000/-** per KW of additional power over EPC.

Bidder’s guaranteed power consumption at motor input terminals (not shaft power) as furnished in relevant schedule shall be demonstrated by the successful bidder during performance testing at works/ site. In case power consumption is noted higher than EPC / bidder's quoted GPC whichever is higher, during inspection/ PG test, penalty **@ Rs 2,52,000/-** per KW shall be levied on vendor.

SECTION: IV

APPENDIX – I

MASTER DRAWING LIST WITH STATUS

(COPY OF APPROVED DRAWING / DOCUMENTS ARE ENCLOSED WITH THE SPECIFICATION)

S.NO.	DOCUMENT NO	DOCUMENT TITLE	REV NO	REF. DOC. NO.	APPROVAL STATUS OF REF. DOC.	SCHD SUBM DATE FROM LOA
1	PE-V0-440-553-A001	INSPECTION CATEGORIZATION & SUBVENDOR LIST FOR HVAC SYSTEM FOR FGD	0	PE-V0-411-553-A001 & PE-V0-411-554-A001	APPROVED	-------
2	PE-V0-440-553-A003	QUALITY PLAN OF PRECISION PU	1	PE-V0-411-553-A003	APPROVED	-------
3	PE-V0-440-553-A101	HEAT LOAD CALCULATION FOR MAIN CONTROL ROOM AREAS IN FGD CONTROL BUILDING	0	----	TO BE SUBMITTED FOR APPROVAL.	3 WEEKS
4	PE-V0-440-553-A103	CONTROL & OPERATION PHILOSOPHY OF HVAC SYSTEM FOR FGD	0	-----	TO BE SUBMITTED	8 WEEKS
5	PE-V0-440-553-A203	DATA SHEET AND GA FOR AIR COOLED PRECISION PU	0	PE-V0-411-553-A203	TO BE SUBMITTED	6 WEEKS
6	PE-V0-440-553-A208	DATA SHEET AND G.A. FOR PRE AND FINE FILTER ALONGWITH FIXING DETAILS FOR HVAC SYSTEM FOR FGD	0	PE-V0-411-553-A208 & PE-V0-411-554-A210	APPROVED	-------
7	PE-V0-440-553-A210	DATA SHEET AND GA FOR FRESH AIR FANS	0	PE-V0-411-553-A210	TO BE SUBMITTED	6 WEEKS
8	PE-V0-440-553-A215	DATA SHEET FOR INSTRUMENTS FOR HVAC SYSTEM FOR FGD	0	PE-V0-411-553-A215 & PE-V0-411-554-A207	TO BE SUBMITTED	8 WEEKS
9	PE-V0-440-553-A216	DATA SHEET OF INSULATION FOR DUCT, PIPE AND ACCOUSTIC LINING ALONG WITH TYPICAL DETAIL FOR DUCT, PIPE AND ACCOUSTIC INSULATION FOR HVAC SYSTEM FOR FGD	0	PE-V0-411-553-A216 & PE-V0-411-554-A205	APPROVED	-------
10	PE-V0-440-553-A217	DATA SHEET FOR SPLIT AC.	0	PE-V0-411-553-A217	APPROVED	-------
11	PE-V0-440-553-A218	DATA SHEET FOR PIPES FOR HVAC SYSTEM FOR FGD	0	PE-V0-411-553-A218 & PE-V0-411-554-A208	APPROVED	-------

S.NO.	DOCUMENT NO	DOCUMENT TITLE	REV NO	REF. DOC. NO.	APPROVAL STATUS OF REF. DOC.	SCHD SUBM DATE FROM LOA
12	PE-V0-440-553-A219	DATA SHEET FOR GI AND MS SHEET FOR HVAC SYSTEM FOR FGD	0	PE-V0-411-553-A219 & PE-V0-411-554-A209	APPROVED	-------
13	PE-V0-440-553-A220	DATA SHEET AND GA DRAWING FOR AIR TERMINALS LIKE GRILLS / DIFFUSERS / DAMPERS/ ETC	0	PE-V0-411-553-A220	APPROVED	-------
14	PE-V0-440-553-A501	P&I DIAGRAM FOR AC SYSTEM FOR FGD	0	PE-V0-411-553-A501	TO BE SUBMITTED	4 WEEKS
15	PE-V0-440-553-A502	PAC PLANT ROOM LAYOUT WITH EQPT FOUNDATION DETAILS FOR FGD CONTROL BUILDING	0	------	TO BE SUBMITTED	8 WEEKS
16	PE-V0-440-553-A503	AC DUCT LAYOUT DRAWING FOR CONTROL ROOM ARES FOR FGD CONTROL BUILDING	0	--------	TO BE SUBMITTED	7 WEEKS
17	PE-V0-440-553-A509	TYPICAL DETAILS, DUCT: FABRICATION, SUPPORT AND ERECTION., INSULATION: DUCTING, PIPING, EQUIPMENTS AND ACOUSTIC LINING., PIPING: FABRICATION, SUPPORT AND ERECTION FOR HVAC SYSTEM FOR FGD	0	PE-V0-411-553-A509 & PE-V0-411-554-A401	APPROVED	-------
18	PE-V0-440-553-A510	SPLIT AC SCHEDULE ALONGWITH HEAT LOAD CALCULATION FOR AUXILIARY BUILDING FOR FGD PKG	0	-----	TO BE SUBMITTED	6 WEEKS
19	PE-V0-440-553-A702	I/O LIST & DRIVE LIST FOR HVAC SYSTEM FOR FGD	0	------	TO BE SUBMITTED	9 WEEKS
20	PE-V0-440-553-A703	ELECTRICAL FEEDER LIST FOR HVAC SYSTEM FOR FGD	0	HVAC FEEDER LIST ATTACHED	TO BE SUBMITTED	7 WEEKS
21	PE-V0-440-553-A704	CABLE SCHEDULE FOR AIR CONDITIONING SYSTEM FOR FGD	0	------	TO BE SUBMITTED	8 WEEKS
22	PE-V0-440-553-A901	DEMONSTRATION TEST PROCEDURE FOR HVAC SYSTEM FOR FGD	0	------	TO BE SUBMITTED	6 WEEKS

S.NO.	DOCUMENT NO	DOCUMENT TITLE	REV NO	REF. DOC. NO.	APPROVAL STATUS OF REF. DOC.	SCHD SUBM DATE FROM LOA
23	PE-V0-440-553-A902	O & M MANUAL FOR HVAC SYSTEM FOR FGD	0	-------	TO BE SUBMITTED	10 WEEKS
24	PE-V0-440-554-A002	QUALITY PLAN OF AIR WASHER	0	PE-V0-411-554-A002	APPROVED	-------
25	PE-V0-440-554-A003	QUALITY PLAN OF CENTRIFUGAL PUMPS	0	PE-V0-411-554-A003	APPROVED	-------
26	PE-V0-440-554-A004	QUALITY PLAN OF CENTRIFUGAL FANS	0	PE-V0-411-554-A004	APPROVED	-------
27	PE-V0-440-554-A005	QUALITY PLAN OF AXIAL FLOW FANS & RE UNITS	0	PE-V0-411-554-A005	APPROVED	-------
28	PE-V0-440-554-A006	QUALITY PLAN OF MOTOR	0	PE-V0-411-554-A006	APPROVED	-------
29	PE-V0-440-554-A007	QUALITY PLAN OF FIRE DAMPER	0	PE-V0-411-554-A007	APPROVED	-------
30	PE-V0-440-554-A101	VENTILATION FAN SCHEDULE FOR FGD	0	------	TO BE SUBMITTED	6 WEEKS
31	PE-V0-440-554-A102	VENTILATION AIR CALCULATION FOR FGD CONTROL BUILDING	1	-------	TO BE SUBMITTED	3 WEEKS
32	PE-V0-440-554-A202	DATA SHEET & GA FOR AIR WASHER ALONGWITH FAN AND PUMP FOUNDATION DETAILS.	0	PE-V0-411-554-A201	TO BE SUBMITTED	4 WEEKS
33	PE-V0-440-554-A203	DATA SHEET & GA FOR ROOF EXTRACTOR, AXIAL EXHAUST AND SUPPLY AIR FANS WITH FIXING ARRANGEMENT.	0	PE-V0-411-554-A203	TO BE SUBMITTED	6 WEEKS
34	PE-V0-440-554-A204	DATA SHEET & GA FOR VALVES AND STRAINER.	0	PE-V0-411-554-A204	TO BE SUBMITTED	6 WEEKS
35	PE-V0-440-554-A206	DATA SHEET AND GA FOR FIRE DAMPER ALONGWITH FIXING DETAILS FOR HVAC SYSTEM FOR FGD	0	PE-V0-411-553-A209 & PE-V0-411-554-A206	APPROVED	-------
36	PE-V0-440-554-A211	DATA SHEET FOR MOTORS (AIR WASHER FAN, AIR WASHER PUMP, RE UNITS, SUPPLY AND EXHAUST AXIAL FANS, FRESH AIR FAN ETC.)	0	PE-V0-411-554-A211	TO BE SUBMITTED	8 WEEKS
37	PE-V0-440-554-A403	GA OF PROPELLER FAN.	0	PE-V0-411-554-A403	APPROVED	-------

S.NO.	DOCUMENT NO	DOCUMENT TITLE	REV NO	REF. DOC. NO.	APPROVAL STATUS OF REF. DOC.	SCHD SUBM DATE FROM LOA
38	PE-V0-440-554-A601	SCHEME FOR AIR DISTRIBUTION IN FGD CONTROL BUILDING	0	-------	TO BE SUBMITTED	3 WEEKS
39	PE-V0-440-554-A602	PID FOR AIR WASHER UNIT.	0	PE-V0-411-554-A602	TO BE SUBMITTED	3 WEEKS
40	PE-V0-440-554-A605	AIR WASHER LAYOUT ALONGWITH FOUNDATION DETAILS – FGD CONTROL BUILDING.	0	--------	TO BE SUBMITTED	6 WEEKS
41	PE-V0-440-554-A608	VENTILATION DUCT LAYOUT FOR FGD CONTROL BUILDINGS.	0	-------	TO BE SUBMITTED	6 WEEKS
42	PE-V0-440-554-A611	VENT. ARRANGEMENT FOR VARIOUS AUXILIARY BUILDING FOR FGD.	0	-------	TO BE SUBMITTED	8 WEEKS
43	PE-V0-440-554-A702	VENTILATION CABLE SCHEDULE FOR VENTILATION SYSTEM	0	-------	TO BE SUBMITTED	8 WEEKS

Note:

1. Drawing / Document shall be uploaded by the successful bidder on WRENCH /DMS. Procedure for the same will be informed after award of contract. Document submission through mail is not acceptable.
2. Bidder to furnish hardcopies for above drawings / documents as per the dwg. / documents distribution as per project requirement.
3. **Split AC / Ductable Split / Cassette AC shall be provided & designed with maximum star rating as available in line with energy conservation policies notified by BEE, GOI at the time of supply.
4. Drawings shall be prepared in auto-cad latest edition and shall be shared with BHEL during detail engineering of review.
5. Submission and approval of Drawings / documents marked with "*" basic engineering documents and are linked with payment against engineering charges.
6. The drawings/ documents submitted by vendor shall be complete in all respects with revised drawing submitted incorporating all comments. Any incomplete drawing submitted shall be treated as non- submission with delays attributable to vendor's account. For any clarification/discussion required to complete the drawings, the bidder shall himself depute his personal to BHEL / Customer's place as per the requirement for across the table discussions/ finalizations/ submissions of drawings.
7. Detailed erection manual for each of the equipment as well as complete system supplied under this contract shall be submitted at least 3 months before the scheduled erection of the concerned equipment / component or along with supply of concerned equipment / component whichever is earlier.
8. The Field Quality Plan of bidder shall also be submitted by the successful bidder during detail engineering for customer's / consultant's approval. All comments made by customer/ consultant shall be incorporated by the successful bidder without any commercial and delivery implication.
9. Any other drawings and documents as required by BHEL / Customer / Consultant shall be furnished by the successful bidder during detail engineering stage for which no commercial implication shall be entertained by BHEL.
10. All possible efforts shall be made by the bidder to get the approval of drawings and

documents from BHEL / customer / consultant at the earliest and the documents prepared / generated by them or their sub-vendors shall be checked by their competent authority before submission to BHEL.

11. Bidder to resubmit documents within one week after receipt of comments.

12. Revision made by the bidder in any drawings and documents shall be highlighted by indicating the no. of revisions in a triangle without fail so that the minimum time is required by BHEL to review the drawings and documents. Drawings/ documents to be submitted for BHEL review / approval shall be under Revision A, B, C… etc. while drawings /documents to be submitted thereafter for customer's approval after purchaser's approval shall be under R-0, 1, 2, 3 …. etc.

13. All drawings and documents including general arrangement drawing, data sheet, calculation etc. shall be furnished to BHEL during detailed engineering stage and shall include / indicate the following details for clarity w.r.t. inspection, construction, erection and maintenance etc.: -

- ❖ All drawings and documents shall bear BHEL's title block and drawing / document number. However, BHEL's drawing / document numbering scheme shall be furnished to the successful bidder after the placement of L.O.I.
- ❖ All drawings and documents shall indicate the list of all reference drawings including general arrangement.
- ❖ All drawings shall include / show plan, elevation, side view, cross - section, skin section, blow - up view, all major self-manufactured and bought out items shall be labelled and included in BOQ / BOM in tabular form.
- ❖ Specification / schedule of painting shall be made as a part of general arrangement drawing of each item
- ❖ All text/ numeric in the document / drawings to be generated by the successful bidder will be in English language only.

14. Drawings / documents mentioned at sr. no. 1, 3, 4, 5, 14, 15, 31, 32, 38, 39 & 40 in above table shall be considered as basic engineering documents for all contractual purposes.

Annexure

BHADADRI TPS (TSGENCO, 4 X 270 MW)

Inspection Categorization Plan for BHEL/PEM.

Lr.No.ED-CE/TPC /SE-IV/EME-12/ADE-II/AE1/BTPS/F.Categ.plan/D. No. 214/17, Dt.19.03.2018

Sl. No.	Item Description	Inspection Category					Remarks
		CATEGORY	TSGENCO/BHEL	BHEL	S&W	Manufacturer	
1	SCREW CHILLER	I	Y	Y	Y	Y	Inspection As Per Approved QAP
2	PRECISION PACKAGE UNITS	II	N	Y	Y	Y	Inspection As Per Approved QAP
3	PACKAGE UNIT	II	N	Y	Y	Y	Inspection As Per Approved QAP
4	SPLIT/ CASETTE AIR CONDITIONER	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
5	AIR HANDLING UNITS	II	N	Y	Y	Y	Inspection As Per Approved QAP
6	AHU FAN (CENTRIFUGAL FAN)	II	N	Y	Y	Y	Inspection As Per Approved QAP
7	CHILLED & CONDENSER WATER PUMP	II	N	Y	Y	Y	Inspection As Per Approved QAP
8	COOLING TOWER	II	N	Y	Y	Y	Inspection As Per Approved QAP
9	COOLING COIL FOR AHU	II	N	Y	Y	Y	Inspection As Per Approved QAP
10	INDUCTION MOTOR (LT)	II	N	Y	Y	Y	Inspection As Per Approved QAP
11	AIR FILTER	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
12	AXIAL FAN	II	N	Y	Y	Y	Inspection As Per Approved QAP
13	INSULATIONMATERIAL(FIBREGLASS /EPS/PUF/NITRILE)	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
14	GRILLS/ DIFFUSERS/VCD	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
15	GM VALVES	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
16	CI GATE/GLOBE VALVE	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
17	CHECK VALVE	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
18	Y& POT-STRAINER	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
19	BALANCING VALVE	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
20	BUTTERFLY VALVE	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
21	FLOAT VALVE	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
22	BUTTERFLY VALVE (MOTORISED)	II	N	Y	Y	Y	Inspection As Per Approved QAP
23	ACTUATOR FOR BUTTERFLY VALVE(MOTORISED)	II	N	Y	Y	Y	Inspection As Per Approved QAP
24	STRIP HEATER	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
25	PAN HUMIDIFIER/ELECTRODE HUMIDIFIER	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
26	MS / GI PIPES	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
27	GI SHEET FOR DUCTING	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
28	REFIEF/PURGE VALVES	III	N	N	N	Y	Material will be cleared based on
29	PRESSURE GAUGE/DP GAUGE	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
30	TEMPERATURE GAUGE	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
31	LEVEL GAUGE	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
32	PRESSURE SWITCH / DP SWITCHES	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
33	TEMPERATURE SWITCH	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
34	LEVEL SWITCH	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
35	FLOW SWITCH	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
36	3-WAY MIXING VALVE WITH ACTUATING MOTOR	II	N	Y	Y	Y	Inspection As Per Approved QAP
37	LEVEL INDICATOR	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
38	TRANSMITTERS	II	N	Y	Y	Y	Inspection As Per Approved QAP
39	SIGHT FLOW INDICATORS	II	N	Y	Y	Y	Inspection As Per Approved QAP
40	FLOW ELEMENT	I	Y	Y	Y	Y	Inspection As Per Approved QAP
41	TEMPERATURE ELEMENT	II	N	Y	Y	Y	Inspection As Per Approved QAP
42	FLOW METER	II	N	Y	Y	Y	Inspection As Per Approved QAP
43	RH SENSOR/TEMP SENSOR	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
44	PLC BASED PANEL	I	Y	Y	Y	Y	Inspection As Per Approved QAP
45	OWS / PC	II	N	Y	Y	Y	Inspection As Per Approved QAP

Executive Director/TPC.

Sl. No.	Item Description	CATEGORY	TSGENCO/ BHEL	BHEL	S&W	Manufacturer	Remarks
46	PRINTER	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
47	UPS	I	Y	Y	Y	Y	Inspection As Per Approved QAP
48	FIBRE OPTIC CABLE	II	N	Y	Y	Y	Inspection As Per Approved QAP
49	ANNUNCIATOR FOR PANEL	I	Y	Y	Y	Y	Inspection As Per Approved QAP
50	LT ADAPTER BOX FOR AL TO CU CABLE CONVERTOR	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
51	METERING PUMP	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
52	CONTROL PANEL	II	N	Y	Y	Y	Inspection As Per Approved QAP
53	WATER SOFTENING PLANT/NON CHEMICAL TREATMENT EQUIPMENT	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
54	PRESSURE/LEVEL TRANSMITTER	II	N	Y	Y	Y	Inspection As Per Approved QAP
55	TEMPERATURE TRANSMITTER	II	N	Y	Y	Y	Inspection As Per Approved QAP
56	ROTAMETER	II	N	Y	Y	Y	Inspection As Per Approved QAP
57	EXPANSION TANK/MAKE-UP WATER TANK	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
58	MONO RAIL/ ELECTRIC HOIST/CHAIN PULLEY BLOCK	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
59	JUNCTION BOX	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
60	POWER CABLE (PVC & XLPE)	II	N	Y	Y	Y	Inspection As Per Approved QAP
61	CONTROL CABLE (PVC & XLPE)	II	N	Y	Y	Y	Inspection As Per Approved QAP
62	BATTERY CHARGER	II	N	Y	Y	Y	Inspection As Per Approved QAP
63	BATTERY (NI -Cd)	II	N	Y	Y	Y	Inspection As Per Approved QAP
64	BATTERY (MAINTENANCE FREE FOR PLC)	I	Y	Y	Y	Y	Inspection As Per Approved QAP
65	FAN COIL UNIT	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
66	THERMOSTATS	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
67	PAINT	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
68	PUSH BUTTONS	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
69	HUMID STAT	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
70	DPIS	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
71	AT & GT	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
72	TROLLEY	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
73	BALL VALVES	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
74	ANTI FREEZE THERMOSTAT	III	N	N	N	Y	Material will be cleared based on Manufacturer TC
75	FIRE DAMPER	II	N	Y	Y	Y	Inspection As Per Approved QAP

Note:

1. Main Vendor
2. Y (Yes)
3. N (No)

19/07

Executive Director/TPC.

Project : (4X270 MW) BHADRADRI THERMAL POWER PROJECT

Main Contractor: Bharat Heavy Electricals Ltd.

Package :Ventilation Systems

BHEL Doc No: PE-V0-411-554-A001 , R- 01

CATEGORISATION ON INSPECTION

Date: As on 20.02.18

Sl. No	Item Description	Inspection Category					Remarks
		Category	TSGENCO /DESEIN	BHEL	S&W	Manufacturer	
1	AIR WASHER & UAF*	I	Y	Y	Y	Y	Inspection As Per Approved QAP
2	CENTRIFUGAL FAN for AW and UAF	II	N	Y	Y	Y	Inspection As Per Approved QAP
3	FRESH AIR/ SUPPLY/ EXHAUST/ RE UNIT FANS /PROPELLAR	III	N	N	Y	Y	Inspection As Per Approved QAP
4	PUMPS	III	N	N	Y	Y	Inspection As Per Approved QAP
5	INDUCTION MOTOR (LT): (FLAME PROOF) & (NON FLAME PROOF)	II	N	Y	Y	Y	Motor of Rating below 30 Kw shall be cleared on the basis of TC as per IS -325 & Motor of rating 30 Kw and above inspection will be offered as per Approved QAP.
6	AIR FILTER	III	N	N	N	Y	Material will be cleraed based on Manufacturer TC
7	INSULATION MATERIAL	III	N	N	N	Y	Material will be cleraed based on Manufacturer TC
8	GRILLS/ DIFFUSERS/VCD	III	N	N	N	Y	Material will be cleraed based on Manufacturer TC
9	GM VALVES	III	N	N	N	Y	Material will be cleraed based on Manufacturer TC
10	CI GATE/GLOBE VALVE	III	N	N	N	Y	Material will be cleraed based on Manufacturer TC
11	CHECK VALVE	III	N	N	N	Y	Material will be cleraed based on Manufacturer TC
12	Y& POT-STRAINER	III	N	N	N	Y	Material will be cleraed based on Manufacturer TC
13	BUTTERFLY VALVE	III	N	N	N	Y	Material will be cleraed based on Manufacturer TC
14	FLOAT VALVE	III	N	N	N	Y	Material will be cleraed based on Manufacturer TC
15	BUTTERFLY VALVE (MOTORISED)	III	N	N	N	Y	Material will be cleraed based on Manufacturer TC
16	ACTUATOR FOR BUTTERFLY VALVE (MOTORISED)	III	N	N	N	Y	Material will be cleraed based on Manufacturer COC/TC
17	MS / GI PIPES	III	N	N	N	Y	Material will be cleraed based on Manufacturer TC
18	GI/MS SHEET FOR DUCTING	III	N	N	N	Y	Material will be cleraed based on Manufacturer TC
19	PRESSURE GAUGE/DP GAUGE	III	N	N	N	Y	Material will be cleraed based on Manufacturer TC
20	TEMPERATURE GAUGE	III	N	N	N	Y	Material will be cleraed based on Manufacturer TC
21	LEVEL GAUGE	III	N	N	N	Y	Material will be cleraed based on Manufacturer TC
22	PRESSURE SWITCH / DP SWITCHES	III	N	N	N	Y	Material will be cleraed based on Manufacturer TC
23	TEMPERATURE SWITCH	III	N	N	N	Y	Material will be cleraed based on Manufacturer TC
24	LEVEL SWITCH	III	N	N	N	Y	Material will be cleraed based on Manufacturer TC
25	FLOW SWITCH	III	N	N	N	Y	Material will be cleraed based on Manufacturer TC

Executive Director
Thermal Projects Construction
TSGENCO, Vidyut Soudha,
Khairatabad, Hyderabad-500 082.

Project : (4X270 MW) BHADRADRI THERMAL POWER PROJECT

Main Contractor: Bharat Heavy Electricals Ltd.

Package :Ventilation Systems

BHEL Doc No: PE-V0-411-S54-A001 , R- 01

CATEGORISATION ON INSPECTION

Date: As on 20.02.18

Sl. No	Item Description	Inspection Category					Remarks
		Category	TSGENCO /DESEIN	BHEL	S&W	Manufacturer	
26	LEVEL INDICATOR	III	N	N	N	Y	Material will be cleraed based on Manufacturer TC
27	LEVEL TRANSMITTERS	III	N	N	N	Y	Material will be cleraed based on Manufacturer TC
28	HUMIDISTAT	III	N	N	N	Y	Material will be cleraed based on Manufacturer TC
29	DPIT	III	N	N	N	Y	Material will be cleraed based on Manufacturer TC
30	TEMPERATURE ELEMENT	III	N	N	N	Y	Material will be cleraed based on Manufacturer TC
31	FLOW METER	III	N	N	N	Y	Material will be cleraed based on Manufacturer TC
32	RH SENSOR/TEMP SENSOR	III	N	N	N	Y	Material will be cleraed based on Manufacturer TC
33	CONTROL PANEL	III	N	N	Y	Y	Material will be cleraed based on Manufacturer TC
34	PRESSURE TRANSMITTER	III	N	N	N	Y	Material will be cleraed based on Manufacturer TC
35	TEMPERATURE TRANSMITTER	III	N	N	N	Y	Material will be cleraed based on Manufacturer TC
36	JUNCTION BOX	III	N	N	N	Y	Material will be cleraed based on Manufacturer TC
37	POWER CABLE (PVC & XLPE)	III	N	N	N	Y	Material will be cleraed based on Manufacturer TC
38	CONTROL CABLE (PVC & XLPE)	III	N	N	N	Y	Material will be cleraed based on Manufacturer TC
39	PAINT	III	N	N	N	Y	Material will be cleraed based on Manufacturer TC
40	PUSH BUTTONS	III	N	N	N	Y	Material will be cleraed based on Manufacturer TC
41	FIRE DAMPER	III II	N	N	N	Y	Material will be cleraed based on Manufacturer TC

for 21/3/2018
Executive Director
Thermal Projects Construction
TSGENCO, Vidyut Soudha,
Khairatabad, Hyderabad-500 082.

STULZ	STULZ CHSPL (I) PVT LTD A-173, TTC, KHAIRANE NAVI MUMBAI	**MANUFACTURING QUALITY PLAN** ITEM : PRECISION AIR CONDITIONER	QP NO.: PE-V0-411-553-A003 REV.NO : 0.1 DATE: 04.06.18 PAGE: 1 CUSTOMER-TSGENCO	PROJECT: 4X270 MW BHADRADRI TPP PACKAGE: AIRCONDITIONING PACKAGE CONTRACT NO.: V/17/0191 MAIN- /SUB SUPPLIER:

SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
					M	C/N					M	C	N	
1.	2.	3.	4.	5.	6.		7.	8.	9.		10.			11.
1.0	BROUGHT OUT ITEMS													
1.1	SCROLL COMPRESSOR MAKE-COPELAND	MODEL, MAKE, CAPACITY,	MAJOR	VERIFICATION	100%		MANUFACTURER STANDARD TDS/GA`	INVOICE / GRN	√		P	V	V	
		PHYSICAL STATUS	MINOR	VISUAL	100%		NO DEFECT	-			P	-	-	
1.2	SHEET METAL	MATERIAL PROPERTIES, DIMENSION CORRECTNESS, PHYSICAL SURFACE DEFECT	MAJOR	VISUAL, CHEMICAL & MECHANICAL	SAMPLE/ LOT		AS PER APPROVED DRAWING BY STULZ AND RELEVANT MATERIAL STD. TDS/GA`	IR, SUPPIERS TEST REPORTS	√		P	V	V	REFERENCE FOR MATERIAL PROPERTIES TEST REPORT FROM SUPPLIER ALONG WITH MATERIAL TC FOR THEIR MATERIAL
1.3	EVAPORATOR COILS & CONDENSER COILS	MATERIAL PROPERTIES, DIMENSION CORRECTNESS, PHYSICAL SURFACE DEFECT	MAJOR	VISUAL, CHEMICAL & MECHANICAL	SAMPLE/ LOT		AS PER APPROVED DRAWING BY STULZ AND RELEVANT MATERIAL STD. TDS/GA`	IR, SUPPIERS TEST REPORTS	√		P	V	V	REFERENCE FOR MATERIAL PROPERTIES TEST REPORT FROM SUPPLIER ALONG WITH MATERIAL TC FOR THEIR MATERIAL
1.4	FAN FOR EVAPORATOR & CONDENSER MAKE- EBMPAPST	MAKE, MODEL ,CAPACITY,	MAJOR	VISUAL & VERIFICATION	100%		MANUFACTURER STANDARD	INVOICE / GRN	√		P	V	V	
1.5	EXPANSION VALVE MAKE-CAREL	MAKE, RATING	MAJOR	VISUAL & VERIFICATION	100%		MANUFACTURER STANDARD	INVOICE / GRN	√		P	V	V	

MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER
SIGNATURE	

LEGEND: * RECORDS, INDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
** M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER, N: BHEL
P: PERFORM W: WITNESS AND V: VERIFICATION, AS APPROPRIATE.

DOC. NO.: PE-V0-411-553-A003		
REVIEWED BY	APPROVED BY	APPROVAL SEAL

FORMAT NO.: QS-01-QA1-P-09/F1-R1

ENGG. DIV. /QA&I

Khairatabad, Hyderabad.

STULZ	STULZ CHSPL (I) PVT LTD A-173, TTC, KHAIRANE, NAVI MUMBAI	MANUFACTURING QUALITY PLAN		PROJECT	4X270 MW BHADRADRI TPP
		ITEM : PRECISION AIR CONDITIONER	QP NO.: PE-V0-411-553-A003 REV.NO 01 DATE: 04.06.18 PAGE: 2 CUSTOMER-TSGENCO	PACKAGE	AIRCONDITIONING PACKAGE
				CONTRACT NO.	V/17/0191
				MAIN- /SUB SUPPLIER:	

SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
					M	C/N					M	C	N	
1.	2.	3.	4.	5.	6.		7.	8.	9.		10			11
1.6	HEATER MAKE- RAVIRAJ/ MAGMA HUMIDIFIER MAKE- CAREL	MAKE, RATING	MAJOR	VISUAL & VERIFICATION	100%		MANUFACTURER STANDARD AND SUPPLIERS DATASHEET /GA		INVOICE/ GRN	√	P	V	V	
1.7	MCB, MPCB, CONTACTOR : MAKE-SCHNEIDER /SIEMENS TRANSFORMER: MAKE-BLOCK, Germany	MAKE, RATING	MAJOR	VISUAL & VERIFICATION	RANDOM/ LOT		MANUFACTURER STANDARD		INVOICE/ GRN	√	P	V	V	
2.0	IN PROCESS INSPECTION /FINAL INSPECTION													
2.1	BRAZING OF TUBES	LEAKAGE TEST	MAJOR	PRESSURE TEST	100%		MFR STD	NO LEAKAGE	IR	√	P	V	V	
2.2	CONTROL PANEL	PANEL COMPONENTS	MAJOR	VISUAL	100%		AS PER APPROVED DRAWING BY STULZ				P	V	V	
		HV,IR	MAJOR	HIPOT TEST	100%		MFR PROCEDURE		TEST REPORT	√	P	V	V	
2.3	PAC UNIT	CAPACITY TEST	MAJOR	MEASURE	1 PER TYPE/ SIZE –		MFR PROCEDURE	TECHNICAL SPECIFICAT-ION	TEST REPORT	√	P	V	W	BHEL WILL WITNESS RANDOM ONE PAC
		CONTROL ALARMS & PROTECTIONS FUNCTIONAL TEST	MAJOR	RUN TEST	100 %		MFR PROCEDURE	TECHNICAL SPECIFICAT ION	IR	√	P	V	V	

MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER
SIGNATURE	

LEGEND: * RECORDS INDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
** M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER, N: BHEL
P: PERFORM W: WITNESS AND V: VERIFICATION AS APPROPRIATE.

DOC. NO.: PE-V0-411-553-A003

REVIEWED BY	APPROVED BY	APPROVAL SEAL

FORMAT NO.: QS-01-QAI-P-09/F1-R1

ENGG. DIV. /QA&I

I) SCOPE-

This procedure describes the method and guidelines for Dry Run test for functional correctness.

II) PARAMETERS TO CHECK :-

i. Dimensional verification and visual inspection :-

Check the important outer dimensions of one unit per type.

ii. Review Internal inspection reports during manufacturing

1. Pressure Test QA Report
2. HIPOT(High Potential) Test Report
3. Controller Alarm QA Report

iii. Control Alarms: - As per the Controller QA report, check the various alarm for one unit per type as follows,

1. Comp 1- Low Pressure,
2. Comp 2- Low Pressure,
3. Comp 1- High Pressure,
4. Comp 2- High Pressure,
5. Fan failure,
6. E-heat failure,
7. Humidifier failure,
8. Water alarm,
9. Fire alarm,
10. Return air temp too high alarm,
11. Return air temp too low alarm,
12. Return air humidity too high alarm,
13. Return air humidity too low alarm,
14. Sensor Defect.

At given values of temperature and pressure as per valid condition or check alarms with voltage simulation conditions.

STULZ	SOP for DRY & RUN TEST	Doc No: SOP/UNIT-TEST/QA/08 Date of Issue: 1/9/2015 Date of Rev: Rev no: 00 Total Pages: 1 Of 1

Sr. No.	Testing Process
1	Connect 3 phase supply to incomer & keep it OFF.
2	Check all High voltage & Low voltage wires are connected properly.
3	Check all wires are tightened with proper ferrules.
4	Check FAN MPCB/ MCB are in OFF state.
5	Remove low voltage fuse.
6	Turn ON the main power supply.
7	Set the LVM as per given in Default setting for (PCC/DS-D&R/QA/14 , PCC/DS-D&R/QA/14B)
8	Check the 24 V of transformer.
9	Connect low voltage fuse & controller will turn ON.
10	Do the setting , for required System setting as per default setting sheet. (PCC/DS-D&R/QA/14 , PCC/DS-D&R/QA/14B , PCC/DS-D&R/QA/14A)
11	Switch ON the Fan MPCB/MCB.
12	Compressor will be turn ON/OFF according to Temperature setpoint .
13	Heater will be ON/OFF according to Temperature setpoint .
14	Check Point -> If Room Temp > Set point Temp. Then, Compressor will turn ON . If Room Temp < Set point Temp. Then, Heater will turn ON .
15	Humidification & Dehumidification mode will be , according to humidity setpoint.
16	Check Point -> If Room Hum. > Set point Hum. Then, Dehumidification start . If Room Hum < Set point Hum. Then , Humidification start.
17	Check the all Alarm's listed in Alarm check list (F/CACL/QA/04) .
18	Label the Tested OK sticker to panel.

Abbreviations: CACL : Control Alarm Check List, DS-D&R: Default Setting for Dry & Run Test.

Prepared by: Mahesh Gharat **Approved by: Shailesh Purohit**

PROJECT:(4X270 MW) BHADRADRI THERMAL POWER PROJECT
PACKAGE: AC SYSTEMS
CUSTOMER: TELANGANA STATE POWER GENERATION CORPORATION LIMITED
CONSULTANT:DESEIN PVT. LTD.
MAIN CONTRACTOR: BHEL

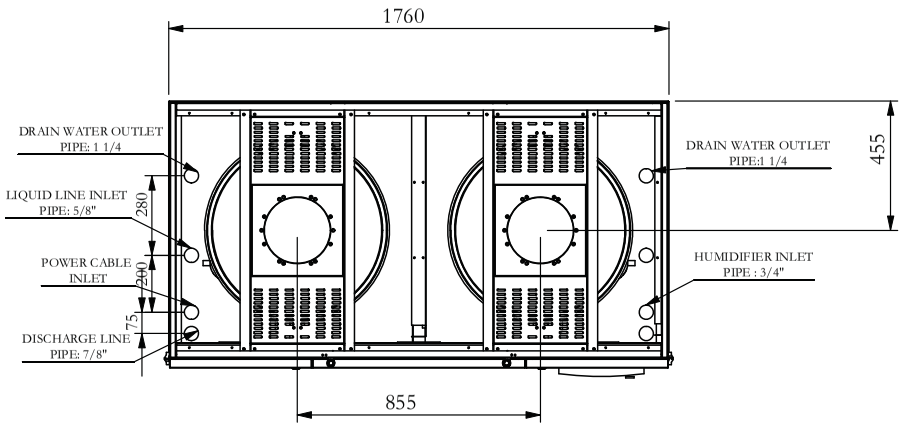
STULZ

TECH DATA SHEET

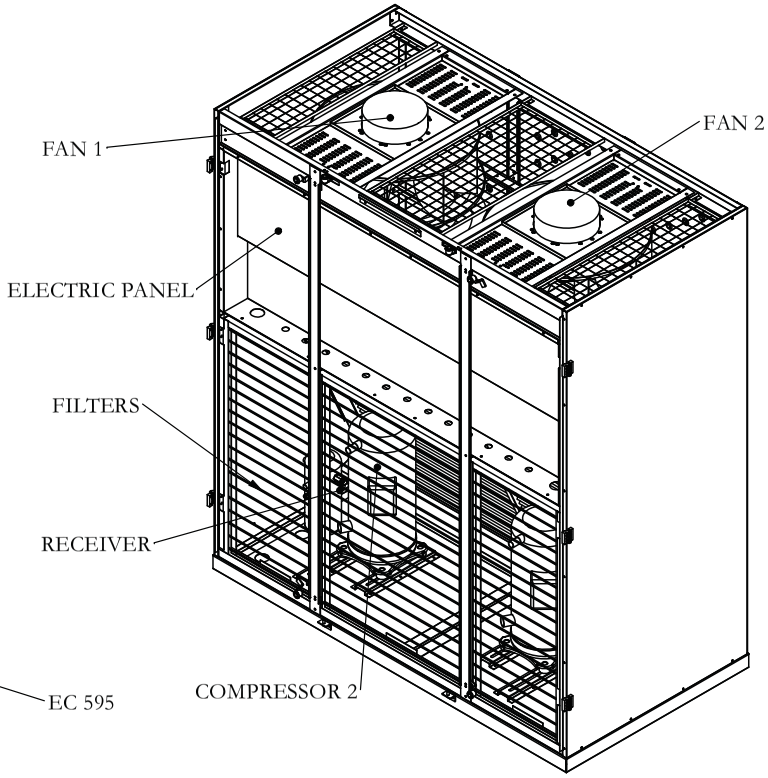
Sr. No	Description	Details
1	**GENERAL**	
a	Type of unit	**DX** Type
b	Manufacturer	STULZ India.
c	**Model No.**	**SEC 652 A**
d	Capacity	15 TR
e	Airflow	9000 CFM
f	Discharge Type	TOP Discharge
2	**UNIT CONSTRUCTION**	
a	Cabinet casing	Double skin side panels
b	Material	GI powder
c	Insulation Material & Thickness	Mineral wool/ 25 mm
d	Wet floor sensor for water leak detection	Included
3	**COMPRESSOR**	
a	Type	Fixed Scroll - Hermetic
b	Make	Copeland
c	No. of Compressor	2 Nos.
d	Operating Speed	2900 Rpm.
e	Electrical characteristics	415 v/ 3 ph / 50 Hz
f	Type of refrigerant	R407 C
g	Compressor Chart	Attached
4	**EVAPORATOR FAN**	
a	Type of Fan	Backward curved Plug Fan
b	Type of Drive	Direct Drive
c	Type of Motor	EC Motor
d	Make of Fan	EBM
e	Number of Fans	2 nos.
f	Statically & dynamically balanced	Yes
g	Type of bearings	Ball bearings
h	Electrical characteristics - V/P/H	415/3/50
i	Motor Protection	IP 54
j	Class of Insulation	CLASS F
k	Fan Curve	Attached

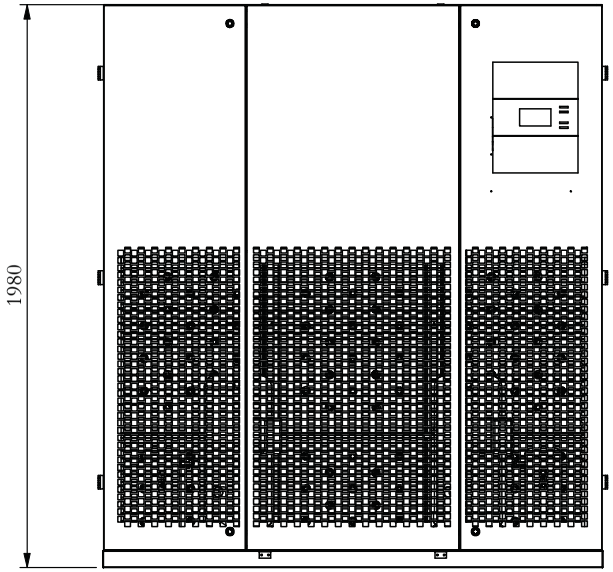
5	**EVAPORATOR COIL: DX:**	
a	Manufacturer	OEM supply
b	Material of Tube	Copper
c	Material of Fin	Aluminum
d	Diameter of Tube	9.5 mm
e	Type of Bonding	Mechanical
f	No of Fins per Inch	12-14 fins per inch
g	Type of Fins	SINE
6	**CONDENSER**	
a	Number of Condenser / Unit	2 nos.
b	Material	GI powder coated
7	**CONDENSER FAN**	
a	Type of Fan	Axial Fan
b	Type of Drive	Direct Drive
c	Type of Motor	AC Motor
d	Make of Fan	EBM PAPST /Rosenberg / EQ
e	No. of Fans	2 fans / Condenser
f	Diameter of Fan	500 mm
g	Electrical characteristics	220 v/ 1 ph / 50 Hz
8	**CONDENSER COIL**	
a	Manufacturer	OEM supply
b	Material of Tube	Copper
c	Material of Fin	Aluminum
d	Diameter of Tube	9.5 mm
e	Type of Bonding	Mechanical
f	No of Fins per Inch	12-14 fins per inch
g	Type of Fins	SINE
9	**HEATER**	
a	Capacity	15 Kw / 2 Stage
b	Type	Electric Strip
c	Make	OEM supply
d	No. of Heater / unit	1 no.
e	Type of protection	Over Heat protection
f	Electrical characteristics	415 v/ 3 ph / 50 Hz
10	**HUMIDIFIER**	
a	Type	Steam Electrode Type
b	Make	Carel
c	Capacity	8 kg / hr
d	No. of Humidifier / unit	1 No
e	Electrical characteristics	415/3/50

11	**FILTERS**	
a	Type	Washable
b	Make	OEM Supply
c	Filter Media	HDPE
d	No. of Filters / unit	As per coil size
e	Efficiency	99.5 % down to 5 microns.
12	**INDOOR UNIT DIMENSIONS**	
a	**HEIGHT**	1980 mm
b	**WIDTH**	1760 mm
c	**DEPTH**	920 mm
13	**INDOOR UNIT WEIGHT**	740 kgs
14	**OUTDOOR UNIT DIMENSIONS**	
a	**HEIGHT**	760 mm
b	**WIDTH**	1820 mm
c	**DEPTH**	365 mm
15	**OUTDOOR UNIT WEIGHT**	70 kgs

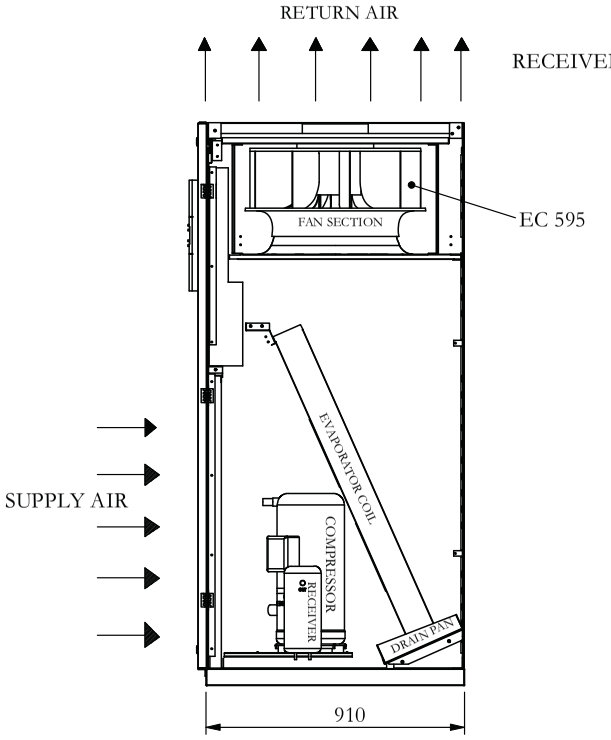


TOP VIEW





FRONT VIEW



RHS VIEW

	Clients Specific	
	Optional Attachments	
1	Heater	2KW,6KW,12KW,18KW
2	Humidifier	5kg/hr. ,8kg/hr

DRAWN BY	ENG.		3/3/2012
CHECKED BY	PRD.		5/3/2012
APPROVED			13/3/2012
	NAME	SIGN	DATE

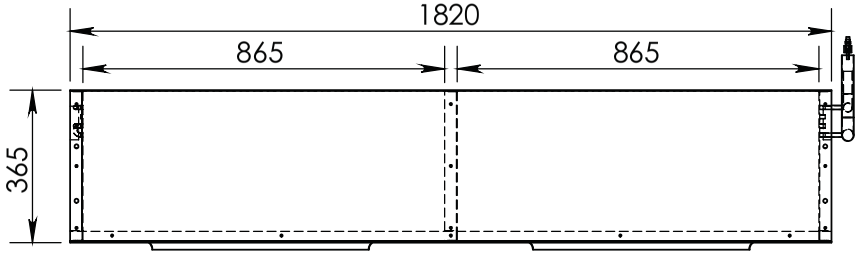
STULZ CHSPL (INDIA) PVT. LTD.

STULZ

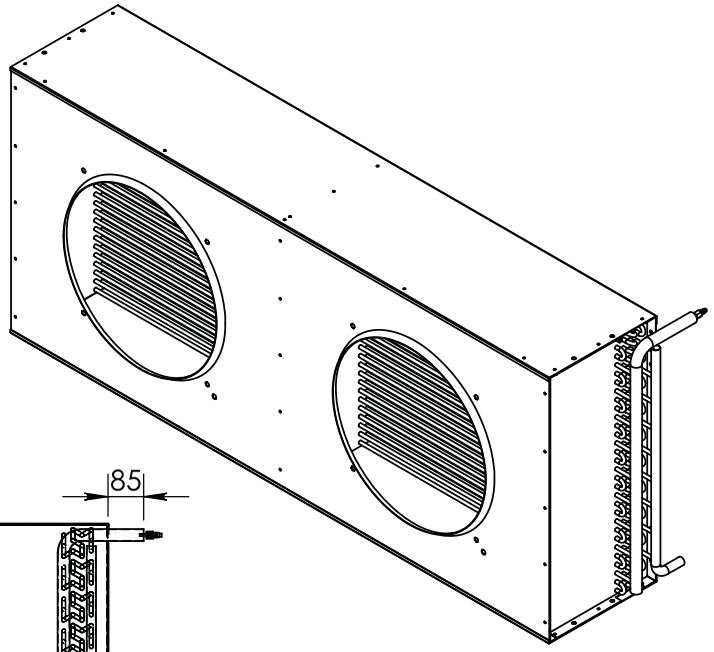
TITLE: SEC-F3-UP

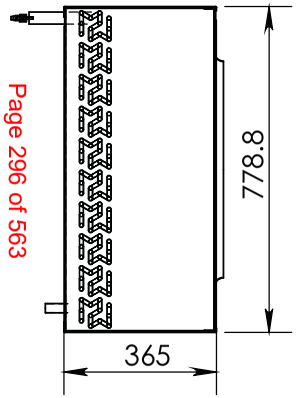
NOTE:
ALL DIMENSIONS ARE IN mm
UNSPECIFIED TOLERANCES ±2mm

DRW. NO.:
PART NO.:
REV. NO.: R01-3/03/2012
SHEET NO.: 1/1

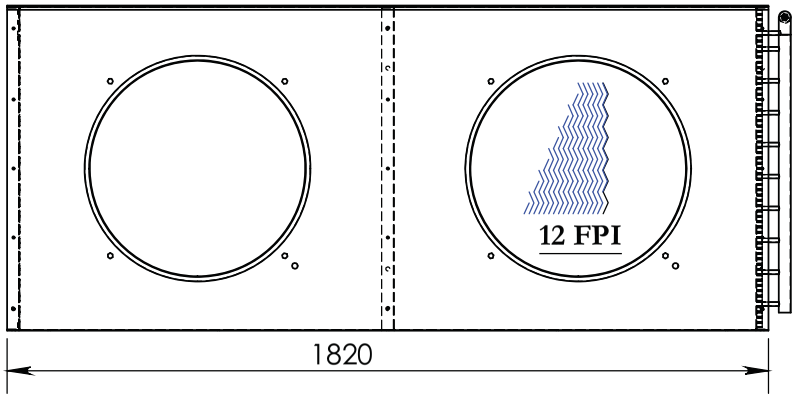


TOP VIEW

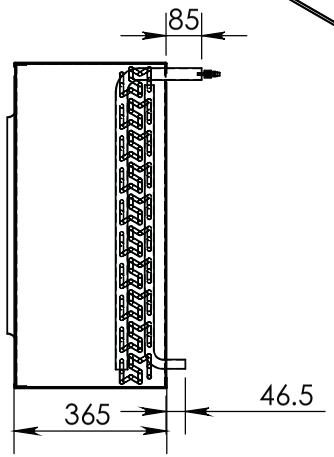




LHSV



FRONT VIEW



RHSV

DRAWN BY	ENG.			STULZ CHSPL (INDIA) PVT. LTD.	STULZ	TITLE:	DRW. NO.:HR-46
CHECKED BY	PRD.						PART NO.:HR-46
APPROVED				DRAWINGS ARE PROPERTY OF STULZ CHSPL (INDIA) PVT. LTD. COPYING/USING THESE FILES WITHOUT CONSENT WILL LEAD TO PENAL ACTION.		NOTE: ALL DIMENSIONS ARE IN mm UNSPECIFIED TOLERANCES ±2mm	REV. NO.: R01 / SHEET NO.: 1/1
	NAME	SIGN	DATE				

R3G595-AB31-79(mID:162390)

EC centrifugal fan

backward curved, single inlet

epM inlet nozzle

Nominal data

Nominal voltage range		V	3~ 380 .. 480
Frequency		Hz	50/60
Fan speed	n	min-1	1400
Input power	P_{ed}	W	2950
Current draw	I	A	4.5
Mass		kg	27.7
Min. ambient temp.		°C	-25
Max. ambient temp.		°C	55
Protection class			55
Approvals			
Number of blades			6
Mounting position			Shaft horizontal or rotor on bottom

Air performance measured as per ISO 5801 Installation category A.

For detailed information on the measuring setup, please contact ebm-papst.

Suction-side noise levels: L_wA measured as per ISO 13347 / L_pA with 1 m distance to fan axis.

The values given are valid under the measuring conditions mentioned above and may vary according to the actual installation situation.

With any deviation from the standard setup, the specific values have to be checked and reviewed with the unit installed.

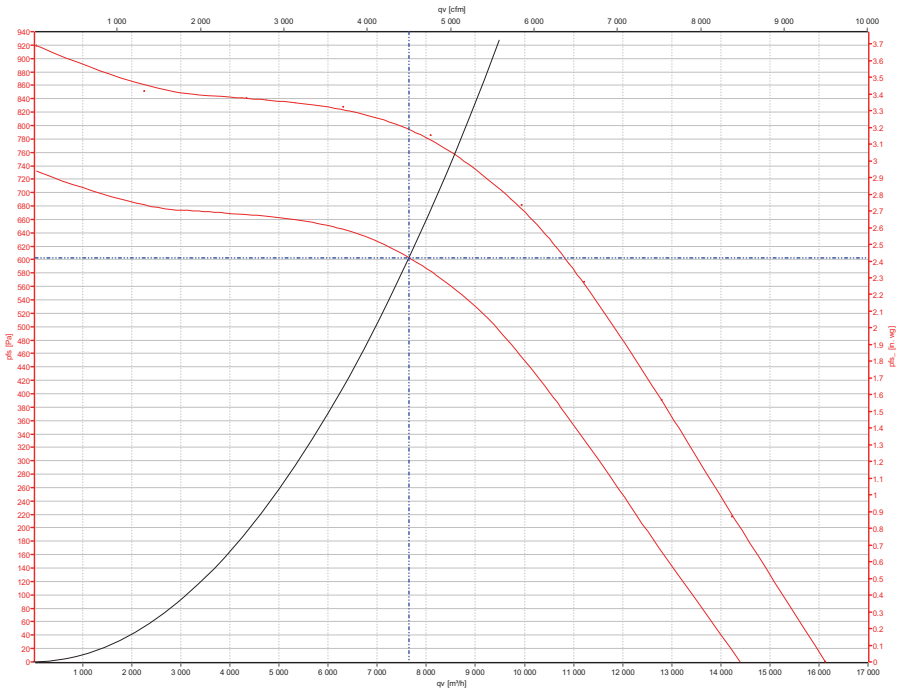
q_v = airflow
p_f = total pressure (static + dynamic)
P_{ed} = electrical input power
$\eta_{ed} = q_v \times p_f / P_{ed}$ (overall efficiency)
I = current draw
$L_WA(A,out)$ = sound power outlet
$L_WA(A,in+out)$ = sound power inlet+outlet
$\rho_{calculated\ to}$ = air density converted to the application
$\rho_{measured\ at}$ = air density measured environment
$U_{control}$ = control voltage
p_{fs} = static pressure
n = fan speed
SFP = specific fan power
η_{es} = overall static efficiency
$L_WA(A,in)$ = sound power inlet

Data in operating point

q_v	m³/h	7650
q_v	cfm	4503
p_{fs}	Pa	603
p_f	Pa	623
n	min-1	1248
P_{ed}	W	2046
SFP	kW/(m³/s)	0.963
η_{ed}	%	64.7
η_{es}	%	62.6
I	A	3.14
$L_WA(A,in)$	dB(A)	76.1
$L_WA(A,out)$	dB(A)	81.9
$L_WA(A,in+out)$	dB(A)	82.9
$U_{control}$	V	-

Settings

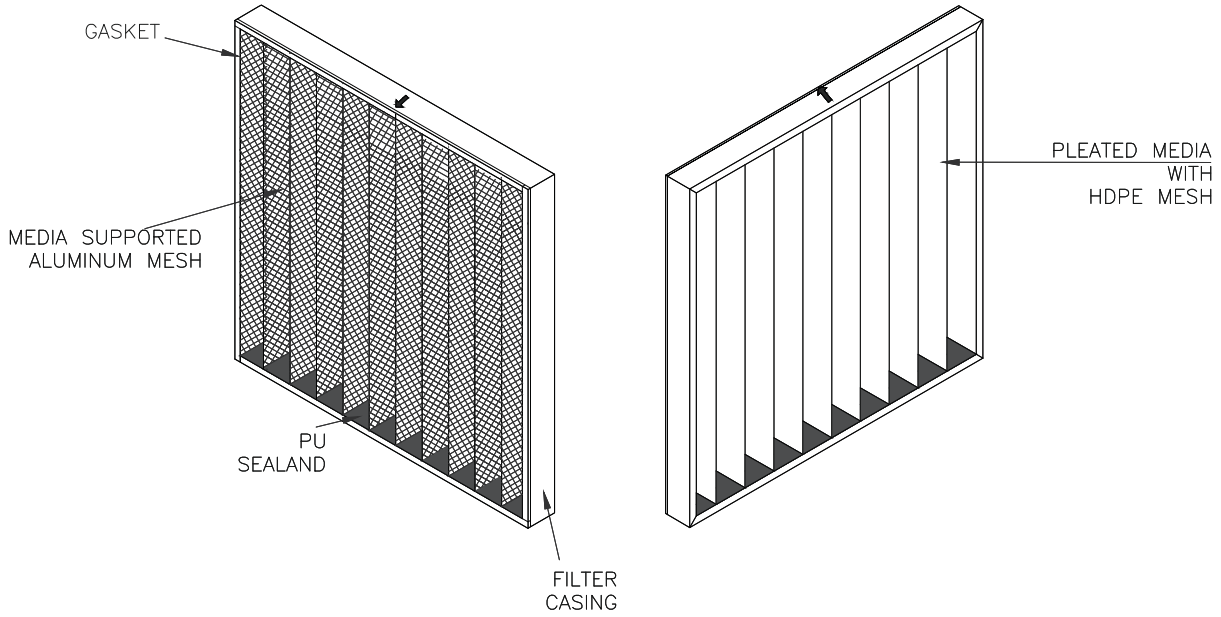
$\rho_{calculated\ to}$	kg/m³	1.2
$\rho_{measured\ at}$	kg/m³	1.17



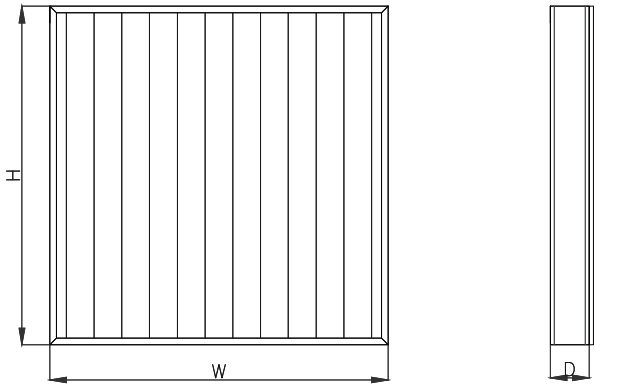
TECHNICAL DATA SHEET OF FILTER

SL NO	Description	Particulars
1	**Item**	Pre-filter
2	**Make**	As Per Make List
3	**Application**	AHUs,PAC Units,Fresh Air Fan in Airconditioning System
4	**Type**	Box type, Dry HDPE Filter
5	**Cleanable or non cleanable**	cleanable
6	**Velocity of Air across the filter**	2.5 m/sec
7	**Filter media**	Synthetic non-oven(washable and fire returndant)
8	**Efficiency**	90 % down to 10 µm
9	**Allowable pressure drop**	2.5 mm & 6.0 mm in clean and dirty Condition respectively
10	**Frame work**	18G GSS
11	**Size**	(As per approved Layout Drawings)
12	**Quantity**	
13	**Capacity**	
14	**Temperature resistance**	70^0 C
15	**AVG. ARRESTANCE**	**65-80 % EFFICIENCY**

SL NO	Description	Particulars
1	**Item**	Fine-filter
2	**Make**	As Per Make List
3	**Application**	AHUs and in PAC units and in Fresh Air Fan in Airconditioning System
4	**Type**	Box type
5	**Cleanable or non cleanable**	cleanable
6	**Maximum face Velocity of Air across the filter**	1.5 m/sec
7	**Filter media**	Reinforced glass fibre or cotton fabric or any type of fabric materials sandwitched in between two galvanised wire netting.
8	**Efficiency**	99.5 % down to 5 µm
9	**Allowable pressure drop**	Maximum pressure drop shall be limited to12 mm WG in all conditions.
10	**Frame work**	18G GSS
11	**Size**	(As per approved Layout Drawings)
12	**Quantity**	
13	**Capacity**	
14	**Temperature resistance**	70^0C
15	**AVG. ARRESTANCE**	**80-90 % EFFICIENCY**



ISOMETRIC VIEW



FRONT VIEW

SIDE VIEW

SPECIFICATION	
MODEL	PRE FILTER
FILTER MEDIA	SYNTHETIC NON WOVEN
FILTER GRADE	G4 (EU4)
SIZE	H*W*D
AVG. ARRESTANCE	90% DOWN TO 10μm
FRAME WORK	18G GSS
SEALANT	POLYURETHANE
OPERATING TEMP.	AMBIENT
NUMBER OF PLEATS	7 PLEATS PER FOOT
CONTRACTION	PLEATED TYPE
GASKET	XLP GASKET (CROSS LINKED POLYETHYLENE)

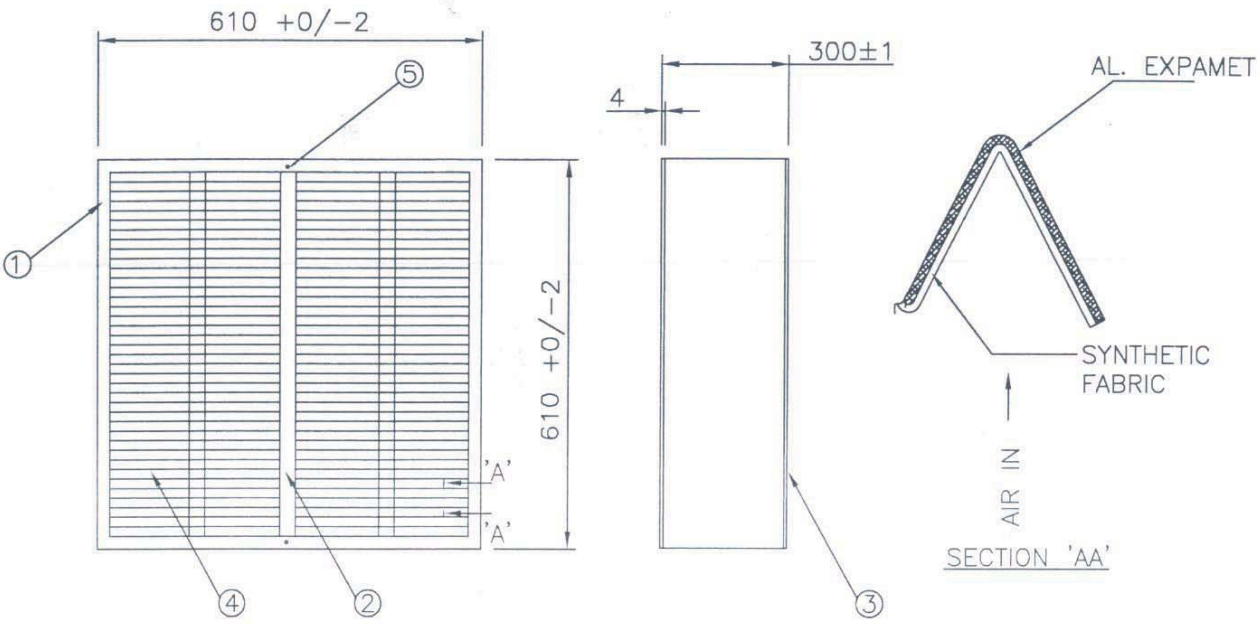
FILTER SIZES					
BOX SIZE (H*W*D)			AIR FLOW IN CFM @2.5m/sec	IPD	FPD
HEIGHT	WIDTH	DEPTH			
610	610	50	2000	60Pa±10%	250pa

Tolerances :

Height : +0–3mm.
Width : +0–3mm.
Depth : ±1mm.
Diagonal : Max Difference 5mm.

PROJECT :(4X270 MW) BHADRADRI

3RD ANGLE PROJECTION		TITLE	PRE FILTER BOX TYPE
SIZE	A3		
UNIT	MM		
SCALE	NTS	MAKE	AS PER APPROVED MAKE LIST
DATE		DWG NO	



NO. OF FINS : 9 ±1.

FILTER MEDIA : ONE LAYER OF SYNTHETIC FABRIC MEDIA WITH AL. EXPAMET WIRE MESH AT OUTLET SIDE.

EFFICIENCY : 99.5% DOWN TO 5 MICRON AS PER BS:2831

S.NO.	DESCRIPTION	MATL	REMARKS	QTY.
5	RIVET	AL.		6
4	FILTER MEDIA	SYNTHETIC FABRIC		1
3	SEALING GASKET	SPONGE RUBBER		8
2	SPACER	Al.	26 SWG.	3
1	FILTER FRAME	GI.	18 SWG.	1

PROJECT ::(4X270 MW) BHADRADRI

TITLE: FINE FILTER

SIZE	CODE IDENT.NO.	DWG. NO.
A4	–	ASK 4501

SCALE 1 : 1 | RELEASE DATE | SHEET 5 OF 5

Lev – | Ver – | Rev -0

FILE NAME: A4501FF

PUROMATIC
Committed to Excellence

Technical Data Sheet

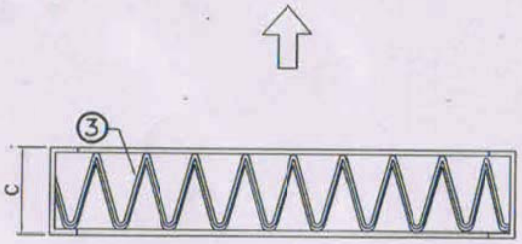
ITEM	PRE FILTER CASSETTE TYPE		
CONTRACTOR	STERLING & WILSON PVT LTD.KOLKATA		
PROJECT	4× 270 MW BHADRADRI THERMAL POWER PROJECT	Main Contractor	BHEL

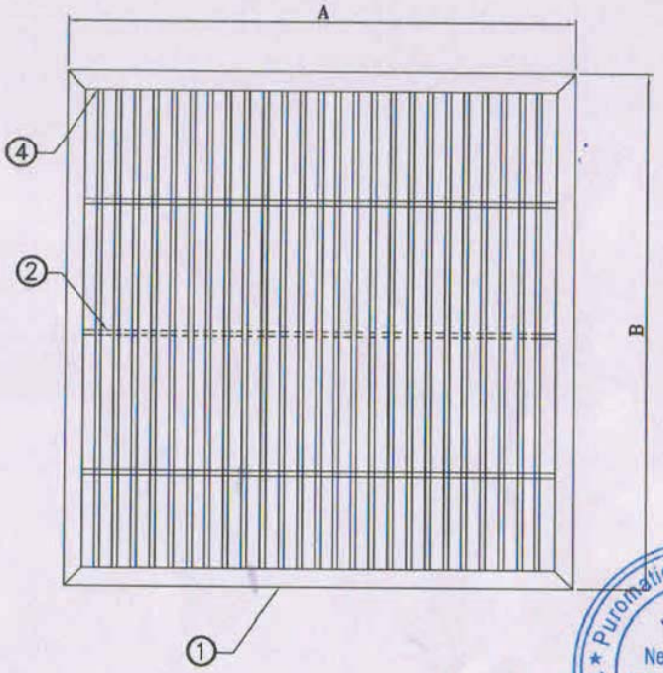
Sno.	Description	Specification
1	Manufacturer	Puromatic Filters Pvt Ltd
2	Overall Dimensions (mm)/ Qty in Nos.	1. 610 X 610 X 50 – 2. 305 X 610 X 50 –
3	Frame Type	Cassette
4	Frame Material	18 G GSS (1.25±0.12mm) as per IS 277
5	Spacer	3 Nos, Al Sheet 20 G (0.91±0.08 mm)
6	Filter Media	Synthetic Non Woven(fire retardant and resistant to moisture, fungi ,bacteria & frost) **Progressive density filter media having high dust holding capacity at lesser pressure drop** with HDPE mesh on air entry side & Al expanded mesh on air exit side.
7	End Sealing	Epoxy
8	Testing Standards	BS:6540/ASHRAE-52-76/EN779
9	Maximum Face velocity(M/Sec)	2.5
10	Flow Rate (CMH) Per Filter	3030 (Effective Area -580x580) 1437 (Effective Area -275x580)
11	Initial Pressure Drop(mm of WC)	< 5 @ Rated Flow
12	Final Pressure Drop (mm of WC)	Up to 7.5 mm of WC
13	Average Synthetic Dust Wt. Arrestance	65 - 80%
14	Whether Cleanable	Yes By Water / Air
15	Inspection & Testing	As per Manufacturer TC
Prepared By		Approved By

Puromatic Filters (P) Ltd. New Delhi-20 011-26388013-14 12 DSIDC Scheme-2, Okhla Ph-II

NOTE: Efficiency: 90% down to particle size of 10 microns.

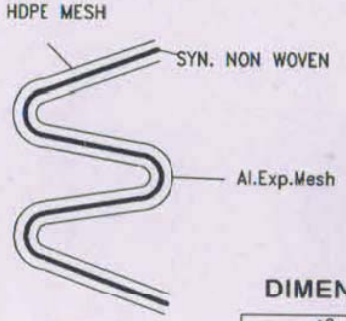
Puromatic Filters Pvt. Ltd
Telefax: +91-11-26388013,14,26389158
Email: sales.puromatic@gmail.com
filters@ndb.vsnl.net.in
website: www.puromaticfilters.com





S.No.	ITEM	MATERIAL	QTY.	REMARKS
4.	SEALING	EPOXY	1 SET	
3.	FILTER MEDIA	SYN. NONWOVEN	1 SET	
2.	SPACER	ALUMINIUM	3 Nos.	20 SWG
1.	FILTER FRAME	GI 18 SWG	1 No.	

BILL OF MATERIAL



NOTE:-

FILTER MEDIA : Thickness 3.0-4.5 mm
Basic Weight -100± 10 % GSM
FILTER MEDIA No of Folds:-11 ±1/RFT
Sheet Thickness: GI 18 G -1.25 ± 0.12 mm
AlSheet 20 G-0.91 ± 0.08 mm

DIMENSIONS

A^{+0}_{-3}	B^{+0}_{-3}	C^{+0}_{-2}
610	610	50
305	610	50

PROJECT : 4 × 270 MW BHADRADRI TPP

CONTRACTOR : STERLING & WILSON KOLKATA.

PUROMATIC FILTERS PVT.LTD.
12,DSIDC,Scheme-2,Okhla Industrial Area
Phase-2,New Delhi-110020,India
Telefax:+91-11-26388013,14,26389158
Email:sales.puromatic@gmail.com
filters@ndb.vsnl.net.in
web:www.puromaticfilters.com

Puromatic Filters (P) Ltd. New Delhi-20 011-26388013-14 12 DSIDC Scheme-2, Okhla Ph-II

ITEM: PRE FILTER
TYPE: CASSETTE
ALL DIMENSIONS ARE IN MM.
DRWN. BY MD DATE:15.12.16
CHKD. BY AM
PART.NO. 1612383A
SHEET 2 OF 2 REV.:00

Technical Data Sheet

ITEM	FINE FILTER CASSETTE TYPE
PROJECT	(4X270 MW) BHADRADRI THERMAL POWER PROJECT
CONTRACTOR	STERLING AND WILSONS PVT. LTD.

S.No.	Description	Specification
1	Frame type	Cassette
2	Frame material	GI sheet 18 G (1.2 ± 0.12mm) as per IS 277
3	Spacers	Al sheet 20 G (0.91 ± 0.08 mm)
4	Filter Media	Synthetic non woven(fire retardant and resistant to moisture, fungi ,bacteria & frost) progressive density filter media having high dust holding capacity at lesser pressure drop with **HDPE mesh** on air entry side & **Aluminium expanded** mesh on air exit side.
5	Gasket	Not required on cassette type filter
6	Test standard	BS:6540/ASHRAE-52-76/EN779
7	Maximum face velocity	2.4 m/sec
8	Initial pressure drop	6 mm of WC
9	Final pressure drop	12 mm of WC
10	Average synthetic dust wt. arrestance	>90%
11	Filter cleaning	By compressed air/ water
12	Inspection & Testing	As per approved QAP

Efficiency: not less than 99.5% down to particle size of 5 microns.

S.No.	Overall dimensions (mm) (H X W X D)	Rated air flow (CMH)	Qty (nos)	Remarks
1	610 X 610 X 305	3215	As Per Layout	
3	305 X 610 X 305	1607	As Per Layout	

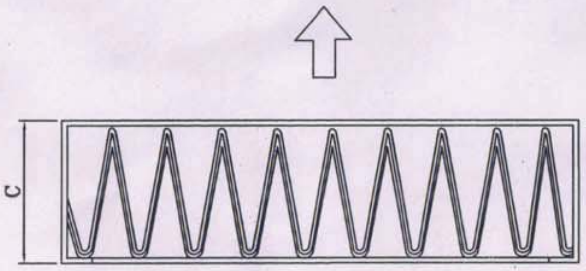
Prepared By Mohan Dehran

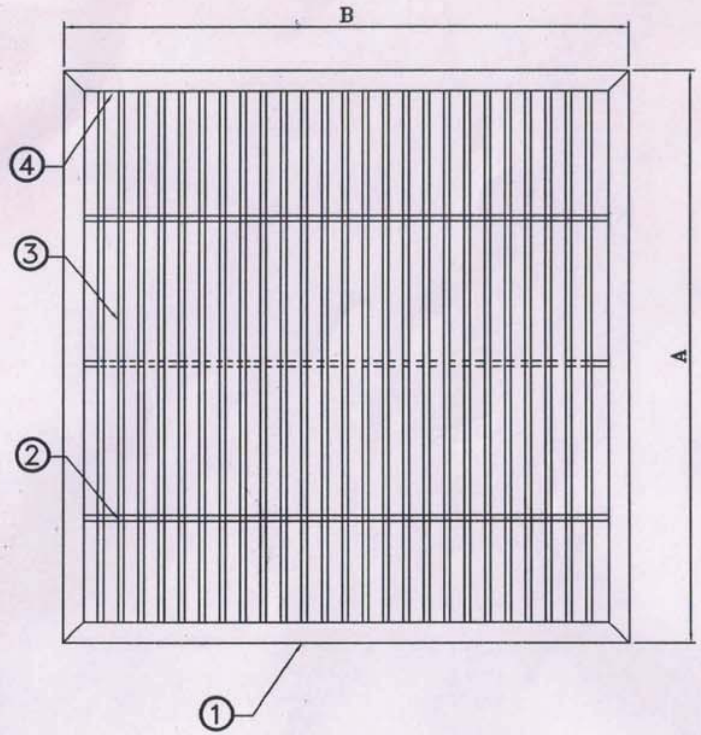
Approved By

Puromatic Filters (P) Ltd. New Delhi-20 011-26388013-14 12 DSIDC Scheme-2, Okhla Ph-II

Annexure PF- 2 (1 of 1)

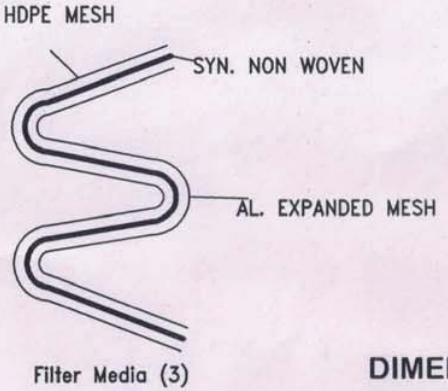
Puromatic Filters Pvt. Ltd
Telefax: +91-11-26388013,14,26389158
Email: sales.puromatic@gmail.com
filters@ndb.vsnl.net.in
website: www.puromaticfilters.com





S.No.	ITEM	MATERIAL	QTY.	REMARKS
4.	END SEALING	EPOXY		
3.	FILTER MEDIA	SYN. NONWOVEN*	1 Set	
2.	SEPARATOR	ALUMINIUM		20 SWG
1.	FILTER FRAME	GI 18 SWG	1 No.	

BILL OF MATERIAL



NOTE:-

FILTER MEDIA : Thickness 1.5-1.6 mm
Basic Weight -200± 10% GSM
FILTER MEDIA No of Folds:-11 ±1/RFT
Sheet Thickness: GI 18 G -1.2 ± 0.12 mm
AlSheet 20 G-0.91 ± 0.08 mm

DIMENSIONS

$A^{\pm 0}_{3}$	$B^{\pm 0}_{3}$	C^{+2}_{-}
610	610	305
305	610	305

Puromatic Filters (P) Ltd. New Delhi-20

PROJECT: (4X270 MW) BHADRADRI THERMAL POWER PROJECT
CONTRACTOR : STERLING & WILSONS PVT.LTD.

PUROMATIC FILTERS PVT.LTD.

12,DSIDC,Scheme-2,Okhla Industrial Area
Phase-2,New Delhi-110020,India
Telefax:+91-11-26388013,14,26389158
Email:sales.puromatic@gmail.com
filters@ndb.vsnl.net.in
web:www.puromaticfilters.com

ITEM: FINE FILTER
TYPE: CASSETTE
ALL DIMENSIONS ARE IN MM.

DRWN. BY	MD	DATE: 23.09.17
CHKD. BY	AM	DATE:

DRG NO. 1709365B
SHEET 4 OF 4 | REV.: 00

SHEET- A3

DATA SHEET OF METALLIC FILTERS FOR AIR WASHER & UAF

Technical Data Sheet

ITEM	METALLIC FILTER CASSETTE TYPE		
PROJECT	(4X270 MW) BHADRADRI THERMAL POWER PROJECT	Date.	250718
CONTRACTOR	STERLING & WILSONS PVT LTD. KOLKATA	REV	00
MANUFACTURER	PUROMATIC FILTERS PVT. LTD.	REV DATE	..

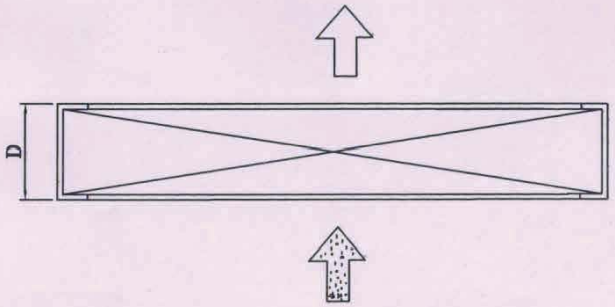
S.No.	Description	Specification
1	Manufacturer	Puromatic Filters Pvt Ltd.
2	Overall Dimensions (mm) Qty in Nos.	610 X 610 X 50 – As per approved GA
3	Frame type	Cassette
4	Frame material	Al sheet 16 G (1.5 ± 0.11mm) as per IS 737
5	Face Guard	Al. Expanded mesh heavy duty on both sides.
6	Filter Media	Multiple layers of V fold SS expanded mesh inter spaced with flat layer of aluminium expanded mesh.
7	Test standard	BS:6540/ASHRAE-52-76/EN779
8	Maximum face velocity	2.5 m/sec
9	Flow Rate (CMH) Per filter	3030 (Effective Area- 580x580 mm)
10	Initial pressure drop	≤ 5 mm of WC at rated flow
11	Final pressure drop	Up to 7.5 mm of WC
12	Average synthetic dust wt. arrestance	60% to 80%
13	Filter cleaning	By compressed air/ water
14	Inspection & Testing	As per Manufacturer TC
Prepared By	Mohan Delhi	Approved By 21/7/17

Puromatic Filters (P) Ltd. New Delhi-20 011-26388013-14 12 DSIDC Scheme-2, Okhla Ph-II

Note:
1. SS 316 wire netting with three or more layers of wire mesh, SS wire diameter shall be 0.16mm providing an aperture of max 0.025mm.
2. Filter Efficiency: 90% down to particle size of 10 microns.

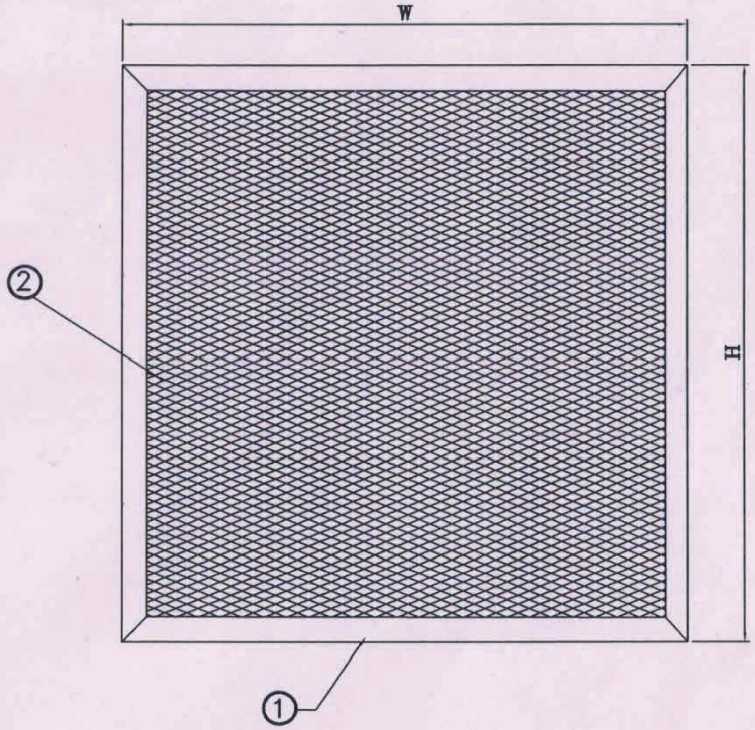
Puromatic Filters Pvt. Ltd
Telefax: +91-11-26388013,14,26389158
Email: sales.puromatic@gmail.com
filters@ndb.vsnl.net.in
website: www.puromaticfilters.com
CIN:U74899DL1992PTC048328

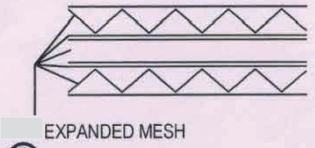
METALLIC FILTER



S.No.	ITEM	MATERIAL	QTY.	REMARKS
3.	FILTER MEDIA	SS EXPANDED MESH *	1 SET	
2.	FACE GAURD	AL. EXPANDED MESH	02 NOS.	
1.	FILTER FRAME	Al 16 SWG (1.5±0.11mm)	1 No.	

BILL OF MATERIAL





EXPANDED MESH

3

*FILTER MEDIA DETAIL

DIMENSIONS

H +0/-3	W +0/-3	D ± 2
610	610	50

Puromatic Filters (P) Ltd. New Delhi-20 011-26388013-14 12 DSIDC Scheme-2, Okhla Ph-II

PROJECT: 4 × 270 MW BHADRADRI TPP

CONTRACTOR: STERLING & WILSONS PVT LTD.

ITEM: METALLIC FILTER

TYPE: CASSETTE

ALL DIMENSIONS ARE IN MM.

PUROMATIC FILTERS PVT.LTD.

12,DSIDC,Scheme-2,Okhla Industrial Area
Phase-2,New Delhi-110020,India
Telefax:+91-11-26388013,14,26389158
Email:sales.puromatic@gmail.com
filters@ndb.vsnl.net.in
web:www.puromaticfilters.com

DRWN. BY	MD	DATE: 17.07.17
CHKD. BY	AM	

DRG NO. 1707283A

SHEET 3 OF 4 | REV.:00

SHEET- A3

TECHNICAL DATA SHEET OF TUBE AXIAL FAN			
Project : (4X270 MW) BHADRADRI THERMAL POWER PROJECT			
Package : AIR CONDITION SYSTEM			
Document No : PE-V0-411-553-A210, REV-00			
SL. No	DESCRIPTION	TECHNICAL DATA	TECHNICAL DATA
1	Location	TG BLDG (U#1,2 & 3,4)	ESP Unit 1, 2 & 3,4
2	Application	Fresh Air Fan	Fresh Air Fan
3	Manufacturer	**MARATHON Electric Motors (India) Limited**	
4	Model No.	30J/2K2-P4	15J/K55-P2
5	Fan Type	Tube Axial	Tube Axial
6	Specific Weight of Air at Temp.	1.2 kg/M3 at 20°c	1.2 kg/M3 at 20°c
7	Selected Capacity	10,000 M3/hr	1,020 M3/hr
8	Selected Capacity	5882 CFM	600 CFM
9	Static Pressure at 20°c	30 mmwg	30 mmwg
10	Total Pressure at 20°c	32.35 mmwg	30.38 mmwg
11	Impeller Speed	1450 rpm	2800 rpm
12	Shaft Power at operating speed at 20°c	1.64 kw	0.28 kw
13	Fan Static Efficiency	50.81%	29.76%
14	Fan Total Efficiency	54.79%	30.14%
15	Critical Speed	1885 rpm	3640 rpm
16	Bearings		
	a) Make & Type	SKF or Equiv / Ball	SKF or Equiv / Ball
	b) Manufacturer's designation	Refer Motor Data Sheet	Refer Motor Data Sheet
17	Static Weight of Fan-Motor Assembly	120 kg approx	50 kg approx
18	Dynamic Weight of Fan-Motor Assembly	150 kg approx	65 kg approx
19	Performance curve enclosed (Yes/No)	-Yes-	-Yes-
20	Motor Data		
21	Motor Rating at 50°c	2.2 kw 4 pole	0.55 kw 2 pole
22	Motor Type	IE-3	IE-3
23	Motor Method of mounting	Foot Mounted	Foot Mounted
24	Direction of rotation	Clockwise (Viewed from DE)	Clockwise (Viewed from DE)
25	Material / Thickness		
	a) Impeller	LM-6, BS:1490 / Aerofoil	LM-6, BS:1490 / Aerofoil
	b) Casing	IS:1079 gr 'O' / 2 mm Thick	IS:1079 gr 'O' / 2 mm Thick
26	Quantity	2 No	4 Nos
27	Impeller Diameter	757 mm	376 mm
28	No.of Blade	9 nos	7 nos
29	Painting Spec. of fan	AS PER BHEL SPECIFICATION	
30	Fan Sound Level at 1 M from fan in free field cond.	85 dB (A)	
31	Inspection & Testing	AS PER NTPC APPROVD QAP	

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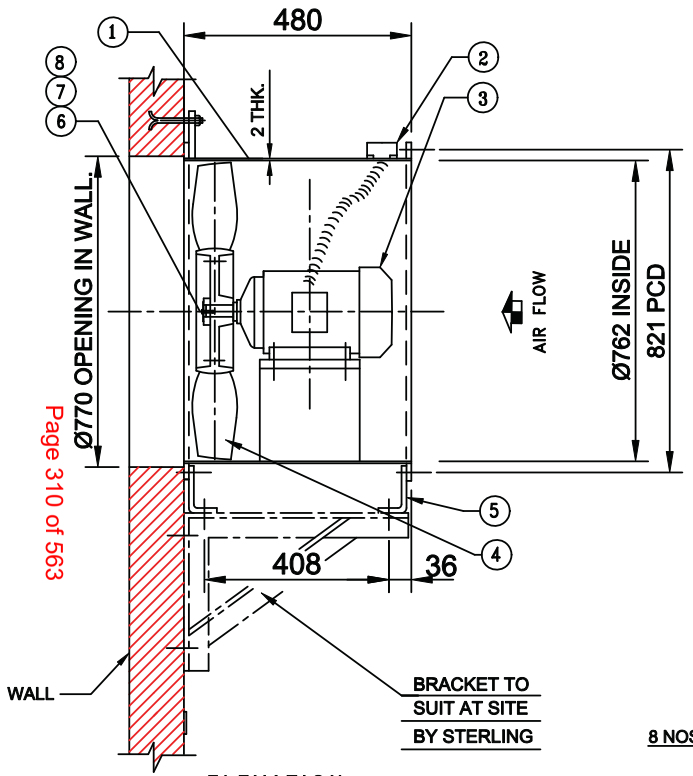
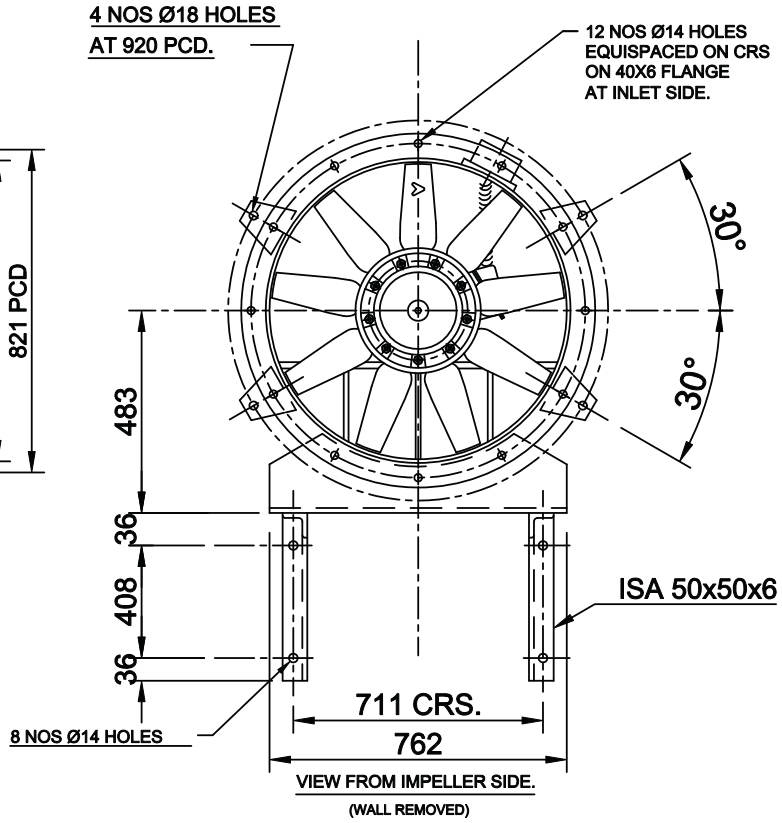
Note:
MOC of Impeller- LM-6, BS:1490 /Aerofoil,
Total Pressure- Mentioned in the TDS. It will be @ 20 deg C. Fan Motor Starting DOL- Testing as per approved QAP. Design as per OEM Standard. FAN DYNAMICALLY BALANCED AS PER GR. 6.3, ISO:1940.
SP for Fine Filters-18 MMWC & Prefilters 7 MM WC, So total SP we have considered 30 MM WC

REV	DRAWING NO.	REF. DRG. NO.	For General Tolerance,Definition of various Symbols and Instructions refer Drawing No. CP3933/*. *(Rev. No.) should be taken from online "Drawing Master"	IF IN DOUBT , PLEASE ENQUIRE	These drawing and design are the property of Marathon Electric Motors (India) Limited. These must not be copied or lent to any other party without the written consent of Marathon Electric Motors (India) Limited.
00	C12.R6.01.30.00. AC3844				





ALL DIMENSIONS ARE IN mm.

NOTES -

1. POWER SUPPLY.
   415 V , 3 PH, 50 HZ , AC.
2. MOTOR DEGREE OF PROTECTION : IP-55.
3. MOTOR CLASS OF INSULATION : 'F' (TEMP. RISE LIMIT 70°C).
4. MOTOR AMB. TEMP. : 50°C .
5. PAINTING SPECIFICATION.
   As Per BHEL Specification

SL.NO	DESCRIPTION	QTY	MATL.	REMARKS
8	LOCKING SCREW (at center)	1	IS:1367	
7	LOCKING WASHER.	1	IS:1079/2062	
6	LOCKING PLATE.	1	IS:1079/2062	
5	ATTACHABLE FEET	2	IS:1079/2062	
4	IMPELLER.	1	LM-6, BS:1490	DIE CAST
3	MOTOR,'MARATHON' MAKE.	1	STD.	
2	TERMINAL BOX	1	IS: 617	STD.
1	FAN CASING 2 THK	1	IS:1079/2062	

MODEL	FAN SIZE	TYPE & FRAME OF MOTOR	RATING (KW/P)	FLOW (M3/HR)	STATIC PR. mmwg at 20°c	SPEED (RPM)	SHAFT POWER AT 20°C (BKW)	QTY	SALES REF NO
30J/2K2-P4	30"	TEFC,SQ CAGE FOOT MTD.,D100L	2.2 KW 4-POLE	10,200	30	1450	1.64	1	

REV.	DATE	DETAIL OF REVISION	DONE BY	APPRVD	DDN NO.	DCN NO.

DDN NO.
PATTERN NO.
PATTERN TYPE
PROJECTION
MATERIAL:
S.O. NO.

marathon electric
A Regal Beloit Company

Marathon Electric Motors (India) Limited
Paharpur Works, 58 Taratala Road.
Kolkata - 700024 , INDIA

TITLE

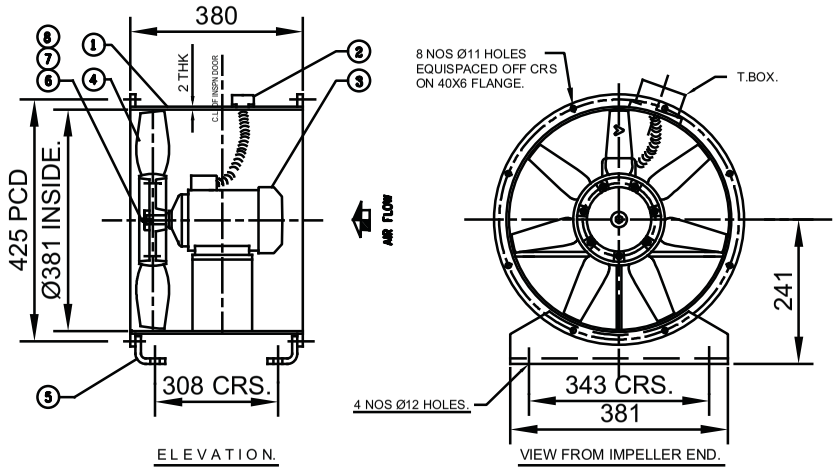
GEN. ARRGT. OF AXIAL FLOW FANS

MODEL : 30J/2K2-P4

DRAWN	B.Majumder		22.06.11	
CHECKED	S.BHOWMICK			
APPRVD.	S.Majumder		22.06.11	
SCALE	N.T.S	SIGN	DATE	

DRAWING NO. C12. R6. 01. 30. 00. AC3844 | REV 00

REV	DRAWING NO.	REF. DRG. NO.	For General Tolerance,Definition of various Symbols and Instructions refer Drawing No. CP3933/*. *(Rev. No.) should be taken from online "Drawing Master"	IF IN DOUBT , PLEASE ENQUIRE	These drawing and design are the property of Marathon Electric Motors (India) Limited. These must not be copied or lent to any other party without the written consent of Marathon Electric Motors (India) Limited.
00	C12.R6.01.15.01. AC6007				



ELEVATION.

VIEW FROM IMPELLER END.

MODEL	FAN SIZE	TYPE & FRAME OF MOTOR	RATING (KW/P)	FLOW (M3/HR)	STATIC PR. mmwg at 20°c	SPEED (RPM)	SHAFT POWER AT 20°C (BKW)	QTY	SALES REF NO
15J/K55-P2	15"	TEFC,SQ CAGE FOOT MTD.,80	0.55 KW 2-POLE	1,020	30	2800	0.28	04	EC17A12595/01-04

NOTES -

1. POWER SUPPLY. 415 V , 3 PH, 50 HZ , AC.
2. MOTOR DEGREE OF PROTECTION : IP-55.
3. MOTOR CLASS OF INSULATION : 'F' (TEMP. RISE LIMIT CLASS 'B').
4. MOTOR AMBIENT TEMP. : 50°C.
5. MOTORS ARE AS PER IE-3.
6. PAINTING :-

As Per BHEL Specification

7. NOISE LEVEL 85 DBA AT 1 METER (IN FREE FIELD COND.).
8. VIBRATION LEVEL CONFORMS TO ISO:14694 TABLE 1 & 4 FAN APPLICATION CATEGORY BV-2 & BV-3.
9. FAN DYNAMICALLY BALANCED AS PER GR. 6.3,ISO:1940.

SL.NO	DESCRIPTION	QTY	MATL.	REMARKS
8	LOCKING SCREW (at center)	1	IS:1367	
7	LOCKING WASHER.	1	IS:1079/2062	
6	LOCKING PLATE.	1	IS:1079/2062	
5	ATTACHABLE FEET	2	IS:1079/2062	
4	IMPELLER (AEROFOIL).	1	BS:1490	LM-6
3	MOTOR.	1	IE-3	
2	TERMINAL BOX	1	IS: 617	STD.
1	FAN CASING 2 THK.	1	IS:1079/2062	

CLIENT :

REV.	DATE	DETAIL OF REVISION	DONE BY	APPRVD	DDN NO.	DCN NO.

ALL DIMENSIONS ARE IN mm.

DDN NO. / PATTERN NO. / PATTERN TYPE / PROJECTION / MATERIAL: / S.O. NO.

marathon

Marathon Electric Motors (India) Limited
Paharpur Works, 58 Taratala Road.
Kolkata - 700024, INDIA

TITLE: GEN. ARRGT. OF TUBE AXIAL FLOW FANS
MODEL : 15J/K55,& K75-P2

DRAWN	B.Majumder		29.03.17	
CHECKED	S.Bhowmick			
APPRVD.	S.Majumder			
SCALE	N.T.S	SIGN	DATE	

DRAWING NO. C12.R6.01.15.01. AC6007 REV 00

TECHNICAL DATA SHEET			
Client	BHEL		**Drawing No. : FOO00376**
Project	BHADRADRI TPP	Rev - 0	
Item	Mineral Insulated RTD Assembly with thermowell		

Sl No.	Description	Requirement
1	Make	GIC Panvel
2	Model Code	RTD-H-A-2Pt100-6-S6-WAL-15N-"E"-S4-50-8
3	Element	2 Pt-100, Duplex 3 Wire System. 6mm OD in SS316 sheathed, Mineral Insulated, Cal. As per IEC-751 Cl-A
4	Insulation	Comapct mass of Mgo
5	Head	Die Cast Aluminium, Screwed Cap with SS chain, Weather proof to IP-67 as per IS:2147
6	Open End	Terminated into Ceramic Spring loaded terminal block with SS base plate
7	Process Connection	1/2" NPT (M) Adjustable Gland in SS304
8	Head Cover	Screwed cap with SS chain
9	Cable entry	One, 1/2" NPT (F) cable entry
10	ACCURACY	+/-0.5% AT 100 DEG C
11	Tag Plate	SS Tag plate Provided
12	Range	0-100 Deg C
13	Thermowell	
	Model Code	TW-BT-6L-28-15 NTF-15 NTM-7-17-17-"U"-50-4-0
	Well Material	SS316L
	Instrument Connection	1/2" NPT (F)
	Process Connection	1/2" NPT (M)
	Bore (ID)	7 mm
	Dia (OD)	17 mm
	Insertion Length below Threads "U"	3/4 Times of Pipe Dia.
	Extension Length "T"	50 mm
	Total well Length	U + 50 mm
	Tip Thickness	4 mm

R-1

R-1

Note:
ACCURACY +/-0.5% AT 100 DEG C
Response time: 30sec (with thermowell)
Terminal block: nickel plated brass screw type
Accessories: adjustable nipple-union-nipple flanges, fittings, unions, SS nameplate

TECHNICAL DATA SHEET FOR DUCT SENSOR

SR. NO.		MEASUREING RANG	DATA
1.		INSTRUMENT	DUCT SENSORS(TEMPERATURE AND RH SENSOR)
2.		MAKE	SIEMENS
3.		QTY	AS PER APPROVED P&ID
3(A)		MODEL NO.	QFM 2160
4.	FUNCTIONAL DATA	MEASURING RANG	-30…+125˚C FOR NTC-TYPE -30…+130˚C FOR OTHER-TYPE
		SENSING ELEMENT	PT 100
		MEASURING ACCURACY	±.5%
		IMMERSION LENGTH	150 MM
		NOMINAL PRESSURE	PN 10
5.	PROTECTIVE DATA	DEGREE OF PROTECTION OF HOUSING	IP 54
		SAFETY CLASS	III TO EN 60 730
6.	ELECTRICAL CONNECTIONS	SCREW TERMINALS	1X2.5 MM^2 OR 1.5 MM^2
7.	MATERIALS AND COLORS	BASE	POLYCARBONATE, RAL 7001(SILVER-GREY)
		COVER	POLYCARBONATE, RAL 7035(LIGHT-GREY)
		IMMERSION ROAD	STAINLESS STEEL TO DIN 17 440, STEEL 1.4571
		PROTECTION POCKET	BRASS(CuZn37)
		COMPRESSION FITTING	STAINLESS STEEL1.4404,1.4435,1.4571
8.		INSPECTION & TESTING	AS PER COC FROM VENDOR

R-1

Note: Display display with two three digit seven segments LED display

Power supply: 240 V AC, 50 Hz

Output: 4-20mA signal

Technical Data Sheet for Geyserstat AC System	
Project :-	(4X270 MW) BHADRADRI THERMAL POWER PROJECT
Supplier:	M/s STERLING & WILSON
Main Supplier	M/s BHEL
Customer	M/s TSGENCO
Consultant	M/s DESEIN PVT. LTD.
NTPC document Title	Technical Data Sheet for Geyserstat AC System
NTPC document No	PE-V0-411-553-A215

Sr. No.	Description	
1	Manufacturer	M/s Honeywell Automation,USA
2	Item	Geyserstat
3	Model	L6006A1012
4	Quantity	As Per Approved BBU
5	Location	Please refer the annexure
6	Type	Thermal Cut Out Type
7	Out Put Signal	Single Pole ,SNAP- Action Switches Operate on Temp. Rise to Set Point
8	Mid Scale Differential ° F.(°C.)	5 °F to 30 °F.(3 °C. to 17 °C.) Adjustable
9	Maximum Ambient Temperature	111.2 °F (44 °C)
10	Instrument Range	38 °C. to 116 °C.(100 °F to 240 °F)
11	Process Range	50 °C. to 110 °C.
12	Set Point	80 °C
13	Surface Mounting	Horizontal Surface Mounting in the Tank
14	Switching	SPDT (Breaks R-B and Makes R-W on Temp. Rise at Set Point
15	Inductive Current(240 VAC)	0.25 at 1/4 To 12 Vdc
16	Sensing Bulb Materal	Copper
17	Sensing Bulb Fill	Liquid - Toluene or Silicon Oil
18	Sensing Bulb Dimension	73 mm Long and 10 mm Diameter
19	Wiring	Screw Terminals
20	Catalogue	Enclosed

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Technical Data Sheet for Airstat AC System		
Project :-	(4X270 MW) BHADRADRI THERMAL POWER PROJECT	
Supplier:	M/s STERLING & WILSON	
Sub Supplier	M/s BHEL	
Customer	M/s TSGENCO	
Consultant	M/s DESEIN PVT.LTD	
NTPC document Title	Technical Data Sheet for Airstat AC System	
NTPC document No	PE-V0-411-553-A215	

Sr. No.	Description	
1	Manufacturer	M/s Honeywell Automation,USA
2	Item	Airstat
3	Model	L4006B1163U
4	Type	Thermal Cut Out Type
5	Location & quantity	Please refer the annexure
5	Out Put Signal	Single Pole ,SNAP- Action Switches Operate on Temp. Rise to Set Point
6	Mid Scale Differential ° F.(°C.)	5 °F to 30 °F.(3 °C. to 17 °C.) Adjustable
7	Maximum Ambient Temperature	44 °C
8	Instrument Range	18 °C. to 93 °C.(65 °F to 200 °F)
9	Process Range	20 °C. to 70 °C.
10	Set Point	22 °C
11	Surface Mounting	Horizontal Surface Mounting in the Heater Box
12	Switching	SPDT (Breaks R-B and Makes R-W on Temp. Rise at Set Point
13	Inductive Current(240 VAC)	0.25 at 1/4 To 12 Vdc
14	Sensing Bulb Materal	Copper
15	Sensing Bulb Fill	Liquid - Toluene or Silicon Oil
16	Sensing Bulb Dimension	73 MM Long and 10 MM Diameter
17	Wiring	Screw Terminals
18	Catalogue	Enclosed

R-1

Honeywell	TECHNICAL DATA SHEET FOR TEMPERATURE TRANSMITTER	
DOCU.NO: SA/SW/BHADRADRI		
1	Make	Honeywell
2	Type	Electronic (HART) Smart-2 Wire
3	Model No.	STT650-S2-0-A-CH0-13C-B-F1-0000
4	INPUT	PT-100 OR TC (R& K TYPE) SELECTABLE AT SITE THROUGH HART COMMUNICATOR
5	Power Supply	8 TO 30 VDC
6	Output	4 to 20 mA
7	Load resistance	956 Ω AT 30 VDC
8	Communication	HART protocol
9	Isolation	1500VAC GALVANIC ISOLATION
10	Operating Temperature	0 TO 85 DEG C
11	Accessories	MOUNTING ARRANGEMENT INCLUDING CLAMPS
12	CJC Accuracy	(+/-) 1°C
13	Response Time	1 TO 60Sec
14	CAL. Certificate	WILL BE PROVIDED
15	Approval	Intrinsically Safe, Non-incendive, & Dustproof
16	Housing Material	PLASTIC, IP -20
17	Mounting	DIN Rail Mounted Type
18	Qty	AS PER Approved P&ID
Note: Accuracy calculation as per Annexure		

DATASHEET OF PRESSURE GAUGE

Rev-00 ; 18.08.16

Sl No	Design Parameters	Description
1	Type	Bourdon Type Pressure Gauge R-1
2	Make (AS PER APVD.INSPECTION CATEGORISATION LIST & SUB VENDOR LIST)	Gauges Bourdon India Pvt.Ltd (GIC) MODEL-BSPG-V-15-S4S-S6S-S6S-S4S-15NTM -0-10-KSC-ACC3W
3	Dial Size	150 mm. (6")
4	Range	0 to 10 Kg/Cm2
	Normal process pressure	50-70 % of range Pressure (Approx)
5	Over range protection	125%
6	Accuracy	± 1% of FSD
7	Sensing Element	Diaphragm
8	MATERIAL	
9	Bourdon Tube	AISI 316 L SS
10	Socket	SS 316
11	Movement	SS316
12	Enclosure	Pressed AISI 304 SS case with Bayonet type bezel weather proof IP-65 self-colour finish.
13	Mounting	Direct with bottom entry
14	Connection	½" NPT (M)
		Bottom connection for local mounting
15	Standard fitment	Blow out disc, Micro adjustable pointer
16	Window Material	Shatterproof glass
17	Adjustment	Micrometer adjustable pointer with gear arrangement
18	Reference Standard	IS-3624/1996
19	**Accessories:-**	
a.	3-Way gauge cock	MOC: SS 316 Size: ½"
20	Quantity	Shall be as per Apvd.P&I Diagram

R-1

Note:

1.Refer P&ID: PE-V0-411-553-A501

2.Operating ambient: 0-50 Deg C

3.Shatterproof glass window.Black lettering on white in 270 Deg arc scale.Element connection : argon welding

4.Internal zero adjustment provided with micrometer screw internal.

5.Accessories:Snubber, 3 way gauge cock, blow out disc & tag plate are provided but diaphragm sealed are not applicable.

DATASHEET OF TEMPERATURE GAUGE

Rev-00 ; 18.08.16

MODEL :BDT-V-15-S4-B-SL-S6-15NTF-R-0-60C-A-TW-BT-S6-15NTM-15NTS

Sl No	Design Parameters	Description
1	Make AS PER APVD.INSPECTION CATEGORISATION LIST & SUB VENDOR LIST)	Gauges Bourdon India Pvt.Ltd (GIC) R-1
2	Type	Expansion type, liquid filled
3	Dial size	150 mm
4	Dial	Aluminium dia,white background with black markings in 270 deg arc
5	Range	0 – 60 Deg. C
	Normal temperature	50-70% of Range (Approx)
6	Accuracy	±1%
7	Over range protection	150 % FSD
8	Adjustment	Internal zero adjustment
9	Connection	½" NPT (M) adjustable gland in SS-316
10	Case material	SS 304 confirming to IP67
11	Stem /Bulb	SS-316
12	Window	Shutter proof glass
13	Mounting	Bottom entry, local mounting
14.	THERMOWELL	
a.	Well material	SS316
b.	Instrument connection	1/2" NPT(F)
c.	Process connection	½" NPT(M)
d.	Insertion length	Immersion length shall be ½ of Pipe ID (As per ASME PTC -19.3)
15.	Quantity	As per Approved P & I Diagram

R-1

Following points are Noted & Confirmed:

1.Compression fittings SS, extension length 50 mm will be provided
2.Accuracy : 1% FSD
3.Repeatability less than +/-0.5% of FSD
4.Respons time 15 sec max.
5.Capillary not applicable, Case compensation will be provided.
6.Shatterproof glass, tag no & service engraved in SS tag plate
7.Refer P&ID: PE-V0-411-553-A501

DATASHEET OF LEVEL SWITCH

Rev-00: dt:18.08.16

Sl No	Design Parameters	Description		
1	Manufacturer AS PER APVD.INSPECTION CATEGORISATION LIST & SUB VENDOR LIST	Gauges Bourdon India Pvt.Ltd (GIC) MODEL- TMLS-1000		
2	Type	Magnetically coupled Float type		
3	location	M.U Tank	Exp Tank	Cooling tower
4	Quantity	As per Apvd. P & I Diagram		
5	Mounting	Side Mounted		
6	Service liquid	Clear water		
7	Material of Construction of Float and Float Link	316 SS (wetted parts SS316)		
8	Switch Cover	Float chamber shall be CS with Construction welded		
9	Process Connection	Flange Connection		
10	Switch type	Snap acting dry contact type (micro switch)		
11	Contact form	2NO + 2NC (2 SPDT)		
12	Contact Rating	5A 240V AC or 0.5 A at 220 V DC		
13	Electrical Connection	½" NPT(F)		
14	Accuracy	±0.5%		
15	Maximum working pressure and temperature	10kg/sq cm & 100^0c .		
16	Repeatability	±0.5%		
17	ON-OFF differential	12±2 mm		

R-1

Note:

1.Process connection : 1" flange (ANSI RF) , drain : 1/2" with plug

2.Pressure rating of chamber: 1.5 times of design pressure

3.Switch housing: CS

4.Accessories: counter flange, nuts, bolts, gaskets etc. Drain valve, 1/2" NPT cable gland, SS name plate with service and tag engraved

4.Refer P&ID: PE-V0-411-553-A501

DATASHEET OF PRESSURE SWITCH (WATER LINE)

Rev-00 : Dt:18.08.16

Sl No	Design Parameters	Description	
1	Manufacturer AS PER APVD.INSPECTION CATEGORISATION LIST & SUB VENDOR LIST	Gauges Bourdon India Pvt.Ltd (GIC) MODELGF-SS-010K-WA-200GF-W13-SS-15MTM-IK	R-1
2	Location	As per P &ID	. As per P &ID
3	Quantity	As per Apvd. P&I Diagram	
	Sensor	SS 316 diaphragm type, snap acting, shock & vib proof	
4	On- off differential	Fixed	
6	Range	1-10 kg /cm^2	
	Normal Pressure	50-70% of range (Approx)	
7	Process connection	1/2 " NPT(M) BOTTOM CONNNECTED	
8	Electrical entry	1/2" NPT (F)	
9	Switch rating	5A,240V AC	
10	Repeatibility	±1% FSR	
11	Enclosure	SS	
12	Weatherproof to	IP : 66	

Element material shall be SS316 and case material shall be SS
Switching :2 SPDT
All wetted parts shall be SS316

AIR LINE-

Sl No	Design Parameters	Description
1	Manufacturer AS PER APVD.INSPECTION CATEGORISATION LIST & SUB VENDOR LIST	Gauges Bourdon India Pvt.Ltd (GIC) GF-SS-PW02-WA-200GF-W13-SS-15MTM-IK
2	Location	As per P &ID
3	Quantity	As per Apvd. P& I As Diagram
	Diaphragm	316 SS
	Sensor	SS 316 (snap acting, shock & vib proof)
4	Over Pressure	Upto 100 bar
6	Range	1-10 kg /cm^2
	Normal pressure	50-70% of range (Approx)
7	Wetted parts	316L SS Diaphragm with SS 316 wetted parts and Nitrile 'O' ring
8	Electrical entry	1/2" NPT (F)
9	Switching	2 X SPDT, 240V/5A, .
12	Weatherproof to	IP : 66

Process connection: 1/2 " NPT(M) BOTTOM CONNNECTED

R-1

Noted & Confirmed: Over-range:150% of max. pressure
Adjustment: internal set point, differential adjustment 2 SPDT (240 V , 5A AC/ 0.5A DC , 220 V)
Ambient temp: 0-50 deg C
Accessories: SS tag name plate.,snubbers, retention rings, screws, 1/2" NPT 2 VALVE SS316 barstock manifold, 1/2 " NPT cable gland
Refer P&ID: PE-V0-411-553-A501

DATASHEET OF DIFFERENTIAL PRESSURE SWITCH

Rev-00._Dt:18.08.16

Sl No	Design Parameters	Description
1	Manufacturer (AS PER APVD.INSPECTION CATAGORISATION LIST & SUB VENDOR LIST)	. Gauges Bourdon India Pvt.Ltd (GIC) DA-SS-001K-WA-200GF-W13-SS-15MTM-IK
2	Location	As Per Apvd. P&I Diagram
3	Quantity	As per Approved P&ID
	Sensor	Diaphragm sealed piston
4	switching differential	Close, Fixed, non adjustable
6	Range	0.1 to 1.5 bar
7	Diaphragm	316L SS
8	Electrical entry	1/2” NPT (F)
9	Switching element	Instrument quality : 2-SPDT micro switch,5A 250 / 125 V AC/240V.5A AC/220V,0-5A DC
10	Sensor	316L SS diaphragm all wetted parts : SS316
11	Enclosure	SS
12	Weatherproof to	IP : 66

R-1

R-1

Noted & Confirmed:
Settings indication accuracy: We will provide 0.5% which are better.
Adjustment: internal set point, differential adjustment 2 SPDT (240 V , 5A AC/ 0.5A DC , 220 V) snap acting, shock & vib proof.Ambient temp: 0-50 deg C
Accessories: SS tag name plate.,snubbers, retention rings, screws, 1/2" NPT 5 VALVE SS316 barstock manifold, 1/2 " NPT cable gland
Over range shall be 150% of max pressure
Refer P&ID: PE-V0-411-553-A501

DATASHEET OF FLOW SWITCH

Rev-00/dt:18.08.16

Sl No	Design Parameters	Description
1	Manufacturer (AS PER APVD.INSPECTION CATAGORISATION LIST & SUB VENDOR LIST)	Gauges Bourdon India Pvt.Ltd (GIC) FS-T-J "SBSPM-S6-S6-2S-W5 R2 R-1
2	Line Size	AS PER P&ID | AS PER P&ID
3	Location	CHILLER & CONDENSER OUTLET
4	Quantity	As per Apvd. P & I Diagram
5	Flow range	As per P &ID
6	Max flow	As per P &ID
7	Max working pressure	30 bar
8	Max working temperature	170^0C
9	Body	304SS
10	Paddle	316SS
11	Bellow	316L SS
12	Process connection	1" BSPM
13	Switching	Snap acting 2 - SPDT
	End Connection	Threaded up to 1" line size / Flanged for Line size 1-1/2" and Above
14	Electrical rating	5A 240V AC
15	No of switches	2 NO +2 NC
16	Electrical connection	½" NPTF & One
17	Repeatability	±2% FSR
18	Enclosure	SS
19	Protection class	IP : 66
20	Mounting	Horizontal / Vertical Pipe

R-1

NOTED & CONFIRMED:

Type: Paddle Type

All wetted parts : SS316

Switching: 2 SPDT (240 V , 5A AC/ 0.5A DC , 220 V)

Accessories: tee, counter flange, nuts, bolts, gaskets, 1/2" NPT Cable gland, SS name plate with tag and service engraved.

Refer P&ID: PE-V0-411-553-A501

TECHNICAL DATA SHEET			
Client	BHEL		
Package	AIR CONDITIONING		
PROJECT	BHADRADRI TPP		
Rev.No. 00	Doc No:-	PE-V0-411-553-A215	
Item	REFLEX TYPE LEVEL GAUGE		

Sl No.	Description	Requirement
1	Make	Gauges Bourden
2	MODEL	RLG-AA-TL-700-N04-ZC-VA-WA-VV-WW-UZ-QU-RU-SO-Z
3	GLASS TUBE:16 mm OD	Tempered toughened Borosilicate gauge glass
4	All Wetted Parts (Including End Block)	SS
5	Isolation Valve	.PROVIDED
6	Glass Guard	MS Tie Rods
7	Calibration Scale (Linear Vertical)	Acrylic engraved black lettering in mm
8	Process Connection	1/2"NPT (F) in SS
9	Vent	1/2"NPT Plug in SS
10	Drain	1/2"NPT Plug in SS
11	Center to Center Distance	700 mm
12	Visibility	500 mm
13	Tag Plate	SS Tag Plate Provided
14	Max. Pressure	10 Kg/cm2
15	Max. Temp.	50 Deg. C

R-1

R-1

1.For larger lengths (greater than 1200mm)tanks, additional gauge glasses shall be provided with minimum of 50 mm overlap.

2.Accessories like integral cocks of SS316, gauge valves/fittings of SS316, nuts,bolts, gaskets to be provided.

3.Body material :SS, ENCLOSURE IP65

4.Pressure rating is twice max max working pressure

5.Process range Maximum 60 Deg. C however this instrument can withstand upto 300 deg C

Honeywell	TECHNICAL DATA SHEET FOR PRESSURE TRANSMITTER	
DOCU.NO: SA/SW/BHEL M/01/PT		
1	Make	Honeywell
2	Type	Electronic (HART) Smart-2 Wire
3	Model No.	STG74L-E1G000-1-C-AHD-11C-B-11A0-F1-0000 + Plug & Socket
4	Sensors	Piezoresistive
5	Power Supply	10.8 to 42.4 V DC
6	Output	4 to 20 mA
7	Load resistance	600 Ohms @ 24 V DC
8	Communication	HART protocol
9	Instrument Range	0.35 Bar to 0-35 Bar
10	Calibration Range	0-16 Kg/cm2
11	Accuracy	+/- 0.065 %
12	Turndown Ration	1OO:1
13	Max. Allow. Working Press	35 Bar
14	Stability / 6 Months	(+/-) 0.043 % of Span (6 Bar), (+/-) 0.026 % of Span (10 Bar)
15	Zero & Span Drift / Per Deg C	(+/-) 0.002 % of Span at Max Span (35 Bar),(+/-) 0.0375 % of Span at Min. Span (0.35 Bar)
16	Over Range Protection	150 % of operating Pressure
17	Max. Allow Working temperature	125° C
18	Process Connection	1/2 " NPT (F)
19	Electrical Connection	Plug & Socket Type
20	Fill Fluid	Silicon Oil
21	Housing Material	Polyester Powder Coated Aluminium
22	Diaphragm Material	SS-316L
23	Protection Class	IP 66
24	Local Zero &Span Adjustment	Provided
25	Connection Location	Bottom
26	Integral Output Meter	2-Line x 8-Character LCD in Engg. Units, Provided
27	Mounting Bracket	Provided, Suitable for 2 Inch Pipe Mounting
28	Scale	Engineering Unit
29	Test Certificate	Provided-Five Point Calibration
30	GA & Catalog	Enclosed
31	Valve Manifold	2 way valve manifold (SS316)will be provided
32	Qty	As Per Approved P&ID

Note:

Accessories: SS Nameplate, universal mounting bracket, 1/2"NPT 2-valve SS manifold,companion flange with nuts & bolts, 1/2"NPT cable gland

Output: 4-20mA (along with superimposed digital signal)

Honeywell	TECHNICAL DATA SHEET FOR LEVEL TRANSMITTER	
1	Make	Honeywell
2	Type	Electronic (HART) Smart-2 Wire
3	Model No.	STD720-E1AC4AS-1-C-AHD-11C-B-11A0-F1-0000+ Plug & Socket
4	Sensors	Piezoresistive
5	Power Supply	10.8 to 42.4 V DC
6	Output	4 to 20 mA
7	Load resistance	0 to 1,440 ohms @ 42.4 V DC
8	Communication	HART protocol
9	Instrument Range/Cal.Range	(-) 400 in H2O to 400 in H2O / (-) 1000 to 1000 mbar/ 0 to6000mmWC
11	Accuracy(Includes Combined effects of linearity, hysteresis, and repeatability)	± 0.05% of span
12	Turndown Ration	100:1
13	Max. Allow. Working Press	4,500 psi, 310 bar
14	Stability	± 0.02% of URL per year for five year
15	Zero & Span	(+/-) ± 0.0525% of Span at Max Span (400 in H2O/1000 mbar),(+/-) 0.0375 % of Span at Min. Span (4 in H2O/10 mbar)
16	Over Range Protection	150 % of operating Pressure
17	Max. Allow Working temperature	125° C (Suitable Length of Impulse line to be used, considering 100° C temperature drop for very one meter Length of Impulse Pipe)
18	Process Connection	1/2" NPT (F) Through Valve Manifold
19	Electrical Connection	Plug & Socket Type
20	Fill Fluid	Silicon Oil
21	Housing Material	Polyester Powder Coated Aluminium
22	Diaphragm Material	SS-316L
23	Protection Class	IP 66
24	Local Zero &Span Adjustment	Provided
25	Connection Location	Horizontal
26	Integral Output Meter	2-Line x 8-Character LCD in Engg. Units, Provided
27	Mounting Bracket	Provided, Suitable for 2 Inch Pipe Mounting
28	Scale	mmWC
29	Test Certificate	Provided-Five Point Calibration
30	GA & Catalog	Enclosed
31	Valve Manifold	5 way valve manifold (SS316) will be provided
32	Qty	AS PER APPROVED P&ID

Note:

Accessories: counter flange,nuts, bolts, gaskets etc., vent & drain lugs, , 1/2" NPT glands, electronic damping facility

Output: 4-20mA (along with superimposed digital signal)

Project: (4X270 MW) BHADRADRI THERMAL POWER PROJECT
Customer: BHEL. **Package: AC Systems**

Document No: *PE-V0-411-553-A216*, Rev -02

DATA SHEETS FOR DUCT THERMAL INSULATIONS & DUCT ACOUSTICS:

Make : Nitrile Rubber-Armacell, Fibreglass: U.P Twiga and EPS- Beardsell. R-2

Type & Application of Insulation: 1.Al Foil Faced Nitrile Rubber (Duct/Refrigerant Pipe/ Chilled & Cond. Water Pipe) 2.Fibreglass (Acoustic Insulation) 3.EPS: Chilled water pipe,valves(Exposed to Sun) R-2

Qty : As Per Approved Drawings

Finish : As Per Technical Specification (DM)

Thickness of Insulation:Nitrile Rubber-

Supply Air Duct (Indoor) : 13 mm
Supply Air Duct (Outdoor) : 13 mm
Return Air Duct : 13 mm

Refrigerant Piping : 39 mm

AHU drain pipe : 26 mm

Chilled water piping, valves (Except pipe exposed to atmosphere) : 39 mm

Expansion tank with pipe : 06 mm

Thickness of EPS (TF Quality 16 Kg Density):

Chilled water piping, valves (Exposed to atmosphere) : 50 mm
Chilled Water Pump : 39 mm

Acoustic (Fibreglass) : 25 mm R-1

Form of Insulating Nitrile Rubber:

Supply air duct : Roll/Slab
Internal lining : Roll/Slab
Return Air Ducting : Roll/Slab

Refrigerant Piping : Roll/Slab

AHU drain pipe : Roll/Slab

Chilled water piping, valves : Roll/Slab

Expansion tank with pipe : Roll/Slab

EPS : Pipe Section R-2

Inspection & Testing: As Per Approved QAP (COC)

Kanara Business Centre,
A-Wing, Unit No. 102-104,
Kanara Engg. Compound, Laxmi Nagar,
Off Ghatkopar - Andheri Link Road,
Ghatkopar (East), Mumbai - 400 075.
Telephone : 2500 0786 / 2500 0295
Fax : 91-22-2500 0791
E-mail : mum@beardsell.co.in
CIN : L65991TN1936PLC001428

BEARDSELL LIMITED

Project: (4X270 MW) BHADRADRI THERMAL POWER PROJECT
Package: Air Conditioning Systems
Customer: TELANGANA STATE POWER GENERATION CORPORATION LIMITED

SR. NO.	PROPERTY	CONDITION OF TEST	VALUE
	Material of insulation	---	EPS
1	Density	---	16 kgs /m3
2	Compressive Strength	At 10% Deformation	0.740 kgs/cm^2
3	Water Vapour Permeability	At 38^0 C & 90% Relative Humidity (R.H.)	48 gms/m^2 24 hrs
4	Thermal Conductivity	---	At 0^0C-0.028891 Kcal/HR M^{0}C At10^0C-0.031471 Kcal/HRM^{0}C
5	Cross Breaking Strength	---	1.44 kg/cm^2
6	Moisture Absorption	7 days	1.8%
7	Thermal Stability	---	1%
8	Flammability	---	Self Extinguishing

The material conforms to IS: 4671 – 1984

For **BEARDSELL LTD.**

finished boards and blocks, and pipe sections/segments for thermal insulation primarily for use in refrigeration and building applications in the temperature range —150° to 80°C.

2. TERMINOLOGY

2.1 For the purpose of this stanndard, the definitions of the terms, symbols and units given in IS : 3069-1965* shall apply.

3. TYPES

3.1 There shall be two types of expanded polystyrene as follows:

Type 1 — Non-self extinguishing type

Type 2 — Self extinguishing type (*see* **4.5.1**)

4. REQUIREMENTS

4.1 Bulk Density — The bulk density of the material, calculated at nominal thickness, excluding facing, shall be 15, 20, 25, 30 or 35 kg/m³, when tested in accordance with the method prescribed in **4** of IS : 5688-1982†. A tolerance of ±5 percent shall be allowed on bulk density.

4.2 Dimensions

4.2.1 *Size* — In the case of finished boards, the size shall be 1·0 × 0·5 m or as agreed to between the purchaser and the supplier. Also, the size for pipe sections/segments shall be 1·0 m or 0·5 m in length, unless otherwise agreed to between the purchaser and the supplier.

4.2.2 *Thickness* — The material shall be supplied in thicknesses of 15, 20, 25, 40, 50, 60, 75 and 100 mm unless otherwise agreed to between the purchser and the supplier.

4.2.3 *Tolerance* — The tolerance on the dimensions of the finished boards, blocks and pipe sections/segments shall be as given below. For other shapes, they shall be as agreed to between the purchaser and the supplier.

Finished Boards and Blocks	*Tolerance*
Length, width and thickness	±2 mm
Pipe Laggings	
Outside diameter	±3 mm
Inside diameter	±2 mm

*Glossary of terms, symbols and units relating to thermal insulation materials.

†Methods of test for preformed block-type and pipe-covering type thermal insulation (*first revision*).

4.3 Thermal Conductivity — The thermal conductivity at 0 and 10°C, respectively of the material shall not exceed the values given below when determined in accordance with the method prescribed in IS : 3346-1980*.

Bulk Density kg/m³	*Thermal Conductivity* mW/cm °C	
	0°C	10°C
15·0	0·34	0·37
20·0	0·32	0·35
25·0	0·30	0·33
30·0	0·29	0·32
35·0	0·28	0·31

NOTE — To convert values from mW/cm deg to kcal/m h deg or *vice versa*, the following conversion factors are used:

Kilocalories	*Milliwatts*
m hr °C	cm °C
1	11·630 0
0·085 985	1

4.4 The material of both the types shall also comply with the requirements given in Table 1.

TABLE 1 REQUIREMENTS FOR EXPANDED POLYSTYRENE

Sl No.	Characteristic	Requirements at Various Nominal Apparent Densities, kg/m³					Method of Test Ref to Cl No. in Appendix
		15	20	25	30	35	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	Compressive strength at 10 percent deformation, in kg/cm², *Min*	0·7	0·9	1·1	1·4	1·7	A
ii)	Cross-breaking strength, in kg/cm², *Min*	1·4	1·6	1·8	2·2	2·6	B
iii)	Water vapour permeance, in g/m²·24 h, *Max*	50	40	30	20	15	C
iv)	Thermal stability, percent, *Max*	1	1	1	1	1	D
v)	Moisture absorption, percent	2	1	1	1	1	E

*Method for the determination of thermal conductivity of thermal insulation materials (two slab, guarded hot-plate method) (*first revision*).

DATA SHEETS FOR DUCT ACOUSTICS:

Make	**:**	**U.P Twiga**
Type of Insulation	:	Resin bonded Fiberglass wool
Standard	:	IS: 8183

Thickness of Glass wool:

Internal Lining : 25 mm

Density of Glass wool:

Internal lining : 48 Kg/m^3

Form of Insulating Glass wool:

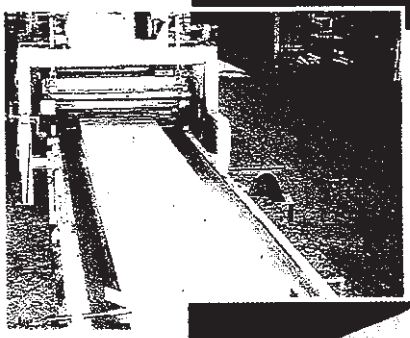
Internal lining : Slab

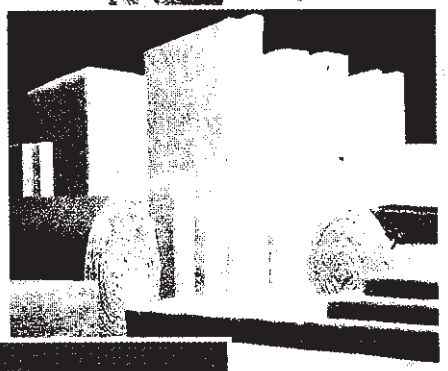
Thermal Conductivity:

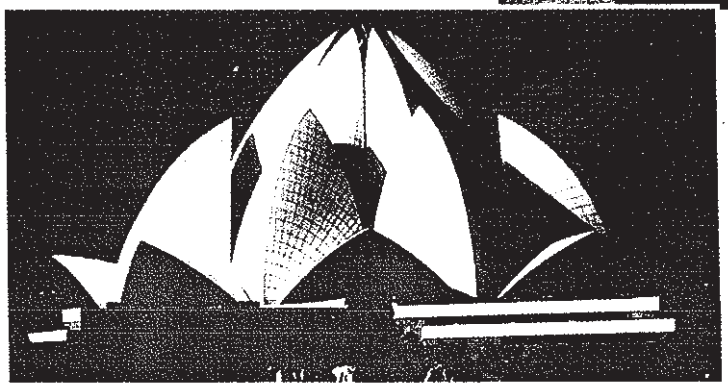
Acoustic Insulation : 0.033 W/M/deg C at 50 °C.

Incombustibility : Noncombustible in accordance With BS 476 Part 4, 1970

Fiberglass Wool Insulation Products







TWIGA INSUL

a total insulation concept

ISO 9002

TWIGA

Twiga fiberglass wool insulation is a world class insulation product manufactured in India. Twiga Insul is made of fine, long, inorganic glass fibers bonded by high temperature resin and is widely recognised for its energy conserving and sound insulating properties. Fiberglass insulation is used with great success in the industrial, building and air-conditioning industries.

Thermal Insulation Values

Twiga Insul possesses high insulation values by virtue of its low fiber diameter, consistent fiber distribution and homogeneous density. This is reflected in Twiga Insul's low thermal conductivity, which meets the requirement of IS:8183 and BS:3958:Part 5 .

Thermal Conductivity Values in W/m.K

Mean	Density in kg/m³			
Temperature	16	24	32	48
10°C	0.035	0.031	0.030	0.027
25°C	0.038	0.033	0.032	0.030
50°C	0.043	0.039	0.035	0.033
100°C	0.057	0.047	0.043	0.040

Thermal Conductivity Values in Btu.in/ft².h.F

Mean	Density in lbs/ft³			
Temperature	1.0	1.5	2.0	3.0
50°F	0.242	0.214	0.208	0.187
77°F	0.263	0.228	0.221	0.208
122°F	0.298	0.270	0.242	0.228
212°F	0.395	0.325	0.298	0.277

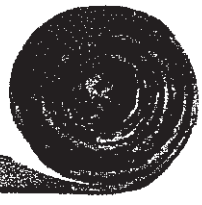
Acoustical Insulation Values

Specification (Density x Thickness)	Average N. R. C. Frequency Range 100Hz - 6200 Hz
16 kg/m³ x 50mm	0.93
24 kg/m³ x 50mm	0.96
32 kg/m³ x 50mm	0.96

accuracy ±5%

Twiga Insul Characteristics

Temperature Range	:	Twiga Insul is suitable for applications ranging from -195°C to 230°C. For special applications upto 450°C high temperature binder is available. Aluminium foil facing is suitable upto 120°C.
Chemical Stability	:	Twiga Insul is chemically inert. Application does not cause or accelerate corrosion. Rot proof and odourless.
Fire Safety	:	Twiga Insul is non-combustible in accordance with BS 476 Part 4, 1970. ✔ incombustible ✔ low fire propagation (index 13.58) ✔ extremely low spread of flame (class 1 BS 476 Part 7) ✔ non emission of dense smoke and toxic gases (low toxicity index 0.86) ✔ non depletion of oxygen (high oxygen index 70%)
Biological	:	Twiga Insul is inorganic. Does not encourage growth of fungi and vermin.
Dimensional	:	Twiga Insul is stable under varying conditions of temperature and humidity when applied correctly. Excellent tear strength and not prone to sagging or settling. Rigid slabs have inherently high compression resistance.
Vibration and Jolting Resistance	:	Conforms to BS 2972.
Moisture Content	:	Less than 2% in accordance with BS 2972.
Water Absorption	:	Less than 2% in accordance with BS 2972.
Shot Content	:	Nil in accordance with BS 2972.
Odourless	:	Conforms to BS 2972.
No Mould Growth	:	Conforms to BS 2972.
Recovery After Compression	:	More than 95% in accordance with BS 3958 Part 5.



Twiga Insul Dimensions and Densities - Rolls 1.2m wide

Product	Density Kg/m³	Thickness mm	Length of Roll m	Area per Roll m²
TI 1000	16	25	20.0	24.0
TI 1000	16	40	15.0	18.0
TI 1000 plain	16	50	10.0	12.0
TI 1000	16	75	7.5	9.0
TI 1500	24	25	20.0	24.0
TI 1500	24	40	12.5	15.0
TI 1500	24	50	10.0	12.0
TI 1500	24	75	6.0	7.2
TI 2000	32	25	15.0	18.0
TI 2000	32	40	10.0	12.0
TI 2000	32	50	7.5	9.0

Other densities, thicknesses and dimensions are available on request.

Twiga Insul Dimensions and Densities - Slabs 1.2m x 1.0m

Product	Density Kg/m³	Thickness mm	No. of Slabs per Carton	Area per Carton m²
TI 2000	32	25	16	19.2
TI 2000	32	50	8	9.6
TI 2000	32	75	8	7.2
TI 3000	48	25	16	19.2
TI 3000	48	50	8	9.6
TI 4000	64	25	16	19.2
TI 4000	64	50	8	9.6

Other densities, thicknesses and dimensions are available on request.

Manufactured by

U.P. Twiga Fiberglass Limited
Twiga House
3 Community Centre
East of Kailash
New Delhi 110 065
India

Tel : +91 11 646 0860
Fax: +91 11 643 1588
+91 11 622 6474

Distributed by

As part of its policy of continuous improvement, U. P. Twiga Fiberglass Limited reserves the right to alter product specifications without prior notice.

Kanara Business Centre,
A-Wing, Unit No. 102-104,
Kanara Engg. Compound, Laxmi Nagar,
Off Ghatkopar - Andheri Link Road,
Ghatkopar (East), Mumbai - 400 075.
Telephone : 2500 0786 / 2500 0295
Fax : 91-22-2500 0791
E-mail : mum@beardsell.co.in
CIN : L65991TN1936PLC001428

BEARDSELL LIMITED

Project: (4X270 MW) BHADRADRI THERMAL POWER PROJECT
Customer: BHEL. Supplier: Sterling &

Document No: *PE-V0-411-554-A205*, Rev -00

DATA SHEETS FOR DUCT THERMALINSULATIONS :

Make	:Beardsell Limited
Type of Insulation	: Expanded Polystyrene (EPS)
Qty	: As Per Approved Drawings
Finish	: As Per Technical Specification

Ventilation Air Duct (Outdoor) : 25 mm

Thickness of EPS (TF Quality 16 Kg Density):

SR. NO.	PROPERTY	CONDITION OF TEST	VALUE
1	Density	---	16 kgs /m3
2	Compressive Strength	At 10% Deformation	0.740 kgs/cm^2
3	Water Vapour Permeability	At 38^0 C & 90% Relative Humidity (R.H.)	48 gms/m^2 24 hrs
4	Thermal Conductivity	---	At 0^{0}C-0.028891 Kcal/HR M^{0}C At10^{0}C-0.031471 Kcal/HRM^{0}C
5	Cross Breaking Strength	---	1.44 kg/cm^2
6	Moisture Absorption	7 days	1.8%
7	Thermal Stability	---	1%
8	Flammability	---	Self Extinguishing

The material conforms to IS: 4671 – 1984

For **BEARDSELL LTD.**

finished boards and blocks, and pipe sections/segments for thermal insulation primarily for use in refrigeration and building applications in the temperature range —150° to 80°C.

2. TERMINOLOGY

2.1 For the purpose of this stanndard, the definitions of the terms, symbols and units given in IS : 3069-1965* shall apply.

3. TYPES

3.1 There shall be two types of expanded polystyrene as follows:

Type 1 — Non-self extinguishing type

Type 2 — Self extinguishing type (*see* **4.5.1**)

4. REQUIREMENTS

4.1 Bulk Density — The bulk density of the material, calculated at nominal thickness, excluding facing, shall be 15, 20, 25, 30 or 35 kg/m³, when tested in accordance with the method prescribed in 4 of IS : 5688-1982†. A tolerance of ±5 percent shall be allowed on bulk density.

4.2 Dimensions

4.2.1 *Size* — In the case of finished boards, the size shall be 1·0 × 0·5 m or as agreed to between the purchaser and the supplier. Also, the size for pipe sections/segments shall be 1·0 m or 0·5 m in length, unless otherwise agreed to between the purchaser and the supplier.

4.2.2 *Thickness* — The material shall be supplied in thicknesses of 15, 20, 25, 40, 50, 60, 75 and 100 mm unless otherwise agreed to between the purchser and the supplier.

4.2.3 *Tolerance* — The tolerance on the dimensions of the finished boards, blocks and pipe sections/segments shall be as given below. For other shapes, they shall be as agreed to between the purchaser and the supplier.

Finished Boards and Blocks	*Tolerance*
Length, width and thickness	±2 mm
Pipe Laggings	
Outside diameter	±3 mm
Inside diameter	±2 mm

*Glossary of terms, symbols and units relating to thermal insulation materials.

†Methods of test for preformed block-type and pipe-covering type thermal insulation (*first revision*).

4.3 Thermal Conductivity — The thermal conductivity at 0 and 10°C, respectively of the material shall not exceed the values given below when determined in accordance with the method prescribed in IS : 3346-1980*.

Bulk Density kg/m³	*Thermal Conductivity* mW/cm °C	
	0°C	10°C
15·0	0·34	0·37
20·0	0·32	0·35
25·0	0·30	0·33
30·0	0·29	0·32
35·0	0·28	0·31

NOTE — To convert values from mW/cm deg to kcal/m h deg or *vice versa*, the following conversion factors are used:

Kilocalories	*Milliwatts*
m hr °C	cm °C
1	11·630 0
0·085 985	1

4.4 The material of both the types shall also comply with the requirements given in Table 1.

TABLE 1 REQUIREMENTS FOR EXPANDED POLYSTYRENE

Sl No.	Characteristic	Requirements at Various Nominal Apparent Densities, kg/m³					Method of Test Ref to Cl No. in Appendix
		15	20	25	30	35	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	Compressive strength at 10 percent deformation, in kg/cm², *Min*	0·7	0·9	1·1	1·4	1·7	A
ii)	Cross-breaking strength, in kg/cm², *Min*	1·4	1·6	1·8	2·2	2·6	B
iii)	Water vapour permeance, in g/m²·24 h, *Max*	50	40	30	20	15	C
iv)	Thermal stability, percent, *Max*	1	1	1	1	1	D
v)	Moisture absorption, percent	2	1	1	1	1	E

*Method for the determination of thermal conductivity of thermal insulation materials (two slab, guarded hot-plate method) (*first revision*).

close status limit switches).

4.6.5	Thermal insulation on the ducting which is exposed to the atmosphere shall be provided with 25 mm thick grade of Expanded Polystyrene insulation conforming to IS – 4671. Such Insulation shall be covered with 500Gauge Polythene sheet, chicken wire mesh, 12mm thick sand cement plaster and an overall cladding of 28 G GI sheet.

DATASHEET OF WALL MOUNTED SPLIT AC UNIT (2 TR/ 6.88 kW)

	MODEL NO (Make – BLUESTAR)		BI-3HW26AATU/ BO-3HW26AATU
1	PERFORMANCE PARAMETERS	NOMINAL CAPACITY (TR)	**2 TR**
2		VOLTAGE / FREQUENCY / PHASE	230 V / 50Hz / SINGLE
3		COOLING CAPACITY (WATT)	6880 (1.954 TR)
4		GUARANTEED TEMPERATURE	22±1 DEG C
5		RELATIVE HUMIDITY	Not more than 65%
6		POWER INPUT (WATT)	1930
7		MIN ISEER	3.50
8		MAX ISEER	3.99
9		STAR RATING – BEE TABLE 2.6	**3 STAR**
10		RUNNING CURRENT (Amps)	8.3
11		MOISTURE REMOVAL (LITRES/HOUR)	3.38
12		AIR FLOW VOLUME (CFM) (HIGH / MEDIUM / LOW)	770 / 690 / 550
13		NOISE LEVEL INDOOR (HIGH / MEDIUM / LOW) in dbA	51.6 / 48 / 44
14		NORMAL RATING CAPACITY @24 ◦C DB AND RH NOT EXCEEDING 65%	1.95 Tr
15	FEATURES	MODES (AUTO/COOL/FAN/DRY)	YES
16		TURBO COOLING	YES
17		SLEEP MODE	YES
18		TIME ON/OFF	YES
19		MOTORIZED – HORIZONTAL LOUVER/ VERTICAL SWING	YES
20		MANUAL – VERTICAL LOUVER/ HORIZONTAL SWING	YES
21		AIR FLOW DIRECTION CONTROL	YES
22		AUTO RESTART WITH MEMORY FUNCTION	YES
23		FAN MODES – (AUTO/HIGH/MEDIUM/LOW)	YES
24		I FEEL	YES

25		BLOW	YES
26		ANTI FREEZE THERMOSTAT	YES
27		SELF DIAGNOSIS	YES
28		LED DISPLAY IN IDU	HIDDEN DISPLAY
29		FILTER CONFIGURATION	ACTIVE CARBON / SILVER ION/ DUST FILTER
30		HYDROPHILIC EVAPORATOR BLUE FINS	YES
31		CONDENSER FINS	ANTI CORROSIVE LOUVERS FINS (BLUE FINS)
32		CONDENSER	ANTI CORROSIVE COPPER WITH BLUE FINS
33		EVAPORATOR	COPPER WITH ANTI CORROSIVE HYDROPHILIC BLUE FINS
34	**DIMENSIONS, WEIGHT & INPUT POWER SUPPLY**	IDU DIMENSION (W X H X D) MM	1260 X 360 X 280
35		INPUT POWER SUPPLY	INDOOR UNIT
36		NET WEIGHT IDU (Kg)	21.2 KG
37		ODU DIMENSION (W X H X D) MM	968 X 367 X 689
38		NOISE LEVEL OUTDOOR in dBA	60
39		NET WEIGHT ODU (Kg)	47 KG
40	**POWER SUPPLY**	INPUT POWER SUPPLY	INDOOR UNIT
41		INDOOR UNIT (V/Hz/PHASE)	230/50/1
42		OUTDOOR UNIT (V/Hz/PHASE)	230/50/1
43		POWER SUPPLY TO IDU (CORE/GUAGE)	3 Core/2.5 Sq mm
44		POWER SUPPLY ODU TO IDU (CORE/GUAGE)	3 Core/2.5 Sq mm
45		MCB RATING (Amps)	32
46		CONNECTION DETAILS	2 Pole MCB
47	**COMPRESSOR**	COMPRESSOR TYPE	HERMETICALLY SEALED ROTARY
48		COMPRESSOR WARRANTY	5 YEAR

49	**REFRIGERANT & AMBIENT OPERATIONS**	REFRIGERANT	R 32 (Eco-friendly)
50		MAX AMBIENT TEMP	52ºC
51	**REMOTE**	REMOTE	LARGE LCD REMOTE WITH BACK LIGHT
52		NIGHT GLOW FUNCTION ON REMOTE BUTTONS	YES
53	**TUBE SIZE & PIPING CAPABILITY**	SUCTION TUBE SIZE OUTER DIAMETER INCH (mm)	5/8” (15.88mm)
54		LIQUID TUBE SIZE OUTER DIAMETER INCH (mm)	3/8" (9.52mm)
55		MAX PIPING CAPACILITY TOTAL (METER)	12
56		MAX PIPING CAPABILITY VERTICAL (METER)	7
57		REFRIGERANT ADDITIONAL CHARGE BEYOND 3.66 m (g/m)	15
58	**OTHER DETAILS & ACCESSORIES**	POWDER COATED GI CASING	YES
59		HDPE FILTERS	YES
60		EVAPORATOR FANS TWO SPEED DRIVE MOTORS	YES
61		SUPPLY AIR GRILLES	SWIVELING TYPE
62		DECORATIVE RA GRILLES	YES
63		INTERCONNECTING REFRIGERANT PIPING	YES
64		CORDLESS REMOTE	YES
65		CAPACITY VARIATION	NOT MORE THAN 5%
66		POWDER COATED M.S SHEET	YES
67		ALUMINIUM FINNED COPPER TUBE COIL	YES
68		DESIGN TEST PRESSURE	20.33 KG/SQ.M
69		SUB COOLING	AT LEAST 4 DEG C

NOTE: REFRIGERANT PIPING INSULATION SHALL BE 13 MM THICK NITRILE RUBBER.

DATASHEET OF WALL MOUNTED SPLIT AC UNIT (1.5 TR)

	MODEL NO (Make – BLUESTAR)		BI-3HW18AATU/ BO-3HW18AATU
1	PERFORMANCE PARAMETERS	NOMINAL CAPACITY (TR)	**1.5 TR**
2		VOLTAGE / FREQUENCY / PHASE	230 V / 50Hz / SINGLE
3		COOLING CAPACITY (WATT)	5150
4		GUARANTEED TEMPERATURE	22±1 DEG C
5		RELATIVE HUMIDITY	Not more than 65%
6		POWER INPUT (WATT)	1450
7		MIN ISEER	3.50
8		MAX ISEER	3.99
9		STAR RATING – BEE TABLE 2.6	**3 STAR**
10		RUNNING CURRENT (Amps)	6.5
11		MOISTURE REMOVAL (LITRES/HOUR)	2.00
12		AIR FLOW VOLUME (CFM) (HIGH / MEDIUM / LOW)	483 / 366 /290
13		NOISE LEVEL INDOOR (HIGH / MEDIUM / LOW) in dbA	47 / 39 / 34
14		NORMAL RATING CAPACITY @24 ◦C DB AND RH NOT EXCEEDING 65%	1.4 Tr
15	FEATURES	MODES (AUTO/COOL/FAN/DRY)	YES
16		TURBO COOLING	YES
17		SLEEP MODE	YES
18		TIME ON/OFF	YES
19		MOTORIZED – HORIZONTAL LOUVER/ VERTICAL SWING	YES
20		MANUAL – VERTICAL LOUVER/ HORIZONTAL SWING	YES
21		AIR FLOW DIRECTION CONTROL	YES
22		AUTO RESTART WITH MEMORY FUNCTION	YES
23		FAN MODES – (AUTO/HIGH/MEDIUM/LOW)	YES
24		I FEEL	YES

25		BLOW	YES
26		ANTI FREEZE THERMOSTAT	YES
27		SELF DIAGNOSIS	YES
28		LED DISPLAY IN IDU	HIDDEN DISPLAY
29		FILTER CONFIGURATION	ACTIVE CARBON / SILVER ION/ DUST FILTER
30		HYDROPHILIC EVAPORATOR BLUE FINS	YES
31		CONDENSER FINS	ANTI CORROSIVE LOUVERS FINS (BLUE FINS)
32		CONDENSER	ANTI CORROSIVE COPPER WITH BLUE FINS
33		EVAPORATOR	COPPER WITH ANTI CORROSIVE HYDROPHILIC BLUE FINS
34	**DIMENSIONS, WEIGHT & INPUT POWER SUPPLY**	IDU DIMENSION (W X H X D) MM	965 X 319 X 215
35		INPUT POWER SUPPLY	INDOOR UNIT
36		NET WEIGHT IDU (Kg)	12 KG
37		ODU DIMENSION (W X H X D) MM	968 X 652.2 X367
38		NOISE LEVEL OUTDOOR in dBA	58
39		NET WEIGHT ODU (Kg)	44 KG
40	**POWER SUPPLY**	INPUT POWER SUPPLY	INDOOR UNIT
41		INDOOR UNIT (V/Hz/PHASE)	230/50/1
42		OUTDOOR UNIT (V/Hz/PHASE)	230/50/1
43		POWER SUPPLY TO IDU (CORE/GUAGE)	3 Core/2.5 Sq mm
44		POWER SUPPLY ODU TO IDU (CORE/GUAGE)	3 Core/2.5 Sq mm
45		MCB RATING (Amps)	16
46		CONNECTION DETAILS	2 Pole MCB
47	**COMPRESSOR**	COMPRESSOR TYPE	HERMETICALLY SEALED ROTARY
48		COMPRESSOR WARRANTY	AS PER OEM

49	**REFRIGERANT & AMBIENT OPERATIONS**	REFRIGERANT	R 32 (Eco-friendly)
50		MAX AMBIENT TEMP	52ºC
51	**REMOTE**	REMOTE	LARGE LCD REMOTE WITH BACK LIGHT
52		NIGHT GLOW FUNCTION ON REMOTE BUTTONS	YES
53	**TUBE SIZE & PIPING CAPABILITY**	SUCTION TUBE SIZE OUTER DIAMETER INCH (mm)	1/2” (12.7mm)
54		LIQUID TUBE SIZE OUTER DIAMETER INCH (mm)	1/4" (6.35mm)
55		MAX PIPING CAPACILITY TOTAL (METER)	12
56		MAX PIPING CAPABILITY VERTICAL (METER)	7
57		REFRIGERANT ADDITIONAL CHARGE BEYOND 3.66 m (g/m)	15
58	**OTHER DETAILS & ACCESSORIES**	POWDER COATED GI CASING	YES
59		HDPE FILTERS	YES
60		EVAPORATOR FANS TWO SPEED DRIVE MOTORS	YES
61		SUPPLY AIR GRILLES	SWIVELING TYPE
62		DECORATIVE RA GRILLES	YES
63		INTERCONNECTING REFRIGERANT PIPING	YES
64		CORDLESS REMOTE	YES
65		CAPACITY VARIATION	NOT MORE THAN 5%
66		POWDER COATED M.S SHEET	YES
67		ALUMINIUM FINNED COPPER TUBE COIL	YES
68		DESIGN TEST PRESSURE	20.33 KG/SQ.M
69		SUB COOLING	AT LEAST 4 DEG C

NOTE: REFRIGERANT PIPING INSULATION SHALL BE 13 MM THICK NITRILE RUBBER.

(a) Star Rating Plan – Voluntary Phase (Valid from 29/06/2015 to 31/12/2017)

Star Rating	Minimum ISEER	Maximum ISEER
1 Star	3.10	3.29
2 Star	3.30	3.49
3 Star	3.50	3.99
4 Star	4.00	4.49
5 Star	4.50	

(b) Star Rating Plan – Mandatory Phase (Valid from 01/01/2018 to 31/12/2019)

Star Rating	Minimum ISEER	Maximum ISEER
1 Star	3.10	3.29
2 Star	3.30	3.49
3 Star	3.50	3.99
4 Star	4.00	4.49
5 Star	4.50	

DATA SHEETS FOR PIPES (AC Systems) (150 NB & Below):

Make : As per Make List

Size : As Per Approved P& ID

Quantity : As Per Approved Layout

Design Code : Heavy Grade, IS: 1239 (Part-I) 2004

Material : Black Steel ERW (MS).

Dimensions : As per IS: 1239 (Part-I) 2004, Plain end

Sizes (N.B) (MM)	Out Side Dia		Wall Thickness (MM)
	(MIN) in MM	(MAX) in MM	
15	21	21.8	3.2
20	26.5	27.3	3.2
25	33.3	34.2	4.0
32	42.0	42.9	4.0
40	47.9	48.8	4.0
50	59.7	60.8	4.5
65	75.3	76.6	4.5
80	88.0	89.5	4.8
100	113.1	115.0	5.4
125	138.5	140.8	5.4
150	163.9	166.5	5.4

DATA SHEETS FOR PIPES (AC Systems) (200 NB & Above):

Make : As per Make List

Size : As Per Approved P& ID

Quantity : As Per Approved Layout

Design Code : Heavy Grade, IS: 3589

Material : Black Steel ERW (MS).

Dimensions : As per IS: 3589, Plain end

DATA SHEETS FOR DRAIN & OVER FLOEW PIPES (AC Systems):

Make	:	As per Make List
Size	:	As Per Approved P& ID
Quantity	:	As Per Approved Layout
Ref IS Standard	:	Heavy Grade, IS: 1239 (Part-I) 2004
Material	:	Black Steel (ERW)M.S.