भारत हैवी ईलैक्ट्रिकल्स लिमिटेड
BHARAT HEAVY ELECTRICALS LIMITED
पारेषण व्यापार अभियांत्रिकी प्रबंधन
TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

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MCC AND ANNUNCIATION PANELS FOR AIR-CONDITIONING & VENTILATION SYSTEM				दिनांक/ DATE	21.10.14	21.10.14	21.10.14
				समूह/GROUP	TBEM	W.O. No	80012

ग्राहक/ CUSTOMER	APGENCO
ठेकेदार / CONTRACTOR	BHARAT HEAVY ELECTRICALS LIMITED
सलाहकार / CONSULTANT	DESEIN PRIVATE LIMITED
परियोजना/ PROJECT	400/220KV SWITCHYARD, RAYALSEEMA, 1 X 600MW, STAGE-IV, UNIT-6

विषय-सूचि/ CONTENTS

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SECTION - 1

INTENT, QUALIFYING REQUIREMENT, AIR CONDITIONING REQUIREMENTS AND SCOPE

1.1.0 INTENT OF SPECIFICATION

1.1.1 This specification covers the design, manufacture, inspection and testing at bidder's and/ or his sub-vendor's work(s), proper packing, transportation, delivery at site of **MCC & ANNUNCIATION PANELS for Air-Conditioning and Ventilation System** as detailed in this section and in various other sections of this specification for **Switchyard Control Building** of 1 **X 600 MW, Stage-IV, Unit-6 TPS at Rayalseema** of APGENCO.

1.1.2 The requirement(s) specified under 'SECTION 2, SECTION 3, SECTION 4' and 'SECTION 5' of this specification shall be considered as part of this section. In case of variance between various sections, requirements of Section-1 shall prevail.

1.1.3 It is not the intent to specify herein all the details of design and manufacture. However, the equipment shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to Purchaser/ Owner, who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material, which in his judgment is not in full accordance herewith.

1.1.4 The bidder shall be deemed to have understood completely all the tender drawings and documents and quoted accordingly.

1.1.5 The bidder has to note carefully the parameters, estimated capacities of equipment indicated and the tender drawing in the specification are only for guidance of the bidder. The system shall be designed as per relevant standards / codes and exact capacities and quantities are to be estimated by the bidder. All such estimations and design calculations shall be submitted for Purchaser's approval.

1.1.6 In case of any deviation, the bidder shall indicate separately the deviations clause-wise with respect to the specification in the 'Schedule of Deviation'. Deviations in

any other form including clarifications / assumptions / etc will not be considered and it will be construed that the bid conforms strictly to the specification.

1.1.7 The **Contract** shall be on **UNIT RATE basis** for the package. Within the scope of the contract no variation shall be admissible to the contractor.

1.1.8 The Purchaser, Consultant and Owner in this specification stand for **BHEL**, **DESEIN** and **APGENCO** respectively. The successful bidder shall be referred to as Contractor.

1.2.0 QUALIFYING REQUIREMENT

"The bidder should have supplied similar equipment of same or higher capacity to Electricity Boards, Power Utilities, installations such as power plants, substations, refineries, fertilizer plants or other industrial or commercial installations in India in any one year during the last five years, as on date of technical bid opening."

1.3.0 PANEL REQUIREMENTS FOR AIR CONDITIONING AND VENTILATION SYSTEM :

Air-conditioning shall be provided on continuous basis to maintain the specified inside conditions for the various rooms in the control building.

11 TR air cooled package units having scroll compressor are envisaged on 3 X 50% basis (two (02) working and one (01) standby) to cater the air conditioning load.

BHEL shall provide 3 Nos. of 11 TR Package Air Conditioning Units (2 working and 1 standby) along with PAN Humidifier and Fans, for various rooms as part of ACVS Scope of work.

The bidder shall provide One No. MCC Panel for Power supply to Package Air Conditioning Units, PAN Humidifier and Fans as shown in Schematic diagram enclosed with Section - 5 of this Technical Specification. Similarly, the bidder shall provide One No. Annunciation Panel for various Alarms & Annunciations as shown in Schematic diagram enclosed with Section - 5 of this Technical Specification. Also, providing Local Push Button Starters for Axial Flow Fans is in scope of bidder.

Control Philosophy

Air conditioning system shall run round the clock.

The following local alarm and annunciation shall be provided :

i. Package unit - ON/OFF for each packaged unit.
ii. Compressor tripped - for each compressor / packaged unit.
iii. Pan Humidifier Failed.
iv. Control supply healthy/failed (remote).

1 No. common Motor Control Centre [MCC] shall be provided for air conditioning system and ventilation systems for extending power supplies to Packaged Units, Fresh Air Fan & Pan Humidifier. This Panel shall be kept in AHU room.

One (1) no. alarm / annunciation panel shall be provided in the control room to take care of the various protections, alarms & annunciations. All the annunciation facia shall have provision for repeat facility.

The Panels should have facility for interlocking with Fire Alarm Panel to trip HVAC System in case of Fire.

The Panels to be supplied should comply to Degree of Protection not less than IP - 52. Type Test Reports for conformance to above shall be submitted along with the Bid itself.

1.4.0 SCOPE

1.4.1 SCOPE OF SUPPLY

1.4.1.1 Complete supplies for Panels for Package Air-conditioning System (As per clause no 1.3.0 above.)

Sl. No.	Item Description	Unit	Qty.
1	MCC Panel	Nos.	01
2	Annunciation Panel	Nos.	01
3	Local Push buttons starters (for axial flow fans)	Nos.	08

1.4.1.2 **SCOPE OF SERVICES :**

NIL

1.4.2 **Exclusions :**

i. **Any Erection, Testing & Commissioning (ETC) requirements**
ii. **Any Civil Works**
iii. Supply of Cable trays for laying cables. Installation wherever required is in contractor scope.
iv. Supply of power and control cables.
v. Laying & termination of power and control cables.
vi. Supply of Package Air Conditioning Units, Fresh Air Fan, Ventilation Fans, Pan Humidifier, Humidistat / any other Control Instrument or Device, and any other item related to Air Conditioning and Ventilation System apart from the MCC & ANNUNCIATION PANELS and Local Push Button Starters as per the BOQ mentioned in Clause 1.4.1.1.

1.4.3 **ENGINEERING DRAWING / DOCUMENT SUBMISSION :**

The successful bidder will start detail engineering immediately after placement of purchase order. The engineering drawing/ document submission schedule is as follows :

SL. NO.	ACTIVITY	ACTIVITY TIME IN WEEKS	CUMULATIVE TIME IN WEEKS FROM LOI/PO DATE	REMARKS IF ANY
1.	Submission of Drawings/ Documents as per list furnished in section-4.	6	6	
2.	Approval of documents from BHEL/Customer	4	10	

1.4.4 **OPERATION & MAINTENANCE (O&M) MANUAL :**

Operation and Maintenance manuals shall be specifically complied for the project by the bidders. The draft O&M manual shall be submitted within 10 weeks after award of contract. The O&M manual shall contain the following information:

a. Description of the system and equipment with design particulars.
b. Instruction for erection.
c. Instruction for operation, maintenance and repair.

d. Recommended inspection practices and inspection schedule.
e. Ordering information for all replaceable parts.
f. Recommendation for type of lubricants and frequency of lubrication.

1.5. Inspection & Testing

All the equipments shall be inspected prior to dispatch in line with relevant IS, approved GTP/ drawing and technical specification, BHEL/ customer approved QAP.

SECTION-2

EQUIPMENT SPECIFICATION

1.0.0 General Design and Constructional Requirements :

i. All the equipment shall be capable of withstanding the stresses, which may be experienced during normal operation and test.

ii. All the equipment shall be designed to permit inter-changeability of parts and ease of access during inspection, maintenance, installation and repair of various parts.

iii. All parts subject to substantial temperature changes shall be designed and supported such as permit free expansion or contraction without resulting in leakage, harmful distortion, misalignment or play.

2.0.0 Equipment Specification :

2.1.0 MCC Panel :

1 No. common Motor Control Centre [MCC] Panel shall be provided for air conditioning and ventilation systems for extending power supplies to Packaged Air Conditioning Units, Fresh Air Fan, Ventilation Fans in AC/DC Borad Room and Battery Room & Pan Humidifier. This Panel shall be kept in AHU room.

MCC shall be fed by 2x100% incoming feeders of 160 Amp each from ACDBs. The two-incomer cables shall be made available by the Purchaser in the AC Plant room from his LVAC board and these incomers shall be terminated at the MCC with contactors of suitable ratings. The two incomers shall have Mechanical Door interlock in order to avoid simultaneous operation.

Ventilation fans for AC/DC Board room and Battery room will be fed from power distribution board directly through single/three phase MCBs.

Contactors in main incomers of air conditioning power distribution board shall be tripped in case of fire. Potential free contacts shall be available in main

fire alarm panel located in control room, which shall be wired to effect tripping.

The MCC shall provide following out-going feeders:

i) 63 Amp Switch-fuse feeder for Packaged Unit-I
ii) 63 Amp Switch-fuse feeder for Packaged Unit-II
iii) 63 Amp Switch-fuse feeder for Packaged Unit-III
iv) 1 No. 63 Amp Spare Switch-fuse feeder for packaged unit
v) 32 Amp Switch-fuse feeder for 1.5 KW Pan Humidifier
vi) 1 No. 32 Amp Spare Switch-fuse feeder for Pan Humidifier
vii) 1 No. 10 Amp MCB Supply feeder for Fresh Air Fan
viii) 3 Nos. 10 Amp MCB Supply feeder for Battery Room Fans
ix) 5 Nos. 10 Amp MCB Supply feeder for AC / DC Room Fans
x) 2 Nos. 10 Amp Spare feeders

A spring return test button shall be provided for testing of pan humidifier.

2.1.1 Design Criteria

a) 415 V motor control center, distribution board, local starters (if any) and local push button stations required shall be offered by the contractor as per the specification.

b) MCC shall be indoor, floor mounted, free standing type while distribution board of ventilation system shall be either wall mounted or floor mounted type.

c) The incomers to Motor control centers/ distribution boards could be load break isolators, whereas miscellaneous outgoing feeders would be switch-fuse units.

d) All switchboard frames load bearing members shall be fabricated using suitable mild steel structural sections or pressed and shaped rolled sheet steel of thickness not less than 2 mm. Frames shall be enclosed in rolled sheet steel of thickness not less than 2 mm. Doors and covers shall also be of rolled sheet steel of thickness not less than 2 mm. Stiffeners shall be provided wherever necessary. Removable gland plates shall be provided for all the panels.

e) All switchboards shall be of dust and vermin proof constructions and shall be provided with a degree of protection of IP-52.

f) Where the front of the breaker/ starter module itself serves as the compartment cover, suitable plates shall be provided to blank the opening of the compartment, when the carriage is withdraw. In such cases, one (1) no. blanking plate suitable for each size of module shall be provided per switchboard.

g) All cut out shall be provided with synthetic rubber/ gaskets.

h) All switchboards and motor control centers shall be divided into distinct vertical sections, each comprising of :

- A completely enclosed busbar compartment for running horizontal and vertical busbars.
- Completely enclosed switchgear compartment(s) one for each circuit for housing circuit breaker, motor starter or switch-fuse feeder.
- A compartment/ alloy/distinct cable box for power and control cables.
- A compartment for relays and other control devices associated with a circuit breaker, wherever necessary.

i) The horizontal and vertical busbars shall be made of high conductivity aluminium alloy or copper. The minimum clearance in air between phases and between phase and earth for the entire run of horizontal and vertical, busbars, bus link connection to ACB shall be 25mm. For all other components, the clearance between two live parts and clearance between a live part and an earthed part shall be at least ten (10) mm throughout. Wherever it is not possible to maintain these clearances, insulation shall be provided by anti tracking sleeving or barriers. However, for horizontal and vertical busbars, clearances specified above shall be maintained even when the busbars are sleeved.

j) MCCs and distribution boards shall be divided into vertical sections. Each vertical section shall be provided with an adequately sized cable alley, which

shall cover the entire height. Wherever cable alleys are not provided for distribution boards, segregated cable boxes with complete shrouding for individual feeders shall be provided at the rear for direct termination of cables in each individual feeder. For circuit breaker external cable connections a separately enclosed cable compartment shall also be acceptable. It shall be possible to carry out maintenance on one feeder with adjacent feeders live.

k) All busbars shall be adequately supported by non-hygroscopic, non-combustible, track-resistant and high strength type polyester fiberglass moulded insulators. Insulators and barriers of inflammable material such as Hylam shall not be accepted. The same should be anti tracking type.

l) All non-current carrying metal work of switchboards/ distribution boards shall be effectively bonded to a Switchgear earth bus of galvanised steel. The earth bus shall be extended throughout the length of the switchboard. Positive Earthing shall also be maintained in all positions of chassis and breaker frame.

m) Panel components such as push buttons, indicating lamps, selector switches, indicating meters etc., shall be flush mounted on the front face of the panel while switch fuses, supervision relays etc., shall be mounted inside the panel. The inside components shall be so located that their terminals are readily and easily accessible for inspection or maintenance.

n) Selection of all type of relays/ releases shall be as per list of approved makes. All relays and timers in protection circuits shall be flush mounted on panel front with connections from the inside. They shall have transparent, dust tight cover, removable from the front, a draw out construction for easy replacement and testing facility. The auxiliary relays and timers may be provided in fixed cases. All protective relays, auxiliary relays and timers shall be provided with hand reset operation indicators (flags) or LED's with push button for resetting. The relays/timers shall not have built in batteries and shall operate on switchgear DC supply.

o) All indicating and integrating meters shall be flush mounted on panel front and shall be of a least 75/96 mm square size with 90 deg. Scale and shall have an accuracy class 2.0 or better. All motors rated 30kW and above shall have an ammeter. All bus section shall have bus VT, voltmeter with selector Switch along with other relays and times required for protection.

p) Control and selector switches, push button and indicating lamps seal are provided as required for operation and control of switchgears / MCC and distribution boards. Thermostatically controlled space heaters shall be furnished to keep the air inside the MCC enclosure sufficiently above the dew point to prevent condensation. The heaters shall be located such that wiring, buses and control devices do not get overheated.

q) Isolating switches and moulded case circuit breakers shall have door interlocks and pad locking facility.

r) The local push button stations shall have metal enclosed, enclosure of die cast aluminium or rolled sheet steel of at least 2 mm thickness, dust and vermin proof to IP-52 degree of protection for indoor application, and IP-55 degree of protection for outdoor applications.

s) MCC, distribution board, local starters and push buttons shall be provided with prominent, engraved identification plates.

t) As per Indian statutory regulations, all motors are required to have an emergency stop push button near the motor. The same shall be provided for all motors. These push buttons shall be of latched type with mushroom knobs.

u) Bus duct enclosure in the indoor-portion shall have a degree of protection not less than IP-52 and that in the outdoor portion shall have a degree of protection not less than IP-55 in accordance with IS-2147. A suitable aluminium sheet hood shall be provided to cover all outdoor bus-duct enclosure joints to facilitate additional protection against rain ingress. The top surface of the bus duct enclosure shall the suitably sloped in the horizontal run to prevent retention of water for both indoor and outdoor portion of bus duct.

v) AC/DC Power Supply

Alarm relays with reverse flag shall be provided to annunciate failure of main incoming A.C. and D.C. power supplies and control D.C. supply in each panel. Lamp indications shall be provided individually for main supply fail and panel annunciation supply fail.

Separate circuits shall be provided for (a) indication and alarm (b) tripping, and (c) control.

For lighting, auxiliary supply and space heating A.C. supply shall be used. D.C. supply shall be used for providing control supply to annunciator.

w) Wiring

The panels shall be fully wired up at the factory to ensure proper functioning.

Wiring shall be done with flexible, heat resistant, 1100V grade, PVC Insulated, switch board wires with stranded copper conductor of 2.5 mm2.

Each wire shall be identified at both ends with wire designation as per Contractor's wiring diagram. Interlocking type ferrules shall be used for identification.

All wire termination shall be made with insulated sleeve solder less crimping type tinned copper lugs. Wires shall not be tapped or spliced between terminals.

Wiring shall be neatly bunched in groups by non-metallic cleats or bands. Each group shall be adequately supported along its run to prevent sagging or strain on the termination.

Colour codes shall be used for wiring as per latest revision of IS: 375.

x) Terminal Block

Multi-way terminal blocks complete with necessary binding screws and washers for wire connections and marking strip for circuit identification shall be furnished for terminating the panel wiring and outgoing cables. Terminals shall be box clamp type, ELMEX 10 sq.mm. Minimum or approved equivalent

Not more than two wires shall be connected to one terminal. If necessary, a number of terminals shall be jumpered together to provide wiring points.

Each terminal shall be identified with designation as per approved schematic. At least 10% of the total number of active terminals shall be furnished as spare in each panel.

The terminal blocks shall be located to allow easy access and also to suit floor openings for cable entry.

The terminal blocks within the panels shall be mounted on vertical support brackets. The support brackets shall be tack welded to the interior sheet steel mounting plates of the cabinet. Support brackets shall not be welded directly to the wails of the enclosure. The terminal blocks shall be attached to the support brackets with round head machine screws.

Terminal blocks shall generally be mounted vertically with adequate spacing (not less than 100 mm) between adjacent rows.

The bottom of the terminal block shall be at least 200 mm above the incoming cable gland plate.

y) Cable Entry

The panels shall have provisions of cable entry from the bottom. Bottom plate shall be provided to make entry dust tight. L.P.B. stations shall have provision for cable/conduit entry from both top and bottom. Suitable cable gland plates shall be provided.

z) Grounding

50 x 6 mm GS flat ground bus shall be provided extending along the entire length of the assembly.

The ground bus shall have two bolts drilling with Gl bolts and nuts at each end and shall be suitable for connection to 50 x 6 mm G.S. flat.

The ground bus shall be bolted to the panel structures and shall effectively ground the entire assembly. The cases of meters, relays and switching devices shall be grounded through the steel structure.

Whenever a circuit is grounded, a single wire from the circuit shall be run independently to the ground bus and connected in it.

aa) Painting

Panels and Panel Push-button Stations shall be power coated with texturised finish semi-glossy paints :

Exterior : Opaline Green 275 of IS-5

Interior : Opaline Green 275 of IS-5

Base Frame : Black

Blanking/Internal Mounting Plate : Panel Exterior/White or Galvanized

Paint Thickness : 80-90 Microns

Caution Notice plate shall be affixed at the back of each vertical panel.

bb) Panel Push Button

All push buttons shall be oil tight, heavy duty, push to actuate type, with coloured button and inscription plate marked with its function. The colour of "ON" and "OFF" push buttons shall be RED and G REEN respectively. RESET push buttons shall be colored black.

Each push button shall have minimum 2 NO. + 2 NC. Contacts rated 10A at 240V AC and 2A at 220V DC.

Push buttons shall be shrouded type except for emergency trip button (press to lock & key to release), which shall be mushroom type for easy identification.

cc) Lamps

Lamps shall be low watt, filament type with series resistor, and coloured lenses. Lamp and lenses shall be easily replaceable from the front of the panel.

Lamp covers shall preferably be moulded from heat resisting material. 10% extra lamps and lenses of assorted colours, shall be provided as part of initial supply.

dd) Operating Range

All Instruments shall be generally suitable for operation on 1A or 5A C T secondary circuit and/or 110V V.T. secondary circuit.

ee) Meters

All indicating instruments shall be switchboard type, back connected, suitable for flush mounting, 96 x 96 mm with 240 Deg. scale, antiglare glass and

accuracy class of + 2% of the full scale. The dials shall be made of such material as to ensure freedom from warping, fading, and discolouring during the lifetime of the Instruments.

All indicating instruments shall be enclosed in dust tight cases suitable for tropical use.

Meters shall have provision for zero adjustment from front of the panel.

Meters shall be compensated for temperature errors and factory calibrated to read the primary quantities directly without using a multiplying factor.

DC ammeters, wherever required, shall be provided with external shunt if the current exceeds 5A. The rated voltage drop for the shunts shall be ~5mV.

ff) Relays

Auxiliary relays shall be furnished in fixed, dust tight casings and mounted inside the panel.

The relays shall have adequate numbers of contacts to suit scheme requirements. Besides, each relay shall have spare contacts for future use.

Contacts shall be silver surfaced. Bounce free. And capable of repeated operation without deterioration.

gg) Auxiliary Devices

The Contractor shall furnish, install, and wire up all auxiliary devices such as timing / switching / lockout/auxiliary relays/auxiliary contactors etc. as required for the proper functioning of the approved schemes.

2.2.0 Annunciation & ALARM Panel

Standard Alarm & Annunciation shall be provided for Air Conditioning system through Alarm & Annunciation panel. The panel shall be wall mounted type and kept in Control room.

Following Provisions shall be made for 1 No. Annunciation Panel to be located in the Control Room.

2.2.1 System requirement

For air conditioning system:

Audio-visual annunciation shall be provided through annunciation windows. A set of "Accept", "Reset" & "System Test" push buttons shall be incorporated. One hooter for any kind of malfunctions shall be provided on the top of the panel for audio effect of the complete system.
Following indications and audio - visual annunciations shall be provided in the Control Cum Annunciation Panel.

Indications (visual)

1. Pan humidifier heater "ON"
2. Packaged Unit - 1 "ON"
3. Packaged Unit - 2 "ON"
4. Packaged Unit - 3 "ON"
5. Control Supply Healthy
6. Spare
7. Spare

Annunciations (audio-visual)

1. Packaged Unit - 1 "TRIPPED"
2. Packaged Unit - 2 "TRIPPED"
3. Packaged Unit - 3 "TRIPPED"
4. Pan Humidifier "FAILED"
5. Pan Humidifier tank "WATER LEVEL LOW"
6. AC System "TRIP ON FIRE"
7. Spare

The spare facia shall be equipped with all devices as provided for active facia.

One no. potential free contact against each of the annunciation above shall be wired up on the terminal block in order to repeat the same (individually or grouped) in the Control room.

2.2.2 Construction

The annunciation panel of air conditioning system shall be free-standing, floor mounted, dead-front assemblies made out of cold rolled sheets of minimum 2 mm thick. The panel shall be free from all surface defects.

The panel shall have rear door of double leaf construction having concealed type hinges and padlocking arrangement. Doors shall be grounded by flexible copper braid.

All doors and removable covers shall be provided with neoprene rubber gaskets all around and latches sufficiently strong to hold them in alignment when closed.

Working height of the panels shall be limited between 550 mm and 1800 mm above floor level.

The panel enclosure shall conform to minimum IP 52.

2.2.3 Name Plate

Nameplates shall be furnished for each panel and for each instrument or device mounted on the panel. Nameplates for panels shall be provided both on the front and on the rear and shall be according to final device/designation list. The material for nameplate shall be lamicoid or approved equal, 3 mm thick, with white letters on black background. The nameplate shall be held by self-tapping screws. The size of the name plate shall be approx. 20 mm x 75 mm for equipment and 40 mm x 150 mm for the panel. Control and meter selection switches shall have integral nameplates. Name Plate for other devices shall be located below the respective devices. The instruments and devices shall also be identified on the rear / inside the panel with instrument or device number. The number may be painted on or adjacent to the instrument or device case.

2.2.4 Wiring

The panels shall be fully wired up at the factory to ensure proper functioning.

Wiring shall be done with flexible, heat resistant, 1100V grade, PVC Insulated, switch board wires with stranded copper conductor of 1.5 mm2.

Each wire shall be identified at both ends with wire designation as per Contractor's wiring diagram. Interlocking type ferrules shall be used for identification.

All wire termination shall be made with insulated sleeve solder less crimping type tinned copper lugs. Wires shall not be tapped or spliced between terminals.

Wiring shall be neatly bunched in groups by non-metallic cleats or bands. Each group shall be adequately supported along its run to prevent sagging or strain on the termination.

Colour codes shall be used for wiring as per latest revision of IS: 375.

2.2.5 Terminal Block

Multi-way terminal blocks complete with necessary binding screws and washers for wire connections and marking strip for circuit identification shall be

furnished for terminating the panel wiring and outgoing cables. Terminals shall be box clamp type, ELMEX 10 sq.mm. Minimum or approved equivalent

Not more than two wires shall be connected to one terminal. If necessary, a number of terminals shall be jumpered together to provide wiring points.

Each terminal shall be identified with designation as per approved schematic. At least 10% of the total number of active terminals shall be furnished as spare in each panel.

The terminal blocks shall be located to allow easy access and also to suit floor openings for cable entry.

The terminal blocks within the panels shall be mounted on vertical support brackets. The support brackets shall be tack welded to the interior sheet steel mounting plates of the cabinet. Support brackets shall not be welded directly to the wails of the enclosure. The terminal blocks shall be attached to the support brackets with round head machine screws.

Terminal blocks shall generally be mounted vertically with adequate spacing (not less than 100 mm) between adjacent rows.

The bottom of the terminal block shall be at least 200 mm above the incoming cable gland plate.

2.2.6 Cable Entry

The panels shall have provisions of cable entry from the bottom. Bottom plate shall be provided to make entry dust tight. L.P.B. stations shall have provision for cable/conduit entry from both top and bottom. Suitable cable gland plates shall be provided.

2.2.7 Grounding

50 x 6 mm GS flat ground bus shall be provided extending along the entire length of the assembly.

The ground bus shall have two bolts drilling with GI bolts and nuts at each end and shall be suitable for connection to 50 x 6 mm G.S. flat.

The ground bus shall be bolted to the panel structures and shall effectively ground the entire assembly. The cases of meters, relays and switching devices shall be grounded through the steel structure.

Whenever a circuit is grounded, a single wire from the circuit shall be run independently to the ground bus and connected in it.

2.2.8 Painting

Panels and Push-button Stations shall be power coated with texturised finish semi-glossy paints :

Exterior : Opaline Green 275 of IS-5

Interior : Opaline Green 275 of IS-5

Base Frame : Black

Blanking/Internal Mounting Plate : Panel Exterior/White or Galvanized

Paint Thickness : 80-90 Microns

Caution Notice plate shall be affixed at the back of each vertical panel.

2.2.9 Lamps

Lamps shall be low watt, filament type with series resistor, and colored lenses. Lamp and lenses shall be easily replaceable from the front of the panel. Alternatively clustered LEDs may also be used.

Lamp covers shall preferably be moulded from heat resisting material.

10% extra lamps and lenses of assorted colours, shall be provided as part of initial supply.

SECTION – 3
PROJECT DETAILS AND GENERAL SPECIFICATIONS

SL.NO.	DESCRIPTION	
1.	**PROJECT INFORMATION**	
	a) Customer	APGENCO
	b) Consultant	Desein Consulting Engineers, New Delhi
	b) Projects	1x600MW RayalseemaTPP, Stage-IV, Unit#6-400/220kV Switchyard
	c) Project locations	The project site is located in VV Reddy nagar, Karamala, about 30KM west-south of Proddatur & 20KM from Yerraguntla. Nearest Rail head is Muddanur, which is approx. 10 kM from Site. Site is approximately 480KM from Hyderabad and 350KM from Chennai.

Equipment to be supplied against this specification shall be suitable for satisfactory continuous operation under the following tropical conditions:

2.	**SITE CONDITIONS**	
i.	Maximum Ambient air temp. (max.)	40.3 ˚C
ii.	Minimum Ambient air temp. (max.) ˚C	19.1 ˚C
iii.	**Design ambient temperature**	**50 ˚C**
iv.	Altitude above MSL	Less Then 1000m
v.	Basic wind speed	39m/s
vi.	Seismic acceleration	Zone-III As per IS-1893
vii.	Average Rainfall	742.8 mm
viii.	Humidity	Max: 49-74%, Min: 35-60%

3. Auxiliary Supply

Normal Voltage	Variation in Voltage	Frequency in Hz	Phase/Wire	Neutral Connection
415 Volts	± 10%	50 ± 5%	3 phsae/4 wire	Solidly earthed
240 Volts	± 10%	50 ± 5%	1 phase/2 wire	Solidly earthed
220 Volts	190V to 240V	DC	---	Isolated 2 wire system (ungrounded)

Combined variation of voltage and frequency shall be limited to ± 10%.

5. DOCUMENTS TO BE SUBMITTED ALONGWITH OFFER

1) Drawings.
2) Guaranteed Technical Particulars
3) Type Test Reports
4) Manufacturing Quality Plan

6. DOCUMENTATION SCHEDULE AT CONTRACT STAGE

A : For & After Approval	Soft copies as per clause no. 5 in 1 set
B : For Approval	Hard copies as per clause no. 5 in 12 sets
B : After Approval	Bound sets of Approved Hard copies and Installation, Operation & Maintenance manual and all as built drawings in 20 sets
	3 Set of Computer CD-ROMs (with unbreakable CD Covers) containing all as-built drawings in Auto-Cad version 2006 or later with 2D and 3D drawings, Instruction Manual and GTP.

7. Title block: Title block shall be forwarded to successful bidder after placement of order.

8. All outdoor enclosures shall provide a degree of protection of not less than IP 55 as per IS-13947 & colour shade of RAL 7032 and one enclosures of each type shall be tested for the same or evidence of testing shall be furnished in lieu of type testing.

9. Quality plan:
BHEL or APGENCO approved QP shall be followed.

10. Type Test reports:
Bidder shall submit valid type test reports (as per relevant IEC/IS Standard) of the tests carried out within last five years from the date of bid opening.. The report should have been conducted on identical or similar equipment/ components to those offered. In case type test reports are more than 5 years old OR the reports of type tests are found to be technically unacceptable, the type test shall be conducted without cost and delivery implication to BHEL/APGENCO.

11. INSPECTION, TESTING AND INSPECTION CERTIFICATE

Inspection testing shall be done as per customer specification and inspection plan.

- - x x - -

SECTION 4

LIST OF DOCUMENTS & DATASHEETS

GUARANTEED TECHNICAL PARTICULARS

The list furnished here is tentative and additional documents may be required during detailed engineering.

List of Drawings		
S.No.	**Item Description**	**BHEL's doc. no.**
01.	Wiring, SLD & GA Drawing of MCC Panel along with type test report for degree of protection.	TB-DRG-344-553-011
02.	Wiring, SLD & GA Drawing of Annunciation Panel for control room building along with type test report for degree of protection.	TB-DRG-344-553-012
03.	Data Sheet for Local Push Button Starters for Axial Flow Fans	TB-DS-344-553-048
List of Other documents		
01.	O & M Manual	TB-PG-344-553-200

SECTION- 5

ENCLOSURES TO SPECIFICATION

SCHEDULES TO BE FILLED UP BY THE BIDDER

Schedule 1 **Format of Schedule of Deviations**

Schedule 2 **Format of Details of contact persons (technical & commercial)**

DRAWINGS ANNEXED WITH THE SPECFICATION

Schedule 3 **APPROVED SINGLE LINE DIAGRAM FOR MCC**

Schedule 4 **APPROVED P & I DIAGRAM FOR HVAC SYSTEM**

SCHEDULE-1

SCHEDULE OF TECHNICAL DEVIATION

The following are the deviations / variations / exceptions from the specification:

Section	Clause No./ Page No.	Statement of deviation/ Variations/Exceptions

1) In case, this schedule is not submitted, it will be presumed that the equipment /material to be supplied under this contract is deemed to be in compliance with the specification.

2) If there is NIL deviation, even then the format to be filled as **NIL DEVIATION**

3) Continuation sheets of like size and format may be used as per the Bidder's Requirement and shall be annexed to this schedule.

Place — Signature of the authorized representative of Bidder

Name ----------

Date — Designation----------

Company seal----------

SCHEDULE-2

DETAILS OF CONTACT PERSON BOTH TECHNICAL AND COMMERCIAL

Name

Address for correspondence

Phone No.

Fax No.

Email

Place

Date

Signature of the authorized representative of Bidder

Name----------

Designation----------

Company seal ----------

Note: Continuation sheets of like size and format may be used as per the Bidder's Requirement and shall be annexed to this schedule.

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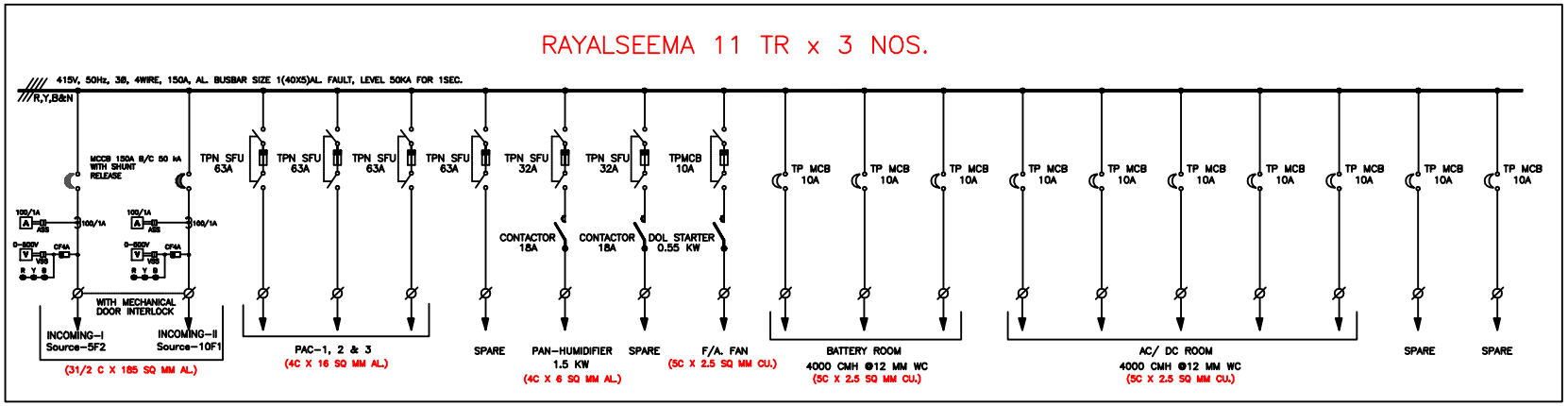
RAYALSEEMA 11 TR x 3 NOS.



	SDFU	SWITCH DISCONNECT FUSE UNIT
	R,Y&B	PHASE INDICATION LIGHT
	MCB	MINIATURE CIRCIUT BREAKER
	MCCB	MOULDED CASE CIRCUIT BREAKER
	NO	NORMALLY OPEN CONTACT
A	A	ANALOG AMMETER
V	V	ANALOG VOLTMETER
	CF4A	CONTROL FUSE 4 AMPS
	ASS	AMMETER SELECTOR SWITCH
	VSS	VOLTMETER SELECTOR SWITCH

ANNUNCIATION PANEL			
S. NO.	ITEMS	ON	OFF
1	PAC NO – 1	1	1
2	PAC NO – 2	1	1
3	PAC NO – 3	1	1
4	PACKAGE AC TRIPPED	3	--
5	CONTROL SUPPLY HEALTHY/FAILED	1	--

REVISIONS	DATE	REV NO.	REV BY.
REVISED AS PER COMMENTS BY DESEIN	04-07-14	01	SANDEEP

BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION PROJECTS DIVISION

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E-mail: info@comfortsystems.co.in

PROJECT
APGENCO
400/220 KV SWITCHYARD-
RAYALSEEMA T.P. STN.
STAGE-IV, UNIT#6 (1X600MW)

TITLE
SINGLE LINE DIAGRAM FOR MCC

SCALE : NTS	DATE :- 26-06-2014	REV.-02
DRW BY : SANDEEP	DRG.NO.-TB-DRG-344-553-003	
CHKD.BY : R.K. TALWAR		

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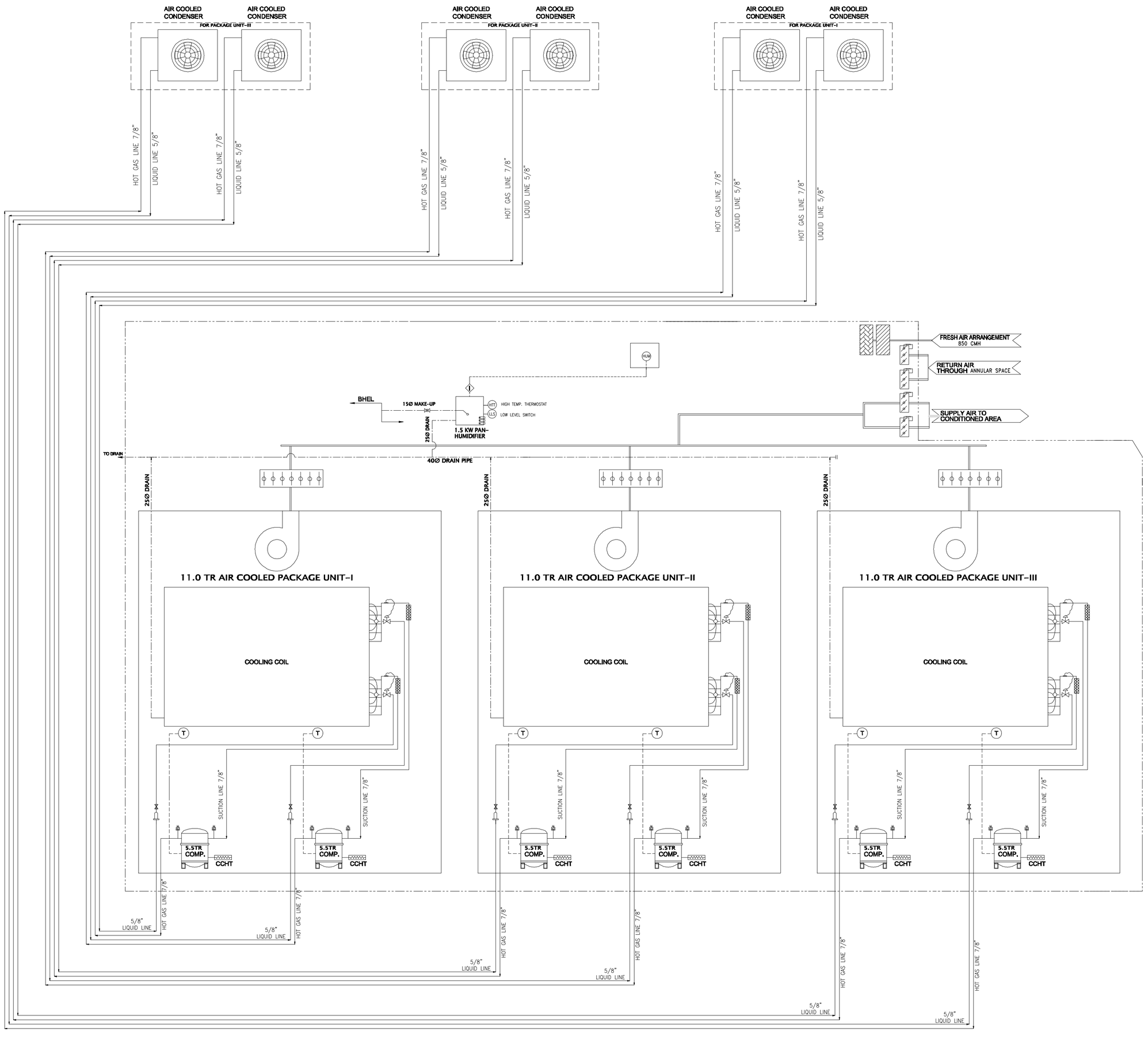

3 NOS.11.0 TR AIR COOLED PACKAGE UNITS

P & I DIAGRAM

B.O.M.

S.No.	ITEM	UNIT	QTY.
1.	AIR COOLED PAC INDOOR UNIT 11.0TR	NOS.	3
2.	COMPRESSOR 5.5TR (PART OF PAC)	NOS.	6
3.	CRANKCASE HEATER (PART OF PAC)	NOS.	6
4.	AIR COOLED CONDENSING UNIT 5.5TR (PART OF PAC)	NOS.	6
5.	NON RETURN AIR DAMPER (PART OF PAC)	NOS.	3
6.	1150x450 SA. FIRE DAMPER	NOS.	1
7.	450x300 SA. FIRE DAMPER	NOS.	1
8.	1500x500 RA. FIRE DAMPER	NOS.	1
9.	650x300 RA. FIRE DAMPER	NOS.	1
11.	THERMOSTATIC EXPANSION VALVE (PART OF PAC)	NOS.	6
12.	HAND SHUT OFF VALVE 3/8" (PART OF PAC)	NOS.	6
13.	HIGH PRESSURE CUTOUT (PART OF PAC)	NOS.	6
14.	LOW PRESSURE CUTOUT (PART OF PAC)	NOS.	6
15.	LIQUID LINE DRIER 3/8" (PART OF PAC)	NOS.	6
16.	COOLING THERMOSTAT (PART OF PAC)	NOS.	3
17.	INTERLOCK (PART OF PAC)	LOT	1
18.	HUMIDISTAT	NOS.	1
19.	PAN HUMIDIFIER 1.5KW	NO.	1
20.	BALL VALVE 1/2" (PART OF PAN HUMIDIFIER)	NO.	1
21.	HIGH TEMP. THERMOSTAT (PART OF PAN HUMIDIFIER)	NO.	1
22.	LOW LEVEL SWITCH (PART OF PAN HUMIDIFIER)	NO.	1

LEGEND

	BLOWER FAN
	HAND SHUT OFF VALVE
	THERMOSTATIC EXPANSION VALVE
	PRE FILTER
	FINE FILTER
	HEATER
	NON RETURN AIR DAMPER
	FIRE DAMPER
	INSULATION
	WATER LINE
	REFRIGERANT LINE
	ELECTRICAL LINE
	AIR LINE
HUM	HUMIDISTAT
HT	HEATING THERMOSTAT
I	INTERLOCK
	DRIER
T	COOLING THERMOSTAT
CCHT	CRANKCASE HEATER
	PRESSURE SWITCH

NOTES:

1) The Main Electrical Panel Shall be Located in ACDB Room
2) Annunciation Panel shall be located in Control Room
3) Main Incoming supply shall be provided by BHEL upto our Main Electrical Panel in PAC's Room.
4) Makeup water line 15mmø near pan humidifier to be provided.
5) Drain point in PAC Room to be provided by BHEL.
6) Air Cooled Condensers are located on the terrace
7) Refrigerant Piping shall be of 18 G Copper.
8) InterLocks

i) The unit shall be started in the following sequence
   * Blower fan of indoor units.
   * Condenser Fan
   * Compressor

ii) The Compressor shall not start, if the following is not running
   * Condenser Fan
   * Blower

iii) Pan Humidifier heater to cut in only when water level in the humidifier tank is sufficient.

iv) AC system shall be tripped on signal from the Fire Alarm Systems Potential free Contact arranged in package unit room.

v) Motorized fire dampers shall close on signal from purchaser's Fire Alarm Panel.

REVISIONS	DATE	REV NO.	REV BY.

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PROJECT

APGENCO
400/220 KV SWITCHYARD-
RAYALSEEMA T.P. STN.
STAGE-IV, UNIT#6 (1X600MW)

TITLE

P & I DIAGRAM FOR HVAC SYSTEM

SCALE : NTS	DATE :- 29-06-2014	REV.-00
DRW BY : SANDEEP		
CHKD.BY : R.K. TALWAR	DRG.:NO. TB-DRG-344-553-004	

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