

**TECHNICAL SPECIFICATION FOR
BLOWER MCC**

PROJECT: 1X800MW KRISHNAPATNAM

CUSTOMER: APGENCO

SPEC REF NO.: EP-BLW-KRP-01 REV 00



**BHARAT HEAVY ELECTRICALS LIMITED
ELECTROPORCELAINS DIVISION
BANGALORE – 560012**



**TECHNICAL SPECIFICATION
FOR
BLOWER MCC**

SPECIFICATION NO.: EP-BLW-KRP-01

VOLUME

SECTION -

REVISION 0

DATE: 18.09.2017

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**IT IS CONFIRMED THAT OUR TECHNICAL OFFER COMPLIES WITH THE SPECIFICATION IN TOTO, & THAT
THERE ARE NO TECHNICAL DEVIATIONS.**

BIDDER'S STAMP & SIGNATURE
(REFER INSTRUCTION NO. 1 OF 'INSTRUCTIONS TO BIDDERS')



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INSTRUCTIONS TO BIDDERS FOR PREPARING TECHNICAL OFFERS

1. Two signed and stamped copies of the following shall be furnished by all bidders as technical offer:
 - a) Complete technical specification.
 - b) Un-priced copy of PRICE FORMAT, duly stamped and signed by the bidder.
 - c) Complete dimension of all the boards including no. of panels, dimensions of each type of panels, module size of each type of feeders and minimum clearances required on all sides for each type of panels.
 - d) **No. of Vertical consider by vendor for each boards are to be compulsory given along with offer.**
 - e) A copy of the sheet "Instructions to Bidders for Preparing Technical Offer" duly stamped and signed by the bidder.
 - f) Technical deviation/ clarification, if any
 - g) No. of MCC panels, Weight & Dimensions of LTMSB & ACP.
2. No technical submittal such as copies of type test certificates, data Sheets, write-up, drawing, technical literature, etc. is required during tender stage. Any such submission, even if made, shall not be considered as part of offer.
3. Confirmations/ comments (if any) regarding delivery schedules shall be furnished as part of the commercial offer. Any reference elsewhere/ covering letter of technical offer shall not be considered by BHEL.
4. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder's covering letter shall not be considered by BHEL, and bidder's offer shall be construed to be in conformance with the specification.
5. Any changes made by the bidder in the price schedule with respect to the Item description/ quantities, notes etc. from those given in annexure-A of specification shall not be considered (i.e., technical description, quantities, notes etc. as per specification shall prevail).
6. Bidders to quote for all items/sub items.
7. In case of any ambiguity in specification between various sections and end customer specification vendor should clearly brought out in technical deviations failing in which BHEL will have choice to prefer which ever it suits at later stage for which vendor should accept.
8. In case bidder is having any queries regarding technical parameters same shall get clarified before quoting, in case if any technical deviations are observed during scrutiny wrt to NIT bidder shall meet the technical requirements without any price implication.
9. Vendor should bring out clearly in deviation sheet if any.
10. Vendor to complete the panel in all respect and dispatch to BHEL. Numerical relay is in BHEL scope and same shall be fitted by BHEL in BHEL Premises. Vendor to do the relay wiring up to relay with proper ferruling and lugs terminals.



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11. The panel shall be tested at BHEL-EPD after fixing of relay. In case any wiring mistake observed during testing at BHEL-EPD, vendor has to depute their representative/service engineer at BHEL-EPD to modify the same without any commercial implication. The representative shall be deputed within 2 working days from the date of intimation by BHEL-EPD.
12. Panel will be dispatched in the name of BHEL EPD as manufacturer, BHEL may conduct the type test at CPRI/ERDA on same panel as manufacturer.

BIDDER'S STAMP & SIGNATURE

**VOLUME :V-A
SECTION-VII
TECHNICAL SPECIFICATION
FOR
415V PMCC/MCC, 415V ACDB AND 220V DCDB**

1.00.00 SCOPE OF SUPPLY

1.01.01 Requisite nos. of following equipment shall be furnished with all accessories :-

- a. Power cum Motor Control Centre (PMCC)
- b. Motor Control Centres (MCC)
- b. A.C. Distribution Board (DB)
- c. D.C. Distribution Board (DB)
- d. D.C. Starters
- e. A.C./D.C. fuse boards

1.01.02 The base channel frame with hardware and lifting angles.

1.01.03 One set of special tools and tackles.

1.01.04 Set of accessories as listed below :

- a) Breaker lifting and handling trolley.
- b) Test cabinet with coupling cables for testing the breaker in drawout position.
- c) Racking in/out handle for breakers.

1.01.05 Mandatory Spare parts.

1.01.06 All relevant drawings, data and instruction manuals.

2.00.00 CODES AND STANDARDS

2.01.01 All equipment and materials shall be designed, manufactured and tested in accordance with the latest applicable Indian Standards (IS) and IEC except where modified and/or supplemented by this specification.

2.01.02 Equipment and material conforming to any other international standard which ensures equal or better quality, may be accepted. In such case, copies of the English version of the standard adopted shall be submitted along with the bid.

2.01.03 The electrical installation shall meet the requirements of Indian Electricity Rules as amended upto date and relevant IS Code of Practice. In addition, other rules and regulations applicable to the work shall be followed.

3.00.00 DESIGN CRITERIA

- 3.01.00 The PMCCs/MCCs/DBs will be used to provide power, control and protection for 415/240V A.C. and 220V D.C. auxiliary services (Motors & Feeders) of generating units.
- 3.02.00 Duty involves direct-on-line starting of large squirrel cage motors below 175kW. The starting current varies from 6 to 8 times rated current at very low power factor.
- 3.03.00 The equipment will be located in a hot, humid and tropical atmosphere, highly polluted at places with coal dust and/or fly ash.
- 3.04.00 For continuous operation at specified ratings, the temperature rise of various equipment/components shall be limited to the permissible values stipulated in relevant standards and/or this specification.
- 3.05.00 Equipment ratings and quantities are detailed in the enclosed drawings and annexure. Equipment shall be furnished in strict compliance with the same.
- 3.06.00 All equipment and components thereof shall be capable of withstanding the mechanical forces and thermal stresses of the short-circuit currents without any damage or deterioration of the materials.
- 3.07.00 The PMCCs/ MCCs / DBs shall have two incomers and one bus-coupler. In addition to electrical interlocks, mechanical castle key interlock shall be provided between the two incomers and the bus-coupler so that any two of the three may be closed at a time.
- 3.08.00 Busbars of PMCCs shall be sized to carry continuously the associated transformer secondary current plus a 20% margin.
- Busbars of MCC/DBs shall be sized to carry continuously the total running load of MCC/DB plus a 20% margin.
- 3.09.00 In cubicle of incomers & bus section breakers/MCCBs shall be identical to the associated busbar rating.
- 3.10.00 For continuous operation at specified ratings, the temperature rise of various equipment/components shall be limited to the permissible values specified in relevant standards and/or this specification.
- 3.11.00 Circuit breakers shall not produce any harmful over voltage during switching off of induction motors. If required, surge protective devices shall be included in the scope of supply to limit over voltages.
- 3.12.00 Incomers, Bus-couplers & outgoing feeders rated upto & including 630A shall be MCCB controlled. Above 630A all incomers, Bus-couplers & outgoing Feeders shall be ACB controlled. For critical loads ACB control feeders shall be provided which will be decided during detailed engineering.
- 3.13.00 All motor rated 110kW & above, below 175kW shall be ACB controlled. Motor rated upto 110kW shall be contactor operated.

- 3.14.00 MCC & PMCC shall have sufficient number of spare modules (at least 20% of various sizes used with a minimum of 1 no. for each rating and type).
- 3.15.00 Outgoing feeders of PMCC shall be limited to minimum number of different sizes so that max. standardization is achieved from MCCB & contactor size point of view.
- 3.16.00 Incomers & bus section breakers of PMCCs/MCCs shall have provisions for remote operation from control room.
- 3.17.00 All breaker operated motor feeder shall be supplied from PMCC.
- 3.18.00 One no. Normal/Emergency switchgear to cater power supply to important emergency load / motors for safe shut-down of unit including 220V battery chargers shall be provided for each unit. The main incoming supply shall be from 415V unit service switchgear. When main incoming supply fails, reserve incoming supply shall be switched ON automatically from 415V station service switchgear. In case of total failure of AC supply of the power station, the supply from DG shall be switched ON automatically.
- 3.19.00 Each switchgear shall be provided with two bus sections, two incomer and a bus coupler rated for 100% of the loads connected to the switchgear.
- 3.20.00 For each auxiliary or load, one feeder shall be provided except for the following cases:
- One feeder for a maximum 2 nos. isolator motor operating mechanism.
- 3.21.00 The switchgears shall be provided with suitable number and type of outgoing feeders for the respective auxiliary loads of the system/area, power supply feeders to various panels, lighting transformer, space heating panels, control cabinets and all other loads encountered in the plant. In addition, following feeders shall be provided in each bus section of each switchgear.
- a) Bus VT module: One (1) no.
- b) Switchgear test supply module: One (1) no.
- c) 240V, 1 phase essential supply module with five nos. 1 phase outlets: One (1) no.
Necessary 415V/240V dry type transformer shall be provided.
- d) Alarm module for common alarm for outgoing feeder fault: One (1) no.
- e) DC supply alarm module for incomer, bus coupler fault: One (1) no.
- 3.22.00 Each feeder shall be provided with two nos. interposing relays for start & stop. These interposing relays shall be located in separate IPR panel described under C&I specification.

4.00.00 **SPECIFIC REQUIREMENTS**

4.01.00 **Construction**

4.01.01 PMCC / MCC / DB shall be indoor, metal-clad, air insulated and floor mounting type. All MCCs shall be fully draw out type and DBs shall be fixed type. ACB modules of PMCCs/MCCs shall be fully drawout type. MCCB / Switch Fuse modules shall also be fully drawout type. The design and construction shall be such as to allow extension at either end.

4.01.02 All PMCC/MCC shall be of double front construction.

4.01.03 PMCC /MCC/DB enclosure shall be dust and splash proof, conforming to a degree of protection IP-54. All switchboard frames and load bearing members shall be fabricated using suitable mild steel structural sections or pressed and shaped cold rolled sheet steel of thickness 2.0mm. Frames shall be enclosed in cold rolled sheet steel of thickness 1.6 mm. Doors and covers shall also be of cold rolled sheet steel thickness 1.6 mm. Stiffeners shall be provided wherever necessary. The gland plate thickness shall be 3.0 mm for hot/cold rolled sheet steel and 4.0 mm for non-magnetic material.

4.01.04 PMCC / MCC / DB assembly shall comprise a continuous line up of dead front, free-standing vertical sections, housing the control modules in multi tier formation.

4.01.05 The design shall be fully compartmentalized with metal/insulating partitions between compartments. **Operating height shall be as per drawings**

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4.01.06 Each control module shall be housed in a separate compartment, complete with an individual front access door having sufficient opening with concealed type hinges. Each vertical section shall have a removal back cover. All doors and covers shall be gasketed.

4.01.07 All push buttons, lamps, indicating instruments shall be flush / semi-flush mounted on respective module compartment.

4.01.08 A full height vertical cable chamber with cable supports shall be provided in each section to facilitate unit wiring. The chamber shall be liberally sized to accommodate all cables and shall have removable cover at the front for access.

4.01.09 A horizontal wireway, extending the entire length, shall be provided at the top of each PMCC / MCC / DB for inter panel wiring.

4.01.10 The width of the cable alley shall not be less than 250 mm.

4.02.00 **Bus and Bus Taps**

4.02.01 All PMCCs/MCCs/DBs shall be provided with three phase & neutral bus bars . All DCDBs shall be provided with two busbars. All busbar compartments shall be completely enclosed.

- 4.02.02 The main buses and connections shall be of high conductivity Aluminium / Aluminium alloy, sized for specified current ratings with maximum temperature limited to 85°C (i.e., 35°C rise over 50°C ambient).
- 4.02.03 Vertical busbars shall be designed for minimum current rating of 200A. Separate vertical busbars shall be provided for each vertical panel.
- 4.02.04 All bus connections shall be silver plated. Adequate contact pressure shall be ensured by means of two-bolt connection with plain and spring washers and locknuts.
- Bimetallic connector shall be furnished for connection between dissimilar metals.
- 4.02.05 Busbars and connections shall be fully insulated for working voltage with adequate phase/ground clearances. Insulating sleeves for busbars and shrouds for joints and tap-off points shall be provided.
- Bus insulators shall be flame retardant, non-hygroscopic track-resistant type with high creepage surface.
- 4.02.06 Busbars shall be supported and braced to withstand the stresses due to maximum short circuit current and also to take care of any thermal expansion.
- 4.02.07 Busbars shall be colour coded for easy identification and so located that the sequence R-Y-B shall be from left to right, top to bottom or front to rear when viewed from the front of the assembly.
- 4.03.00 **Control Modules**
- 4.03.01 Draw-out type control module shall have self-aligning power/control disconnects. All disconnects shall be silver plated to ensure good contacts.
- 4.03.02 The design shall be such as to permit easy withdrawal/reinsertion of the unit with guide rails to ensure correct alignment.
- 4.03.03 Control Module shall house the control components for a circuit such as switch fuse / MCCB, contactors, relays, push buttons, lamps etc. as per requirement of the control circuit.
- 4.03.04 The equipment layout shall provide sufficient working space in between the components and subject to Owner's approval.
- 4.03.05 Various module/compartments sizes shall be multiple of one basic unit to facilitate modifications at site. Suitable provision for this purpose should also be incorporated in the vertical bus bars.
- 4.03.06 Draw-out type control modules of same size and type shall be electrically and physically interchangeable.
- 4.04.00 **Air Circuit Breaker**
- 4.04.01 Circuit breaker shall be provided on the incomer having minimum interrupting capacity equal to the 50kA(r.m.s) fault level.

- 4.04.02 Circuit breaker shall be three pole, single throw, air-break type with independent manual spring closing, trip-free mechanism and shunt trip. However Incomer and bus coupler breakers (ACB) shall be four pole type.
- 4.04.03 Circuit breaker shall be draw-out type, having service, test & isolated position with positive indication for each position.
- 4.04.04 Circuit breakers of identical rating shall be physically and electrically interchangeable.
- 4.04.05 Each breaker shall be provided with microprocessor based protection unit having three overload protection with adjustable current and time, three short circuit protection with adjustable current and time and three instantaneous short circuit protection. The operating characteristic shall be suitable for co-ordination with down-stream fuses.
- 4.04.06 Circuit breakers shall be provided with motor wound spring charging mechanism. Spring charging shall take place automatically after each breaker closing operation. One open-close-open operation of the circuit breaker shall be possible after failure of power supply to the motor. In addition, facility for manual charging of spring shall be provided.
- 4.04.07 Mechanical safety interlock shall be provided to prevent the circuit breaker from being racked in or out of the service position when the breaker is closed. It shall not be possible to open the circuit breaker door cubicle unless the breaker is in 'OFF' position.
- 4.04.08 Automatic safety shutters shall be provided to cover up the stationary disconnects when the breaker is withdrawn.
- 4.04.09 Each breaker shall be provided with an emergency manual trip, mechanical ON-OFF indicator, an operation counter and spring mechanism charge/discharge indicator, and electrical anti-pumping feature.
- 4.04.10 In addition to the auxiliary contacts required for normal breaker operation and indication, each breaker shall be provided with the following for interlocking purpose :-
- a. Position/Cell switch with 4 NO + 4 NC contacts.
 - b. Auxiliary switch, with minimum 6NO + 6NC contacts,
- 4.04.11 Spring charge limit switch shall be provided for breakers with motor wound spring charging mechanism. These limit switches shall be provided with minimum 2NO + 2NC contact.
- 4.04.12 Limit/auxiliary switches shall be convertible type, that is, suitable for changing N.O. contact to N.C. and vice-versa.
- 4.04.13 Each breakers operated feeder shall be provided with protective devices as specified in Annexure–B.

4.05.00 Switches

4.05.01 Switches shall be triple pole, air break, AC23 motor duty for motor feeders and AC22 heavy duty for other feeders.

Motors duty switches shall be capable of safely making and breaking the locked rotor current of the associated motor circuit.

4.05.02 The switch shall have a quick-make, quick-break mechanism operated by a suitable external handle, complete with position indicator. This handle shall have provision for padlocking in ON and OFF position.

4.05.03 The compartment door shall be interlocked mechanically with the switch such that the door cannot be opened unless the switch is in OFF position. Means shall be provided for releasing this interlock at any time.

4.05.04 Switches shall be capable of withstanding the let-through fault current of back-up fuses or circuit breakers.

4.05.05 Wherever two incoming switches and one bus-section switch are provided for an assembly, these shall be mechanically/key interlocked to ensure that only two out of the three can be closed at time.

Wherever two incoming switches are provided for an assembly, these shall be mechanically/key interlocked to ensure that one of the two can be closed at time.

4.05.06 All incoming and outgoing feeders shall be provided with bolted disconnect link for isolation of neutral if necessary.

4.06.00 Fuses

4.06.01 Fuses shall be HRC, preferably link type, with a minimum interrupting capacity equal to the short circuit current of the LT system. Fuses shall be mounted on insulated fuse carriers, which are mounted on fuse bases. Wherever it is not possible to mount fuses on carriers, fuses shall be directly mounted on plug-in type of base. In such cases, one set of insulated fuse pulling handles shall be supplied with each board.

4.06.02 Fuses shall be furnished complete with fuse bases and fittings of such design as to permit easy and safe replacement of fuse element.

Visible indication shall be provided on blowing of the fuse.

4.06.03 Motor fuse characteristics and ratings shall be chosen to ride over starting period without blowing. The fuse on incoming feeder wherever provided, shall be chosen to provide discrimination with motor/feeder fuses.

4.07.00 Moulded Case Circuit Breaker (MCCB)

4.07.01 The MCCBs shall be of drawout type with trip-free operating mechanism of quick make & quick break type. Each MCCB shall be equipped with thermal release for thermal overload and magnetic release for short circuit protection on each pole.

- 4.07.02 MCCBs / MPCBs shall be suitable for manual closing and opening and also automatic trip on overload and short circuit. MCCB shall have intermediate position to indicate trip condition.
- 4.07.03 The MCCBs shall be provided with mechanical ON-OFF indicator at the front panel. The MCCB handles, after the breaker tripped due to faults, shall occupy a mean position indicating trip condition.
- 4.07.04 The compartment door shall be interlocked mechanically with the MCCB such that the door cannot be opened unless the MCCB is in OFF position. Means shall be provided for releasing this interlock at any time.
- 4.07.05 All feeders of PMCC / MCC rated up to & including 630 Amp shall be provided with MCCB. Air circuit breaker shall be provided for feeders rated above 630 Amp. For critical loads ACB control feeders shall be provided which will be decided during detailed engineering.
- 4.07.06 Motors rating above 110 KW will be operated by Air circuit breaker and protected by consolidated numerical motor protection relay.
- 4.08.00 **A.C. Starter**
- 4.08.01 Contactors
- a. The contactors shall be three pole, air break type designed for duty class III - Category AC3 (for unidirectional motor) with non-bouncing silver/ silver alloy contacts. Contacts for reversible motors will be of AC4 duty.
 - b. Each contactor shall be provided with minimum two (2) normally open and two (2) normally closed auxiliary contacts rated 10 A at 240V A.C.
 - c. Reversing contacts shall be electrically and mechanically interlocked.
 - d. Contactors with delayed dropout feature shall be provided for some essential auxiliaries. These contactors shall not dropout on power failure if the voltage is restored within 3 seconds.
- 4.08.02 **Protection**
- a. Thermal overload relays shall be three element, positive acting, ambient temperature compensated with adjustable settings.
 - b. Single phase preventor relay shall be provided, preferably as an inbuilt feature of thermal overload relay.
 - c. Relays shall be manual reset type with two changeover potential-free contacts. Resetting of relays shall be possible with compartment door closed. Colour of the resetting button shall be BLACK.
 - d. Relays may be direct acting or C.T. operated, depending on current rating. C.T.s shall be included in the scope of supply.
 - e. Motor starters shall have type '2' co-ordination according to IEC 947-4.

- f. Earth fault relays with adjustable settings and time delays fed from core balance CT shall be provided.
- g. Numerical / Digital Motor protection relay with short circuit, over load, earth fault, locked rotor and unbalance (NPS) load protection functions shall be provided for motor rated above 90 kW.

4.09.00 Control Transformer

4.09.01 LT Switchboard control supply

The Bidder shall provide one (1) no. adequately rated 415V/110V Control Transformer in each bus section with necessary taps and auto changeover facility for providing control power supply to various modules of the board. The sizing of control transformer shall be carried out by the Bidder considering the actual load of power contactors, auxiliary contactors, indicating lamps and other equipment in the module circuit. An additional load of 15watts shall be considered for each module for remote auxiliary relays and lamps to be connected in the control circuit of modules. Bidder shall also ensure that control transformer are adequately designed for meeting the momentary loading requirements and the voltage drop during this condition shall not be more than 5%. Each transformer shall be sized for catering to control supply of both bus sections.

4.09.02 LT Switchboard space heater supply

The Bidder shall provide one (1) no. adequately rated 415V/240V Control Transformer in each bus section with necessary taps and auto changeover facility for providing power supply to panel space heater, Motor space heater of motor rated 30 KW & above, Panel Illumination & Socket. The supply of these two (2) nos. control transformer are tapped from incoming supply of 415V PMCC/MCC before the incoming breaker. Incoming circuit to the space heater auxiliary bus shall be through isolating switch HRC fuse and neutral link of suitable rating. The supply of different modules shall be tapped individually from the auxiliary bus bars. Control supply healthy indication shall be provided. Each transformer shall be sized for catering to space heater supply of both bus sections.

4.10.00 D.C. Starters

4.10.01 D.C. Starter for emergency oil pump shall be fixed resistance type, designed to provide fast acceleration during starting.

4.10.02 DC starters shall be complete with switch-fuse units, contactors, resistors, relays, meters, push-buttons, lamps, etc.

4.10.03 Starters shall be furnished in totally enclosed floor-mounting, sheet steel cubicles complete with a hinged front access door. Minimum thickness of sheet steel shall be 2mm.

4.10.04 The cubicle enclosure shall provide dust and humidity protection, the degree of protection being not less than IP-54.

The resistor enclosure shall be provided with ventilating louvers and wire mesh guard and shall have a degree of protection IP-23.

4.10.05 Cubicle space heater shall be provided to maintain internal temperature above dew point. Heater shall be furnished with switch-fuse unit and thermostat control.

4.11.00 **Relays**

4.11.01 All incoming and bus-coupler circuits and circuit breaker operated outgoing feeders shall be provided with numerical relays. Breaker operated motor feeders shall be provided with numerical motor protection relay.

4.11.02 The numerical relays shall have provisions for interfacing with Plant DDCMIS / PLC.

4.11.03 Relays shall be of drawout design with built-in testing facilities. Small auxiliary relays may be in non-drawout execution.

4.11.04 All protective relays, auxiliary relays, and timers shall be provided with hand reset operation indicator (flag).

4.11.05 Relays shall be rated for operation on 110V secondary voltage and 5 A or 1 A. Number and rating of relay contacts shall suit the job requirements.

4.12.00 **Control and Indication**

4.12.01 Circuit breakers shall be wired up for local and remote operation. Each breaker cubicle shall be equipped with the following :

- i) One (1) TEST-NORMAL-TRIAL selector switch with pistol grip handle and key interlock for breakers with motor wound spring charging mechanism.
- ii) On-Off control switches shall have three positions (T-N-C) and shall be spring return to 'Neutral' from close and trip positions. They shall have two contacts closing in close position and two contacts closing in trip positions, and shall have Pistol Grip handles. Lost motion feature shall be provided wherever required.
- iii) Following indicating lamps on the front of the compartment:

Breaker open	-	GREEN
Breaker closed	-	RED
Breaker tripped	-	AMBER
Spring charged	-	WHITE
Trip Ckt. Healthy	-	BLUE

Motor Space heater 'ON' for motor circuit - YELLOW

4.12.02 Push button shall be heavy duty, oil tight, push to actuate type with integral escutcheon plate marked with its function.

- 4.12.03 Each push button shall have minimum two (2) nos. normally open and two (2) nos. normally closed contacts rated 10 A at 240 V.
- 4.12.04 One (1) NORMAL-TRIAL selector switch shall be provided for all motor feeders.
- 4.12.05 Selectors switches shall be stay-put, rotary type with escutcheon plates marked to indicate the function and positions, and shall be lockable in each position. Selector switch contacts shall be rated for 10A at 240 V A.C.
- 4.12.06 Selector switches shall be provided with minimum three (3) contact blocks of 1 NO + 1 NC each.
- The exact requirements of contacts shall be decided by the Tenderers taking into account the scheme requirement and spares.
- 4.12.07 Lamps shall be clustered LED type with series resistor and coloured lens. Lens and lamps shall be replaceable from the front. Lamps shall be located just above the associated push button/control switch
- 4.12.08 The general scheme of connections for control, interlock and protection is shown in the enclosed drawings. Detailed requirements of individual circuits will be intimated later to the successful bidder, who shall develop and furnish the schemes accordingly.
- 4.13.00 **Meters**
- 4.13.01 All indicating instruments (96 x 96 mm) shall be switchboard type, with 250° scale, anti-glare glass and accuracy class of $\pm 2\%$ full scale. Each meter shall have zero adjuster on the front.
- 4.13.02 Motor ammeter shall be suitable to indicate starting current (6 to 8 times full load current) for DOL starting of motor.
- Motor ammeter shall be provided for motor rated 30 kW and above and for critical drives, to be finalized during detail engineering.
- 4.13.03 All incomers, tie feeders, circuit breaker operated motor feeders shall be provided with 3-phase multifunction meter with pulse output and communication port for interfacing with Plant DDCMIS / PLC.
- 4.13.04 Meter selector switches shall be maintained contact, stay-put type, with knob handle. Ammeter and voltmeter selector switches shall be four position type. Ammeter selector switches shall have made before break contacts, to prevent open circuiting of CT secondary.
- 4.14.00 **Current Transformer**
- 4.14.01 Current Transformer, shall be cast resin type rated 10 VA. All secondary connections shall be brought out to terminal blocks where wye or delta connection will be made.
- 4.14.02 Accuracy class of the current transformers shall be:
- a) Class PS for REF

- b) Class 5P20 for other relaying.
- c) Class 1.0 ISF < 5 for metering.
- d) Class 0.5 ISF < 5 for metering (Incomer & Bus coupler of PMCC)

Other CT particulars like ratio, burden, knee point, excitation current & secondary resistance shall be decided by the bidder.

4.14.03 CT secondary shall be rated for 1A for metering & either 5A or 1A for protection.

4.15.00 Voltage Transformer

4.15.01 Voltage transformers shall be cast-resin, drawout type and shall have an accuracy class of 1.0. Voltage transformer mounted on breaker carriage is not acceptable. For Incomer and bus coupler of PMCC accuracy class of voltage transformer shall be 0.5.

4.15.02 High voltage windings of voltage transformer shall be protected by current limiting fuses. The voltage transformer and fuses shall be completely disconnected and visibly grounded in fully draw out position.

4.15.03 Secondary winding MCBs, sized to prevent overload shall be installed in all ungrounded secondary leads. MCBs shall be suitably located to permit easy replacement while the switchgear/PMCC is energized.

4.15.04 Both primary side & secondary side fuse failure / voltage loss monitoring system of VT shall be provided.

4.16.00 Transducers

4.16.01 Transducer for conversion of AC electrical quantities such as voltage, current, KW etc. shall be supplied as required for remote connection to Plant DDCMIS / PLC. All transducers shall be dual output type.

4.16.02 The transducers for indicating type instruments shall be of very low burden type having 4-20 mA DC linear, galvanically isolated output, compatible with secondary instruments and Plant DDCMIS system.

4.17.00 Secondary Wiring

4.17.01 The PMCC/MCC/DB shall be fully wired at the factory to ensure proper functioning of control, protection and interlocking schemes.

4.17.02 Fuse and links shall be provided to permit individual circuit isolation from bus wires without disturbing other circuits. All spare contacts of relays, push buttons and other devices shall be wired upto terminal blocks.

4.17.03 Wiring shall be done with flexible, 650V grade, fire resistance PVC insulated switchboard wires with stranded Copper conductors of 2.5 mm² for control & current circuits and 1.5 mm² for voltage circuits.

- 4.17.04 Each wire shall be identified, at both ends, with permanent markers bearing wire numbers as per Contractor's wiring diagrams.
- 4.17.05 Wire terminations shall be made with crimping type connector with insulating sleeves. Wires shall not be spliced between terminals. Separate colour code shall be used for AC & DC circuit wiring for easy identification.
- 4.18.00 **Terminal Blocks**
- 4.18.01 Terminal blocks shall be 650V grade box-clamp type with marking strips similar to ELMEX 10 mm² or equal. Terminals for C.T. secondary leads shall have provision for shorting.
- 4.18.02 Terminal blocks used for interface with DDCMIS / PLC via termination cabinet shall be suitably sized to facilitate proper termination of interconnecting cables.
- 4.18.03 Not more than two wires shall be connected to any terminal. Spare terminals equal in number to 20% active terminals shall be furnished.
- 4.18.04 Terminal blocks shall be located to allow easy access. Wiring shall be so arranged that individual wires of an external cable can be connected to consecutive terminals.
- 4.19.00 **Cable Terminations**
- 4.19.01 PMCC shall be designed for cable entry from bottom. MCC/DB shall be designed for cable entry both from top and bottom. Actual configuration shall be intimated later sufficient space shall be provided for ease of termination and connection.
- 4.19.02 Power cables shall be 1100V, Copper/Aluminum conductor, XLPE insulated, armoured, FRLS PVC overall sheathed.
- Control cables shall be 1100V, PVC insulated, armoured, PVC overall sheathed with 2.5 mm² stranded Copper conductor.
- 4.19.03 All provisions and accessories shall be furnished for termination and connection of cables, including removable gland plates, cable supports, crimp type tinned Copper/Aluminium lugs, brass compression glands with tapered washer (Power Cables only) and Terminal blocks.
- 4.19.04 Sufficient space shall be provided between the lower most power cable termination and gland plate for easy cable connection.
- 4.20.00 **Bus Duct Connection**
- 4.20.01 Bus duct connections shall be furnished along with transition panel, if required. Unless mentioned otherwise bus duct connections shall generally be from the top.

- 4.20.02 All connecting bus work shall have the same continuous current rating as associated PMCC bus and shall be fully braced for the LT system short circuit current.
- 4.20.03 All provisions such as matching flange and other accessories shall be furnished for connection to bus duct.
- 4.21.00 **Ground Bus**
- 4.21.01 A Cu / Al ground bus rated to carry the maximum fault current, shall extend full length of the MCC/DB.
- 4.21.02 The ground bus shall be provided with two-bolt drilling with G.I. bolts & nuts at each end to receive 50 x 6 mm G.I. flats.
- 4.21.03 All stationary structures shall be directly connected to the ground bus for effective grounding.
- 4.21.04 The frame of draw out module shall be grounded at all times except when the power disconnects are separated by a safe distance.
- 4.21.05 All hinged doors shall be earthed through flexible copper braid wire.
- 4.22.00 **Nameplate**
- 4.22.01 Nameplate of approved design shall be provided for each control compartment and also at the top of each PMCC / MCC / DB.
- 4.22.02 The material of the name plate shall be anodized aluminium / lamicaid or approved equal, 3 mm thick, with white letter on black background. Name plates shall be minimum 20 x 75 mm for instrument / devices and 40 x 150 mm for panels.
- 4.22.03 Caution notice on suitable metal plate shall be affixed at the back of each vertical panel.
- 4.23.00 **Space Heater**
- 4.23.01 Panel and motor space heater shall be fed from separate AC auxiliary busbars running throughout the switchboard. The space heater bus shall be fed from control transformer described earlier. Suitable terminals shall also be provided to facilitate energisation of the control transformer from outside during long shutdown of the board.
- 4.23.02 Each vertical section of the PMCC / MCC / DB shall be furnished with thermostat controlled space heater and 5A, 5 pin plug socket.
- 4.23.03 In addition, motor feeders 30 KW and above shall be wired up for feeding motor space heater through starter auxiliary 'OFF' contacts.
- 4.23.04 Cubicle heater, Motor heater and plug socket circuit shall be provided with individual MCB/switch fuse units.

4.24.00 A.C./D.C. Power Supplies

4.24.01 Necessary 415V AC and 220V DC power supplies as required for control and service shall be arranged by the contractor. Single feeder shall be arranged for A.C. supply and duplicate feeder shall be arranged for D.C. supply.

4.24.02 Isolating switch fuse units shall be provided at each switchgear for the incoming supplies, 4-pole, single throw for A.C. and 2-pole, double throw for D.C. Molded case circuit breaker (MCCB) shall also be accepted as an alternative.

4.24.03 Bus-wires of adequate capacity shall be provided to distribute the incoming supplies to different cubicles. Isolating switch fuse units / MCCB shall be provided at each cubicle for A.C/D.C. supplies.

4.24.04 A.C. load shall be so distributed as to present a balanced loading on three-phase supply system.

4.25.00 Tropical Protection

All equipment, accessories and wiring shall have fungus protection, involving special treatment of insulation and metal against fungus, insects & corrosion.

Screens of corrosion resistant material shall be furnished on all ventilating louvers to prevent the entrance of insects.

4.26.00 Painting

4.26.01 All steel surfaces shall be sand blasted, grounded and pickled as required to produce a smooth, clean surface free of scale, grease & rust.

4.26.02 After cleaning, the surfaces shall be given a phosphate coating followed by two coats of high quality primer and stoved after each coat.

4.26.03 For paint shade of finish coat, refer clause no.1.16.00 of Section E1, Volume V-A.

4.26.04 Sufficient quantity of touch-up paint shall be furnished for application at site.

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

5.00.00 TESTS

5.01.00 All equipment shall be completely assembled, wired, adjusted and tested at the factory as per the relevant standards.

5.02.00 Routine Test

The tests shall include but not necessarily be limited to the following :-

- a. Operation under simulated service condition to ensure accuracy of wiring, correctness of control scheme and proper functioning of the equipment.

- b. All wiring and current carrying part shall be given appropriate High Voltage Test.
- c. Primary current & voltages shall be applied to all instrument transformers.
- d. Routine test shall be carried out on all equipment such as circuit breakers, switch - fuse, contactors, relays, meters etc.

5.03.00 Type Tests

All the Type Tests (as per IS- 8623/IEC) should have been carried out on an identical & similar type of switchgear for each rating involved in the project with ACB mounted in service condition inside the switchgear panel.

Bidder has to submit ACB type test reports for test sequence 1 and combined test sequence and Type 2 co-ordination test reports of any 3 ratings of starter ratings involved.

Type test certificates of any equipment shall be furnished if so designed by the purchaser/ owner. Otherwise the equipment shall have to be type tested free of charge, to prove the design. Type test performed before five (5) years are not acceptable.

6.00.00 DRAWINGS, DATA & MANUALS

6.01.00 Drawings, Data & Manuals shall be submitted in triplicate with the bid and in quantities and procedures as specified in General Conditions of Contract and/or elsewhere in the specification for approval and subsequent distribution after the issue of 'Letter of Intent'.

6.02.00 To be submitted with the bid :-

- a. General arrangement drawing showing constructional features, space required in front for withdrawals, power & control cable entry points etc.
- b. Typical foundation plan
- c. Typical control schematic
- d. Bill of materials
- e. Type test reports on circuit breaker
- f. Technical leaflets on :-
 - i) Circuit breaker
 - ii) Switch-fuse units
 - iii) Contactors
 - iv) Relays, meters, push buttons, selector switches etc.
 - v) Glands/terminals blocks

6.03.00 To be submitted for Owner / Purchaser's Approval and Distribution

All relevant drawings and data pertaining to the equipment like GTP, GA drawing, foundation plan, BOM, control & schematics, QAP, etc. shall be submitted by the Bidder for approval of Owner/Owner's consultant. Also refer clause no. 1.19.02(u) of Section-I of Volume – V-A: Technical Specifications for Electrical Equipment & Accessories.

ANNEXURE-A

RATINGS AND REQUIREMENTS

1.0 General

Type	:	ACB Modules - Drawout type MCCB Modules – Drawout type
Service	:	Indoor
Enclosure	:	IP52

2.0 System

		AC	DC
Voltage	:	415V ± 10%	220V (187-242V)
Phase	:	3-phase, 4-wire	2- wire
Frequency	:	50 Hz +3% to - 5%	
Combined voltage and Frequency variation	:	10% (absolute sum)	
System grounding	:	Solidly grounded	Ungrounded

3.0 Rating

Rated current	:	To be decided by the tenderers.
Design Ambient Temperature	:	50°C
Short Circuit Current Symm.	:	50 KA 25* KA

* Indicative only, the actual value will be decided by the tenderers.

S/C Withstand Time	:	----- 1 second -----
High voltage test for 1 minute	:	2.5 kV 1.5 kV

4.0 Duty

Circuit Breaker	:	0-3'-CO-3'-0
Contactor (AC)	:	Class III - Category AC3 for unidirectional drives and AC4 for bi- directional / inching duty drives
Contactor (DC)	:	Class I – category DC2
MCCB / Switch Duty for		AC DC
Motor Feeder	:	AC23 DC22

	Other Feeder	:	AC22	DC22
5.0	A.C. / D.C. Power Supply			
	Control Voltage for Circuit breaker	:	220V DC +10% to -15%	
	Control voltage for MCCB modules	:	110V AC $\pm$ 10%, 1Ph, 50Hz +3% to - 5%	
	Service voltage	:	240V AC $\pm$ 10%, 1Ph, 50Hz +3% to - 5%	

ANNEXURE-B

PROTECTIONS

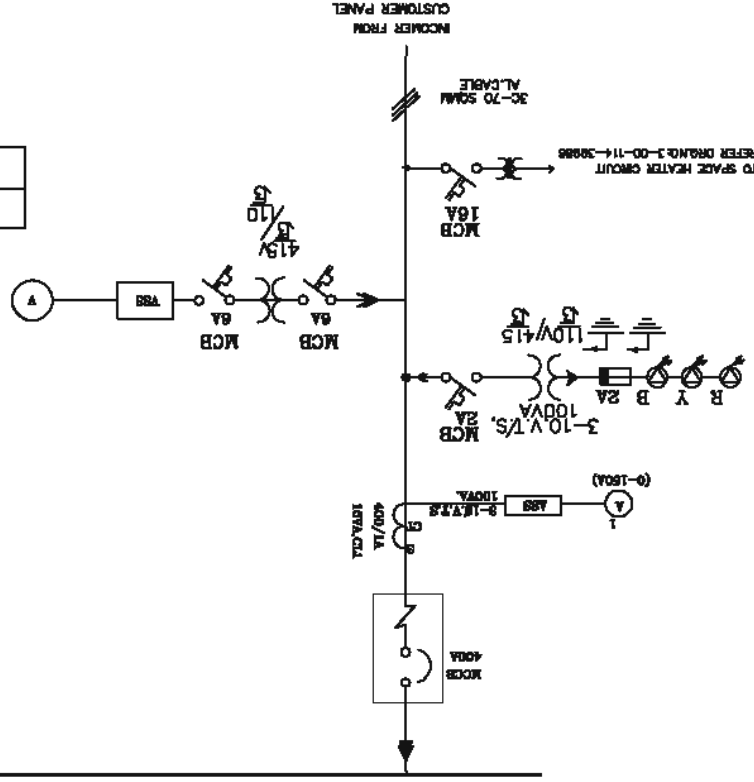
- 1.0 All Protective relays shall be microprocessor based numerical type having communication facility with Plant DDCMIS system / PLC.
- 2.0 The minimum protections to be provided for different types of circuits are listed below:
- a. Incoming Feeder & Bus-coupler with ACB:
 - 3 - inverse time O/C relays (51) for phase fault.
 - 1 - Inverse time O/C relay (51N) for Earth fault.
 - 3 - Under Voltage (27), Range : 40-80% with timer
 - b. Motor Feeder with ACB: (above 110 kW)
 - 1 - Composite Motor protection relay (99) for protection against
 - Thermal overload
 - Phase faults
 - Unbalance (negative sequence)
 - Locked rotor
 - Excessive Start-up time and Start-Stop.
 - Earth fault
 - c. Outgoing Feeder : with ACB
 - 3 - Inverse time O/C relays (51) for phase fault.
 - 1 - Inverse time O/C relay (51N) for Earth fault.
- 3.0 Apart from protection relays, each electrically operated breaker shall be provided with anti-pumping (94), trip annunciation (30), lockout (86) and trip circuit supervision (74) relays. Lockout relay shall be hand reset type.
- 4.0 Both primary side & secondary side fuse failure / voltage loss monitoring system of VT shall be provided..
- 5.0 For Auto-bus change-over as well as live bus change-over through synchronization refer enclosed Control Schematic drawings.
- 6.0 Each incomer shall be provided with three (3) nos. Bus Energised indicating lamps – Red/Yellow/Blue for each phase.

Sl. No	CAT	Description	Qty	Blower MCC
INCOMER 400A			M	1
1	MCCB	MCCB TP 400A 50KA TM	1	1
1	MCCB	MCCB TP 400A 50KA TM EROHM	1	1
1	MCCB	MCCB TP 400A 50KA TM SPREADERS	1	1
1	MCCB	MCCB TP 400A 50KA TM NO-NC CONTACTS	1	1
1	MCCB	MCCB TP 400A 50KA TM PHASE BARRIER	1	1
2	MPCB	MPCB TP 1A	2	2
2	MPCB	1NO+1NC FOR MPCB	2	2
3	MCB	MCB FP 6A AC	1	1
4	MCB	MCB DP 6A AC	1	1
5	CT	400/1A CL-1 15VA	3	3
6	CST	415/110V CST 500VA	1	1
7	MFM	MULTI FUNCTION METER	1	1
8	METER	AMMETER 1A	1	1
9	METER	VOLTMETER 500V	1	1
10	SWITCH	AMMETER SELECTOR SWITCH 10A 415V AC	1	1
11	SWITCH	VOLTMETER SELECTOR SWITCH 10A 415V AC	1	1
12	LED	INDICATING LAMP RED 110V AC	1	1
13	LED	INDICATING LAMP GREEN 110V AC	1	1
14	LED	INDICATING LAMP RED 63.5V AC	1	1
15	LED	INDICATING LAMP YELLOW 63.5V AC	1	1
16	LED	INDICATING LAMP BLUE 63.5V AC	1	1
17	CTTB	10SO.MM	10	10
18	NL	NEUTRAL LINK 400A	1	1
19	NL	NEUTRAL LINK 32A	2	2
20	TB	TERMINAL BLOCK 4SO.MM	10	10
3-00-114-39986(32KW)			M	7
1	MCCB	MCCB FOR 32KW TP MOTOR DOL SC	1	7
1	MCCB	MCCB EROHM	1	7
1	MCCB	MCCB NO-NC CONTACTS	1	7
2	POWER CONT	POWER CONTACTOR TP 120A AC	1	7
3	POWER CONT	POWER CONTACTOR AC 2NO+2NC CONTACTS	1	7
4	OLR	OLR FOR 32KW MOTOR DOL	1	7
5	AUX CONT	AUX CONTACTOR WITH 2NO+2NC 110V AC	2	14
6	MCB	MCB DP 6A AC	2	14
7	CT	CT 60/1A CL-1 15VA WPL	1	7
11	TD	CURRENT TRANSDUCER AUX 110V AC	1	7
12	METER	AMMETER FOR MOTORS 1A	1	7
13	SWITCH	2POLE 2WAY SWITCH 10A 110V AC LOCKABLE	1	7
14	LED	INDICATING LAMP RED 110V AC	1	7
15	LED	INDICATING LAMP GREEN 110V AC	1	7
16	LED	INDICATING LAMP AMBER 110V AC	1	7
17	CTTB	DISCONNECTING TYPE	2	14
18	PB	PUSH BUTTON BLACK 110V AC	1	7
VM 50VA			M	1
1	MPCB	MPCB TP 1A	2	2
1	MPCB	MPCB 1NO+1NC	2	2
2	MCB	MCB FP 6A AC	1	1
3	TD	AC VOLTAGE TRANSDUCER AUX 220V DC	3	3
4	METER	VOLTMETER 500V	1	1
5	PT	PT 1-PH 415/RT(3) / 110/RT(3) 50VA CL-0.5	3	3
6	SWITCH	VOLTMETER SELECTOR SWITCH 10A 415V AC	1	1
7	LED	INDICATING LAMP RED 63.5V AC	1	1
8	LED	INDICATING LAMP YELLOW 63.5V AC	1	1
9	LED	INDICATING LAMP BLUE 63.5V AC	1	1
SPACE HEATER CST J2 (.5KVA)			M	1
1	MPCB	MPCB 6A	1	1
2	MCB	MCB DP 16A AC	1	1
3	CST	415/110V CST 0.5KVA	1	1
4	LED	INDICATING LAMP RED 110V AC	1	1
5	TB	TERMINAL BLOCK 4SO. MM	6	6

Sl. No	CAT	Description	Qty	Blower MCC
MOTOR FEEDER CONTROL SUPPLY CST J1 (0.5KVA)			M	1
1	MPCB	MPCB 6A	1	1
2	MCB	MCB DP 32A AC	1	1
3	CST	415/240V CST 0.5KVA	1	1
4	LED	INDICATING LAMP RED 240V AC	1	1
5	SWITCH	ON OFF SWITCH 6A 240V AC	5	5
6	TB	TERMINAL BLOCK 4SQ. MM	15	15

A	AMMETER
V	VOLTMETER
ASS	ANMETER SELECTOR SWITCH
VSS	VOLTMETER SELECTOR SWITCH
SFU	SWITCH FUSE UNIT
IS	ISOLATING SWITCH
CT	CURRENT TRANSFORMER
TP	TRIPLE POLE
SH	SPACE HEATER
TPN	TRIPLE POLE & NEUTRAL
C	CONTACTOR
SS	SELECTOR SWITCH
TPDT	TRIPLE POLE DOUBLE THROW
CTD	CURRENT TRANSDUCER
VTD	VOLTAGE TRANSDUCER
PF	POWER FUSE
CF	CONTROL FUSE
SW	CONTROL SWITCH
PB	PUSH BUTTON
O/V	THERMAL OVERLOAD RELAY
Ø	FIXED TERMINAL
LNK	LINK
ACB	AIR CIRCUIT BREAKER
L	INDICATING LAMP
D	DIODE
L	INDICATING LAMP FOR BREAKER CONTROL SUPPLY (DC) 'ON'-RED
DC-IS	DC ISOLATING SWITCH
R	DC RELAY
RS	HAND RESET LOCK-OUT RELAY WITH BLUE LAMP
SI	DEFINITE TIME DELAY OVER CURRENT RELAY FOR ALL THREE PHASES(SELF RESET) CURRENT SETTING RANGE 150% – 600% TIMING SETTING RANGE 0.1 – 1SEC
BM	BLOWER MOTOR
⏏	DRAWOUT TERMINAL
⚡	INDICATION LAMP (CLUSTER LED)

LEGEND



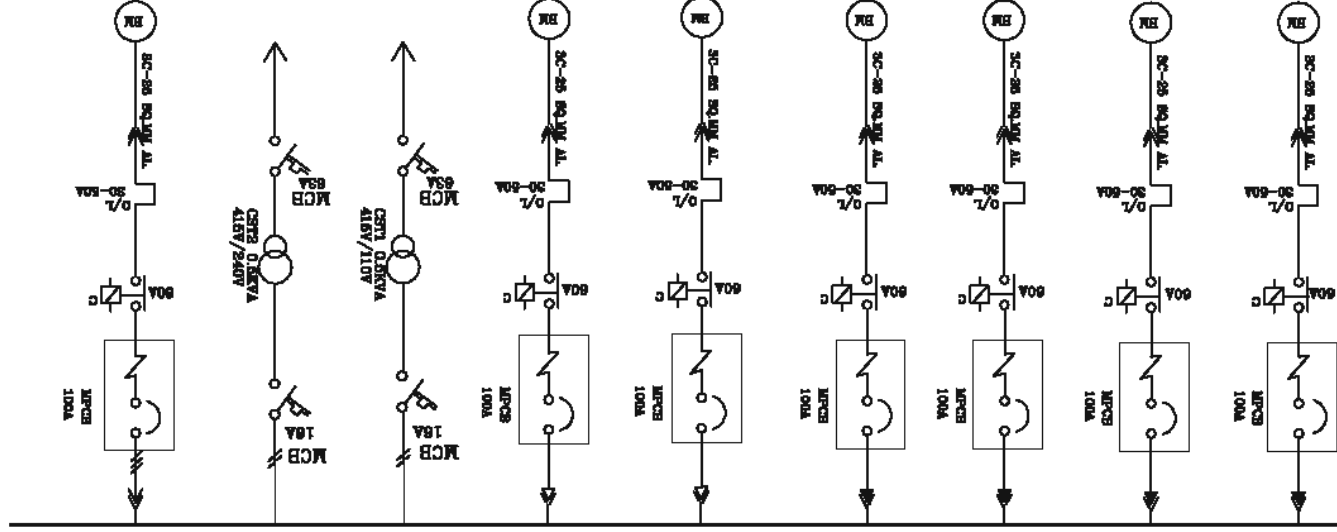
NOTE: THIS DRAWING SHALL BE READ ALONG WITH THE
WITH THE FOLLOWING DRAWINGS.

1. 3-00-114-39985/00
2. 3-00-114-39986/00
3. 3-00-114-39987/00
4. 3-00-114-39988/00

STANDARD	CABLE	FROM	TO	CABLE SIZE	SCORE	NO. OF WINDS	REMARKS
01	POWER	LEARNED	BLOWER MCC	BC-PROGRAM(41)	CUSTOMER	01	INTEGRATE TO HATCH
02	POWER	BLOWER MCC	BLOWER MOTOR	SC-98800(41)	CUSTOMER	02	FOR 02 MOTORS
03	INSTRUMENTATION	INCH	ATTEMPTIVE FLOW	2-PH-0-80000	CUSTOMER	01	FOR REMOTE COMPANY
04	INSTRUMENTATION	ATTEMPTIVE FLOW	CONTROL VALVE	2-PH-0-80000	CUSTOMER	01	FOR REMOTE COMPANY

210-01-33 21873

* THE HAVING OF THE BLOWN MOTHER IS MAXIMUM POSSIBLE ONE AND HENCE THE SWIMMING COMPANIES, THE ALL CHANCE AFTER PROSECUTION OF HIGHER MOTHER.

[illegible]

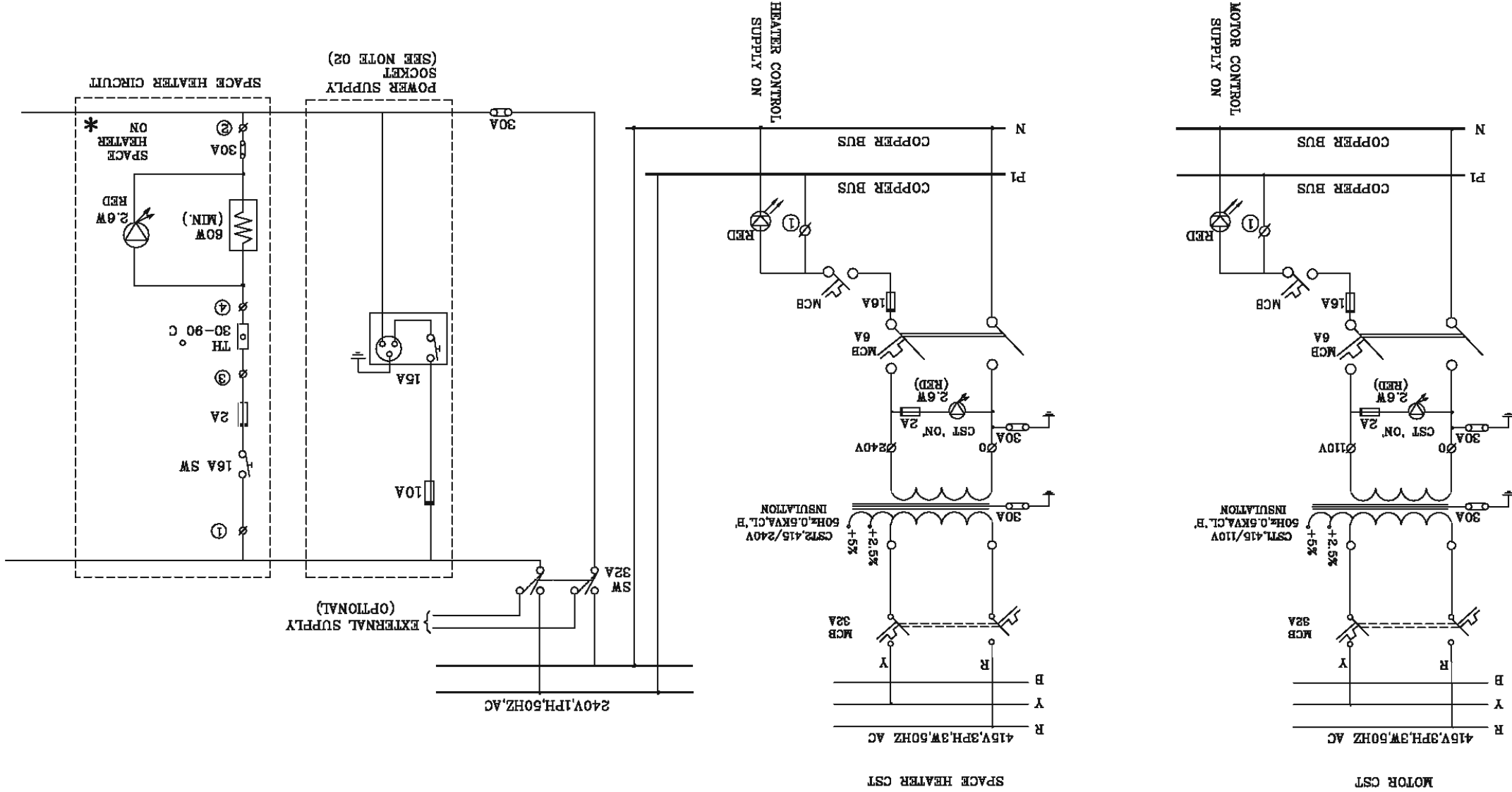
415V, 3PH, 2WIRE, 50HZ AC ALUMINUM, BUSBAR RATING: 250A FAULT LEVEL- 60KA FOR 1 SEC.(FOR R,Y,B)

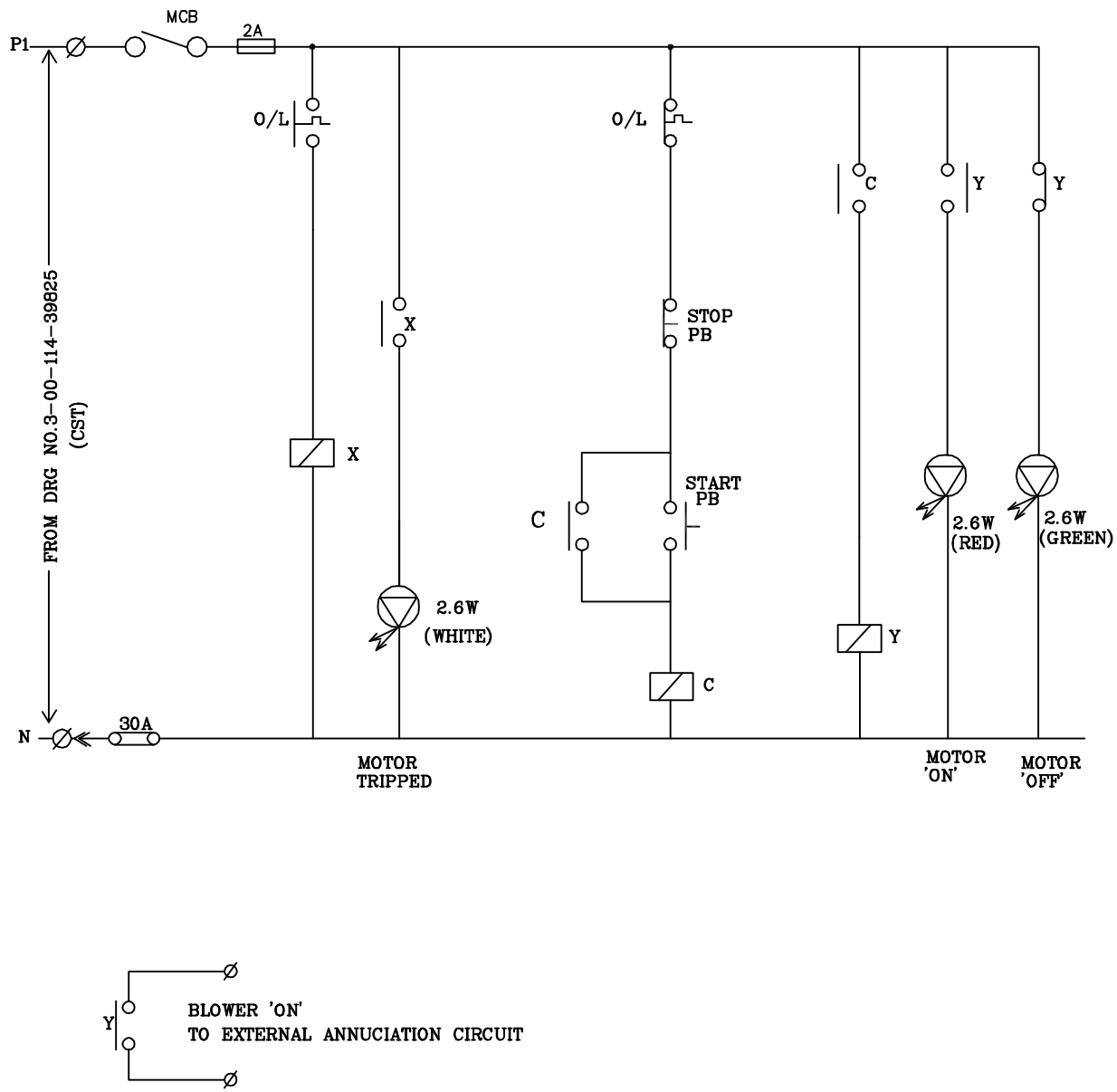
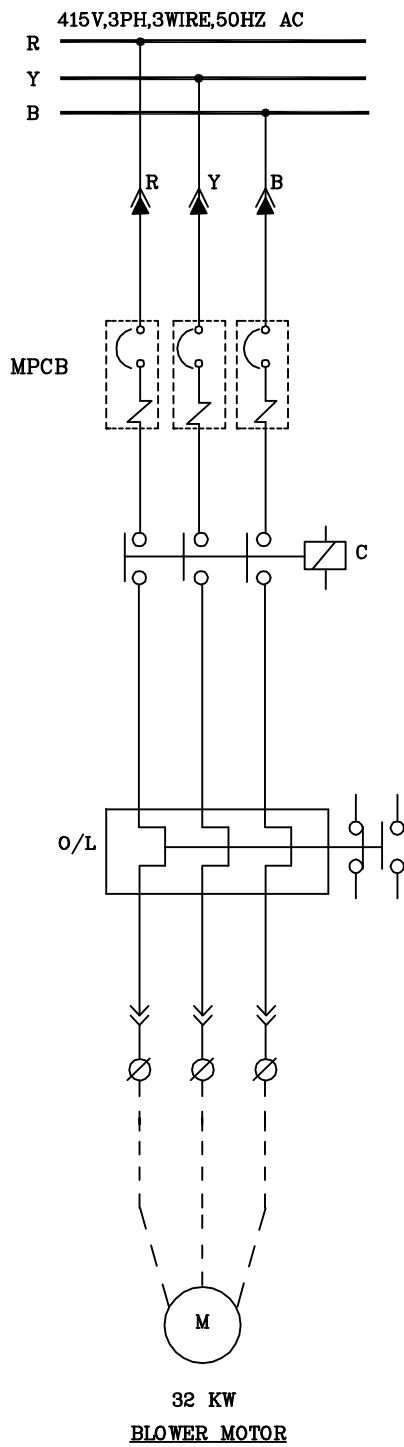
ALL DIMENSIONS ARE IN MILLIMETRES

 CUSTOMER:	 OMNICORE CONSULTANT		ANDHRA PRADESH POWER GENERATION CORPORATION LTD (APGENCO)		1X800 MW DR.NTPS STAGE-V, UNIT-B, VIJAYAWADA BRG PKG		BHARAT HEAVY ELECTRICALS LTD UNIT- BOILER AUXILIARY PLANT RANIPET-832 406		SLD FOR BLOWER MCC		TITLE :
			DRAWING NAME SIGN DATED	PERD.BY M.VIN 15.05.17 CHRD.BY D.GUNY 16.05.17 APPD.BY M.TM 16.05.17	BHEL DRAWING NO 3-00-114-39984	REV NO 00					

CUSTOMER: ANDHRA PRADESH POWER GENERATION CORPORATION LTD (APGENCO)			OWNER'S CONSULTANT: APGENCO		
BTG PKG			APGENCO		
1X800 MW DR.NTPS STAGE-V, UNIT-8, VIJAYAWADA			APGENCO		
BHARAT HEAVY ELECTRICALS LTD			APGENCO		
UNIT- BOILER AUXILIARY PLANT			APGENCO		
RANIPET-632 406.			APGENCO		
APPD.BY M.J.M			APGENCO		
BHEL DRAWING NO			APGENCO		
3-00-114-39985			APGENCO		
REV NO			APGENCO		
00			APGENCO		

NOTE:
01. THE SPACE HEATER CIRCUIT SHOWN IS FOR ONE CABLE ALLEY. NUMBER OF SUCH CIRCUIT DEPENDS UPON THE NUMBER OF CABLE ALLEY.
02. ONE NO INDUSTRIAL TYPE POWER SUPPLY SOCKET PER PANEL SHALL BE LOCATED IN THE MIDDLE PANEL CABLE ALLEY.





CUSTOMER:  OWNER'S CONSULTANT: 	ANDHRA PRADESH POWER GENERATION CORPORATION LTD (APGENCO) 1X800 MW Dr.NTTPTS STAGE-V, UNIT-8, VIJAYAWADA BTG PKG				
	BHARAT HEAVY ELECTRICALS LTD UNIT- BOILER AUXILIARY PLANT RANIPET-632 406.	DRAWING	NAME	SIGN	DATED
		PRRD.BY	M.VIJI	-SD-	15.05.17
		CHKD.BY	D.QUILY	-SD-	15.05.17
		APPD.BY	M.J.M	-SD-	15.05.17
TITLE :	P & C CIRCUIT FOR BLOWER MOTOR	BHEL DRAWING NO 3-00-114-39986			REV NO 00

MAKE OF COMPONENTS FOR BMCC PANEL.

01. MCCB / SIEMENS / SCHNEIDER
02. POWER SWITCH / SIEMENS / SCHNEIDER
03. CONTROL SWITCH / SIEMENS / KAYCEE / SWITCHGEAR / SCHNEIDER
04. SELECTOR SWITCH / SIEMENS / KAYCEE / SWITCHGEAR / SCHNEIDER
05. POWER FUSE / SIEMENS / SCHNEIDER
06. CONTROL FUSE & FUSE BASE / SIEMENS / S & S POWER / SWITCHGEAR / BUSMANN
07. AUXILIARY CONTACTOR / SIEMENS / SCHNEIDER / BCH
08. BIMETAL OVERLOAD RELAY WITH BASE / SIEMENS / TELEMECHANIQUE(SCHNEIDER) / SWITCHGEAR(TC) / SCHNEIDER
09. FUSE CARRIER / SIEMENS / S & S POWER / CANDS / SWITCHGEAR / BUSMANN
10. PUSH BUTTON / SIEMENS / BCH / TEKNIC / SWITCHGEAR(RAAS CONTROLS) / SCHNEIDER
11. INDICATING LAMP(CLUSTERED TYPE) / SIEMENS / RAAS CONTROLS / BINAY / TEKNIC / SCHNEIDER / CANDS / BCH / ESSEN / VAISHNO / SIEMENS
12. INDICATING METER / A E / IMP / RISHAB / I&T / MECO
13. TERMINAL BLOCK / ELMEX / TOSHA / CONTROLS & SWITCHGEAR(WAGO) / CONNECTWELL / ESSEN / JAINSON
14. WIRE / ISI CERTIFIED
15. CABLE GLAND / COMET / SIEMENS / SUNIL&CO / BRACCO / CONTROLS & SWITCHGEAR / ARUP ENGINEERING / QUALITY PRECISION / LOTUS
16. CABLE LUG / DOWELTS / JAINSON / LOTUS
17. NEUTRAL LINK / CANDS / CONTROLS & SWITCHGEAR / L & T / SIEMENS / SCHNEIDER
18. SWITCH PLUG / SOCKET / CROMPTON GREAVES / ANCHOR / BEST & CROMPTON / BCH
19. SPACE HEATER / CANDS / VILCO / PYROSYSTEM/CONTROLS & SWGR / SOPHIA / CROMPTON GREAVES
20. THERMOSTAT / TEMPTROL / VIKAS ELECTRIC / AI / RENTROL / ANCO

THE PANEL MANUFACTURER CAN USE ANY ONE OF THE MAKES INDICATED AGAINST EACH ITEM HOWEVER FOR THE SUPPLY OF PANEL TO ONE SITE, ONLY ONE MAKE SHALL BE USED, ie, NO MIX-UP IN MAKES AGAINST EACH ITEM IS ALLOWED.



TITLE :

MAKE OF COMPONENTS FOR BMCC.

DRAWING	NAME	SIGN	DATED
BHARAT HEAVY ELECTRICALS LTD	PRRD.BY M.VIJ	-SD-	15.05.17
UNIT- BOILER AUXILIARY PLANT	CHRD.BY D.GUJLY	-SD-	15.05.17
	APPD.BY M.T.M	-SD-	15.05.17
BHEL DRAWING NO	3-00-114-39987		
REV NO	00		

NOTES:

GENERAL (PANELS):

01. NO. OF BLOWER MCC : ONE NUMBER.
02. CONSTRUCTION: SINGLE FRONT FOR OUTGOING FEEDERS SHALL BE PROVIDED.
DRAWOUT TYPE FOR ALL FEEDERS EXCEPT CST & SPACE HEATER FEEDERS SHALL BE PROVIDED.
03. OPERATING HEIGHT (HANDLE/PUSH BUTTON POSITION) SHALL BE BETWEEN 200 MM AND 2000MM FROM THE FLOOR LEVEL.
04. SHEET STEEL USED FOR CONSTRUCTION SHALL BE AS FOLLOWS:
STRUCTURAL LOAD BEARING MEMBERS : MIN 2 MM THICK CRCA.
ALL NON LOAD BEARING MEMBERS : MIN 1.6 MM THICK CRCA.
GLAND PLATE FOR MULTI CORE OUTGOING : MIN 3 MM THICK CRCA.
GLAND PLATE FOR SINGLE CORE INCOMING : MIN 4 MM THICK NON-MAGNETIC/ NON INDUCTIVE TYPE.
05. DOOR INTERLOCK SHALL BE SUCH THAT THE DOOR CAN NOT BE OPENED WITH THE BREAKER AND POWER SWITCH IN 'ON' POSITION.
- 06.A. DEGREE OF PROTECTION : IP 55 AS IS 13947 OF LATEST VERSION. AS THE PANEL IS IN OUTDOOR, SUITABLE CANOPY SHALL BE PROVIDED. THE DESIGN/DIMENSION/ GA DRAWING OF THE CANOPY SHALL BE INCORPORATED WITHOUT COMMERCIAL IMPLICATION TO BHEL/RANIPET.
- 06.B. SEPARATE HINGED TRANSPARENT COVER SHALL BE PROVIDED FOR THE PUSH BUTTONS.
07. THE CIRCUIT IS DRAWN FOR THE FOLLOWING CONDITIONS:
i). POWER AND CONTROL SUPPLY OFF.
ii). ALL CONTACTORS ARE IN DE-ENERGISED CONDITION.
08. PANEL COLOUR : SHADE RAL 7032
09. TWO SETS OF OPERATION AND MAINTENANCE MANUAL WITH AS BUILT DRG SHALL BE SUPPLIED ALONG WITH PANEL.
10. THE G.A.BASE FRAME FIXING ARRANGEMENT,SCHEME DRAWINGS & BOM FOR CUSTOMER APPROVAL SHALL BE FURNISHED.
11. MCC SHALL BE SUITABLE FOR 3PH,3 WIRE, 415V, 50HZ POWER SUPPLY & SUITABLE FOR 110V AC CONTROL SUPPLY.
12. FAULT LEVEL 50KA FOR 1SEC SHALL BE DESIGNED FOR ALL BUSES (HORIZONTAL & VERTICAL) R,Y,B.
13. THE COMPONENTS RATING SHOWN ARE MINIMUM. HOWEVER THE RATING OF THE COMPONENTS SHALL BE SUITABLY UP-RATED IN ORDER TO MEET TYPE 2 CO-ORDINATION AS PER IS 13947.
14. ADDITIONAL SUPPORT FRAME OF 300 mm SHALL BE PROVIDED IN THE BOTTOM SEPARATELY TO PLACE THE PANEL THROUGHWHICH THE INCOMING/OUTGOING CABLES ENTER/LEAVE.
15. EARTH BUS SHALL RUN ALONG THE PANEL BOTTOM OF MINIMUM 65X10MM GI.
16. PANEL GA/BOM/BQO/SLD WILL BE APPROVED BY CUSTOMER IN THE EVENT OF ORDER.

SPECIFIC REQUIREMENTS:

01. IN CST MODULE, ONLY ONE CONTROL TRANSFORMER SHALL BE FITTED.
02. MINIMUM 2'NO'+2'NC' SPARE CONTACTS SHALL BE WIRED UP TO TB FOR CUSTOMER'S USE.
03. ALL SPARE CONTACTS OF ALL CONTACTORS AND RELAY DEVICES SHALL BE WIRED UPTO THE TERMINAL BLOCK.
04. CLUSTERED LED TYPE INDICATING LAMPS SHALL BE PROVIDED.
05. INDICATING LAMP SHALL BE PROVIDED FOR THE FOLLOWING:
a) MOTOR 'ON'.
b) MOTOR 'OFF'.
c) MOTOR 'TRIPPED'.
d) CONTROL SUPPLY AVAILABLE.
06. A POTENTIAL FREE CONTACT SHOULD BE PROVIDED IN THE PANEL FOR BLOWER 'ON' TO REMOTE ALARM AT CENTRAL CONTROL ROOM.

CABLES AND CABLE GLANDS:

01. CABLE ENTRY SHALL BE FROM THE BOTTOM. ENVSAGED FOR ALL MODULES AND THE SAME SHALL BE FITTED AND SUPPLIED WITH THE PANEL.
02. DOUBLE COMPRESSION TYPE BRASS CABLE GLANDS AND HEAVY DUTY ANNEALED TINNED COPPER(ATC) LUGS ARE ENVSAGED FOR ALL MODULES AND THE SAME SHALL BE SUPPLIED AND FITTED WITH THE PANEL BY PANEL MANUFACTURER.
03. CABLE ALLAY OF MINIMUM 250MM SHALL BE PROVIDED.



TITLE :

BHARAT HEAVY ELECTRICALS LTD
UNIT- BOILER AUXILIARY PLANT
RANIPET-632 406.
PRRD.BY M.VIJU
CHKD.BY D.GUJLY
APPD.BY M.J.M
SIGN DATED

NOTES FOR BLOWER MCC.

BHEL DRAWING NO
3-00-114-39988
REV NO
00



ADDITION/ DELETION LIST LTMSB

SL. NO	COMPONENT DESCRIPTION	RATING	UNIT PRICE
1	ACB OF EACH TYPE AND RATING		
2	MCCB(EACH TYPE AND RATING)		
3	AUXILIARY CONTACTOR (EACH RATING AND TYPE)		
4	PROTECTION RELAY (EACH RATING AND TYPE)		
5	INDICATION LAMP (EACH RATING AND TYPE)		
6	PUSH BUTTON (EACH RATING AND TYPE)		
7	CONTROL TRANSFORMER (EACH RATING AND TYPE)		
8	CURRENT TRANSFORMER (EACH RATING AND TYPE)		
9	VOLTMETER(EACH RATING AND TYPE)		
10	AMMETER (EACH RATING AND TYPE)		
11	NEUTRAL LINK (EACH RATING AND TYPE)		
12	CONTROL SWITCHES (EACH RATING AND TYPE)		
13	CONTROL/POWER TERMINAL (EACH RATING AND TYPE)		
14	DFDO ENCLOSURE (EACH RATING AND TYPE)		
15	MODULES OF EACH TYPE AND RATING		

2. i. Vendor to give UNIT price for addition/ deletion of all COMPONENTS for all rating as indicated in the BOM. Also vendor to give option price for addition/ deletion of ENCLOSURE.

ii. The cost price of Individual items related to this project should match to total price .



Bharat Heavy Electricals Limited
Electroporcelains Division, Bangalore – 560 012
Control Panel Business Group
PRICE FORMAT

PROJECTS: 1X800MW VIJAYAWADA THERMAL POWER PLANT
1X800MW KRISHNAPATNAM THERMAL POWER PLANT
MATERIAL: DRAWOUT PANELS FOR APGENCO PROJECT REQUIREMENT

sl.no	MATL.CODE	DESCRIPTION	UNIT	QTY	UNIT PRICE	TOTAL
1	ELSBMCCSDST01	SBMCC FOR KRISHNAPATNAM	EA	1		
2	ELSBMCCVTPS01	SBMCC FOR VIJAYAWADA	EA	1		
3	ELLTMSBSDST01	LTMSB FOR KRISHNAPATNAM	EA	4		
4	ELACPSDST01	ACP FOR KRISHNAPATNAM	EA	4		
5	ELLTMSBVTPS01	LTMSB FOR VIJAYAWADA	EA	4		
6	ELACPVTPS01	ACP FOR VIJAYAWADA	EA	4		
7	ELCOMSPRVTP001	COMMISSIONING SPARES FOR VIJAYAWADA	LOT	1		
8	ELCOMSPRKR001	COMMISSIONING SPARES FOR krishnapatnam	LOT	1		
9	ELBLWVTPS01	BLOWER MCC FOR VIJAYAWADA	EA	1		
10	ELBLWKR001	BLOWER MCC FOR KRISHNAPATNAM	EA	1		
11	ELCOMSPRAP001	COMMISSIONING SPARES FOR BLOWER MCC,AP	LOT	1		

NOTES:

- SUMMATION OF ALL UNIT RATES OF MODULES SHALL BE EQUIVALENT TO TOTAL BOARD COST QUOTED, VARIANCE OF +/- 5% IS ACCEPTABLE. BEYOND 5% OFFER WILL NOT BE CONSIDER AS VALID OFFER. IN UNIT ADDITION-DELETION PRICES, PRICES QUOTED FOR COMPONENTS SHALL BE AS PER LIST PRICE OF CONCERNED MANUFACTURES. IF ANY ABNORMAL PRICES ON HIGHER SIDE OBSERVED OFFER MAY BE REJECTED.
- ALL BOARDS SHALL BE SUPPLIED ALONGWITH THE INTEGRAL BASE FRAMES, FOUNDATION BOLTS, CABLE GLANDS & LUGS. ALL FIXING NUTS & BOLTS TOGETHER WITH FOUNDATION BOLTS SHALL ALSO BE SUPPLIED. PRICES FOR THE BASE FRAME SHALL BE BUILT IN THE SWITCHBOARD PRICE.
- ITEM WISE PRICES WITH DESCRIPTION AND RATING OF EACH ITEM COMPLYING TO LIST FURNISHED IN THE SCHEDULE OF UNIT PRICES SHALL BE FURNISHED IN SCHEDULE OF UNIT PRICE.
- ADDITION/DELETION OF QUANTITIES SHALL BE APPLICABLE AT THE QUOTED PRICE. THE UNIT RATE OF SUPPLY OF ALL EQUIPMENTS & SERVICES QUOTED BY THE BIDDER SHALL BE FIRM FOR A VARIATION OF QUANTITIES, WHICH MAY BE TO THE EXTENT OF $\pm 30\%$ OF THE TOTAL ORDERED QUANTITY. SUM OF INDIVIDUAL MODULE SHALL EQUAL TO BOARD PRICE.
- THE MAKE OF COMPONENTS SHALL BE SUBJECT TO CUSTOMER APPROVAL.

TECHNICAL DEVIATION SHEET

SI No.	Document Title	Clause No.	NIT requirement	Bidders Deviation

Total Number of Deviation(s):(Both in figures & Words)

BIDDER’S STAMP & SIGNATURE

**TECHNICAL SPECIFICATION FOR
BLOWER MCC**

PROJECT: 1X800MW VIJAYAWDA

CUSTOMER: APGENCO

SPEC REF NO.: EP-BLW-VTP -01 REV 00



**BHARAT HEAVY ELECTRICALS LIMITED
ELECTROPORCELAINS DIVISION
BANGALORE – 560012**



**TECHNICAL SPECIFICATION
FOR
BLOWER MCC**

SPECIFICATION NO.: EP-BLW-VTP -01

VOLUME

SECTION -

REVISION 0

DATE: 18.09.2017

CONTENTS

<u>S. NO.</u>	<u>DESCRIPTION</u>
1.0	COVER PAGE
2.0	CONTENTS
3.0	INSTRUCTIONS FOR BIDDERS
4.0	TECHNICAL SPECIFICATION & DRAWINGS
5.0	PRICE SCHEDULE
6.0	UNIT PRICE SCHEDULE
7.0	DEVIATION SHEET

**IT IS CONFIRMED THAT OUR TECHNICAL OFFER COMPLIES WITH THE SPECIFICATION IN TOTO, & THAT
THERE ARE NO TECHNICAL DEVIATIONS.**

BIDDER'S STAMP & SIGNATURE
(REFER INSTRUCTION NO. 1 OF 'INSTRUCTIONS TO BIDDERS')



**TECHNICAL SPECIFICATION
FOR
BLOWER MCC**

SPECIFICATION NO.: EP-BLW-KRP-01

VOLUME NO. :

SECTION :

REV NO. : 00 DATE: 18-09-2017

SHEET : 1 OF 1

INSTRUCTIONS TO BIDDERS FOR PREPARING TECHNICAL OFFERS

1. Two signed and stamped copies of the following shall be furnished by all bidders as technical offer:
 - a) Complete technical specification.
 - b) Un-priced copy of PRICE FORMAT, duly stamped and signed by the bidder.
 - c) Complete dimension of all the boards including no. of panels, dimensions of each type of panels, module size of each type of feeders and minimum clearances required on all sides for each type of panels.
 - d) **No. of Vertical consider by vendor for each boards are to be compulsory given along with offer.**
 - e) A copy of the sheet "Instructions to Bidders for Preparing Technical Offer" duly stamped and signed by the bidder.
 - f) Technical deviation/ clarification, if any
 - g) No. of MCC panels, Weight & Dimensions of LTMSB & ACP.
2. No technical submittal such as copies of type test certificates, data Sheets, write-up, drawing, technical literature, etc. is required during tender stage. Any such submission, even if made, shall not be considered as part of offer.
3. Confirmations/ comments (if any) regarding delivery schedules shall be furnished as part of the commercial offer. Any reference elsewhere/ covering letter of technical offer shall not be considered by BHEL.
4. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder's covering letter shall not be considered by BHEL, and bidder's offer shall be construed to be in conformance with the specification.
5. Any changes made by the bidder in the price schedule with respect to the Item description/ quantities, notes etc. from those given in annexure-A of specification shall not be considered (i.e., technical description, quantities, notes etc. as per specification shall prevail).
6. Bidders to quote for all items/sub items.
7. In case of any ambiguity in specification between various sections and end customer specification vendor should clearly brought out in technical deviations failing in which BHEL will have choice to prefer which ever it suits at later stage for which vendor should accept.
8. In case bidder is having any queries regarding technical parameters same shall get clarified before quoting, in case if any technical deviations are observed during scrutiny wrt to NIT bidder shall meet the technical requirements without any price implication.
9. Vendor should bring out clearly in deviation sheet if any.
10. Vendor to complete the panel in all respect and dispatch to BHEL. Numerical relay is in BHEL scope and same shall be fitted by BHEL in BHEL Premises. Vendor to do the relay wiring up to relay with proper ferruling and lugs terminals.



**TECHNICAL SPECIFICATION
FOR
BLOWER MCC**

SPECIFICATION NO.:EP-BLW-KRP-01

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SHEET : 1 OF 1

11. The panel shall be tested at BHEL-EPD after fixing of relay. In case any wiring mistake observed during testing at BHEL-EPD, vendor has to depute their representative/service engineer at BHEL-EPD to modify the same without any commercial implication. The representative shall be deputed within 2 working days from the date of intimation by BHEL-EPD.
12. Panel will be dispatched in the name of BHEL EPD as manufacturer, BHEL may conduct the type test at CPRI/ERDA on same panel as manufacturer.

BIDDER'S STAMP & SIGNATURE

**VOLUME :V-A
SECTION-VII
TECHNICAL SPECIFICATION
FOR
415V PMCC/MCC, 415V ACDB AND 220V DCDB**

1.00.00 SCOPE OF SUPPLY

1.01.01 Requisite nos. of following equipment shall be furnished with all accessories :-

- a. Power cum Motor Control Centre (PMCC)
- b. Motor Control Centres (MCC)
- b. A.C. Distribution Board (DB)
- c. D.C. Distribution Board (DB)
- d. D.C. Starters
- e. A.C./D.C. fuse boards

1.01.02 The base channel frame with hardware and lifting angles.

1.01.03 One set of special tools and tackles.

1.01.04 Set of accessories as listed below :

- a) Breaker lifting and handling trolley.
- b) Test cabinet with coupling cables for testing the breaker in drawout position.
- c) Racking in/out handle for breakers.

1.01.05 Mandatory Spare parts.

1.01.06 All relevant drawings, data and instruction manuals.

2.00.00 CODES AND STANDARDS

2.01.01 All equipment and materials shall be designed, manufactured and tested in accordance with the latest applicable Indian Standards (IS) and IEC except where modified and/or supplemented by this specification.

2.01.02 Equipment and material conforming to any other international standard which ensures equal or better quality, may be accepted. In such case, copies of the English version of the standard adopted shall be submitted along with the bid.

2.01.03 The electrical installation shall meet the requirements of Indian Electricity Rules as amended upto date and relevant IS Code of Practice. In addition, other rules and regulations applicable to the work shall be followed.

3.00.00 DESIGN CRITERIA

- 3.01.00 The PMCCs/MCCs/DBs will be used to provide power, control and protection for 415/240V A.C. and 220V D.C. auxiliary services (Motors & Feeders) of generating units.
- 3.02.00 Duty involves direct-on-line starting of large squirrel cage motors below 175kW. The starting current varies from 6 to 8 times rated current at very low power factor.
- 3.03.00 The equipment will be located in a hot, humid and tropical atmosphere, highly polluted at places with coal dust and/or fly ash.
- 3.04.00 For continuous operation at specified ratings, the temperature rise of various equipment/components shall be limited to the permissible values stipulated in relevant standards and/or this specification.
- 3.05.00 Equipment ratings and quantities are detailed in the enclosed drawings and annexure. Equipment shall be furnished in strict compliance with the same.
- 3.06.00 All equipment and components thereof shall be capable of withstanding the mechanical forces and thermal stresses of the short-circuit currents without any damage or deterioration of the materials.
- 3.07.00 The PMCCs/ MCCs / DBs shall have two incomers and one bus-coupler. In addition to electrical interlocks, mechanical castle key interlock shall be provided between the two incomers and the bus-coupler so that any two of the three may be closed at a time.
- 3.08.00 Busbars of PMCCs shall be sized to carry continuously the associated transformer secondary current plus a 20% margin.
- Busbars of MCC/DBs shall be sized to carry continuously the total running load of MCC/DB plus a 20% margin.
- 3.09.00 In cubicle of incomers & bus section breakers/MCCBs shall be identical to the associated busbar rating.
- 3.10.00 For continuous operation at specified ratings, the temperature rise of various equipment/components shall be limited to the permissible values specified in relevant standards and/or this specification.
- 3.11.00 Circuit breakers shall not produce any harmful over voltage during switching off of induction motors. If required, surge protective devices shall be included in the scope of supply to limit over voltages.
- 3.12.00 Incomers, Bus-couplers & outgoing feeders rated upto & including 630A shall be MCCB controlled. Above 630A all incomers, Bus-couplers & outgoing Feeders shall be ACB controlled. For critical loads ACB control feeders shall be provided which will be decided during detailed engineering.
- 3.13.00 All motor rated 110kW & above, below 175kW shall be ACB controlled. Motor rated upto 110kW shall be contactor operated.

- 3.14.00 MCC & PMCC shall have sufficient number of spare modules (at least 20% of various sizes used with a minimum of 1 no. for each rating and type).
- 3.15.00 Outgoing feeders of PMCC shall be limited to minimum number of different sizes so that max. standardization is achieved from MCCB & contactor size point of view.
- 3.16.00 Incomers & bus section breakers of PMCCs/MCCs shall have provisions for remote operation from control room.
- 3.17.00 All breaker operated motor feeder shall be supplied from PMCC.
- 3.18.00 One no. Normal/Emergency switchgear to cater power supply to important emergency load / motors for safe shut-down of unit including 220V battery chargers shall be provided for each unit. The main incoming supply shall be from 415V unit service switchgear. When main incoming supply fails, reserve incoming supply shall be switched ON automatically from 415V station service switchgear. In case of total failure of AC supply of the power station, the supply from DG shall be switched ON automatically.
- 3.19.00 Each switchgear shall be provided with two bus sections, two incomer and a bus coupler rated for 100% of the loads connected to the switchgear.
- 3.20.00 For each auxiliary or load, one feeder shall be provided except for the following cases:
- One feeder for a maximum 2 nos. isolator motor operating mechanism.
- 3.21.00 The switchgears shall be provided with suitable number and type of outgoing feeders for the respective auxiliary loads of the system/area, power supply feeders to various panels, lighting transformer, space heating panels, control cabinets and all other loads encountered in the plant. In addition, following feeders shall be provided in each bus section of each switchgear.
- a) Bus VT module: One (1) no.
 - b) Switchgear test supply module: One (1) no.
 - c) 240V, 1 phase essential supply module with five nos. 1 phase outlets: One (1) no.
Necessary 415V/240V dry type transformer shall be provided.
 - d) Alarm module for common alarm for outgoing feeder fault: One (1) no.
 - e) DC supply alarm module for incomer, bus coupler fault: One (1) no.
- 3.22.00 Each feeder shall be provided with two nos. interposing relays for start & stop. These interposing relays shall be located in separate IPR panel described under C&I specification.

4.00.00 **SPECIFIC REQUIREMENTS**

4.01.00 **Construction**

4.01.01 PMCC / MCC / DB shall be indoor, metal-clad, air insulated and floor mounting type. All MCCs shall be fully draw out type and DBs shall be fixed type. ACB modules of PMCCs/MCCs shall be fully drawout type. MCCB / Switch Fuse modules shall also be fully drawout type. The design and construction shall be such as to allow extension at either end.

4.01.02 All PMCC/MCC shall be of double front construction.

4.01.03 PMCC /MCC/DB enclosure shall be dust and splash proof, conforming to a degree of protection IP-54. All switchboard frames and load bearing members shall be fabricated using suitable mild steel structural sections or pressed and shaped cold rolled sheet steel of thickness 2.0mm. Frames shall be enclosed in cold rolled sheet steel of thickness 1.6 mm. Doors and covers shall also be of cold rolled sheet steel thickness 1.6 mm. Stiffeners shall be provided wherever necessary. The gland plate thickness shall be 3.0 mm for hot/cold rolled sheet steel and 4.0 mm for non-magnetic material.

4.01.04 PMCC / MCC / DB assembly shall comprise a continuous line up of dead front, free-standing vertical sections, housing the control modules in multi tier formation.

4.01.05 The design shall be fully compartmentalized with metal/insulating partitions between compartments. **Operating height shall be as per drawings**

3-96-186-15391 Rev 02.

4.01.06 Each control module shall be housed in a separate compartment, complete with an individual front access door having sufficient opening with concealed type hinges. Each vertical section shall have a removal back cover. All doors and covers shall be gasketed.

4.01.07 All push buttons, lamps, indicating instruments shall be flush / semi-flush mounted on respective module compartment.

4.01.08 A full height vertical cable chamber with cable supports shall be provided in each section to facilitate unit wiring. The chamber shall be liberally sized to accommodate all cables and shall have removable cover at the front for access.

4.01.09 A horizontal wireway, extending the entire length, shall be provided at the top of each PMCC / MCC / DB for inter panel wiring.

4.01.10 The width of the cable alley shall not be less than 250 mm.

4.02.00 **Bus and Bus Taps**

4.02.01 All PMCCs/MCCs/DBs shall be provided with three phase & neutral bus bars . All DCDBs shall be provided with two busbars. All busbar compartments shall be completely enclosed.

- 4.02.02 The main buses and connections shall be of high conductivity Aluminium / Aluminium alloy, sized for specified current ratings with maximum temperature limited to 85°C (i.e., 35°C rise over 50°C ambient).
- 4.02.03 Vertical busbars shall be designed for minimum current rating of 200A. Separate vertical busbars shall be provided for each vertical panel.
- 4.02.04 All bus connections shall be silver plated. Adequate contact pressure shall be ensured by means of two-bolt connection with plain and spring washers and locknuts.
- Bimetallic connector shall be furnished for connection between dissimilar metals.
- 4.02.05 Busbars and connections shall be fully insulated for working voltage with adequate phase/ground clearances. Insulating sleeves for busbars and shrouds for joints and tap-off points shall be provided.
- Bus insulators shall be flame retardant, non-hygroscopic track-resistant type with high creepage surface.
- 4.02.06 Busbars shall be supported and braced to withstand the stresses due to maximum short circuit current and also to take care of any thermal expansion.
- 4.02.07 Busbars shall be colour coded for easy identification and so located that the sequence R-Y-B shall be from left to right, top to bottom or front to rear when viewed from the front of the assembly.
- 4.03.00 **Control Modules**
- 4.03.01 Draw-out type control module shall have self-aligning power/control disconnects. All disconnects shall be silver plated to ensure good contacts.
- 4.03.02 The design shall be such as to permit easy withdrawal/reinsertion of the unit with guide rails to ensure correct alignment.
- 4.03.03 Control Module shall house the control components for a circuit such as switch fuse / MCCB, contactors, relays, push buttons, lamps etc. as per requirement of the control circuit.
- 4.03.04 The equipment layout shall provide sufficient working space in between the components and subject to Owner's approval.
- 4.03.05 Various module/compartments sizes shall be multiple of one basic unit to facilitate modifications at site. Suitable provision for this purpose should also be incorporated in the vertical bus bars.
- 4.03.06 Draw-out type control modules of same size and type shall be electrically and physically interchangeable.
- 4.04.00 **Air Circuit Breaker**
- 4.04.01 Circuit breaker shall be provided on the incomer having minimum interrupting capacity equal to the 50kA(r.m.s) fault level.

- 4.04.02 Circuit breaker shall be three pole, single throw, air-break type with independent manual spring closing, trip-free mechanism and shunt trip. However Incomer and bus coupler breakers (ACB) shall be four pole type.
- 4.04.03 Circuit breaker shall be draw-out type, having service, test & isolated position with positive indication for each position.
- 4.04.04 Circuit breakers of identical rating shall be physically and electrically interchangeable.
- 4.04.05 Each breaker shall be provided with microprocessor based protection unit having three overload protection with adjustable current and time, three short circuit protection with adjustable current and time and three instantaneous short circuit protection. The operating characteristic shall be suitable for co-ordination with down-stream fuses.
- 4.04.06 Circuit breakers shall be provided with motor wound spring charging mechanism. Spring charging shall take place automatically after each breaker closing operation. One open-close-open operation of the circuit breaker shall be possible after failure of power supply to the motor. In addition, facility for manual charging of spring shall be provided.
- 4.04.07 Mechanical safety interlock shall be provided to prevent the circuit breaker from being racked in or out of the service position when the breaker is closed. It shall not be possible to open the circuit breaker door cubicle unless the breaker is in 'OFF' position.
- 4.04.08 Automatic safety shutters shall be provided to cover up the stationary disconnects when the breaker is withdrawn.
- 4.04.09 Each breaker shall be provided with an emergency manual trip, mechanical ON-OFF indicator, an operation counter and spring mechanism charge/discharge indicator, and electrical anti-pumping feature.
- 4.04.10 In addition to the auxiliary contacts required for normal breaker operation and indication, each breaker shall be provided with the following for interlocking purpose :-
- a. Position/Cell switch with 4 NO + 4 NC contacts.
 - b. Auxiliary switch, with minimum 6NO + 6NC contacts,
- 4.04.11 Spring charge limit switch shall be provided for breakers with motor wound spring charging mechanism. These limit switches shall be provided with minimum 2NO + 2NC contact.
- 4.04.12 Limit/auxiliary switches shall be convertible type, that is, suitable for changing N.O. contact to N.C. and vice-versa.
- 4.04.13 Each breakers operated feeder shall be provided with protective devices as specified in Annexure–B.

4.05.00 Switches

4.05.01 Switches shall be triple pole, air break, AC23 motor duty for motor feeders and AC22 heavy duty for other feeders.

Motors duty switches shall be capable of safely making and breaking the locked rotor current of the associated motor circuit.

4.05.02 The switch shall have a quick-make, quick-break mechanism operated by a suitable external handle, complete with position indicator. This handle shall have provision for padlocking in ON and OFF position.

4.05.03 The compartment door shall be interlocked mechanically with the switch such that the door cannot be opened unless the switch is in OFF position. Means shall be provided for releasing this interlock at any time.

4.05.04 Switches shall be capable of withstanding the let-through fault current of back-up fuses or circuit breakers.

4.05.05 Wherever two incoming switches and one bus-section switch are provided for an assembly, these shall be mechanically/key interlocked to ensure that only two out of the three can be closed at time.

Wherever two incoming switches are provided for an assembly, these shall be mechanically/key interlocked to ensure that one of the two can be closed at time.

4.05.06 All incoming and outgoing feeders shall be provided with bolted disconnect link for isolation of neutral if necessary.

4.06.00 Fuses

4.06.01 Fuses shall be HRC, preferably link type, with a minimum interrupting capacity equal to the short circuit current of the LT system. Fuses shall be mounted on insulated fuse carriers, which are mounted on fuse bases. Wherever it is not possible to mount fuses on carriers, fuses shall be directly mounted on plug-in type of base. In such cases, one set of insulated fuse pulling handles shall be supplied with each board.

4.06.02 Fuses shall be furnished complete with fuse bases and fittings of such design as to permit easy and safe replacement of fuse element.

Visible indication shall be provided on blowing of the fuse.

4.06.03 Motor fuse characteristics and ratings shall be chosen to ride over starting period without blowing. The fuse on incoming feeder wherever provided, shall be chosen to provide discrimination with motor/feeder fuses.

4.07.00 Moulded Case Circuit Breaker (MCCB)

4.07.01 The MCCBs shall be of drawout type with trip-free operating mechanism of quick make & quick break type. Each MCCB shall be equipped with thermal release for thermal overload and magnetic release for short circuit protection on each pole.

- 4.07.02 MCCBs / MPCBs shall be suitable for manual closing and opening and also automatic trip on overload and short circuit. MCCB shall have intermediate position to indicate trip condition.
- 4.07.03 The MCCBs shall be provided with mechanical ON-OFF indicator at the front panel. The MCCB handles, after the breaker tripped due to faults, shall occupy a mean position indicating trip condition.
- 4.07.04 The compartment door shall be interlocked mechanically with the MCCB such that the door cannot be opened unless the MCCB is in OFF position. Means shall be provided for releasing this interlock at any time.
- 4.07.05 All feeders of PMCC / MCC rated up to & including 630 Amp shall be provided with MCCB. Air circuit breaker shall be provided for feeders rated above 630 Amp. For critical loads ACB control feeders shall be provided which will be decided during detailed engineering.
- 4.07.06 Motors rating above 110 KW will be operated by Air circuit breaker and protected by consolidated numerical motor protection relay.
- 4.08.00 **A.C. Starter**
- 4.08.01 Contactors
- a. The contactors shall be three pole, air break type designed for duty class III - Category AC3 (for unidirectional motor) with non-bouncing silver/ silver alloy contacts. Contacts for reversible motors will be of AC4 duty.
 - b. Each contactor shall be provided with minimum two (2) normally open and two (2) normally closed auxiliary contacts rated 10 A at 240V A.C.
 - c. Reversing contacts shall be electrically and mechanically interlocked.
 - d. Contactors with delayed dropout feature shall be provided for some essential auxiliaries. These contactors shall not dropout on power failure if the voltage is restored within 3 seconds.
- 4.08.02 **Protection**
- a. Thermal overload relays shall be three element, positive acting, ambient temperature compensated with adjustable settings.
 - b. Single phase preventor relay shall be provided, preferably as an inbuilt feature of thermal overload relay.
 - c. Relays shall be manual reset type with two changeover potential-free contacts. Resetting of relays shall be possible with compartment door closed. Colour of the resetting button shall be BLACK.
 - d. Relays may be direct acting or C.T. operated, depending on current rating. C.T.s shall be included in the scope of supply.
 - e. Motor starters shall have type '2' co-ordination according to IEC 947-4.

- f. Earth fault relays with adjustable settings and time delays fed from core balance CT shall be provided.
- g. Numerical / Digital Motor protection relay with short circuit, over load, earth fault, locked rotor and unbalance (NPS) load protection functions shall be provided for motor rated above 90 kW.

4.09.00 Control Transformer

4.09.01 LT Switchboard control supply

The Bidder shall provide one (1) no. adequately rated 415V/110V Control Transformer in each bus section with necessary taps and auto changeover facility for providing control power supply to various modules of the board. The sizing of control transformer shall be carried out by the Bidder considering the actual load of power contactors, auxiliary contactors, indicating lamps and other equipment in the module circuit. An additional load of 15watts shall be considered for each module for remote auxiliary relays and lamps to be connected in the control circuit of modules. Bidder shall also ensure that control transformer are adequately designed for meeting the momentary loading requirements and the voltage drop during this condition shall not be more than 5%. Each transformer shall be sized for catering to control supply of both bus sections.

4.09.02 LT Switchboard space heater supply

The Bidder shall provide one (1) no. adequately rated 415V/240V Control Transformer in each bus section with necessary taps and auto changeover facility for providing power supply to panel space heater, Motor space heater of motor rated 30 KW & above, Panel Illumination & Socket. The supply of these two (2) nos. control transformer are tapped from incoming supply of 415V PMCC/MCC before the incoming breaker. Incoming circuit to the space heater auxiliary bus shall be through isolating switch HRC fuse and neutral link of suitable rating. The supply of different modules shall be tapped individually from the auxiliary bus bars. Control supply healthy indication shall be provided. Each transformer shall be sized for catering to space heater supply of both bus sections.

4.10.00 D.C. Starters

4.10.01 D.C. Starter for emergency oil pump shall be fixed resistance type, designed to provide fast acceleration during starting.

4.10.02 DC starters shall be complete with switch-fuse units, contactors, resistors, relays, meters, push-buttons, lamps, etc.

4.10.03 Starters shall be furnished in totally enclosed floor-mounting, sheet steel cubicles complete with a hinged front access door. Minimum thickness of sheet steel shall be 2mm.

4.10.04 The cubicle enclosure shall provide dust and humidity protection, the degree of protection being not less than IP-54.

The resistor enclosure shall be provided with ventilating louvers and wire mesh guard and shall have a degree of protection IP-23.

4.10.05 Cubicle space heater shall be provided to maintain internal temperature above dew point. Heater shall be furnished with switch-fuse unit and thermostat control.

4.11.00 **Relays**

4.11.01 All incoming and bus-coupler circuits and circuit breaker operated outgoing feeders shall be provided with numerical relays. Breaker operated motor feeders shall be provided with numerical motor protection relay.

4.11.02 The numerical relays shall have provisions for interfacing with Plant DDCMIS / PLC.

4.11.03 Relays shall be of drawout design with built-in testing facilities. Small auxiliary relays may be in non-drawout execution.

4.11.04 All protective relays, auxiliary relays, and timers shall be provided with hand reset operation indicator (flag).

4.11.05 Relays shall be rated for operation on 110V secondary voltage and 5 A or 1 A. Number and rating of relay contacts shall suit the job requirements.

4.12.00 **Control and Indication**

4.12.01 Circuit breakers shall be wired up for local and remote operation. Each breaker cubicle shall be equipped with the following :

- i) One (1) TEST-NORMAL-TRIAL selector switch with pistol grip handle and key interlock for breakers with motor wound spring charging mechanism.
- ii) On-Off control switches shall have three positions (T-N-C) and shall be spring return to 'Neutral' from close and trip positions. They shall have two contacts closing in close position and two contacts closing in trip positions, and shall have Pistol Grip handles. Lost motion feature shall be provided wherever required.
- iii) Following indicating lamps on the front of the compartment:

Breaker open	-	GREEN
Breaker closed	-	RED
Breaker tripped	-	AMBER
Spring charged	-	WHITE
Trip Ckt. Healthy	-	BLUE

Motor Space heater 'ON' for motor circuit - YELLOW

4.12.02 Push button shall be heavy duty, oil tight, push to actuate type with integral escutcheon plate marked with its function.

- 4.12.03 Each push button shall have minimum two (2) nos. normally open and two (2) nos. normally closed contacts rated 10 A at 240 V.
- 4.12.04 One (1) NORMAL-TRIAL selector switch shall be provided for all motor feeders.
- 4.12.05 Selectors switches shall be stay-put, rotary type with escutcheon plates marked to indicate the function and positions, and shall be lockable in each position. Selector switch contacts shall be rated for 10A at 240 V A.C.
- 4.12.06 Selector switches shall be provided with minimum three (3) contact blocks of 1 NO + 1 NC each.
- The exact requirements of contacts shall be decided by the Tenderers taking into account the scheme requirement and spares.
- 4.12.07 Lamps shall be clustered LED type with series resistor and coloured lens. Lens and lamps shall be replaceable from the front. Lamps shall be located just above the associated push button/control switch
- 4.12.08 The general scheme of connections for control, interlock and protection is shown in the enclosed drawings. Detailed requirements of individual circuits will be intimated later to the successful bidder, who shall develop and furnish the schemes accordingly.
- 4.13.00 **Meters**
- 4.13.01 All indicating instruments (96 x 96 mm) shall be switchboard type, with 250° scale, anti-glare glass and accuracy class of $\pm 2\%$ full scale. Each meter shall have zero adjuster on the front.
- 4.13.02 Motor ammeter shall be suitable to indicate starting current (6 to 8 times full load current) for DOL starting of motor.
- Motor ammeter shall be provided for motor rated 30 kW and above and for critical drives, to be finalized during detail engineering.
- 4.13.03 All incomers, tie feeders, circuit breaker operated motor feeders shall be provided with 3-phase multifunction meter with pulse output and communication port for interfacing with Plant DDCMIS / PLC.
- 4.13.04 Meter selector switches shall be maintained contact, stay-put type, with knob handle. Ammeter and voltmeter selector switches shall be four position type. Ammeter selector switches shall have made before break contacts, to prevent open circuiting of CT secondary.
- 4.14.00 **Current Transformer**
- 4.14.01 Current Transformer, shall be cast resin type rated 10 VA. All secondary connections shall be brought out to terminal blocks where wye or delta connection will be made.
- 4.14.02 Accuracy class of the current transformers shall be:
- a) Class PS for REF

- b) Class 5P20 for other relaying.
- c) Class 1.0 ISF < 5 for metering.
- d) Class 0.5 ISF < 5 for metering (Incomer & Bus coupler of PMCC)

Other CT particulars like ratio, burden, knee point, excitation current & secondary resistance shall be decided by the bidder.

4.14.03 CT secondary shall be rated for 1A for metering & either 5A or 1A for protection.

4.15.00 Voltage Transformer

4.15.01 Voltage transformers shall be cast-resin, drawout type and shall have an accuracy class of 1.0. Voltage transformer mounted on breaker carriage is not acceptable. For Incomer and bus coupler of PMCC accuracy class of voltage transformer shall be 0.5.

4.15.02 High voltage windings of voltage transformer shall be protected by current limiting fuses. The voltage transformer and fuses shall be completely disconnected and visibly grounded in fully draw out position.

4.15.03 Secondary winding MCBs, sized to prevent overload shall be installed in all ungrounded secondary leads. MCBs shall be suitably located to permit easy replacement while the switchgear/PMCC is energized.

4.15.04 Both primary side & secondary side fuse failure / voltage loss monitoring system of VT shall be provided.

4.16.00 Transducers

4.16.01 Transducer for conversion of AC electrical quantities such as voltage, current, KW etc. shall be supplied as required for remote connection to Plant DDCMIS / PLC. All transducers shall be dual output type.

4.16.02 The transducers for indicating type instruments shall be of very low burden type having 4-20 mA DC linear, galvanically isolated output, compatible with secondary instruments and Plant DDCMIS system.

4.17.00 Secondary Wiring

4.17.01 The PMCC/MCC/DB shall be fully wired at the factory to ensure proper functioning of control, protection and interlocking schemes.

4.17.02 Fuse and links shall be provided to permit individual circuit isolation from bus wires without disturbing other circuits. All spare contacts of relays, push buttons and other devices shall be wired upto terminal blocks.

4.17.03 Wiring shall be done with flexible, 650V grade, fire resistance PVC insulated switchboard wires with stranded Copper conductors of 2.5 mm² for control & current circuits and 1.5 mm² for voltage circuits.

- 4.17.04 Each wire shall be identified, at both ends, with permanent markers bearing wire numbers as per Contractor's wiring diagrams.
- 4.17.05 Wire terminations shall be made with crimping type connector with insulating sleeves. Wires shall not be spliced between terminals. Separate colour code shall be used for AC & DC circuit wiring for easy identification.
- 4.18.00 **Terminal Blocks**
- 4.18.01 Terminal blocks shall be 650V grade box-clamp type with marking strips similar to ELMEX 10 mm² or equal. Terminals for C.T. secondary leads shall have provision for shorting.
- 4.18.02 Terminal blocks used for interface with DDCMIS / PLC via termination cabinet shall be suitably sized to facilitate proper termination of interconnecting cables.
- 4.18.03 Not more than two wires shall be connected to any terminal. Spare terminals equal in number to 20% active terminals shall be furnished.
- 4.18.04 Terminal blocks shall be located to allow easy access. Wiring shall be so arranged that individual wires of an external cable can be connected to consecutive terminals.
- 4.19.00 **Cable Terminations**
- 4.19.01 PMCC shall be designed for cable entry from bottom. MCC/DB shall be designed for cable entry both from top and bottom. Actual configuration shall be intimated later sufficient space shall be provided for ease of termination and connection.
- 4.19.02 Power cables shall be 1100V, Copper/Aluminum conductor, XLPE insulated, armoured, FRLS PVC overall sheathed.
- Control cables shall be 1100V, PVC insulated, armoured, PVC overall sheathed with 2.5 mm² stranded Copper conductor.
- 4.19.03 All provisions and accessories shall be furnished for termination and connection of cables, including removable gland plates, cable supports, crimp type tinned Copper/Aluminium lugs, brass compression glands with tapered washer (Power Cables only) and Terminal blocks.
- 4.19.04 Sufficient space shall be provided between the lower most power cable termination and gland plate for easy cable connection.
- 4.20.00 **Bus Duct Connection**
- 4.20.01 Bus duct connections shall be furnished along with transition panel, if required. Unless mentioned otherwise bus duct connections shall generally be from the top.

- 4.20.02 All connecting bus work shall have the same continuous current rating as associated PMCC bus and shall be fully braced for the LT system short circuit current.
- 4.20.03 All provisions such as matching flange and other accessories shall be furnished for connection to bus duct.
- 4.21.00 **Ground Bus**
- 4.21.01 A Cu / Al ground bus rated to carry the maximum fault current, shall extend full length of the MCC/DB.
- 4.21.02 The ground bus shall be provided with two-bolt drilling with G.I. bolts & nuts at each end to receive 50 x 6 mm G.I. flats.
- 4.21.03 All stationary structures shall be directly connected to the ground bus for effective grounding.
- 4.21.04 The frame of draw out module shall be grounded at all times except when the power disconnects are separated by a safe distance.
- 4.21.05 All hinged doors shall be earthed through flexible copper braid wire.
- 4.22.00 **Nameplate**
- 4.22.01 Nameplate of approved design shall be provided for each control compartment and also at the top of each PMCC / MCC / DB.
- 4.22.02 The material of the name plate shall be anodized aluminium / lamicaid or approved equal, 3 mm thick, with white letter on black background. Name plates shall be minimum 20 x 75 mm for instrument / devices and 40 x 150 mm for panels.
- 4.22.03 Caution notice on suitable metal plate shall be affixed at the back of each vertical panel.
- 4.23.00 **Space Heater**
- 4.23.01 Panel and motor space heater shall be fed from separate AC auxiliary busbars running throughout the switchboard. The space heater bus shall be fed from control transformer described earlier. Suitable terminals shall also be provided to facilitate energisation of the control transformer from outside during long shutdown of the board.
- 4.23.02 Each vertical section of the PMCC / MCC / DB shall be furnished with thermostat controlled space heater and 5A, 5 pin plug socket.
- 4.23.03 In addition, motor feeders 30 KW and above shall be wired up for feeding motor space heater through starter auxiliary 'OFF' contacts.
- 4.23.04 Cubicle heater, Motor heater and plug socket circuit shall be provided with individual MCB/switch fuse units.

4.24.00 A.C./D.C. Power Supplies

4.24.01 Necessary 415V AC and 220V DC power supplies as required for control and service shall be arranged by the contractor. Single feeder shall be arranged for A.C. supply and duplicate feeder shall be arranged for D.C. supply.

4.24.02 Isolating switch fuse units shall be provided at each switchgear for the incoming supplies, 4-pole, single throw for A.C. and 2-pole, double throw for D.C. Molded case circuit breaker (MCCB) shall also be accepted as an alternative.

4.24.03 Bus-wires of adequate capacity shall be provided to distribute the incoming supplies to different cubicles. Isolating switch fuse units / MCCB shall be provided at each cubicle for A.C/D.C. supplies.

4.24.04 A.C. load shall be so distributed as to present a balanced loading on three-phase supply system.

4.25.00 Tropical Protection

All equipment, accessories and wiring shall have fungus protection, involving special treatment of insulation and metal against fungus, insects & corrosion.

Screens of corrosion resistant material shall be furnished on all ventilating louvers to prevent the entrance of insects.

4.26.00 Painting

4.26.01 All steel surfaces shall be sand blasted, grounded and pickled as required to produce a smooth, clean surface free of scale, grease & rust.

4.26.02 After cleaning, the surfaces shall be given a phosphate coating followed by two coats of high quality primer and stoved after each coat.

4.26.03 For paint shade of finish coat, refer clause no.1.16.00 of Section E1, Volume V-A.

4.26.04 Sufficient quantity of touch-up paint shall be furnished for application at site.

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

5.00.00 TESTS

5.01.00 All equipment shall be completely assembled, wired, adjusted and tested at the factory as per the relevant standards.

5.02.00 Routine Test

The tests shall include but not necessarily be limited to the following :-

- a. Operation under simulated service condition to ensure accuracy of wiring, correctness of control scheme and proper functioning of the equipment.

- b. All wiring and current carrying part shall be given appropriate High Voltage Test.
- c. Primary current & voltages shall be applied to all instrument transformers.
- d. Routine test shall be carried out on all equipment such as circuit breakers, switch - fuse, contactors, relays, meters etc.

5.03.00 Type Tests

All the Type Tests (as per IS- 8623/IEC) should have been carried out on an identical & similar type of switchgear for each rating involved in the project with ACB mounted in service condition inside the switchgear panel.

Bidder has to submit ACB type test reports for test sequence 1 and combined test sequence and Type 2 co-ordination test reports of any 3 ratings of starter ratings involved.

Type test certificates of any equipment shall be furnished if so designed by the purchaser/ owner. Otherwise the equipment shall have to be type tested free of charge, to prove the design. Type test performed before five (5) years are not acceptable.

6.00.00 DRAWINGS, DATA & MANUALS

6.01.00 Drawings, Data & Manuals shall be submitted in triplicate with the bid and in quantities and procedures as specified in General Conditions of Contract and/or elsewhere in the specification for approval and subsequent distribution after the issue of 'Letter of Intent'.

6.02.00 To be submitted with the bid :-

- a. General arrangement drawing showing constructional features, space required in front for withdrawals, power & control cable entry points etc.
- b. Typical foundation plan
- c. Typical control schematic
- d. Bill of materials
- e. Type test reports on circuit breaker
- f. Technical leaflets on :-
 - i) Circuit breaker
 - ii) Switch-fuse units
 - iii) Contactors
 - iv) Relays, meters, push buttons, selector switches etc.
 - v) Glands/terminals blocks

6.03.00 To be submitted for Owner / Purchaser's Approval and Distribution

All relevant drawings and data pertaining to the equipment like GTP, GA drawing, foundation plan, BOM, control & schematics, QAP, etc. shall be submitted by the Bidder for approval of Owner/Owner's consultant. Also refer clause no. 1.19.02(u) of Section-I of Volume – V-A: Technical Specifications for Electrical Equipment & Accessories.

ANNEXURE-A

RATINGS AND REQUIREMENTS

1.0 General

Type	:	ACB Modules - Drawout type MCCB Modules – Drawout type
Service	:	Indoor
Enclosure	:	IP52

2.0 System

		AC	DC
Voltage	:	415V ± 10%	220V (187-242V)
Phase	:	3-phase, 4-wire	2- wire
Frequency	:	50 Hz +3% to - 5%	
Combined voltage and Frequency variation	:	10% (absolute sum)	
System grounding	:	Solidly grounded	Ungrounded

3.0 Rating

Rated current	:	To be decided by the tenderers.
Design Ambient Temperature	:	50°C
Short Circuit Current Symm.	:	50 KA 25* KA

* Indicative only, the actual value will be decided by the tenderers.

S/C Withstand Time	:	----- 1 second -----
High voltage test for 1 minute	:	2.5 kV 1.5 kV

4.0 Duty

Circuit Breaker	:	0-3'-CO-3'-0
Contactor (AC)	:	Class III - Category AC3 for unidirectional drives and AC4 for bi- directional / inching duty drives
Contactor (DC)	:	Class I – category DC2
MCCB / Switch Duty for		AC DC
Motor Feeder	:	AC23 DC22

	Other Feeder	:	AC22	DC22
5.0	A.C. / D.C. Power Supply			
	Control Voltage for Circuit breaker	:	220V DC +10% to -15%	
	Control voltage for MCCB modules	:	110V AC $\pm$ 10%, 1Ph, 50Hz +3% to - 5%	
	Service voltage	:	240V AC $\pm$ 10%, 1Ph, 50Hz +3% to - 5%	

ANNEXURE-B

PROTECTIONS

- 1.0 All Protective relays shall be microprocessor based numerical type having communication facility with Plant DDCMIS system / PLC.
- 2.0 The minimum protections to be provided for different types of circuits are listed below:
 - a. Incoming Feeder & Bus-coupler with ACB:
 - 3 - inverse time O/C relays (51) for phase fault.
 - 1 - Inverse time O/C relay (51N) for Earth fault.
 - 3 - Under Voltage (27), Range : 40-80% with timer
 - b. Motor Feeder with ACB: (above 110 kW)
 - 1 - Composite Motor protection relay (99) for protection against
 - Thermal overload
 - Phase faults
 - Unbalance (negative sequence)
 - Locked rotor
 - Excessive Start-up time and Start-Stop.
 - Earth fault
 - c. Outgoing Feeder : with ACB
 - 3 - Inverse time O/C relays (51) for phase fault.
 - 1 - Inverse time O/C relay (51N) for Earth fault.
- 3.0 Apart from protection relays, each electrically operated breaker shall be provided with anti-pumping (94), trip annunciation (30), lockout (86) and trip circuit supervision (74) relays. Lockout relay shall be hand reset type.
- 4.0 Both primary side & secondary side fuse failure / voltage loss monitoring system of VT shall be provided..
- 5.0 For Auto-bus change-over as well as live bus change-over through synchronization refer enclosed Control Schematic drawings.
- 6.0 Each incomer shall be provided with three (3) nos. Bus Energised indicating lamps – Red/Yellow/Blue for each phase.

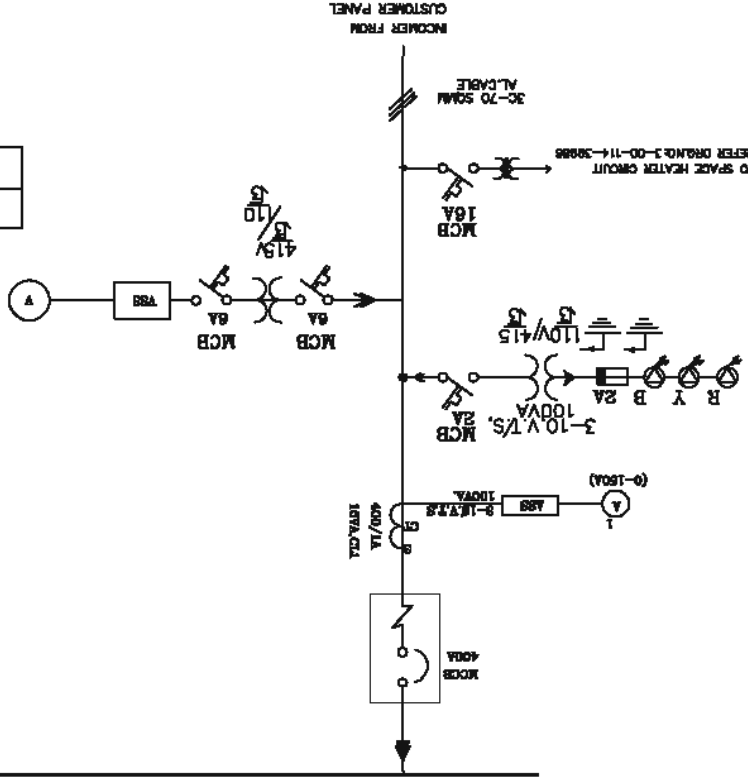
Sl. No	CAT	Description	Qty	Blower MCC
INCOMER 400A			M	1
1	MCCB	MCCB TP 400A 50KA TM	1	1
1	MCCB	MCCB TP 400A 50KA TM EROHM	1	1
1	MCCB	MCCB TP 400A 50KA TM SPREADERS	1	1
1	MCCB	MCCB TP 400A 50KA TM NO-NC CONTACTS	1	1
1	MCCB	MCCB TP 400A 50KA TM PHASE BARRIER	1	1
2	MPCB	MPCB TP 1A	2	2
2	MPCB	1NO+1NC FOR MPCB	2	2
3	MCB	MCB FP 6A AC	1	1
4	MCB	MCB DP 6A AC	1	1
5	CT	400/1A CL-1 15VA	3	3
6	CST	415/110V CST 500VA	1	1
7	MFM	MULTI FUNCTION METER	1	1
8	METER	AMMETER 1A	1	1
9	METER	VOLTMETER 500V	1	1
10	SWITCH	AMMETER SELECTOR SWITCH 10A 415V AC	1	1
11	SWITCH	VOLTMETER SELECTOR SWITCH 10A 415V AC	1	1
12	LED	INDICATING LAMP RED 110V AC	1	1
13	LED	INDICATING LAMP GREEN 110V AC	1	1
14	LED	INDICATING LAMP RED 63.5V AC	1	1
15	LED	INDICATING LAMP YELLOW 63.5V AC	1	1
16	LED	INDICATING LAMP BLUE 63.5V AC	1	1
17	CTTB	10SO.MM	10	10
18	NL	NEUTRAL LINK 400A	1	1
19	NL	NEUTRAL LINK 32A	2	2
20	TB	TERMINAL BLOCK 4SO.MM	10	10
3-00-114-39986(32KW)			M	7
1	MCCB	MCCB FOR 32KW TP MOTOR DOL SC	1	7
1	MCCB	MCCB EROHM	1	7
1	MCCB	MCCB NO-NC CONTACTS	1	7
2	POWER CONT	POWER CONTACTOR TP 120A AC	1	7
3	POWER CONT	POWER CONTACTOR AC 2NO+2NC CONTACTS	1	7
4	OLR	OLR FOR 32KW MOTOR DOL	1	7
5	AUX CONT	AUX CONTACTOR WITH 2NO+2NC 110V AC	2	14
6	MCB	MCB DP 6A AC	2	14
7	CT	CT 60/1A CL-1 15VA WPL	1	7
11	TD	CURRENT TRANSDUCER AUX 110V AC	1	7
12	METER	AMMETER FOR MOTORS 1A	1	7
13	SWITCH	2POLE 2WAY SWITCH 10A 110V AC LOCKABLE	1	7
14	LED	INDICATING LAMP RED 110V AC	1	7
15	LED	INDICATING LAMP GREEN 110V AC	1	7
16	LED	INDICATING LAMP AMBER 110V AC	1	7
17	CTTB	DISCONNECTING TYPE	2	14
18	PB	PUSH BUTTON BLACK 110V AC	1	7
VM 50VA			M	1
1	MPCB	MPCB TP 1A	2	2
1	MPCB	MPCB 1NO+1NC	2	2
2	MCB	MCB FP 6A AC	1	1
3	TD	AC VOLTAGE TRANSDUCER AUX 220V DC	3	3
4	METER	VOLTMETER 500V	1	1
5	PT	PT 1-PH 415/RT(3) / 110/RT(3) 50VA CL-0.5	3	3
6	SWITCH	VOLTMETER SELECTOR SWITCH 10A 415V AC	1	1
7	LED	INDICATING LAMP RED 63.5V AC	1	1
8	LED	INDICATING LAMP YELLOW 63.5V AC	1	1
9	LED	INDICATING LAMP BLUE 63.5V AC	1	1
SPACE HEATER CST J2 (.5KVA)			M	1
1	MPCB	MPCB 6A	1	1
2	MCB	MCB DP 16A AC	1	1
3	CST	415/110V CST 0.5KVA	1	1
4	LED	INDICATING LAMP RED 110V AC	1	1
5	TB	TERMINAL BLOCK 4SO. MM	6	6

Sl. No	CAT	Description	Qty	Blower MCC
MOTOR FEEDER CONTROL SUPPLY CST J1 (0.5KVA)			M	1
1	MPCB	MPCB 6A	1	1
2	MCB	MCB DP 32A AC	1	1
3	CST	415/240V CST 0.5KVA	1	1
4	LED	INDICATING LAMP RED 240V AC	1	1
5	SWITCH	ON OFF SWITCH 6A 240V AC	5	5
6	TB	TERMINAL BLOCK 4SQ. MM	15	15

AMMETER	A
VOLTMETER	V
AMMETER SELECTOR SWITCH	ASS
VOLTMETER SELECTOR SWITCH	VSS
SWITCH FUSE UNIT	SFU
ISOLATING SWITCH	IS
CURRENT TRANSFORMER	CT
TRIPLE POLE	TP
SPACE HEATER	SH
TRIPLE POLE & NEUTRAL	TPN
CONTACTOR	C
SELECTOR SWITCH	SS
TRIPLE POLE DOUBLE THROW	TPDT
CURRENT TRANSDUCER	CTD
VOLTAGE TRANSDUCER	VTD
POWER FUSE	PF
CONTROL FUSE	CF
CONTROL SWITCH	SW
PUSH BUTTON	PB
THERMAL OVERLOAD RELAY	O/L
FIXED TERMINAL	Ø
LINK	LK
AIR CIRCUIT BREAKER	ACB
INDICATING LAMP	L
DIODE	D
INDICATING LAMP FOR BREAKER	L
CONTROL SUPPLY (DC) ON-RED	L
DC ISOLATING SWITCH	DC-IS
DC RELAY	R
HAND RESET LOCK-OUT RELAY	BS
WITH BLUE LAMP	BS
DEFINITE TIME DELAY OVER CURRENT RELAY	S1
FOR ALL THREE PHASES(SELF RESET)	
CURRENT SETTING RANGE 150% - 600%	
TIMING SETTING RANGE 0.1 - 1 SEC	
BLOWER MOTOR	BM
DRAWOUT TERMINAL	⋈
INDICATION LAMP (CLUSTER LED)	⦿

LEGEND

NOTE:
1. THIS DRAWING SHALL BE READ ALONG WITH THE
WITH THE FOLLOWING DRAWINGS.
1. 3-00-114-39985/00
2. 3-00-114-39986/00
3. 3-00-114-39987/00
4. 3-00-114-39988/00

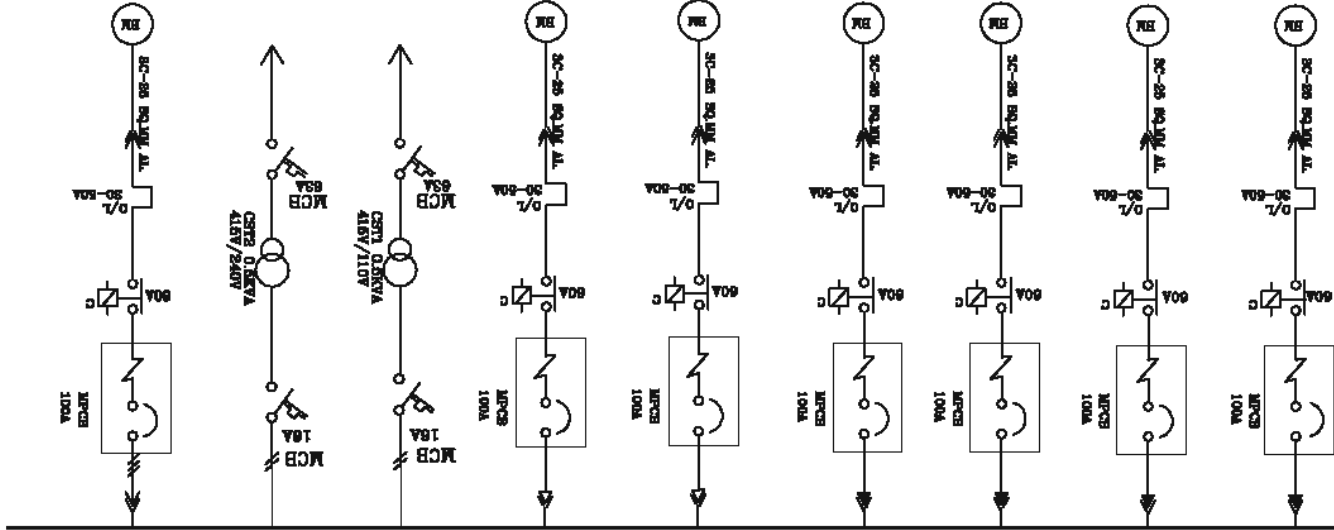


SL.NO.	CABLE	FROM	TO	CABLE SIZE	SCOPE	NO. OF WIRES	REMARKS
01	POWER	LOWVOLT MCC	BLOWER MCC	BC-70SQMM(4)	CUSTOMER	01	INDICATOR TO MCB
02	POWER	BLOWER MCC	BLOWER MOTOR	3C-95SQMM(4)	CUSTOMER	02	FOR 02 MOTORS
03	INTERCOMUNICATION	DCS	INTERCOMUNICATION	2 PAIR-0.5SQMM	CUSTOMER	02	FOR REMOTE COMMAND
04	INTERCOMUNICATION	CONTROL VALVE	DCS	2 PAIR-0.5SQMM	CUSTOMER	01	FOR FEEDBACK

CABLE SCHEDULE

* THE LAYOUT OF THE BLOWER MOTOR IS MARKED POSSIBLY ONE AND HENCE THE SWITCHGEAR COMPONENTS, THIS WILL CHANGE AFTER
PROCUREMENT OF BLOWER MOTOR.

WORKING	WORKING	WORKING	WORKING	STAND BY	STAND BY	—	SPARE PHOENIX
3C 16#	3C 16#	3C 16#	3C 16#	3C 16#	0.5 1YA	0.5 1YA	3C 16#

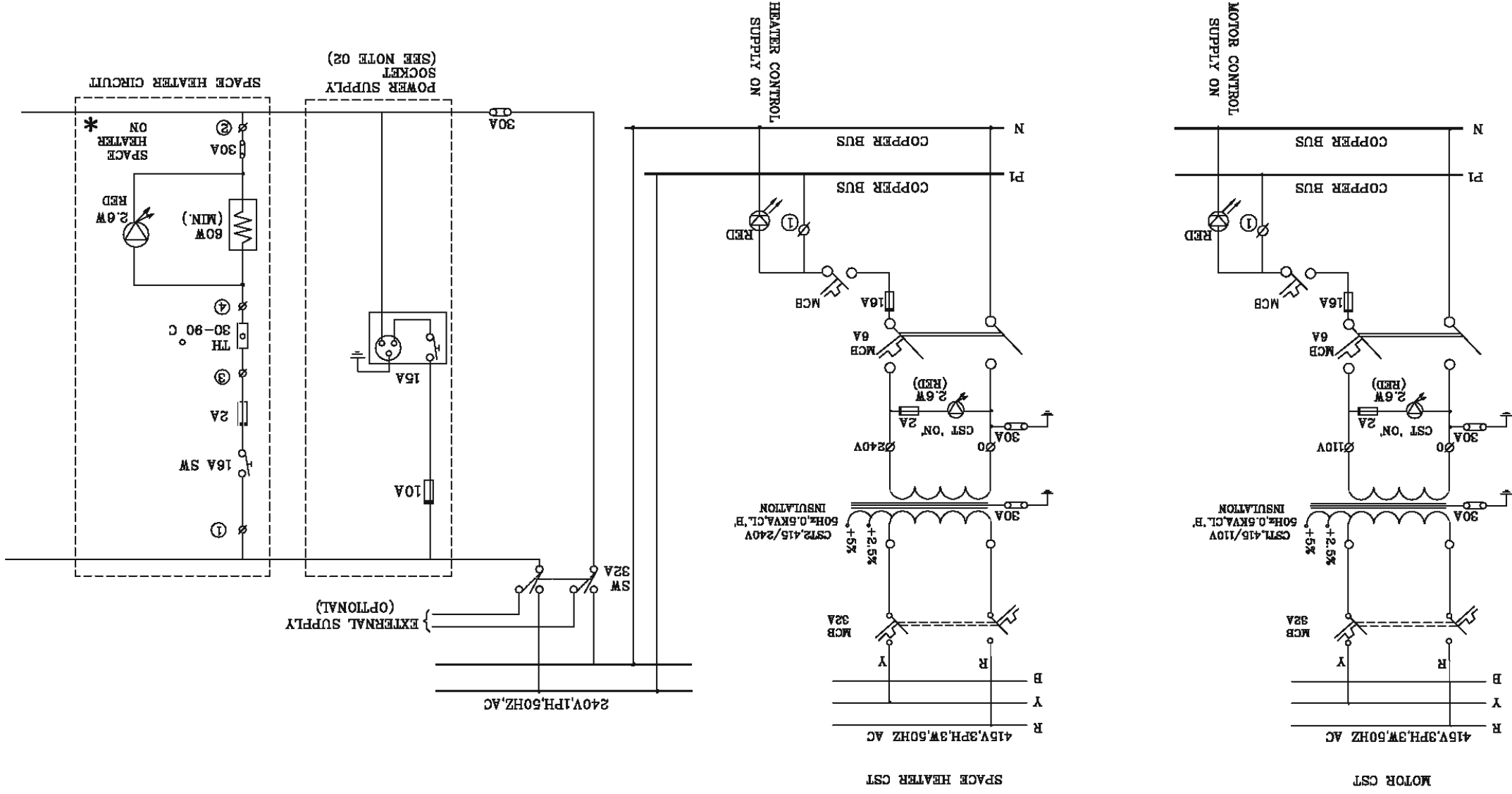


415V,3PH,50HZ AC, ALUMINIUM, RUBBER RATING: 250A FAULT LEVEL- 60KA FOR 1 SEC.(FOR R.Y.B)

ALL DIMENSIONS ARE IN MILLIMETRES

CUSTOMER: ANDHRA PRADESH POWER GENERATION CORPORATION LTD (APGENCO)		OWNER'S CONSULTANT: BTG PKG		TITLE : S1D FOR BLOWER MCC	
DRAWING NAME	SIGN	DATED	BHARAT HEAVY ELECTRICALS LTD	UNIT- BOILER AUXILIARY PLANT	RANIPET-832 406.
CHKD.BY	D.G.VILY	-SD-	16.05.17	APPD.BY	M.L.M
REV NO	00	3-00-114-39984	BHEL DRAWING NO		

ALL DIMENSIONS ARE IN MILLIMETRES



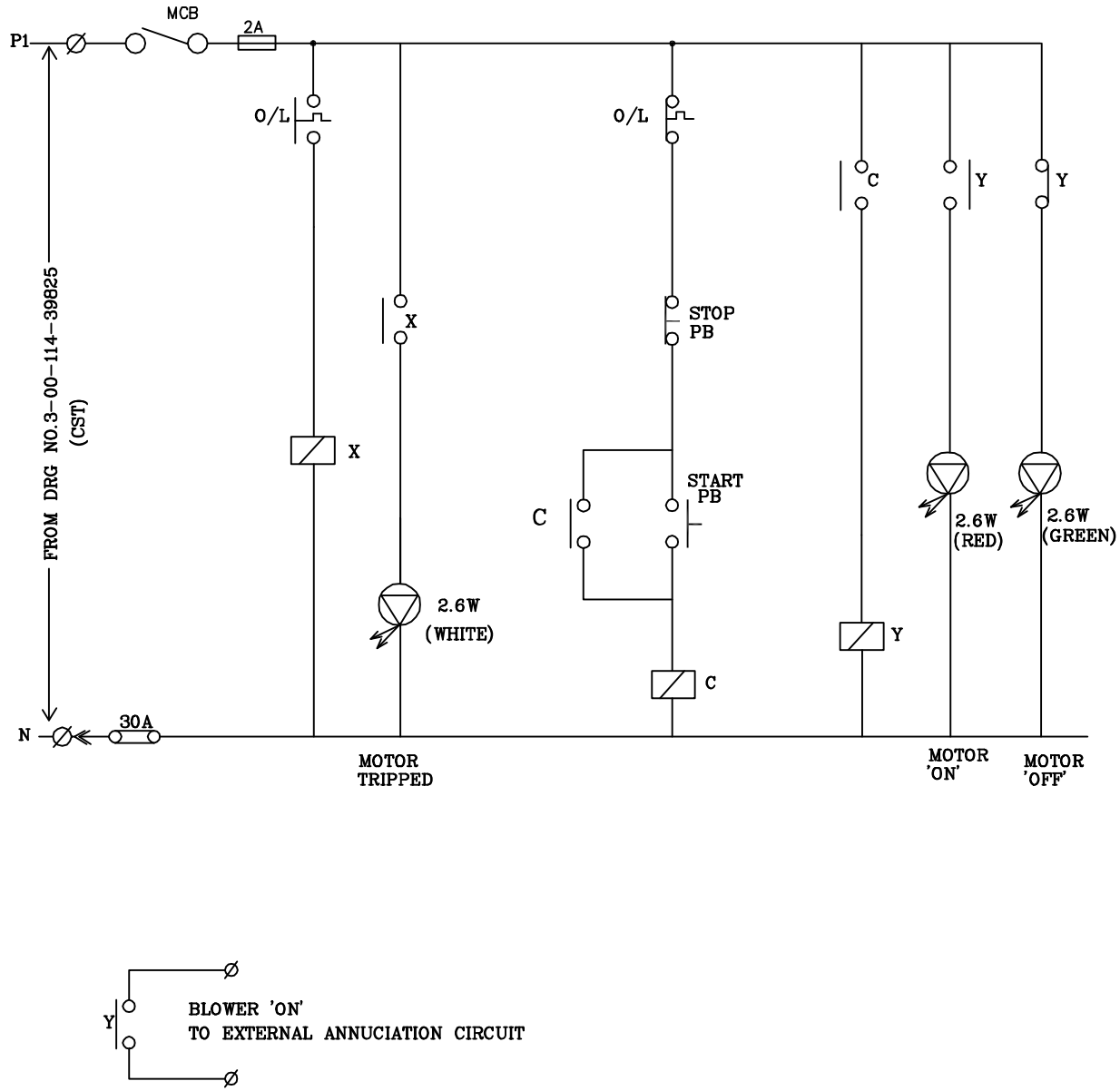
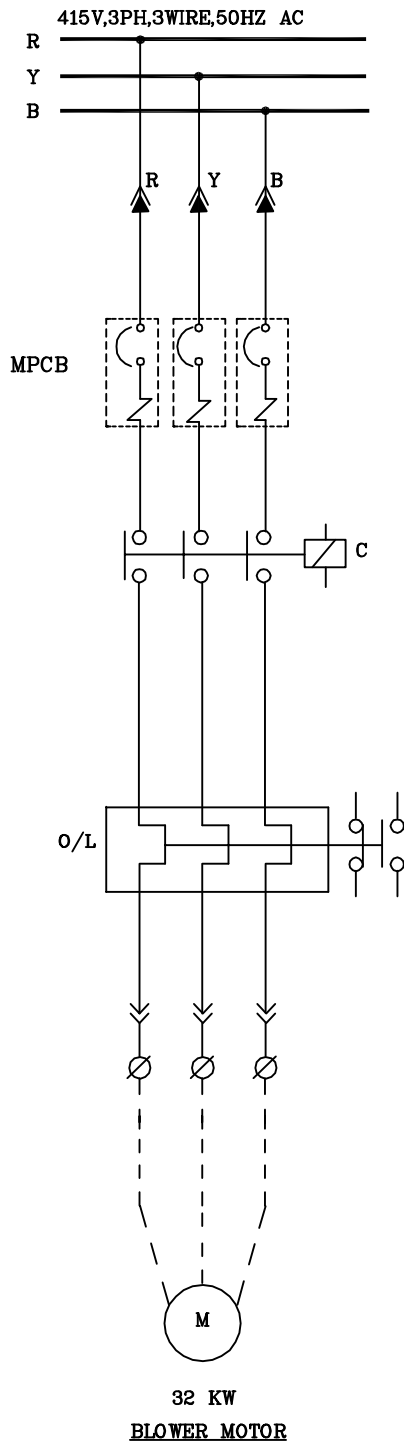
NOTE:

01. THE SPACE HEATER CIRCUIT SHOWN IS FOR ONE CABLE ALLEY. NUMBER OF SUCH CIRCUIT DEPENDS UPON THE NUMBER OF CABLE ALLEY.

02. ONE NO INDUSTRIAL TYPE POWER SUPPLY SOCKET PER PANEL SHALL BE LOCATED IN THE MIDDLE PANEL CABLE ALLEY.

			
CUSTOMER:		TITLE :	
ANDHRA PRADESH POWER GENERATION CORPORATION LTD (APGENCO)		MOTOR CST AND SPACE HEATER CST	
1X800 MW DR.NTTPS STAGE-V, UNIT-8, VIJAYAWADA BTG PKG		BHARAT HEAVY ELECTRICALS LTD UNIT- BOILER AUXILIARY PLANT RANIPET-632 406.	
DRAWING NAME SIGN DATED		APPD.BY M.J.M -SD- 15.05.17 CHKD.BY D.GUILY -SD- 15.05.17 PRRD.BY M.VII -SD- 15.05.17	
REV NO 00		BHEL DRAWING NO 3-00-114-39985	

ALL DIMENSIONS ARE IN MILLIMETRES



CUSTOMER:  OWNER'S CONSULTANT: 	ANDHRA PRADESH POWER GENERATION CORPORATION LTD (APGENCO) 1X800 MW Dr.NTTPTS STAGE-V, UNIT-8, VIJAYAWADA BTG PKG				
	BHARAT HEAVY ELECTRICALS LTD UNIT- BOILER AUXILIARY PLANT RANIPET-632 406.	DRAWING	NAME	SIGN	DATED
		PRRD.BY	M.VIJI	-SD-	15.05.17
		CHKD.BY	D.QUILY	-SD-	15.05.17
		APPD.BY	M.J.M	-SD-	15.05.17
TITLE :	P & C CIRCUIT FOR BLOWER MOTOR	BHEL DRAWING NO 3-00-114-39986			REV NO 00

MAKE OF COMPONENTS FOR BMCC PANEL.

- 01. MCCB - L & T / SIEMENS / SCHNEIDER
- 02. POWER SWITCH - L & T/ SIEMENS / CONTROLS & SWITCHGEAR / SCHNEIDER
- 03. CONTROL SWITCH - L & T(SALZER) / SIEMENS / KAYCEE / CONTROLS & SWITCHGEAR / SCHNEIDER
- 04. SELECTOR SWITCH - L & T(SALZER) / SIEMENS / KAYCEE/ SWITRON
- 05. POWER FUSE - L & T/ SIEMENS / CONTROLS & SWITCHGEAR / BUSMANN
- 06. CONTROL FUSE & FUSE BASE - L & T / SIEMENS / S & S POWER / CONTROLS & SWITCHGEAR/ BUSMANN
- 07. AUXILIARY CONTACTOR - L & T / SIEMENS / TELEMECHANIQUE(SCHNEIDER) / CONTROLS & SWITCHGEAR(TC)/ SCHNEIDER/ BCH
- 08. BIMETAL OVERLOAD RELAY WITH BASE - L & T / SIEMENS / TELEMECHANIQUE(SCHNEIDER) / CONTROLS & SWITCHGEAR(TC)/ SCHNEIDER
- 09. FUSE CARRIER - L & T / SIEMENS / S & S POWER / CANDS / CONTROLS & SWITCHGEAR/ BUSMANN
- 10. PUSH BUTTON - L & T / SIEMENS / BCH / TEKNIC / CONTROLS & SWITCHGEAR(RAAS CONTROLS)/ SCHNEIDER
- 11. INDICATING LAMP(CLUSTERED TYPE) - L & T / RAAS CONTROLS / BINAY / TEKNIC/ SCHNEIDER / CANDS/ BCH/ ESSEN/ VAISHNO/ SIEMENS
- 12. INDICATING METER - A E / IMP / RISHAB/ I&T / MECO
- 13. TERMINAL BLOCK - ELMEX / TOSHA / CONTROLS & SWITCHGEAR(WAGO) / CONNECTWELL/ ESSEN/ JAINSON
- 14 WIRE - ISI CERTIFIED
- 15. CABLE GLAND - COMET / SIEMENS / SUNIL&CO / BRACCO / CONTROLS & SWITCHGEAR/ ARUP ENGINEERING/ QUALITY PRECISION/ LOTUS
- 16. CABLE LUG - DOWELTS / JAINSON/ LOTUS
- 17. NEUTRAL LINK - CANDS / CONTROLS & SWITCHGEAR/ L & T / SIEMENS/ SCHNEIDER
- 18. SWITCH PLUG / SOCKET - CROMPTON GREAVES / ANCHOR / BEST & CROMPTON / BCH
- 19. SPACE HEATER - CANDS / VILCO / PYROSYSTEM/CONTROLS & SWGR/ SOPHIA/ CROMPTON GREAVES
- 20. THERMOSTAT - TEMPTROL / VIKAS ELECTRIC / AI / RENTROL/ ANCO

THE PANEL MANUFACTURER CAN USE ANY ONE OF THE MAKES INDICATED AGAINST EACH ITEM HOWEVER FOR THE SUPPLY OF PANEL TO ONE SITE, ONLY ONE MAKE SHALL BE USED, ie, NO MIX-UP IN MAKES AGAINST EACH ITEM IS ALLOWED.



ANDHRA PRADESH POWER GENERATION CORPORATION LTD (APGENCO)
1XB00 MW DR.NTPS STAGE-V, UNIT-8, VIJAYAWADA
BTG PKG

BHARAT HEAVY ELECTRICALS LTD



UNIT- BOILER AUXILIARY PLANT
RANIPET-632 406.

DRAWING	NAME	SIGN	DATED
APPD.BY	M.T.M	-SD-	15.05.17
CHKD.BY	D.GUILY	-SD-	15.05.17
PRRD.BY	M.VIJU	-SD-	15.05.17

MAKE OF COMPONENTS FOR BMCC.

BHEL DRAWING NO
3-00-114-39987

REV NO
00

GENERAL (PANELS):

D1. OVERLOAD REI

02. CONSTRUCTION: SINGLE FRONT FOR OUTGOING FEEDERS SHALL BE PROVIDED.
DRAWOUT TYPE FOR ALL FEEDERS EXCEPT CST & SPACE HEATER FEEDERS SHALL BE PROVIDED.
03. OPERATING HEIGHT (HANDLE/PUSH BUTTON POSITION) SHALL BE BETWEEN 200 MM AND 2000MM FROM THE FLOOR LEVEL.
04. SHEET STEEL USED FOR CONSTRUCTION SHALL BE AS FOLLOWS:
- STRUCTURAL LOAD BEARING MEMBERS : MIN 2 MM THICK CRCA.
ALL NON LOAD BEARING MEMBERS : MIN 1.6 MM THICK CRCA.
GLAND PLATE FOR MULTI CORE OUTGOING : MIN 3 MM THICK CRCA.
GLAND PLATE FOR SINGLE CORE INCOMING : MIN 4 MM THICK NON-MAGNETIC/ NON INDUCTIVE TYPE.
05. DOOR INTERLOCK SHALL BE SUCH THAT THE DOOR CAN NOT BE OPENED WITH THE BREAKER AND POWER SWITCH IN 'ON' POSITION.
- 06.A. DEGREE OF PROTECTION : IP 55 AS IS 13947 OF LATEST VERSION. AS THE PANEL IS IN OUTDOOR, SUITABLE CANOPY SHALL BE PROVIDED. THE DESIGN/DIMENSION/GA DRAWING OF THE CANOPY WILL BE APPROVED BY CUSTOMER IN THE EVENT OF ORDER. ANY CHANGE IN DESIGN/DIMENSION/GA DRAWING OF THE CANOPY SHALL BE INCORPORATED WITHOUT COMMERCIAL IMPLICATION.

01. THE FOLLOWING TERMINALS SHALL

02. PANEL CONTROL WIRING SHALL BE 1100V GRADE PVC INSULATED STRANDED COPPER.

06. A POTENTIAL FREE CONTACT SHOULD BE PROVIDED IN THE PANEL FOR BLOWER 'ON' TO REMOTE ALARM AT CENTRAL CONTROL ROOM.

- ENVISAGED FOR ALL MODULES AND THE SAME SHALL BE SUPPLIED AND FITTED WITH THE PANEL BY PANEL MANUFACTURER.

 CUSTOMER:		 OWNER'S CONSULTANT:		ANDHRA PRADESH POWER GENERATION CORPORATION LTD (APGENCO) 1XB00 MW Dr.NTPS STAGE-V, UNIT-8, VIJAYAWADA BTG PKG	
		BHARAT HEAVY ELECTRICALS LTD UNIT- BOILER AUXILIARY PLANT RANIPET-632 406.		DRAWING NAME SIGN DATED PRRD.BY M.VMI -SD- 15.05.17 CHKD.BY D.GUILY -SD- 15.05.17 APPD.BY M.J.M -SD- 15.05.17	
TITLE :		NOTES FOR BLOWER MCC.		BHET DRAWING NO 3-00-114-39986 REV NO 00	

ADDITION/ DELETION LIST LTMSB

SL. NO	COMPONENT DESCRIPTION	RATING	UNIT PRICE
1	ACB OF EACH TYPE AND RATING		
2	MCCB(EACH TYPE AND RATING)		
3	AUXILIARY CONTACTOR (EACH RATING AND TYPE)		
4	PROTECTION RELAY (EACH RATING AND TYPE)		
5	INDICATION LAMP (EACH RATING AND TYPE)		
6	PUSH BUTTON (EACH RATING AND TYPE)		
7	CONTROL TRANSFORMER (EACH RATING AND TYPE)		
8	CURRENT TRANSFORMER (EACH RATING AND TYPE)		
9	VOLTMETER(EACH RATING AND TYPE)		
10	AMMETER (EACH RATING AND TYPE)		
11	NEUTRAL LINK (EACH RATING AND TYPE)		
12	CONTROL SWITCHES (EACH RATING AND TYPE)		
13	CONTROL/POWER TERMINAL (EACH RATING AND TYPE)		
14	DFDO ENCLOSURE (EACH RATING AND TYPE)		
15	MODULES OF EACH TYPE AND RATING		

2. i. Vendor to give UNIT price for addition/ deletion of all COMPONENTS for all rating as indicated in the BOM. Also vendor to give option price for addition/ deletion of ENCLOSURE.

ii. The cost price of Individual items related to this project should match to total price .



Bharat Heavy Electricals Limited
Electroporcelains Division, Bangalore – 560 012
Control Panel Business Group
PRICE FORMAT

PROJECTS: 1X800MW VIJAYAWADA THERMAL POWER PLANT
1X800MW KRISHNAPATNAM THERMAL POWER PLANT
MATERIAL: DRAWOUT PANELS FOR APGENCO PROJECT REQUIREMENT

sl.no	MATL.CODE	DESCRIPTION	UNIT	QTY	UNIT PRICE	TOTAL
1	ELSBMCCSDST01	SBMCC FOR KRISHNAPATNAM	EA	1		
2	ELSBMCCVTPS01	SBMCC FOR VIJAYAWADA	EA	1		
3	ELLTMSBSDST01	LTMSB FOR KRISHNAPATNAM	EA	4		
4	ELACPSDST01	ACP FOR KRISHNAPATNAM	EA	4		
5	ELLTMSBVTPS01	LTMSB FOR VIJAYAWADA	EA	4		
6	ELACPVTPS01	ACP FOR VIJAYAWADA	EA	4		
7	ELCOMSPRVTP001	COMMISSIONING SPARES FOR VIJAYAWADA	LOT	1		
8	ELCOMSPRKR001	COMMISSIONING SPARES FOR krishnapatnam	LOT	1		
9	ELBLWVTPS01	BLOWER MCC FOR VIJAYAWADA	EA	1		
10	ELBLWKRP01	BLOWER MCC FOR KRISHNAPATNAM	EA	1		
11	ELCOMSPRAP001	COMMISSIONING SPARES FOR BLOWER MCC,AP	LOT	1		

NOTES:

- SUMMATION OF ALL UNIT RATES OF MODULES SHALL BE EQUIVALENT TO TOTAL BOARD COST QUOTED, VARIANCE OF +/- 5% IS ACCEPTABLE. BEYOND 5% OFFER WILL NOT BE CONSIDER AS VALID OFFER. IN UNIT ADDITION-DELETION PRICES, PRICES QUOTED FOR COMPONENTS SHALL BE AS PER LIST PRICE OF CONCERNED MANUFACTURES. IF ANY ABNORMAL PRICES ON HIGHER SIDE OBSERVED OFFER MAY BE REJECTED.
- ALL BOARDS SHALL BE SUPPLIED ALONGWITH THE INTEGRAL BASE FRAMES, FOUNDATION BOLTS, CABLE GLANDS & LUGS. ALL FIXING NUTS & BOLTS TOGETHER WITH FOUNDATION BOLTS SHALL ALSO BE SUPPLIED. PRICES FOR THE BASE FRAME SHALL BE BUILT IN THE SWITCHBOARD PRICE.
- ITEM WISE PRICES WITH DESCRIPTION AND RATING OF EACH ITEM COMPLYING TO LIST FURNISHED IN THE SCHEDULE OF UNIT PRICES SHALL BE FURNISHED IN SCHEDULE OF UNIT PRICE.
- ADDITION/DELETION OF QUANTITIES SHALL BE APPLICABLE AT THE QUOTED PRICE.THE UNIT RATE OF SUPPLY OF ALL EQUIPMENTS & SERVICES QUOTED BY THE BIDDER SHALL BE FIRM FOR A VARIATION OF QUANTITIES , WHICH MAY BE TO THE EXTENT OF $\pm 30\%$ OF THE TOTAL ORDERED QUANTITY. SUM OF INDIVIDUAL MODULE SHALL EQUAL TO BOARD PRICE.
- THE MAKE OF COMPONENTS SHALL BE SUBJECT TO CUSTOMER APPROVAL.

TECHNICAL DEVIATION SHEET

SI No.	Document Title	Clause No.	NIT requirement	Bidders Deviation

Total Number of Deviation(s):(Both in figures & Words)

BIDDER’S STAMP & SIGNATURE

TECHNICAL SPECIFICATION FOR
LTMSB_ACP
PROJECT: 1X800MW KRISHNAPATNAM

CUSTOMER: APGENCO

SPEC REF NO.: EP-LTMSB_ACP-KRP-01 REV 00



BHARAT HEAVY ELECTRICALS LIMITED
ELECTROPORCELAINS DIVISION
BANGALORE – 560012



**TECHNICAL SPECIFICATION
FOR
LTMSB**

SPECIFICATION NO.: EP-LTMSB_ACP-KRP-01

VOLUME

SECTION -

REVISION 0

DATE: 18.09.2017

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<u>S. NO.</u>	<u>DESCRIPTION</u>
1.0	COVER PAGE
2.0	CONTENTS
3.0	INSTRUCTIONS FOR BIDDERS
4.0	TECHNICAL SPECIFICATION & DRAWINGS
5.0	PRICE SCHEDULE
6.0	UNIT PRICE SCHEDULE
7.0	DEVIATION SHEET

**IT IS CONFIRMED THAT OUR TECHNICAL OFFER COMPLIES WITH THE SPECIFICATION IN TOTO, & THAT
THERE ARE NO TECHNICAL DEVIATIONS.**

BIDDER'S STAMP & SIGNATURE
(REFER INSTRUCTION NO. 1 OF 'INSTRUCTIONS TO BIDDERS')



TECHNICAL SPECIFICATION

SPECIFICATION NO.: EP-LTMSB_ACP-KRP-01

VOLUME NO. :

SECTION :

REV NO. : 00 DATE: 18-09-2017

SHEET : 1 OF 1

INSTRUCTIONS TO BIDDERS FOR PREPARING TECHNICAL OFFERS

1. Two signed and stamped copies of the following shall be furnished by all bidders as technical offer:
 - a) Complete technical specification.
 - b) Un-priced copy of PRICE FORMAT, duly stamped and signed by the bidder.
 - c) Complete dimension of all the boards including no. of panels, dimensions of each type of panels, module size of each type of feeders and minimum clearances required on all sides for each type of panels.
 - d) **No. of Vertical consider by vendor for each boards are to be compulsory given along with offer.**
 - e) A copy of the sheet "Instructions to Bidders for Preparing Technical Offer" duly stamped and signed by the bidder.
 - f) Technical deviation/ clarification, if any
 - g) No. of MCC panels, Weight & Dimensions of LTMSB & ACP.
2. No technical submittal such as copies of type test certificates, data Sheets, write-up, drawing, technical literature, etc. is required during tender stage. Any such submission, even if made, shall not be considered as part of offer.
3. Confirmations/ comments (if any) regarding delivery schedules shall be furnished as part of the commercial offer. Any reference elsewhere/ covering letter of technical offer shall not be considered by BHEL.
4. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder's covering letter shall not be considered by BHEL, and bidder's offer shall be construed to be in conformance with the specification.
5. Any changes made by the bidder in the price schedule with respect to the Item description/ quantities, notes etc. from those given in annexure-A of specification shall not be considered (i.e., technical description, quantities, notes etc. as per specification shall prevail).
6. Bidders to quote for all items/sub items.
7. In case of any ambiguity in specification between various sections and end customer specification vendor should clearly brought out in technical deviations failing in which BHEL will have choice to prefer which ever it suits at later stage for which vendor should accept.
8. In case bidder is having any queries regarding technical parameters same shall get clarified before quoting, in case if any technical deviations are observed during scrutiny wrt to NIT bidder shall meet the technical requirements without any price implication.
9. Vendor should bring out clearly in deviation sheet if any.
10. Vendor to complete the panel in all respect and dispatch to BHEL. Numerical relay is in BHEL scope and same shall be fitted by BHEL in BHEL Premises. Vendor to do the relay wiring up to relay with proper ferruling and lugs terminals.



TECHNICAL SPECIFICATION

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11. The panel shall be tested at BHEL-EPD after fixing of relay. In case any wiring mistake observed during testing at BHEL-EPD, vendor has to depute their representative/service engineer at BHEL-EPD to modify the same without any commercial implication. The representative shall be deputed within 2 working days from the date of intimation by BHEL-EPD.
12. Panel will be dispatched in the name of BHEL EPD as manufacturer, BHEL may conduct the type test at CPRI/ERDA on same panel as manufacturer.

BIDDER'S STAMP & SIGNATURE

**VOLUME :V-A
SECTION-VII
TECHNICAL SPECIFICATION
FOR
415V PMCC/MCC, 415V ACDB AND 220V DCDB**

1.00.00 SCOPE OF SUPPLY

1.01.01 Requisite nos. of following equipment shall be furnished with all accessories :-

- a. Power cum Motor Control Centre (PMCC)
- b. Motor Control Centres (MCC)
- b. A.C. Distribution Board (DB)
- c. D.C. Distribution Board (DB)
- d. D.C. Starters
- e. A.C./D.C. fuse boards

1.01.02 The base channel frame with hardware and lifting angles.

1.01.03 One set of special tools and tackles.

1.01.04 Set of accessories as listed below :

- a) Breaker lifting and handling trolley.
- b) Test cabinet with coupling cables for testing the breaker in drawout position.
- c) Racking in/out handle for breakers.

1.01.05 Mandatory Spare parts.

1.01.06 All relevant drawings, data and instruction manuals.

2.00.00 CODES AND STANDARDS

2.01.01 All equipment and materials shall be designed, manufactured and tested in accordance with the latest applicable Indian Standards (IS) and IEC except where modified and/or supplemented by this specification.

2.01.02 Equipment and material conforming to any other international standard which ensures equal or better quality, may be accepted. In such case, copies of the English version of the standard adopted shall be submitted along with the bid.

2.01.03 The electrical installation shall meet the requirements of Indian Electricity Rules as amended upto date and relevant IS Code of Practice. In addition, other rules and regulations applicable to the work shall be followed.

3.00.00 DESIGN CRITERIA

- 3.01.00 The PMCCs/MCCs/DBs will be used to provide power, control and protection for 415/240V A.C. and 220V D.C. auxiliary services (Motors & Feeders) of generating units.
- 3.02.00 Duty involves direct-on-line starting of large squirrel cage motors below 175kW. The starting current varies from 6 to 8 times rated current at very low power factor.
- 3.03.00 The equipment will be located in a hot, humid and tropical atmosphere, highly polluted at places with coal dust and/or fly ash.
- 3.04.00 For continuous operation at specified ratings, the temperature rise of various equipment/components shall be limited to the permissible values stipulated in relevant standards and/or this specification.
- 3.05.00 Equipment ratings and quantities are detailed in the enclosed drawings and annexure. Equipment shall be furnished in strict compliance with the same.
- 3.06.00 All equipment and components thereof shall be capable of withstanding the mechanical forces and thermal stresses of the short-circuit currents without any damage or deterioration of the materials.
- 3.07.00 The PMCCs/ MCCs / DBs shall have two incomers and one bus-coupler. In addition to electrical interlocks, mechanical castle key interlock shall be provided between the two incomers and the bus-coupler so that any two of the three may be closed at a time.
- 3.08.00 Busbars of PMCCs shall be sized to carry continuously the associated transformer secondary current plus a 20% margin.
- Busbars of MCC/DBs shall be sized to carry continuously the total running load of MCC/DB plus a 20% margin.
- 3.09.00 In cubicle of incomers & bus section breakers/MCCBs shall be identical to the associated busbar rating.
- 3.10.00 For continuous operation at specified ratings, the temperature rise of various equipment/components shall be limited to the permissible values specified in relevant standards and/or this specification.
- 3.11.00 Circuit breakers shall not produce any harmful over voltage during switching off of induction motors. If required, surge protective devices shall be included in the scope of supply to limit over voltages.
- 3.12.00 Incomers, Bus-couplers & outgoing feeders rated upto & including 630A shall be MCCB controlled. Above 630A all incomers, Bus-couplers & outgoing Feeders shall be ACB controlled. For critical loads ACB control feeders shall be provided which will be decided during detailed engineering.
- 3.13.00 All motor rated 110kW & above, below 175kW shall be ACB controlled. Motor rated upto 110kW shall be contactor operated.

- 3.14.00 MCC & PMCC shall have sufficient number of spare modules (at least 20% of various sizes used with a minimum of 1 no. for each rating and type).
- 3.15.00 Outgoing feeders of PMCC shall be limited to minimum number of different sizes so that max. standardization is achieved from MCCB & contactor size point of view.
- 3.16.00 Incomers & bus section breakers of PMCCs/MCCs shall have provisions for remote operation from control room.
- 3.17.00 All breaker operated motor feeder shall be supplied from PMCC.
- 3.18.00 One no. Normal/Emergency switchgear to cater power supply to important emergency load / motors for safe shut-down of unit including 220V battery chargers shall be provided for each unit. The main incoming supply shall be from 415V unit service switchgear. When main incoming supply fails, reserve incoming supply shall be switched ON automatically from 415V station service switchgear. In case of total failure of AC supply of the power station, the supply from DG shall be switched ON automatically.
- 3.19.00 Each switchgear shall be provided with two bus sections, two incomer and a bus coupler rated for 100% of the loads connected to the switchgear.
- 3.20.00 For each auxiliary or load, one feeder shall be provided except for the following cases:
- One feeder for a maximum 2 nos. isolator motor operating mechanism.
- 3.21.00 The switchgears shall be provided with suitable number and type of outgoing feeders for the respective auxiliary loads of the system/area, power supply feeders to various panels, lighting transformer, space heating panels, control cabinets and all other loads encountered in the plant. In addition, following feeders shall be provided in each bus section of each switchgear.
- a) Bus VT module: One (1) no.
- b) Switchgear test supply module: One (1) no.
- c) 240V, 1 phase essential supply module with five nos. 1 phase outlets: One (1) no.
Necessary 415V/240V dry type transformer shall be provided.
- d) Alarm module for common alarm for outgoing feeder fault: One (1) no.
- e) DC supply alarm module for incomer, bus coupler fault: One (1) no.
- 3.22.00 Each feeder shall be provided with two nos. interposing relays for start & stop. These interposing relays shall be located in separate IPR panel described under C&I specification.

4.00.00 **SPECIFIC REQUIREMENTS**

4.01.00 **Construction**

4.01.01 PMCC / MCC / DB shall be indoor, metal-clad, air insulated and floor mounting type. All MCCs shall be fully draw out type and DBs shall be fixed type. ACB modules of PMCCs/MCCs shall be fully drawout type. MCCB / Switch Fuse modules shall also be fully drawout type. The design and construction shall be such as to allow extension at either end.

4.01.02 All PMCC/MCC shall be of double front construction.

4.01.03 PMCC /MCC/DB enclosure shall be dust and splash proof, conforming to a degree of protection IP-54. All switchboard frames and load bearing members shall be fabricated using suitable mild steel structural sections or pressed and shaped cold rolled sheet steel of thickness 2.0mm. Frames shall be enclosed in cold rolled sheet steel of thickness 1.6 mm. Doors and covers shall also be of cold rolled sheet steel thickness 1.6 mm. Stiffeners shall be provided wherever necessary. The gland plate thickness shall be 3.0 mm for hot/cold rolled sheet steel and 4.0 mm for non-magnetic material.

4.01.04 PMCC / MCC / DB assembly shall comprise a continuous line up of dead front, free-standing vertical sections, housing the control modules in multi tier formation.

4.01.05 The design shall be fully compartmentalized with metal/insulating partitions between compartments. **Operating height shall be as per drawings**

3-96-186-15391 Rev 02.

4.01.06 Each control module shall be housed in a separate compartment, complete with an individual front access door having sufficient opening with concealed type hinges. Each vertical section shall have a removal back cover. All doors and covers shall be gasketed.

4.01.07 All push buttons, lamps, indicating instruments shall be flush / semi-flush mounted on respective module compartment.

4.01.08 A full height vertical cable chamber with cable supports shall be provided in each section to facilitate unit wiring. The chamber shall be liberally sized to accommodate all cables and shall have removable cover at the front for access.

4.01.09 A horizontal wireway, extending the entire length, shall be provided at the top of each PMCC / MCC / DB for inter panel wiring.

4.01.10 The width of the cable alley shall not be less than 250 mm.

4.02.00 **Bus and Bus Taps**

4.02.01 All PMCCs/MCCs/DBs shall be provided with three phase & neutral bus bars . All DCDBs shall be provided with two busbars. All busbar compartments shall be completely enclosed.

- 4.02.02 The main buses and connections shall be of high conductivity Aluminium / Aluminium alloy, sized for specified current ratings with maximum temperature limited to 85°C (i.e., 35°C rise over 50°C ambient).
- 4.02.03 Vertical busbars shall be designed for minimum current rating of 200A. Separate vertical busbars shall be provided for each vertical panel.
- 4.02.04 All bus connections shall be silver plated. Adequate contact pressure shall be ensured by means of two-bolt connection with plain and spring washers and locknuts.
- Bimetallic connector shall be furnished for connection between dissimilar metals.
- 4.02.05 Busbars and connections shall be fully insulated for working voltage with adequate phase/ground clearances. Insulating sleeves for busbars and shrouds for joints and tap-off points shall be provided.
- Bus insulators shall be flame retardant, non-hygroscopic track-resistant type with high creepage surface.
- 4.02.06 Busbars shall be supported and braced to withstand the stresses due to maximum short circuit current and also to take care of any thermal expansion.
- 4.02.07 Busbars shall be colour coded for easy identification and so located that the sequence R-Y-B shall be from left to right, top to bottom or front to rear when viewed from the front of the assembly.
- 4.03.00 **Control Modules**
- 4.03.01 Draw-out type control module shall have self-aligning power/control disconnects. All disconnects shall be silver plated to ensure good contacts.
- 4.03.02 The design shall be such as to permit easy withdrawal/reinsertion of the unit with guide rails to ensure correct alignment.
- 4.03.03 Control Module shall house the control components for a circuit such as switch fuse / MCCB, contactors, relays, push buttons, lamps etc. as per requirement of the control circuit.
- 4.03.04 The equipment layout shall provide sufficient working space in between the components and subject to Owner's approval.
- 4.03.05 Various module/compartments sizes shall be multiple of one basic unit to facilitate modifications at site. Suitable provision for this purpose should also be incorporated in the vertical bus bars.
- 4.03.06 Draw-out type control modules of same size and type shall be electrically and physically interchangeable.
- 4.04.00 **Air Circuit Breaker**
- 4.04.01 Circuit breaker shall be provided on the incomer having minimum interrupting capacity equal to the 50kA(r.m.s) fault level.

- 4.04.02 Circuit breaker shall be three pole, single throw, air-break type with independent manual spring closing, trip-free mechanism and shunt trip. However Incomer and bus coupler breakers (ACB) shall be four pole type.
- 4.04.03 Circuit breaker shall be draw-out type, having service, test & isolated position with positive indication for each position.
- 4.04.04 Circuit breakers of identical rating shall be physically and electrically interchangeable.
- 4.04.05 Each breaker shall be provided with microprocessor based protection unit having three overload protection with adjustable current and time, three short circuit protection with adjustable current and time and three instantaneous short circuit protection. The operating characteristic shall be suitable for co-ordination with down-stream fuses.
- 4.04.06 Circuit breakers shall be provided with motor wound spring charging mechanism. Spring charging shall take place automatically after each breaker closing operation. One open-close-open operation of the circuit breaker shall be possible after failure of power supply to the motor. In addition, facility for manual charging of spring shall be provided.
- 4.04.07 Mechanical safety interlock shall be provided to prevent the circuit breaker from being racked in or out of the service position when the breaker is closed. It shall not be possible to open the circuit breaker door cubicle unless the breaker is in 'OFF' position.
- 4.04.08 Automatic safety shutters shall be provided to cover up the stationary disconnects when the breaker is withdrawn.
- 4.04.09 Each breaker shall be provided with an emergency manual trip, mechanical ON-OFF indicator, an operation counter and spring mechanism charge/discharge indicator, and electrical anti-pumping feature.
- 4.04.10 In addition to the auxiliary contacts required for normal breaker operation and indication, each breaker shall be provided with the following for interlocking purpose :-
- a. Position/Cell switch with 4 NO + 4 NC contacts.
 - b. Auxiliary switch, with minimum 6NO + 6NC contacts,
- 4.04.11 Spring charge limit switch shall be provided for breakers with motor wound spring charging mechanism. These limit switches shall be provided with minimum 2NO + 2NC contact.
- 4.04.12 Limit/auxiliary switches shall be convertible type, that is, suitable for changing N.O. contact to N.C. and vice-versa.
- 4.04.13 Each breakers operated feeder shall be provided with protective devices as specified in Annexure–B.

4.05.00 Switches

4.05.01 Switches shall be triple pole, air break, AC23 motor duty for motor feeders and AC22 heavy duty for other feeders.

Motors duty switches shall be capable of safely making and breaking the locked rotor current of the associated motor circuit.

4.05.02 The switch shall have a quick-make, quick-break mechanism operated by a suitable external handle, complete with position indicator. This handle shall have provision for padlocking in ON and OFF position.

4.05.03 The compartment door shall be interlocked mechanically with the switch such that the door cannot be opened unless the switch is in OFF position. Means shall be provided for releasing this interlock at any time.

4.05.04 Switches shall be capable of withstanding the let-through fault current of back-up fuses or circuit breakers.

4.05.05 Wherever two incoming switches and one bus-section switch are provided for an assembly, these shall be mechanically/key interlocked to ensure that only two out of the three can be closed at time.

Wherever two incoming switches are provided for an assembly, these shall be mechanically/key interlocked to ensure that one of the two can be closed at time.

4.05.06 All incoming and outgoing feeders shall be provided with bolted disconnect link for isolation of neutral if necessary.

4.06.00 Fuses

4.06.01 Fuses shall be HRC, preferably link type, with a minimum interrupting capacity equal to the short circuit current of the LT system. Fuses shall be mounted on insulated fuse carriers, which are mounted on fuse bases. Wherever it is not possible to mount fuses on carriers, fuses shall be directly mounted on plug-in type of base. In such cases, one set of insulated fuse pulling handles shall be supplied with each board.

4.06.02 Fuses shall be furnished complete with fuse bases and fittings of such design as to permit easy and safe replacement of fuse element.

Visible indication shall be provided on blowing of the fuse.

4.06.03 Motor fuse characteristics and ratings shall be chosen to ride over starting period without blowing. The fuse on incoming feeder wherever provided, shall be chosen to provide discrimination with motor/feeder fuses.

4.07.00 Moulded Case Circuit Breaker (MCCB)

4.07.01 The MCCBs shall be of drawout type with trip-free operating mechanism of quick make & quick break type. Each MCCB shall be equipped with thermal release for thermal overload and magnetic release for short circuit protection on each pole.

- 4.07.02 MCCBs / MPCBs shall be suitable for manual closing and opening and also automatic trip on overload and short circuit. MCCB shall have intermediate position to indicate trip condition.
- 4.07.03 The MCCBs shall be provided with mechanical ON-OFF indicator at the front panel. The MCCB handles, after the breaker tripped due to faults, shall occupy a mean position indicating trip condition.
- 4.07.04 The compartment door shall be interlocked mechanically with the MCCB such that the door cannot be opened unless the MCCB is in OFF position. Means shall be provided for releasing this interlock at any time.
- 4.07.05 All feeders of PMCC / MCC rated up to & including 630 Amp shall be provided with MCCB. Air circuit breaker shall be provided for feeders rated above 630 Amp. For critical loads ACB control feeders shall be provided which will be decided during detailed engineering.
- 4.07.06 Motors rating above 110 KW will be operated by Air circuit breaker and protected by consolidated numerical motor protection relay.
- 4.08.00 **A.C. Starter**
- 4.08.01 Contactors
- a. The contactors shall be three pole, air break type designed for duty class III - Category AC3 (for unidirectional motor) with non-bouncing silver/ silver alloy contacts. Contacts for reversible motors will be of AC4 duty.
 - b. Each contactor shall be provided with minimum two (2) normally open and two (2) normally closed auxiliary contacts rated 10 A at 240V A.C.
 - c. Reversing contacts shall be electrically and mechanically interlocked.
 - d. Contactors with delayed dropout feature shall be provided for some essential auxiliaries. These contactors shall not dropout on power failure if the voltage is restored within 3 seconds.
- 4.08.02 **Protection**
- a. Thermal overload relays shall be three element, positive acting, ambient temperature compensated with adjustable settings.
 - b. Single phase preventor relay shall be provided, preferably as an inbuilt feature of thermal overload relay.
 - c. Relays shall be manual reset type with two changeover potential-free contacts. Resetting of relays shall be possible with compartment door closed. Colour of the resetting button shall be BLACK.
 - d. Relays may be direct acting or C.T. operated, depending on current rating. C.T.s shall be included in the scope of supply.
 - e. Motor starters shall have type '2' co-ordination according to IEC 947-4.

- f. Earth fault relays with adjustable settings and time delays fed from core balance CT shall be provided.
- g. Numerical / Digital Motor protection relay with short circuit, over load, earth fault, locked rotor and unbalance (NPS) load protection functions shall be provided for motor rated above 90 kW.

4.09.00 Control Transformer

4.09.01 LT Switchboard control supply

The Bidder shall provide one (1) no. adequately rated 415V/110V Control Transformer in each bus section with necessary taps and auto changeover facility for providing control power supply to various modules of the board. The sizing of control transformer shall be carried out by the Bidder considering the actual load of power contactors, auxiliary contactors, indicating lamps and other equipment in the module circuit. An additional load of 15watts shall be considered for each module for remote auxiliary relays and lamps to be connected in the control circuit of modules. Bidder shall also ensure that control transformer are adequately designed for meeting the momentary loading requirements and the voltage drop during this condition shall not be more than 5%. Each transformer shall be sized for catering to control supply of both bus sections.

4.09.02 LT Switchboard space heater supply

The Bidder shall provide one (1) no. adequately rated 415V/240V Control Transformer in each bus section with necessary taps and auto changeover facility for providing power supply to panel space heater, Motor space heater of motor rated 30 KW & above, Panel Illumination & Socket. The supply of these two (2) nos. control transformer are tapped from incoming supply of 415V PMCC/MCC before the incoming breaker. Incoming circuit to the space heater auxiliary bus shall be through isolating switch HRC fuse and neutral link of suitable rating. The supply of different modules shall be tapped individually from the auxiliary bus bars. Control supply healthy indication shall be provided. Each transformer shall be sized for catering to space heater supply of both bus sections.

4.10.00 D.C. Starters

4.10.01 D.C. Starter for emergency oil pump shall be fixed resistance type, designed to provide fast acceleration during starting.

4.10.02 DC starters shall be complete with switch-fuse units, contactors, resistors, relays, meters, push-buttons, lamps, etc.

4.10.03 Starters shall be furnished in totally enclosed floor-mounting, sheet steel cubicles complete with a hinged front access door. Minimum thickness of sheet steel shall be 2mm.

4.10.04 The cubicle enclosure shall provide dust and humidity protection, the degree of protection being not less than IP-54.

The resistor enclosure shall be provided with ventilating louvers and wire mesh guard and shall have a degree of protection IP-23.

4.10.05 Cubicle space heater shall be provided to maintain internal temperature above dew point. Heater shall be furnished with switch-fuse unit and thermostat control.

4.11.00 **Relays**

4.11.01 All incoming and bus-coupler circuits and circuit breaker operated outgoing feeders shall be provided with numerical relays. Breaker operated motor feeders shall be provided with numerical motor protection relay.

4.11.02 The numerical relays shall have provisions for interfacing with Plant DDCMIS / PLC.

4.11.03 Relays shall be of drawout design with built-in testing facilities. Small auxiliary relays may be in non-drawout execution.

4.11.04 All protective relays, auxiliary relays, and timers shall be provided with hand reset operation indicator (flag).

4.11.05 Relays shall be rated for operation on 110V secondary voltage and 5 A or 1 A. Number and rating of relay contacts shall suit the job requirements.

4.12.00 **Control and Indication**

4.12.01 Circuit breakers shall be wired up for local and remote operation. Each breaker cubicle shall be equipped with the following :

- i) One (1) TEST-NORMAL-TRIAL selector switch with pistol grip handle and key interlock for breakers with motor wound spring charging mechanism.
- ii) On-Off control switches shall have three positions (T-N-C) and shall be spring return to 'Neutral' from close and trip positions. They shall have two contacts closing in close position and two contacts closing in trip positions, and shall have Pistol Grip handles. Lost motion feature shall be provided wherever required.
- iii) Following indicating lamps on the front of the compartment:

Breaker open	-	GREEN
Breaker closed	-	RED
Breaker tripped	-	AMBER
Spring charged	-	WHITE
Trip Ckt. Healthy	-	BLUE

Motor Space heater 'ON' for motor circuit - YELLOW

4.12.02 Push button shall be heavy duty, oil tight, push to actuate type with integral escutcheon plate marked with its function.

- 4.12.03 Each push button shall have minimum two (2) nos. normally open and two (2) nos. normally closed contacts rated 10 A at 240 V.
- 4.12.04 One (1) NORMAL-TRIAL selector switch shall be provided for all motor feeders.
- 4.12.05 Selectors switches shall be stay-put, rotary type with escutcheon plates marked to indicate the function and positions, and shall be lockable in each position. Selector switch contacts shall be rated for 10A at 240 V A.C.
- 4.12.06 Selector switches shall be provided with minimum three (3) contact blocks of 1 NO + 1 NC each.
- The exact requirements of contacts shall be decided by the Tenderers taking into account the scheme requirement and spares.
- 4.12.07 Lamps shall be clustered LED type with series resistor and coloured lens. Lens and lamps shall be replaceable from the front. Lamps shall be located just above the associated push button/control switch
- 4.12.08 The general scheme of connections for control, interlock and protection is shown in the enclosed drawings. Detailed requirements of individual circuits will be intimated later to the successful bidder, who shall develop and furnish the schemes accordingly.
- 4.13.00 **Meters**
- 4.13.01 All indicating instruments (96 x 96 mm) shall be switchboard type, with 250° scale, anti-glare glass and accuracy class of $\pm 2\%$ full scale. Each meter shall have zero adjuster on the front.
- 4.13.02 Motor ammeter shall be suitable to indicate starting current (6 to 8 times full load current) for DOL starting of motor.
- Motor ammeter shall be provided for motor rated 30 kW and above and for critical drives, to be finalized during detail engineering.
- 4.13.03 All incomers, tie feeders, circuit breaker operated motor feeders shall be provided with 3-phase multifunction meter with pulse output and communication port for interfacing with Plant DDCMIS / PLC.
- 4.13.04 Meter selector switches shall be maintained contact, stay-put type, with knob handle. Ammeter and voltmeter selector switches shall be four position type. Ammeter selector switches shall have made before break contacts, to prevent open circuiting of CT secondary.
- 4.14.00 **Current Transformer**
- 4.14.01 Current Transformer, shall be cast resin type rated 10 VA. All secondary connections shall be brought out to terminal blocks where wye or delta connection will be made.
- 4.14.02 Accuracy class of the current transformers shall be:
- a) Class PS for REF

- b) Class 5P20 for other relaying.
- c) Class 1.0 ISF < 5 for metering.
- d) Class 0.5 ISF < 5 for metering (Incomer & Bus coupler of PMCC)

Other CT particulars like ratio, burden, knee point, excitation current & secondary resistance shall be decided by the bidder.

4.14.03 CT secondary shall be rated for 1A for metering & either 5A or 1A for protection.

4.15.00 Voltage Transformer

4.15.01 Voltage transformers shall be cast-resin, drawout type and shall have an accuracy class of 1.0. Voltage transformer mounted on breaker carriage is not acceptable. For Incomer and bus coupler of PMCC accuracy class of voltage transformer shall be 0.5.

4.15.02 High voltage windings of voltage transformer shall be protected by current limiting fuses. The voltage transformer and fuses shall be completely disconnected and visibly grounded in fully draw out position.

4.15.03 Secondary winding MCBs, sized to prevent overload shall be installed in all ungrounded secondary leads. MCBs shall be suitably located to permit easy replacement while the switchgear/PMCC is energized.

4.15.04 Both primary side & secondary side fuse failure / voltage loss monitoring system of VT shall be provided.

4.16.00 Transducers

4.16.01 Transducer for conversion of AC electrical quantities such as voltage, current, KW etc. shall be supplied as required for remote connection to Plant DDCMIS / PLC. All transducers shall be dual output type.

4.16.02 The transducers for indicating type instruments shall be of very low burden type having 4-20 mA DC linear, galvanically isolated output, compatible with secondary instruments and Plant DDCMIS system.

4.17.00 Secondary Wiring

4.17.01 The PMCC/MCC/DB shall be fully wired at the factory to ensure proper functioning of control, protection and interlocking schemes.

4.17.02 Fuse and links shall be provided to permit individual circuit isolation from bus wires without disturbing other circuits. All spare contacts of relays, push buttons and other devices shall be wired upto terminal blocks.

4.17.03 Wiring shall be done with flexible, 650V grade, fire resistance PVC insulated switchboard wires with stranded Copper conductors of 2.5 mm² for control & current circuits and 1.5 mm² for voltage circuits.

- 4.17.04 Each wire shall be identified, at both ends, with permanent markers bearing wire numbers as per Contractor's wiring diagrams.
- 4.17.05 Wire terminations shall be made with crimping type connector with insulating sleeves. Wires shall not be spliced between terminals. Separate colour code shall be used for AC & DC circuit wiring for easy identification.
- 4.18.00 **Terminal Blocks**
- 4.18.01 Terminal blocks shall be 650V grade box-clamp type with marking strips similar to ELMEX 10 mm² or equal. Terminals for C.T. secondary leads shall have provision for shorting.
- 4.18.02 Terminal blocks used for interface with DDCMIS / PLC via termination cabinet shall be suitably sized to facilitate proper termination of interconnecting cables.
- 4.18.03 Not more than two wires shall be connected to any terminal. Spare terminals equal in number to 20% active terminals shall be furnished.
- 4.18.04 Terminal blocks shall be located to allow easy access. Wiring shall be so arranged that individual wires of an external cable can be connected to consecutive terminals.
- 4.19.00 **Cable Terminations**
- 4.19.01 PMCC shall be designed for cable entry from bottom. MCC/DB shall be designed for cable entry both from top and bottom. Actual configuration shall be intimated later sufficient space shall be provided for ease of termination and connection.
- 4.19.02 Power cables shall be 1100V, Copper/Aluminum conductor, XLPE insulated, armoured, FRLS PVC overall sheathed.
- Control cables shall be 1100V, PVC insulated, armoured, PVC overall sheathed with 2.5 mm² stranded Copper conductor.
- 4.19.03 All provisions and accessories shall be furnished for termination and connection of cables, including removable gland plates, cable supports, crimp type tinned Copper/Aluminium lugs, brass compression glands with tapered washer (Power Cables only) and Terminal blocks.
- 4.19.04 Sufficient space shall be provided between the lower most power cable termination and gland plate for easy cable connection.
- 4.20.00 **Bus Duct Connection**
- 4.20.01 Bus duct connections shall be furnished along with transition panel, if required. Unless mentioned otherwise bus duct connections shall generally be from the top.

- 4.20.02 All connecting bus work shall have the same continuous current rating as associated PMCC bus and shall be fully braced for the LT system short circuit current.
- 4.20.03 All provisions such as matching flange and other accessories shall be furnished for connection to bus duct.
- 4.21.00 **Ground Bus**
- 4.21.01 A Cu / Al ground bus rated to carry the maximum fault current, shall extend full length of the MCC/DB.
- 4.21.02 The ground bus shall be provided with two-bolt drilling with G.I. bolts & nuts at each end to receive 50 x 6 mm G.I. flats.
- 4.21.03 All stationary structures shall be directly connected to the ground bus for effective grounding.
- 4.21.04 The frame of draw out module shall be grounded at all times except when the power disconnects are separated by a safe distance.
- 4.21.05 All hinged doors shall be earthed through flexible copper braid wire.
- 4.22.00 **Nameplate**
- 4.22.01 Nameplate of approved design shall be provided for each control compartment and also at the top of each PMCC / MCC / DB.
- 4.22.02 The material of the name plate shall be anodized aluminium / lamicaid or approved equal, 3 mm thick, with white letter on black background. Name plates shall be minimum 20 x 75 mm for instrument / devices and 40 x 150 mm for panels.
- 4.22.03 Caution notice on suitable metal plate shall be affixed at the back of each vertical panel.
- 4.23.00 **Space Heater**
- 4.23.01 Panel and motor space heater shall be fed from separate AC auxiliary busbars running throughout the switchboard. The space heater bus shall be fed from control transformer described earlier. Suitable terminals shall also be provided to facilitate energisation of the control transformer from outside during long shutdown of the board.
- 4.23.02 Each vertical section of the PMCC / MCC / DB shall be furnished with thermostat controlled space heater and 5A, 5 pin plug socket.
- 4.23.03 In addition, motor feeders 30 KW and above shall be wired up for feeding motor space heater through starter auxiliary 'OFF' contacts.
- 4.23.04 Cubicle heater, Motor heater and plug socket circuit shall be provided with individual MCB/switch fuse units.

4.24.00 A.C./D.C. Power Supplies

4.24.01 Necessary 415V AC and 220V DC power supplies as required for control and service shall be arranged by the contractor. Single feeder shall be arranged for A.C. supply and duplicate feeder shall be arranged for D.C. supply.

4.24.02 Isolating switch fuse units shall be provided at each switchgear for the incoming supplies, 4-pole, single throw for A.C. and 2-pole, double throw for D.C. Molded case circuit breaker (MCCB) shall also be accepted as an alternative.

4.24.03 Bus-wires of adequate capacity shall be provided to distribute the incoming supplies to different cubicles. Isolating switch fuse units / MCCB shall be provided at each cubicle for A.C/D.C. supplies.

4.24.04 A.C. load shall be so distributed as to present a balanced loading on three-phase supply system.

4.25.00 Tropical Protection

All equipment, accessories and wiring shall have fungus protection, involving special treatment of insulation and metal against fungus, insects & corrosion.

Screens of corrosion resistant material shall be furnished on all ventilating louvers to prevent the entrance of insects.

4.26.00 Painting

4.26.01 All steel surfaces shall be sand blasted, grounded and pickled as required to produce a smooth, clean surface free of scale, grease & rust.

4.26.02 After cleaning, the surfaces shall be given a phosphate coating followed by two coats of high quality primer and stoved after each coat.

4.26.03 For paint shade of finish coat, refer clause no.1.16.00 of Section E1, Volume V-A.

4.26.04 Sufficient quantity of touch-up paint shall be furnished for application at site.

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

5.00.00 TESTS

5.01.00 All equipment shall be completely assembled, wired, adjusted and tested at the factory as per the relevant standards.

5.02.00 Routine Test

The tests shall include but not necessarily be limited to the following :-

- a. Operation under simulated service condition to ensure accuracy of wiring, correctness of control scheme and proper functioning of the equipment.

- b. All wiring and current carrying part shall be given appropriate High Voltage Test.
- c. Primary current & voltages shall be applied to all instrument transformers.
- d. Routine test shall be carried out on all equipment such as circuit breakers, switch - fuse, contactors, relays, meters etc.

5.03.00 Type Tests

All the Type Tests (as per IS- 8623/IEC) should have been carried out on an identical & similar type of switchgear for each rating involved in the project with ACB mounted in service condition inside the switchgear panel.

Bidder has to submit ACB type test reports for test sequence 1 and combined test sequence and Type 2 co-ordination test reports of any 3 ratings of starter ratings involved.

Type test certificates of any equipment shall be furnished if so designed by the purchaser/ owner. Otherwise the equipment shall have to be type tested free of charge, to prove the design. Type test performed before five (5) years are not acceptable.

6.00.00 DRAWINGS, DATA & MANUALS

6.01.00 Drawings, Data & Manuals shall be submitted in triplicate with the bid and in quantities and procedures as specified in General Conditions of Contract and/or elsewhere in the specification for approval and subsequent distribution after the issue of 'Letter of Intent'.

6.02.00 To be submitted with the bid :-

- a. General arrangement drawing showing constructional features, space required in front for withdrawals, power & control cable entry points etc.
- b. Typical foundation plan
- c. Typical control schematic
- d. Bill of materials
- e. Type test reports on circuit breaker
- f. Technical leaflets on :-
 - i) Circuit breaker
 - ii) Switch-fuse units
 - iii) Contactors
 - iv) Relays, meters, push buttons, selector switches etc.
 - v) Glands/terminals blocks

6.03.00 To be submitted for Owner / Purchaser's Approval and Distribution

All relevant drawings and data pertaining to the equipment like GTP, GA drawing, foundation plan, BOM, control & schematics, QAP, etc. shall be submitted by the Bidder for approval of Owner/Owner's consultant. Also refer clause no. 1.19.02(u) of Section-I of Volume – V-A: Technical Specifications for Electrical Equipment & Accessories.

ANNEXURE-A

RATINGS AND REQUIREMENTS

1.0 General

Type	:	ACB Modules - Drawout type MCCB Modules – Drawout type
Service	:	Indoor
Enclosure	:	IP52

2.0 System

		AC	DC
Voltage	:	415V ± 10%	220V (187-242V)
Phase	:	3-phase, 4-wire	2- wire
Frequency	:	50 Hz +3% to - 5%	
Combined voltage and Frequency variation	:	10% (absolute sum)	
System grounding	:	Solidly grounded	Ungrounded

3.0 Rating

Rated current	:	To be decided by the tenderers.
Design Ambient Temperature	:	50°C
Short Circuit Current Symm.	:	50 KA 25* KA

* Indicative only, the actual value will be decided by the tenderers.

S/C Withstand Time	:	----- 1 second -----
High voltage test for 1 minute	:	2.5 kV 1.5 kV

4.0 Duty

Circuit Breaker	:	0-3'-CO-3'-0
Contactor (AC)	:	Class III - Category AC3 for unidirectional drives and AC4 for bi- directional / inching duty drives
Contactor (DC)	:	Class I – category DC2
MCCB / Switch Duty for		AC DC
Motor Feeder	:	AC23 DC22

	Other Feeder	:	AC22	DC22
5.0	A.C. / D.C. Power Supply			
	Control Voltage for Circuit breaker	:	220V DC +10% to -15%	
	Control voltage for MCCB modules	:	110V AC $\pm$ 10%, 1Ph, 50Hz +3% to - 5%	
	Service voltage	:	240V AC $\pm$ 10%, 1Ph, 50Hz +3% to - 5%	

ANNEXURE-B

PROTECTIONS

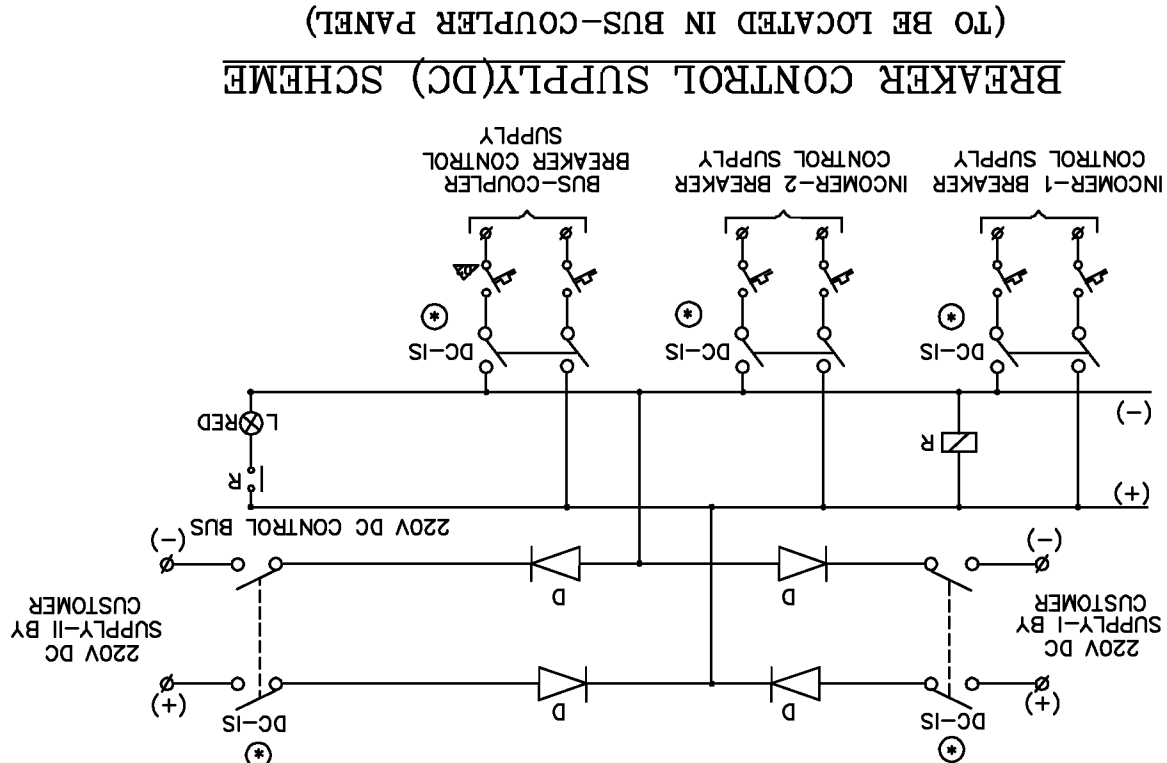
- 1.0 All Protective relays shall be microprocessor based numerical type having communication facility with Plant DDCMIS system / PLC.
- 2.0 The minimum protections to be provided for different types of circuits are listed below:
- a. Incoming Feeder & Bus-coupler with ACB:
 - 3 - inverse time O/C relays (51) for phase fault.
 - 1 - Inverse time O/C relay (51N) for Earth fault.
 - 3 - Under Voltage (27), Range : 40-80% with timer
 - b. Motor Feeder with ACB: (above 110 kW)
 - 1 - Composite Motor protection relay (99) for protection against
 - Thermal overload
 - Phase faults
 - Unbalance (negative sequence)
 - Locked rotor
 - Excessive Start-up time and Start-Stop.
 - Earth fault
 - c. Outgoing Feeder : with ACB
 - 3 - Inverse time O/C relays (51) for phase fault.
 - 1 - Inverse time O/C relay (51N) for Earth fault.
- 3.0 Apart from protection relays, each electrically operated breaker shall be provided with anti-pumping (94), trip annunciation (30), lockout (86) and trip circuit supervision (74) relays. Lockout relay shall be hand reset type.
- 4.0 Both primary side & secondary side fuse failure / voltage loss monitoring system of VT shall be provided..
- 5.0 For Auto-bus change-over as well as live bus change-over through synchronization refer enclosed Control Schematic drawings.
- 6.0 Each incomer shall be provided with three (3) nos. Bus Energised indicating lamps – Red/Yellow/Blue for each phase.

ANNEXURE-C

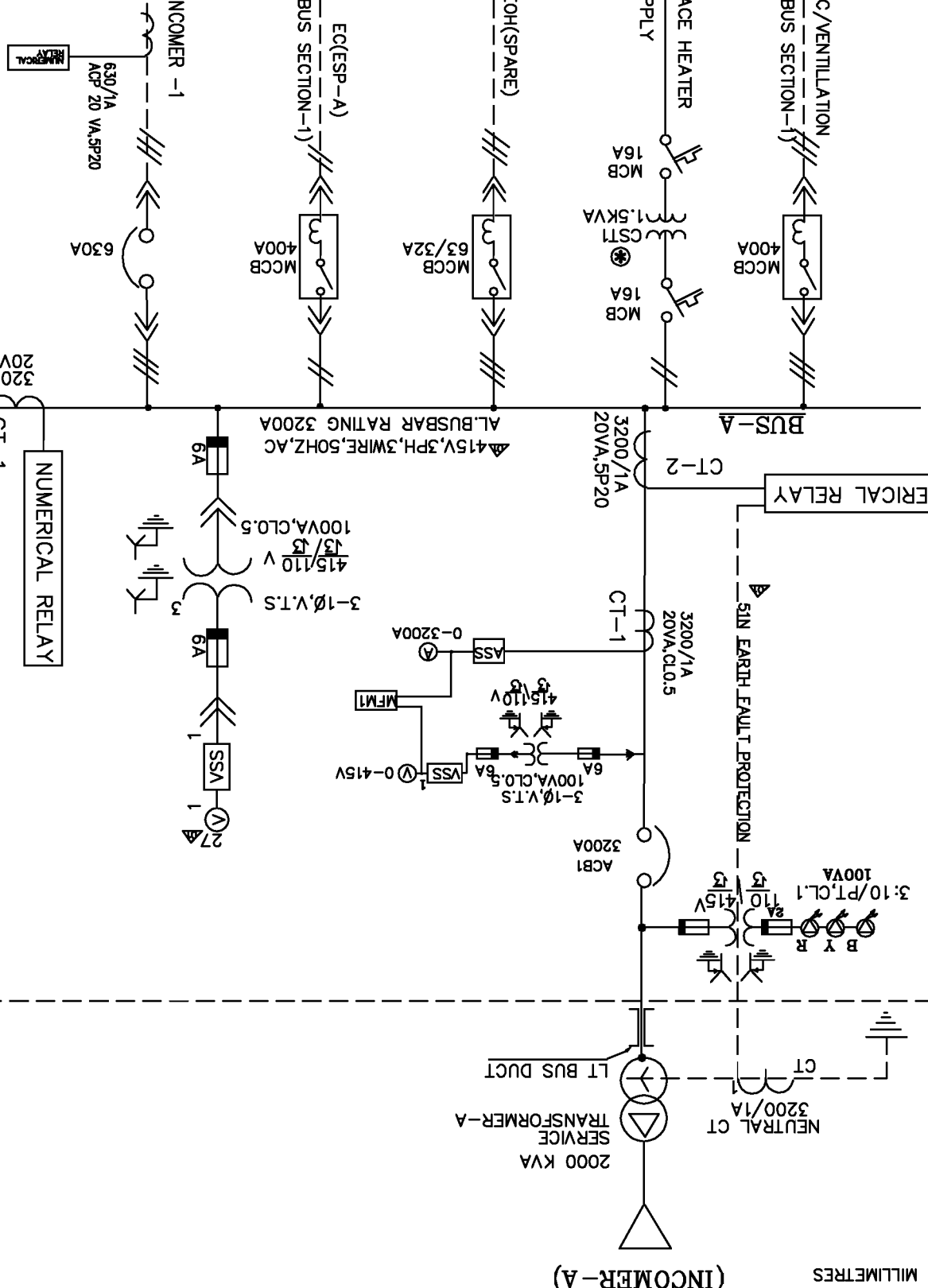
FITTINGS & ACCESSORIES

Each switchboard shall be furnished complete with fittings and accessories as listed below: -

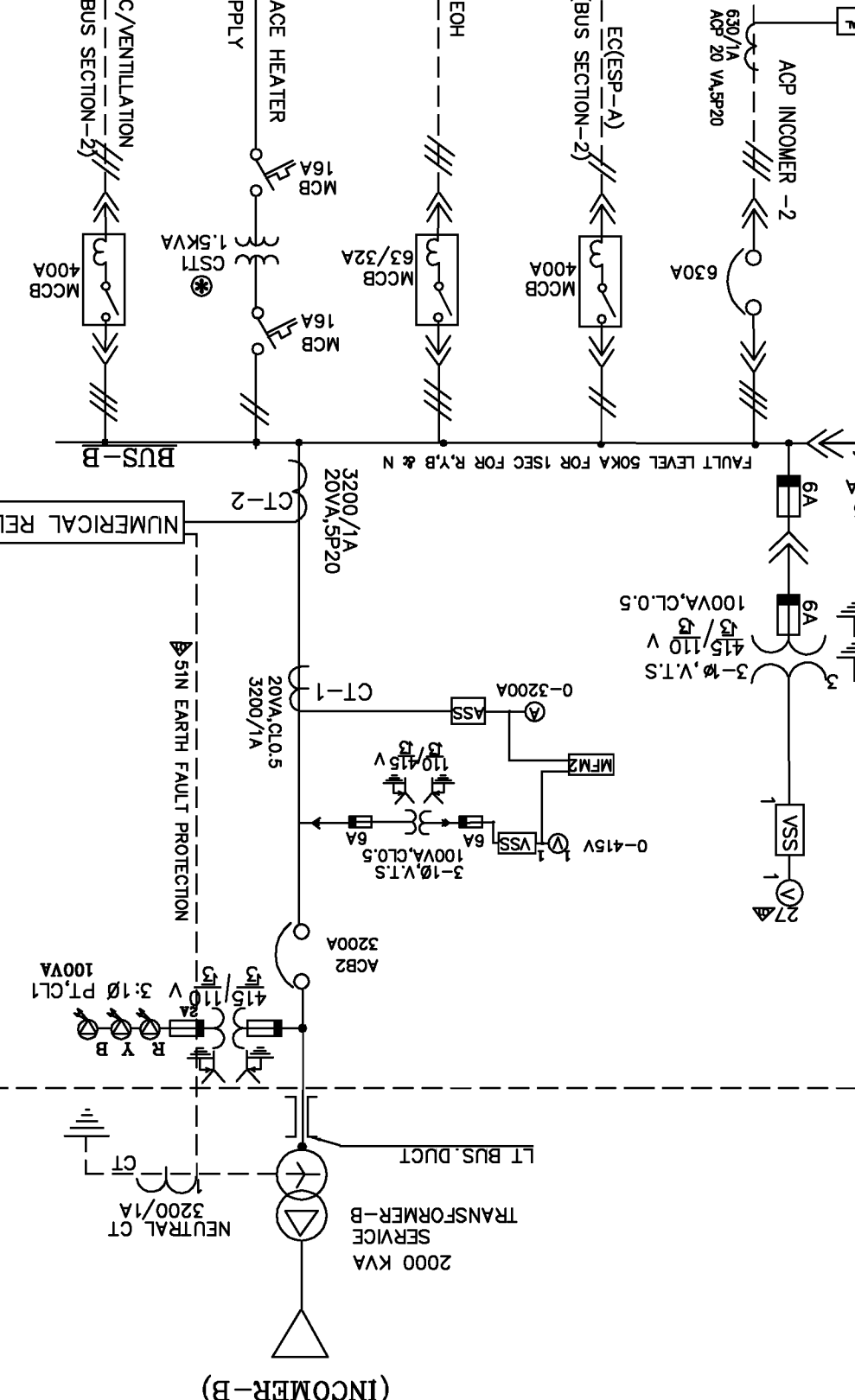
1. Operating mechanism complete with all accessories, fittings and tripping coil and closing coil, pole discrepancy feature etc. as required.
2. Base frame and anchor bolts and nuts.
3. Auxiliary contacts and relays.
4. LOCAL/REMOTE Selector switch, TRIP/CLOSE Push Buttons.
5. Manual tripping devices with protective flap.
6. Mechanical ON-OFF indicator.
7. Operation counters.
8. Set of switch fuse units/MCCB for A.C. and D.C. supply.
9. Space heater with thermostat and ON-OFF switch.
10. Cubicle illumination lamp with ON-OFF switch.
11. 3 Pin 5A Socket with ON-OFF Switch.
12. Terminal blocks and internal wiring - lot as required.
13. Other standard accessories which are not specifically mentioned but supplied with breakers of similar type and rating for efficient and trouble-free operation.
14. Bimetallic terminal connectors.



NO.OF FEEDERS	RATING PER FEEDER	CABLE SIZE
1	400A	-
1	1.5KVA	-
1	7.5KW	1X3C-16
9+2(SP)	316A	2X2C-150
1+1(SP)	570A	2X3.5C-300



NO.OF FEEDERS	RATING PER FEEDER	CABLE SIZE
1	400A	-
1	1.5KVA	-
1	7.5KW	1X3C-16
9+2(SP)	316A	2X2C-150
1	570A	3X3.5C-300



NOTES: -

01. NUMBER OF LTMSB PER ESP : 1 No.

02. NUMBER OF LTMSB PER BOILER : 4 NOS.

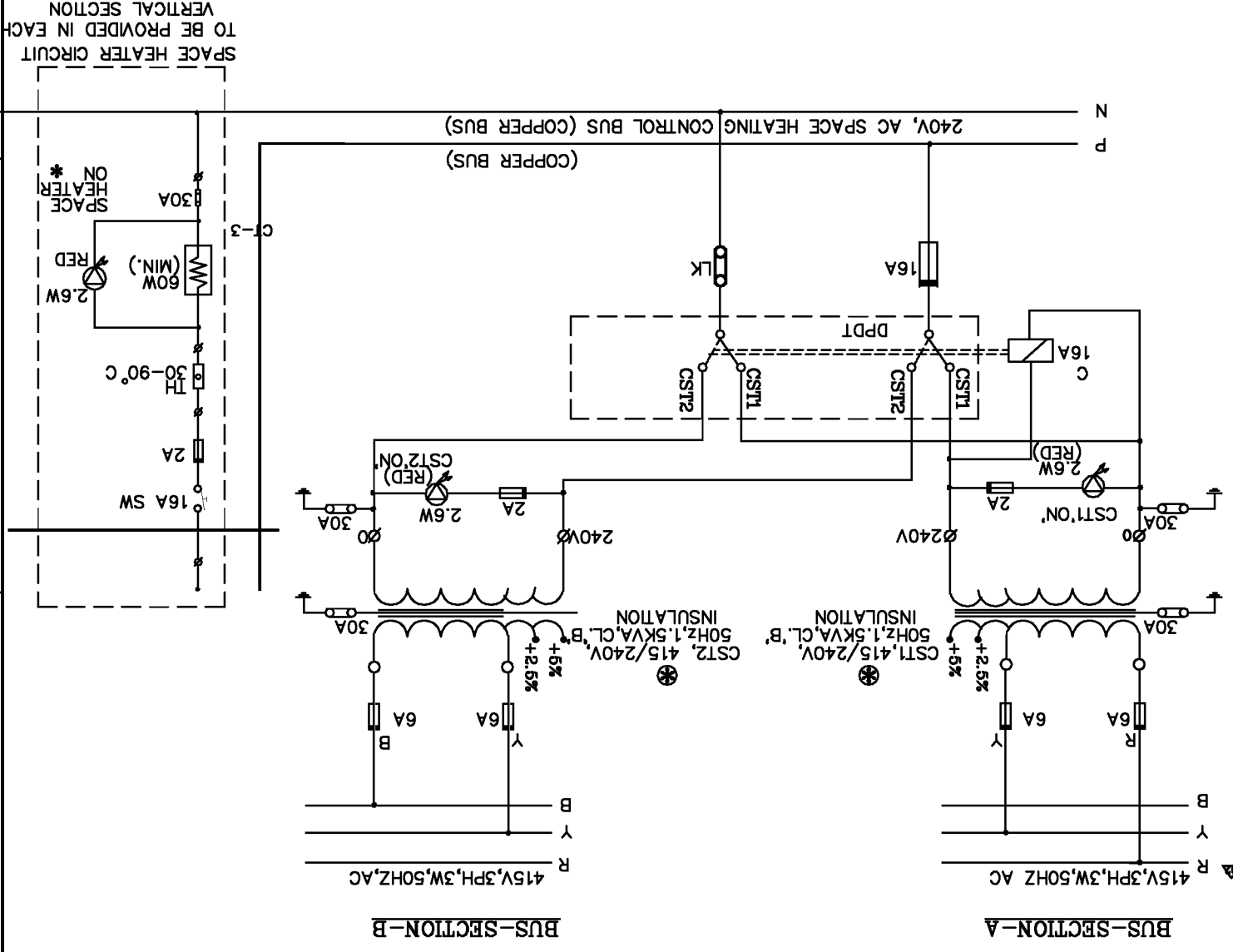
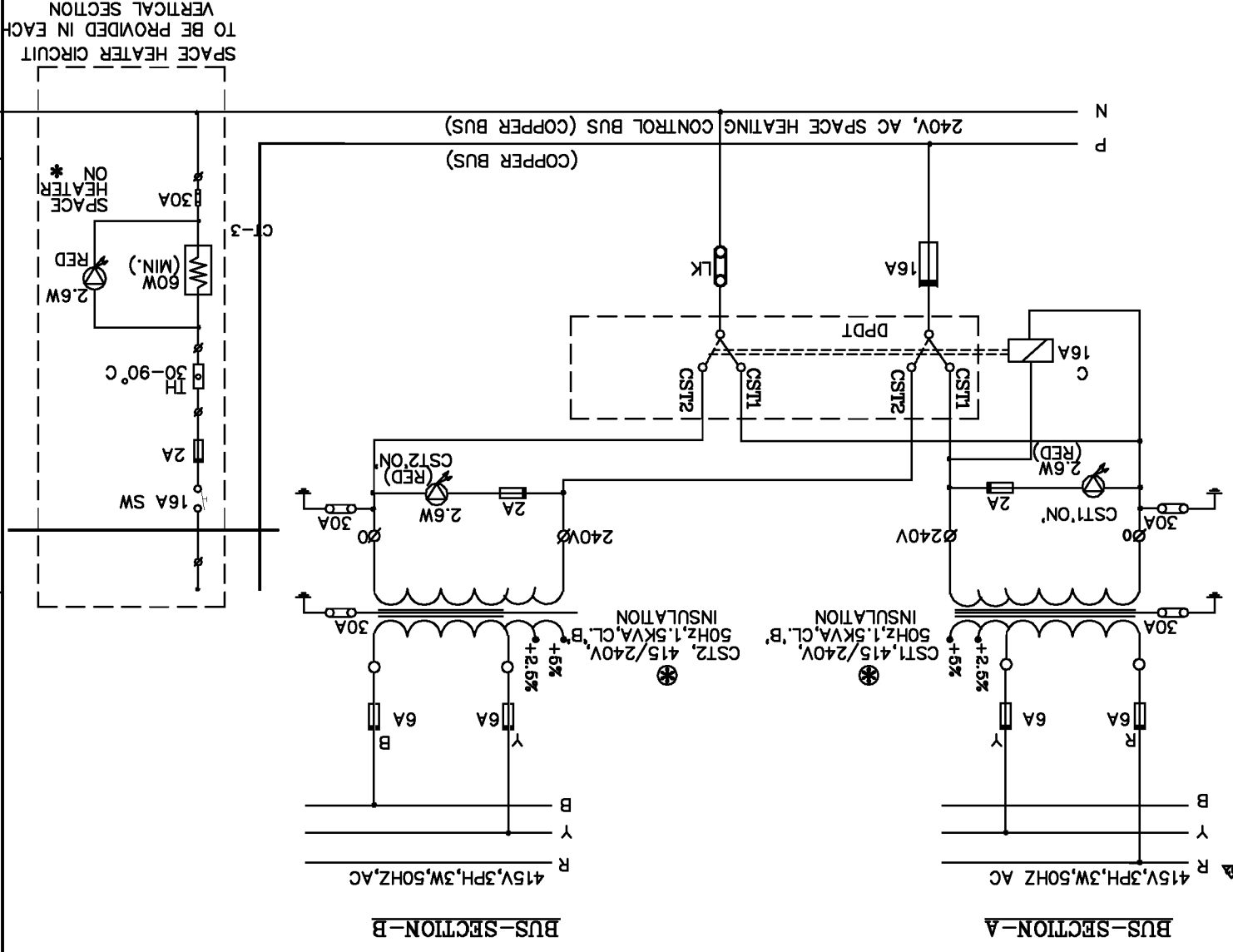
ESP SIZE : 4XF4A-9X45M-2X108150-2

KEY DIAGRAM

ESP-A	ESP-B	ESP-C	ESP-D
1A13, 2A13, 3A13, 4A13, 5A13, 6A13, 7A13, 8A13, 9A13	1B13, 2B13, 3B13, 4B13, 5B13, 6B13, 7B13, 8B13, 9B13	1C13, 2C13, 3C13, 4C13, 5C13, 6C13, 7C13, 8C13, 9C13	1D13, 2D13, 3D13, 4D13, 5D13, 6D13, 7D13, 8D13, 9D13

FLOW
GAS

SPACE HEATER SUPPLY TRANSFORMER CIRCUIT
THIS DRAWING SHALL BE READ ALONG WITH BHEL
DRG.NOS:2-00-114-30205 & 3-00-114-39913



CUSTOMER: ANDHRA PRADESH POWER DEVELOPMENT CO. LTD.
ANDHRA PRADESH, INDIA
1x800 MW STAGE-II UNIT#3, KRISHNAPATNAM

OWNER'S CONSULTANT: DEVELOPMENT CONSULTANTS PVT. LTD.
KOLKATA MUMBAI CHENNAI NEW DELHI

CONSULTANT: BHARAT HEAVY ELECTRICALS LTD.
UNIT : BOILER AUXILIARIES PLANT
RANIPET-TAMILNADU 632 406

DATE: 04.04.17
SIGN:
CODE: P.S.T
DESIGN: M.L.M
APPD: M.L.M

REVISIONS:

REV.	DATE	DESCRIPTION
02	04.04.17	REV. 02
01	04.04.17	REV. 01

DRAWING NO.: 2-00-114-30081
SHEET 1 OF 1

1	2	3	4	5	6	7	8
A	NOTE: —	01. CONSTRUCTION : SINGLE FRONT FOR ACB AND DOUBLE FRONT FOR OUTGOING FEEDERS DRAW OUT FOR INCOMERS, BUS COUPLER AND OUTGOING FEEDERS EXCEPT SPACE HEATER FEEDER. 02. NO.OF LT SWITCH BOARD : FOUR NUMBERS PER BOILER . 03. LTMSB SHALL BE SUITABLE FOR 3PH, 3 WIRE, 415V, 50HZ SUPPLY. ▲ 04. ALL POWER, CONTROL SWITCHES AND RESET PUSH BUTTONS SHALL BE MOUNTED ON MODULE DOORS. ALL INSTRUMENTS AND SWITCHES SHALL BE FLUSH MOUNTED. 05. EC FEEDERS SHALL BE DISTRIBUTED BETWEEN R,Y,B & BR TO HAVE BALANCED LOAD (DELTA). 06. THE ACB SHALL BE SUITABLE FOR 220V DC CONTROL SUPPLY. CUSTOMER SHALL PROVIDE 220V DC DUAL CONTROL SUPPLY AT LTMSB. 07. THE SPACE HEATER SUPPLY SHALL BE ARRANGED WITHIN THE LTMSB WITH A CHANGE OVER SWITCH SO THAT EITHER OF THE INCOMER SUPPLY CAN BE TAPPED. 08. ALL SPARE CONTACTS SHALL BE WIRED UP TO THE TERMINAL BLOCK. 09. DOUBLE COMPRESSION TYPE BRASS CABLE GLANDS AND HEAVY DUTY ANNEALED TINNED COPPER(ATC) LUGS ARE ENVISAGED FOR ALL MODULES AND THE SAME SHALL BE SUPPLIED BY THE LTMSB PANEL MANUFACTURER, FOR ALL EXTERNAL CABLES. 10. THE INCOMERS SHALL BE LOCATED AT EXTREME ENDS AND THE BUS COUPLER SHALL BE LOCATED AT THE CENTRE OF THE PANEL. 11. DOOR INTERLOCK SHALL BE SUCH THAT THE DOOR CAN NOT BE OPENED WITH THE BREAKER AND MCCB IN 'ON' POSITION. 12. TWO SET OF OPERATION AND MAINTANANCE MANUAL SHALL BE SUPPLIED BY PANEL MANUFACTURER ALONG WITH THE PANEL. 13. INCOMING POWER SUPPLY THROUGH BUS-DUCT. (BY CUSTOMER). 14. LED CLUSTER TYPE INDICATING LAMP SHALL BE PROVIDED FOR THE FOLLOWING: (d) MAINS ON R, Y, B. (b) BREAKER ON, (RED) , BREAKER OFF,(GREEN) , BREAKER TRIP, (AMBER). (c) BREAKER SPRING CHARGED (BLUE). (d) BREAKER IN TEST POSITION (WHITE). (e) BREAKER IN SERVICE POSITION (BLUE). (f) BREAKER TRIP CIRCUIT HEALTHY (WHITE). (g) BREAKER CONTACT MULTIPLICATION RELAY. 15. EACH ACB SHALL BE PROVIDED WITH THE FOLLOWING PROTECTIVE RELAYS(NUMERICAL TYPE): (a) ANTI-PUMPING RELAY (94) (b) TRIP CIRCUIT SUPERVISION RELAY (95) (SELF RESET) (c) TRIP ANNUNCIATION RELAY (30A,B) (SELF RESET) (d) LOCK-OUT RELAY HAND RESET(86) WITH BLUE LAMP (e) BREAKER CONTACT MULTIPLICATION REALY.(IF BREAKER CONTACTS ARE REQUIRED TO BE MULTITRIPPED) (f) MASTER TRIP RELAY. IF ANY OF THE ABOVE RELAY FUNCTIONS CANNOT BE PROVIDED IN THE SINGLE NUMERICAL RELAY, THEN THE SAME SHALL BE PROVIDED AS A SEPARATE NUMERICAL TYPE FOR THOSE FUNCTIONS WITH APPLICABLE CTs OR PTs IF REQUIRED. 16. TWO NUMBERS INTERPOSING RELAYS FOR EACH BREAKER (ONE FOR CLOSING, ONE FOR TRIPPING THE BREAKER) SHALL BE SUPPLIED AND WIRED BY THE LTMSB PANEL MANUFACTURER. 17. AUTO CHANGE OVER SCHEME SHALL BE PROVIDED AS FOLLOWS: (a) NORMALLY BUSCOUPLER WILL BE UNDER OPEN CONDITION. (b) AUTO CHANGEOVER SHALL BE EFFECTED WHEN THERE IS PROLONGED UNDERVOLTAGE ON ANY ONE OF THE BUS SECTIONS, THE RESPECTIVE INCOMING BREAKER SHALL TRIP AND THE BUS COUPLER SHALL CLOSE, PROVIDED VOLTAGE IS AVAILABLE ON THE OTHER BUS SECTION. (c) TOTAL CHANGEOVER TIME SHALL NOT EXCEED 1.5 SECONDS. (d) THIS AUTO CHANGEOVER SHALL BE BLOCKED IF THE INCOMING BREAKER HAD TRIPPED EITHER ON A BUS FAULT OR MANUALLY. (e) CHANGEOVER BACK TO NORMAL SOURCE SHALL BE EFFECTED MANUALLY. (f) MANUAL LIVE CHANGEOVER FACILITY SHALL BE PROVIDED. (g) ALL COMPONENTS REQUIRED FOR MEETING THE ABOVE FUNCTIONAL REQUIREMENTS STATED ABOVE SHALL BE PROVIDED BY THE LTMSB MANUFACTURER. (h) CHECK SYNCHRONISATION RELAY SHALL BE PROVIDED FOR AUTO CHANGE OVER OF BREAKERS. (i) WHEN PLANNED OUTAGE OF ONE OF THE NORMAL INCOMING SUPPLY IS REQUIRED, THE RESPECTIVE INCOMER SHALL BE TRIPPED AUTOMATICALLY AFTER THE BUS COUPLER IS CLOSED MANUALLY (FOR THIS PURPOSE A SELECTION SHALL BE PROVIDED IN THE LT MAIN SWITCH BOARD FOR SELECTING THE INCOMER TO BE TRIPPED) THUS DEPENDING UPON THE SELECTION MADE, INCOMER TO BUS SECTION-A OR TO BUS SECTION-B WILL BE TRIPPED ONCE THE BUS COUPLER IS CLOSED MANUALLY, THUS MAINTAINING CONTINUITY OF SUPPLY. (NECESSARY AUTO/MANUAL SELECTOR SWITCH AND TIMERS SHALL BE PROVIDED IN THE LT MAIN SWITCH BOARD). (j) TIMER WITH A TIMER DELAY ON PICK UP OF 0.5 – 5 SEC FOR ANNUNCIATION OF RUNNING BREAKER FAILING TO TRIP, WITH A PRESET TIME (IF THE TWO SOURCES REMAIN PARALLELED FOR MORE THAN A PRESET TIME) SHALL BE PROVIDED. ALSO THIS TIMER SHALL EFFECT TRIP OF THE BREAKER THAT WAS BROUGHT IN IF THE FIRST BREAKER FAILS TO TRIP) (k) WHEN THE NORMAL SUPPLY IS TO BE BROUGHT BACK INTO OPERATION, THE INCOMER BREAKER SHALL BE CLOSED WHEREUPON THE BUS COUPLER SHALL TRIP AUTOMATICALLY.					
B		18. THE FOLLOWING SWITCHES SHALL BE PROVIDED IN EACH BREAKER CIRCUIT. (i) BREAKER CONTROL SWITCH (1NO) (ii) SWITCH GEAR/NORMAL SELECTOR SWITCH(LOCAL/REMOTE)(1NO). 19. DEGREE OF PROTECTION: (i) FOR COMPARTMENTS AND BUSBAR CHAMBERS UP TO 1600A : IP 54 AS PER IS 13947. (ii) FOR COMPARTMENTS AND BUSBAR CHAMBERS ABOVE 1600A : IP 42 AS PER IS 13947. 20. THE LTMSB SHALL BE EXTENDABLE AT BOTH ENDS WITH OUTGOING FEEDERS. 21. NECESSARY AUXILIARY RELAYS AND AUXILIARY CONTACTORS SHALL BE PROVIDED IN THE INCOMER/BUS COUPLER/BUS VT MODULES. 22. CABLE ENTRY SHALL BE FROM BOTTOM. 23. PANEL COLOUR WILL BE INTIMATED DURING DRAWING APPROVAL STAGE. 24. OPERATING HEIGHT (HANDLE/PUSH BUTTON POSITION) SHALL BE RESTERICTED BETWEEN 100MM AND 200MM FROM FLOOR LEVEL. 25. THE SCHEME SHOWN IN THESE DRAWINGS ARE FOR BOILER NO.1-ESP-A, FOR ESP-B,C&D THE REQUIREMENTS ARE IDENTICAL. 26. ALL RELAYS SHALL BE OF FLUSH MOUNTED, DRAW-OUT, SELF RESET TYPE AND SHALL BE PROVIDED WITH FLAG INDICATION (HOWEVER LOCK-OUT RELAY SHALL BE OF HAND RESET TYPE). 27. PANEL CONTROL WIRING SHALL BE 2.5sq.MM PVC 1100V GRADE COPPER FLEXIBLE CABLE. 28. TWO NUMBERS CURRENT TRANSDUCER(CTD) AND VOLTAGE TRANSDUCER(VTD) EACH WITH TWO NUMBERS 4-20mA OUTPUT SHALL BE PROVIDED BY THE PANEL MANUFACTURER FOR USE IN DDCMS AT UCB. 29. SHEET STEEL USED FOR CONSTRUCTION SHALL BE AS FOLLOWS: STRUCTURAL LOAD BEARING MEMBERS : MIN 2 MM THICK CRGA. ALL NON LOAD BEARING MEMBERS : MIN 1.6 MM THICK CRGA. GLAND PLATE FOR MULTI CORE OUTGOING : MIN 3 MM THICK CRGA. GLAND PLATE FOR SINGLE CORE INCOMING : MIN 4 MM THICK NON-MAGNETIC/ NON INDUCTIVE TYPE.					
C		30. INDICATION LAMPS SHALL BE OF CLUSTERED LED TYPE. 31. THE CIRCUIT IS DRAWN FOR THE FOLLOWING CONDITIONS: i. POWER AND CONTROL SUPPLY OFF. ii. ALL CONTACTORS IN DE-ENERGISED CONDITION. 32. EQUIPMENTS SHOWN IN DOTTED LINES IN DETAILED SCHEMES ARE EXTERNAL TO THE PANEL. 33. CT(METERING)ACCURACY & CT(PROTECTION)ACCURACY SHALL BE AS PER TENDER SPECIFICATION ▲ 34. VT SHALL HAVE AN ACCURACY CLASS AS PER TENDER SPECIFICATION AND 3P. ▲ 35. ALL VACB's ARE CONTROLLED FROM REMOTE DDCMS DURING NORMAL OPERATION. 36. THE LTMSB SHALL BE EXTENDABLE AT BOTH ENDS WITH OUTGOING FEEDERS. 37. ALL INSTRUMENTS, METERS SHALL HAVE ACCURACY CLASS OF +/- 2 FULL SCALE. 38. INDICATING METER SIZE SHALL BE 96 x 96 SIZE WITH 90 DEGREE LINEAR SCALE. 39. THREE NUMBERS PROTECTION CT'S SHALL BE PROVIDED FOR REF PROTECTION FOR EACH BREAKER SHALL BE PROVIDED FOR TRIPPING UP-STREAM BREAKER. 40. THE INCOMER, BUS COUPLER BREAKERS FOR THE LTMSB SHALL BE THREE POLE, SPRING CHARGED, HORIZONTAL DRAW OUT TYPE. ALL BREAKERS SHALL BE COMPATIBLE FOR 220V DC SYSTEM. 41. CABLE ALLEY OF MINIMUM 250 MM SHALL BE PROVIDED. 42. ONE NO SYNCHRO CHECK RELAY SHALL BE PROVIDED FOR ACHIEVING MOMENTARY PARALLLELING BETWEEN TWO SOURCES. 43. ALL BREAKERS SHALL BE THREE POLE ELECTRICALLY OPERATED DRAW-OUT TYPE. 44. NECESSARY RELAYS & TIMERS SHALL BE PROVIDED.FOR ALL BREAKERS. 45. THE BUS-COUPLER FEEDER SHALL BE PROVIDED WITH A SINGLE NUMERICAL RELAY COVERING FUNCTIONS OF DEFINITE TIME DELAY, OVER CURRENT RELAY AND HAND RESET LOCK-OUT RELAY WITH BLUE LAMP. 46. THE INCOMER AND BUS-COUPLER BREAKERS SHALL BE ELECTRICALLY OPERATED WITH NUMERICAL RELAYS AND WITH TNC SWITCH.▲ 47. THE BREAKER CONTROL SCHEME SHALL BE AS PER CUSTOMER STANDARD. FIXING ARRANGEMENT, SCHEME DRAWINGS & BOM FOR APPROVAL. 48. THE LTMSB MANUFACTURER SHALL FURNISH THE GA, BASE FRAME 49. SEPARATE SPACE HEATER TRANSFORMER WITH STANDBY SHALL BE PROVIDED. 50. FAULT LEVEL 50KA FOR 1SEC SHALL BE DESIGNED FOR ALL BUSES (HORIZONTAL & VERTICAL) R,Y,B & N.					
D		51. NUMERICAL RELAY COVERING THE FUNCTIONS OF 50,50N,51,51N,86 & OTHERS IN NOTE NO. 15 SHOULD BE PROVIDED FOR EACH I/C & B/C. ALL NUMERICAL RELAYS SHALL HAVE COMMUNICATION ON TWO PORTS, LOCAL FRONT PORT TO COMMUNICATE LAPTOP AND A SECOND PORT ON IEC 61850 PORT TO COMMUNICATE THROUGH LAN & ETHERNET SWITCHES. AND THE SAME WILL BE CONFIRMED BY PEM DURING VENDOR DRAWING APPROVAL. 52. THE COMPONENTS RATING SHOWN ARE MINIMUM. HOWEVER THE RATING OF THE COMPONENTS SHALL BE SUITABLY UP-RATED IN ORDER TO MEET TYPE 2 COORDINATION AS PER IS 13947. 53. MINIMUM 2'N0'+2'N0' SPARE CONTACTS SHALL BE WIRED UP TO TB FOR OWNER'S USE. 54. DRAWOUT MODULES SHALL HAVE SERVICE/TEST/ISOLATED POSITIONS. 55. THE FOLLOWING CONDITIONS SHOULD BE PROVIDED WITH REMOTE ALARM AT CENTRAL CONTROL ROOM. (a)BREAKER AUTO TRIPPED. (b)220V DC SUPPLY FAILED. (c)LOCKOUT RELAY OPERATED. 56. THE LT BUS DUCT ENTRY WILL BE INFORMED DURING DRAWING APPROVAL STAGE.					
E		CUSTOMER: ANDHRA PRADESH POWER DEVELOPMENT CO. LTD ADDRESS: PRADESH, INDIA 1x800 MW STAGE-II UNIT#3, KRISHNAPATNAM DEVELOPMENT CONSULTANTS PVT. LTD. CONSULTING ENGINEERS KOLKATA MUMBAI CHENNAI NEW DELHI BHARAT HEAVY ELECTRICALS LTD UNIT : BOILER AUXILIARIES PLANT RANIPET-TAMILNADU 632 406 TITLE NOTES & LEGENDS FOR LTMSB SLD DRAWING NO. 2-00-114-30205 SHEET 1 OF 1 REV. 02					
F		ALL DIMENSIONS ARE IN MILLIMETRES TPN TRIPLE POLE & NEUTRAL DP DOUBLE POLE KWH MULTIFUNCTION KILOWATT HOUR METER WITH TEST TERMINAL BLOCK PF POWER FUSE CT CURRENT TRANSFORMER EC ELECTRONIC CONTROLLER >> DRAWOUT TERMINAL TP TRIPLE POLE IDMT SPARE LTMSB LT MAIN SWITCH BOARD FOR ESP SETTING RANGE FOR CURRENT : 50% TO 200% SETTING RANGE FOR TIME : 0.1 TO 1.3 SEC. ACP AUXILIARY CONTROL PANEL EC ELECTRONIC CONTROL EOH ELECTRICALLY OPERATED HOIST 94 ANTI-PUMPING RELAY 98 FUSE FAILURE RELAY 27 UNDER VOLTAGE RELAY 30A,B TRIP ANNUNCIATION RELAY 2 TIMER RELAY 95 TRIP CIRCUIT SUPERVISION RELAY. DPDT DOUBLE POLE DOUBLE THROW MCCB MOULDED CASE CIRCUIT BREAKER ALIP ASH LEVEL INDICATOR PANEL. FSU FUSE SWITCH UNIT					
B		51N INVERSE TIME EARTH FAULT RELAY 86 HAND RESET LOCK-OUT RELAY WITH BLUE LAMP 94 ANTI-PUMPING RELAY 98 FUSE FAILURE RELAY 27 UNDER VOLTAGE RELAY 30A,B TRIP ANNUNCIATION RELAY 2 TIMER RELAY 95 TRIP CIRCUIT SUPERVISION RELAY. DPDT DOUBLE POLE DOUBLE THROW MCCB MOULDED CASE CIRCUIT BREAKER ALIP ASH LEVEL INDICATOR PANEL. FSU FUSE SWITCH UNIT					
C		57. 20% SPARE TBS TO BE PROVIDED FOR EACH MODULE. 58. IN EACH CST MODULE, ONLY ONE CONTROL TRANSFORMER SHALL BE FITTED. 59. TRIP SELECTOR SWITCH FOR BREAKERS IS LOCATED IN DDCMS. 60. 20% SPARE FEEDERS OF EACH TYPE & RATING USED IN THE MCC WITH A MIN OF ONE NO. ON EACH BUS SECTION SHALL BE PROVIDED. 61. THE FOLLOWING TERMINALS SHALL BE WIRED TO DDCMS: BINARY SIGNALS: (a) BUS A UNDER VOLTAGE (b) BUS B UNDER VOLTAGE (c) BUS A VT FUSE FAILURE (d) BUS B VT FUSE FAILURE (e) BUS A VT WITHDRAWN (f) BUS B VT WITHDRAWN (g) 220V DC SUPPLY 1 FAILURE (h) 220V DC SUPPLY 2 FAILURE OTHER SIGNALS: SWGR SELECTED, SPRING CHARGED F/B, BKR IN TEST, BKR IN SERVICE, 97 HEALTHY F/B, TRIP CKT FAILURE F/B, 86 OPERATED F/B, BKR OPEN F/B, BKR CLOSE F/B, TRIP & CLOSE COMMANDS, COMMON, SWGR AVAILABLE F/B, LINE PT IN SERVICE F/B.					
D		THIS DRAWING SHALL BE READ ALONG WITH BHEL DRG.NOS : 2-00-114-30081 & 3-00-114-39913 ESP SIZE : 4XFAA-9X45M-2X108150-2					
E		ANDHRA PRADESH POWER DEVELOPMENT CO. LTD ADDRESS: PRADESH, INDIA 1x800 MW STAGE-II UNIT#3, KRISHNAPATNAM DEVELOPMENT CONSULTANTS PVT. LTD. CONSULTING ENGINEERS KOLKATA MUMBAI CHENNAI NEW DELHI BHARAT HEAVY ELECTRICALS LTD UNIT : BOILER AUXILIARIES PLANT RANIPET-TAMILNADU 632 406 TITLE NOTES & LEGENDS FOR LTMSB SLD DRAWING NO. 2-00-114-30205 SHEET 1 OF 1 REV. 02					
F		56. THE LT BUS DUCT ENTRY WILL BE INFORMED DURING DRAWING APPROVAL STAGE. (a)BREAKER AUTO TRIPPED. (b)220V DC SUPPLY FAILED. (c)LOCKOUT RELAY OPERATED. 55. THE FOLLOWING CONDITIONS SHOULD BE PROVIDED WITH REMOTE ALARM AT CENTRAL CONTROL ROOM. (a)BREAKER AUTO TRIPPED. (b)220V DC SUPPLY FAILED. (c)LOCKOUT RELAY OPERATED. 56. THE LT BUS DUCT ENTRY WILL BE INFORMED DURING DRAWING APPROVAL STAGE.					



BHARAT HEAVY ELECTRICALS
(GOVERNMENT OF INDIA UNDERTAKING)
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12-09-2017

To
CONSULTING ENGINEERS
DEVELOPMENT CONSULTANTS HOUSE
BLOCK-DG, PLOT NO.4, SECTOR-II
SALT LAKE CITY, KOLKATA-700 091

Sir:

Sub: Comments on SLD of ESP LTMSB 1 x 800 MW- reg.

Ref. No.: 13A04/HYD/0819 dated 09.09.2017

With reference to above we are furnishing our point wise reply to DCPLs comments as given below.

SL.NO	CUSTOMER COMMENTS	BHEL COMMENTS
01	INSTEAD OF FUSES, MCCB'S TO BE PROVIDED	Noted & corrected
02	3PH 3 WIRE	Noted & corrected
03	MINIMUM OPERATING HEIGHT 750MM AS PER TECHNICAL SPECIFICATION (CLNO 4.01.05 VCLV SEC VI)	We have already discussed with customer & finalized 400mm minimum operating height shall be followed. Accordingly corrected.

We hope that all the queries have been clarified.

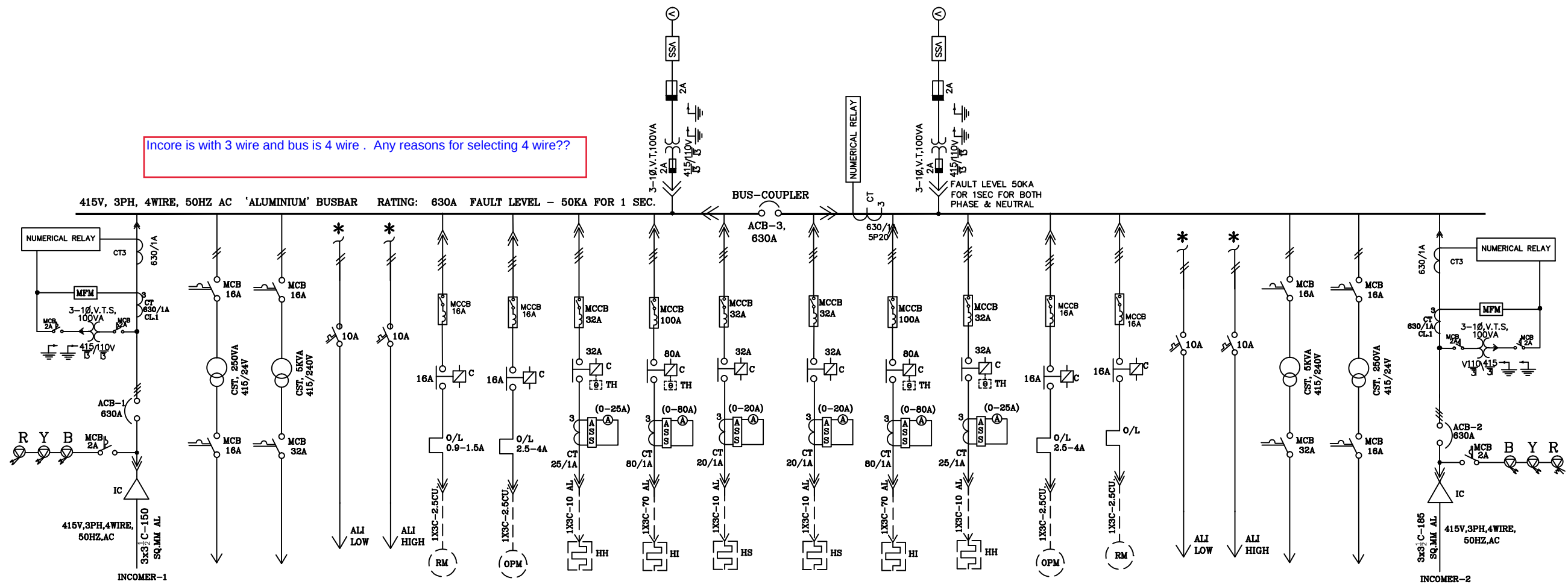
We hereby submit the **revised REV 02 SLD of ESP LTMSB** for your kind approval.

S.NO	DRAWING DESCRIPTION	DRAWING NUMBER	REV
01	LIST OF DRAWINGS FOR ACP	3-00-114-39915	00
02	SINGLE LINE DIAGRAM FOR ACP (TYPICAL)	3-00-114-39916	00
03	NOTES AND LEGENDS FOR ACP (TYPICAL)	3-00-114-39917	00
04	INCOMER CIRCUIT (TYPICAL)	3-00-114-39918	00
05	CONTROL SUPPLY TRANSFORMER AND SPACE HEATER CIRCUIT (TYPICAL)	3-00-114-39919	00
06	P&C CIRCUIT FOR HOPPER HEATER (TYPICAL)	3-00-114-39920	00
07	P&C CIRCUIT FOR RAPPING MOTOR (TYPICAL)	3-00-114-39921	00
08	P & C CIRCUIT FOR SUPPORT INSULATOR HEATER (TYPICAL)	3-00-114-39922	00
09	P&C CIRCUIT FOR OPACITY MONITOR (TYPICAL)	3-00-114-39923	00
10	P&C CIRCUIT FOR SHAFT INSULATOR HEATER	3-00-114-39924	00
11	ASH LEVEL INDICATOR	3-00-114-39925	00
12	TB ARRANGEMENT FOR 'ON' COMMAND, 'ON' FEEDBACK TO EC PANEL (BUS-SEC-1)(TYPICAL)	3-00-114-39926	00
13	TB ARRANGEMENT FOR 'ON' COMMAND, 'ON' FEEDBACK TO EC PANEL (BUS-SEC-2)(TYPICAL)	3-00-114-39927	00
14	MAKE OF COMPONENTS FOR ACP/LTMSB (TYPICAL)	3-00-114-39928	00

	DEVELOPMENT CONSULTANTS PVT. LIMITED.
Reviewed only for general conformance with contract drawings and specifications. Contractor to be responsible for any errors and for fulfillment of detailed requirements of contract documents	
ACTION 4	DATE 26.08.2017
DISTRIBUTED BY. KS	
1 Distributed	4 Approved except as noted. Resubmission required
2 Approved	5 Disapproved see accompanying letter
3 Approved except as noted. Forward final drawings	6 For information only
SEE COVERING LETTER	
LETTER REF NO. 0771	DATE. 26.08.2017

CUSTOMER:	ANDHRA PRADESH POWER DEVELOPMENT CO. LTD ANDHRA PRADESH, INDIA 1x800 MW STAGE-II UNIT#3, KRISHNAPATNAM				
OWNER'S CONSULTANT:	DEVELOPMENT CONSULTANTS PVT. LTD. CONSULTING ENGINEERS KOLKATA MUMBAI CHENNAI NEW DELHI				
	BHARAT HEAVY ELECTRICALS LTD UNIT : BOILER AUXILIARIES PLANT RANIPET-TAMILNADU 632 406				
COPY RIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED it must not be used directly or indirectly in any way detrimental to the interest of the company.		DEPT. CODE	NAME	SIGN	DATE
		DRN	P.S.T	-	04.04.17
		DES	P.S.T	-	04.04.17
		CHK	M.J.M	-	04.04.17
		APPD	M.J.M	-	04.04.17
TITLE TITLE SHEET FOR ACP DRAWINGS					
		DEPT.	SCALE	M.TS	DRAWING NO.
		SIGN			3-00-114-39915
				SHEET	REV. 00
				OF 1	

ALL DIMENSIONS ARE IN MILLIMETRES



NO.OF FEEDERS		1	1	-	-	19+4(SP)	1	9+2(SP)	1+1(SP)	1+1(SP)	1	1	9+2(SP)	1(SP)	19+4(SP)	-	-	1	1	
FEEDER RATING		250VA	5KVA	-	-	0.37KW	1.1KW	12KW	36KW	9KW	9KW	36KW	12KW	1.1KW	0.37KW	-	-	5KVA	250VA	

Indicate feeder rating.

Please furnish Transformer references also

ESP SIZE : 4XFAA-9X45M-2X108150-2

LEGEND

R — RED
G — GREEN
A — AMBER
Y — YELLOW
B — BLUE

NOTE

01. NUMBER OF AUXILIARY CONTROL PANEL PER BOILER IS FOUR.

CUSTOMER:	ANDHRA PRADESH POWER DEVELOPMENT CO. LTD. ANDHRA PRADESH, INDIA 1x800 MW STAGE-II UNIT#3, KRISHNAPATNAM				
OWNER'S CONSULTANT:	DEVELOPMENT CONSULTANTS PVT. LTD. CONSULTING ENGINEERS KOLKATA MUMBAI CHENNAI NEW DELHI				
	BHARAT HEAVY ELECTRICALS LTD UNIT : BOILER AUXILIARIES PLANT RANIPET-TAMILNADU 632 406				
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DEPT CODE		NAME P.S.T		SIGN --- sd ---	DATE 04.04.17
M		DESK CHD M.J.N		SIGN --- sd ---	04.04.17
		APPD M.J.N		SIGN --- sd ---	04.04.17
TITLE SINGLE LINE DIAGRAM FOR APC (TYPICAL)					
DEPT. SCALE N.T.S			DRAWING NO.		
SIGN			3-00-114-39916		
			SHEET 1 OF 1 REV. 00		

NOTE:

01. CONSTRUCTION : SINGLE FRONT FOR ACB AND DOUBLE FRONT FOR OTHER OUTGOING FEEDERS. DRAW-OUT FOR INCOMER AND OUTGOING FEEDERS, EXCEPT CST, ALI AND MARSHALLING COMPARTMENTS.
02. NO.OF AUXILIARY CONTROL PANEL : FOUR NUMBER PER BOILER.
03. ACP SHALL BE SUITABLE FOR 3PH, 4WIRE, 415V, 50HZ SUPPLY.
04. ALL POWER, CONTROL SWITCHES AND RESET PUSH BUTTONS SHALL BE MOUNTED ON MODULE DOORS. ALL INSTRUMENTS AND SWITCHES SHALL BE FLUSH MOUNTED.
05. DOUBLE COMPRESSION TYPE BRASS CABLE GLANDS AND HEAVY DUTY ANNEALED TINNED COPPER(ATC) LUGS ARE ENVISAGED FOR ALL MODULES AND THE SAME SHALL BE SUPPLIED BY THE ACP PANEL MANUFACTURER.
06. DOOR INTERLOCK SHALL BE SUCH THAT THE DOOR CAN NOT BE OPENED WITH THE BREAKER AND FSU IN 'ON' POSITION.
07. TWO SET OF OPERATION AND MAINTANANCE MANUAL WILL BE SUPPLIED BY PANEL MANUFACTURER ALONG WITH THE PANEL.
08. PANEL CONTROL WIRING 1100V GRADE PVC INSULATED COPPER. 2.5SQMM FOR CT/PT AND 2.5SQMM FOR OTHER CONTROL WIRING.
09. ALL INSTRUMENTS AND SWITCHES SHALL BE FLUSH MOUNTED.
10. OVERLOAD RELAYS SHALL BE WITH BUILT-IN SINGLE PHASING PROTECTION. RESET PUSH BUTTON SHALL BE PROVIDED ON DOOR.
11. INDICATION LAMPS SHALL BE OF CLUSTERED LED TYPE.
12. THE CIRCUIT IS DRAWN FOR THE FOLLOWING CONDITIONS:
i). POWER AND CONTROL SUPPLY OFF.
ii). ALL CONTACTORS IN DE-ENERGISED CONDITION.
13. EQUIPMENTS SHOWN IN DOTTED LINES IN DETAILED SCHEMES ARE EXTERNAL TO THE PANEL.
14. OPERATING HEIGHT (HANDLE/PUSH BUTTON POSITION) SHALL BE RESTRICTED BETWEEN 250MM AND 1900MM FROM THE FLOOR LEVEL.
15. CABLE ENTRY SHALL BE FROM THE BOTTOM.
16. CT(METERING) ACCURACY SHALL BE CLASS-1.
17. PANEL COLOUR SHALL BE AS PER IS 631.
18. DEGREE OF PROTECTION : IP-54 AS PER IS-13947.
19. ALL SPARE CONTACTS SHALL BE WIRED UP TO TB.
20. THE ACP SHALL BE EXTENDABLE AT BOTH ENDS WITH OUTGOING FEEDERS.
21. ALL INSTRUMENTS SHALL HAVE ACCURACY CLASS OF 1.
22. THE CONTROL BUS SHALL BE MADE OF COPPER.
23. THE ACP MANUFACTURER SHALL PROVIDE 4 NOS. MARSHALLING COMPARTMENTS IN EACH ACP (TWO NUMBERS ON EACH BUS-SECTION), AT DIFFERENT VERTICAL SECTIONS, FOR HOUSING RAPPING MOTOR& HOPPER THERMOSTAT WIRELESS MASTER MODULE. 20% SPARE TB SHALL BE PROVIDED.
24. MINIMUM MODULE HEIGHT SHALL BE 300mm.
25. THE THICKNESS OF PANEL LOAD BEARING - 2MM (MIN) (CRCA)
NON LOAD BEARING - 1.6MM (MIN) (CRCA)
GLAND PLATE - 3MM (CRCA)
26. INDICATING METER SHALL BE OF SIZE 96X96 SQ. MM.
27. TWO NUMBERS INTERPOSING RELAYS FOR EACH BREAKERS (ONE FOR CLOSING, ONE FOR TRIPPING THE BREAKERS) SHALL BE SUPPLIED AND WIRED BY THE ACP PANEL MANUFACTURER.
28. EARTHING BUS-BAR SHALL BE OF COPPER OF SIZE 50X6MM SHALL BE PROVIDED.
29. ALL PROTECTION RELAYS (O/C RELAY, E/F RELAY, U/V RELAY, TRIP CIRCUIT SUPER VISION RELAY, LOCK OUT RELAY& MASTER TRIP RELAY) SHALL BE OF NEUMERICAL TYPE WITH IEC-61850 PROTOCOL (SAME WILL BE CONFIRMED DURING VENDOR DRAWING APPROVAL STAGE).

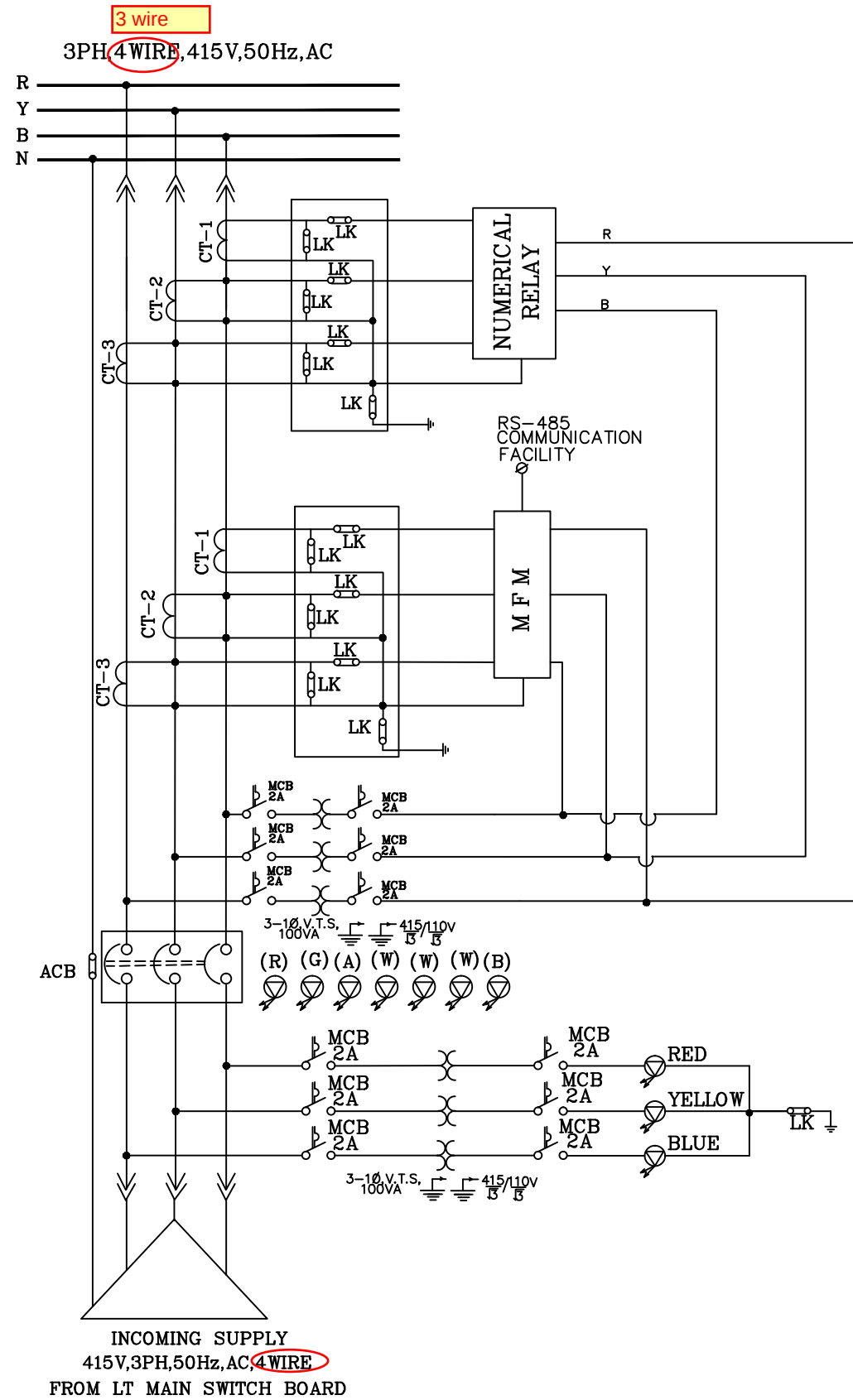
30. ALL WIRELESS CONTROLLER SYSTEM SHALL BE FITTED IN THE ACP MARSHALLING COMPARTMENT /SUITABLE LOCAL FRP JUNCTION BOXES AND THAT SHALL BE SUPPLIED BY BHEL/RANIPET AS A FREE ISSUE ITEMS.THE FRP JUNCTION BOX SHALL BE PAINTED WITH SHADE 631 OF IS-5 AND SHALL BE SUITABLE FOR OUTDOOR & IP-55 DEGREE OF PROTECTION.THE WIRELESS MASTER CONTROLLER SHALL BE SUITABLY FITTED IN THE MARSHALLING MODULE AND SHALL BE WIRED SUITABLY.

LEGEND:-

A	AMMETER		
V	VOLTMETER		
ASS	AMMETER SELECTOR SWITCH	O/L	THERMAL OVERLOAD RELAY
RM	RAPPING MOTOR		FIXED TERMINAL
IS	ISOLATING SWITCH	LK	LINK
CT	CURRENT TRANSFORMER	---	EXTERNAL TO THE PANEL
HH	HOPPER HEATER	>>	DRAWOUT TERMINAL
HI	SUPPORT INSULATOR HEATER	⊗	INDICATION LAMP(LED TYPE)
HS	SHAFT INSULATOR HEATER		
C	CONTACTOR		
TH	THERMOSTAT		
TPDT	TRIPPLE POLE DOUBLE THROW SWITCH		
GDRM	GAS DISTRIBUTION RAPPING MOTOR		
CERM	COLLECTING ELECTRODE RAPPING MOTOR		
EERM	EMITTING ELECTRODE RAPPING MOTOR		
SSPB	START STOP PUSH BUTTON STATION		
ACB	AIR CIRCUIT BREAKER		
MCB	MINIATURE CIRCUIT BREKER		
MCCB	MOULDED CASE CIRCUIT BREAKER		
MPCB	MOTOR PROTECTION CIRCUIT BREAKER		
MFM	MULTIFUNCTION METER.		
30(A,B)	TRIP ANNUNCIATION RELAY		
JB	JUNCTION BOX		
SS	SELECTOR SWITCH		
CST	CONTROL SUPPLY TRANSFORMER		
ACP	AUXILIARY CONTROL PANEL		
EC	ELECTRONIC CONTROLLER		
SW	CONTROL SWITCH		
PB	PUSH BUTTON		

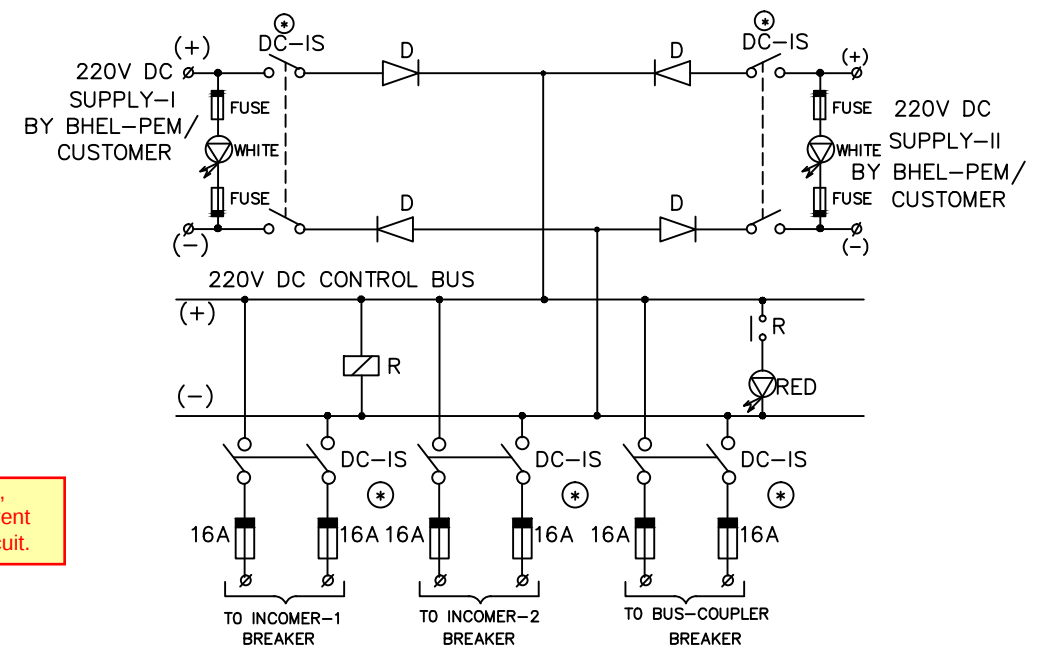
1. Panel color:4Exterior : Opaline green and Interior : Brilliant white
2. BHEL to verify Point No: 29. Lock out relay and Trip ckt
Supervision will be with IEC 61850 protocol???
3. BHEL shall furnish the Numerical relay details to BOP vendore as Numerical relay networking for ESP area are in BOP scope.

CUSTOMER:	ANDHRA PRADESH POWER DEVELOPMENT CO. LTD ANDHRA PRADESH, INDIA 1x800 MW STAGE-II UNIT#3, KRISHNAPATNAM				
OWNER'S CONSULTANT:	DEVELOPMENT CONSULTANTS PVT. LTD. CONSULTING ENGINEERS KOLKATA MUMBAI CHENNAI NEW DELHI				
	BHARAT HEAVY ELECTRICALS LTD UNIT : BOILER AUXILIARIES PLANT RANIPET-TAMILNADU 632 406				
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TITLE NOTES AND LEGENDS FOR ACP (TYPICAL)					
		DEPT.	SCALE	N.T.S	
		SIGN			
		DRAWING NO.		3-00-114-39917	
		SHEET 1 OF 1		REV. 00	



Incomer will be 3 wire as per earlier confirmation

BHEL shall indicate Ammeter, ammeter selector switch, current transducer in the incomer circuit.

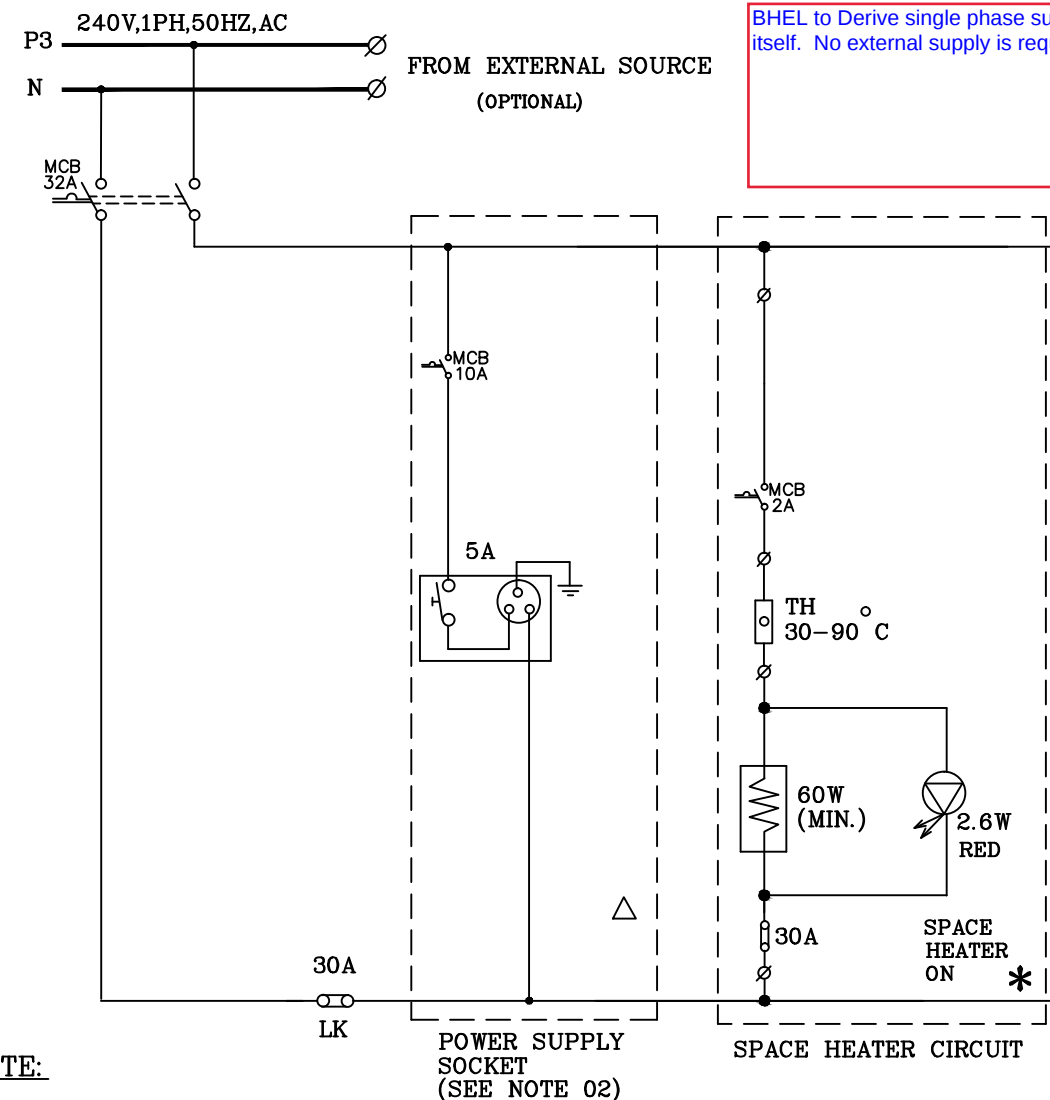
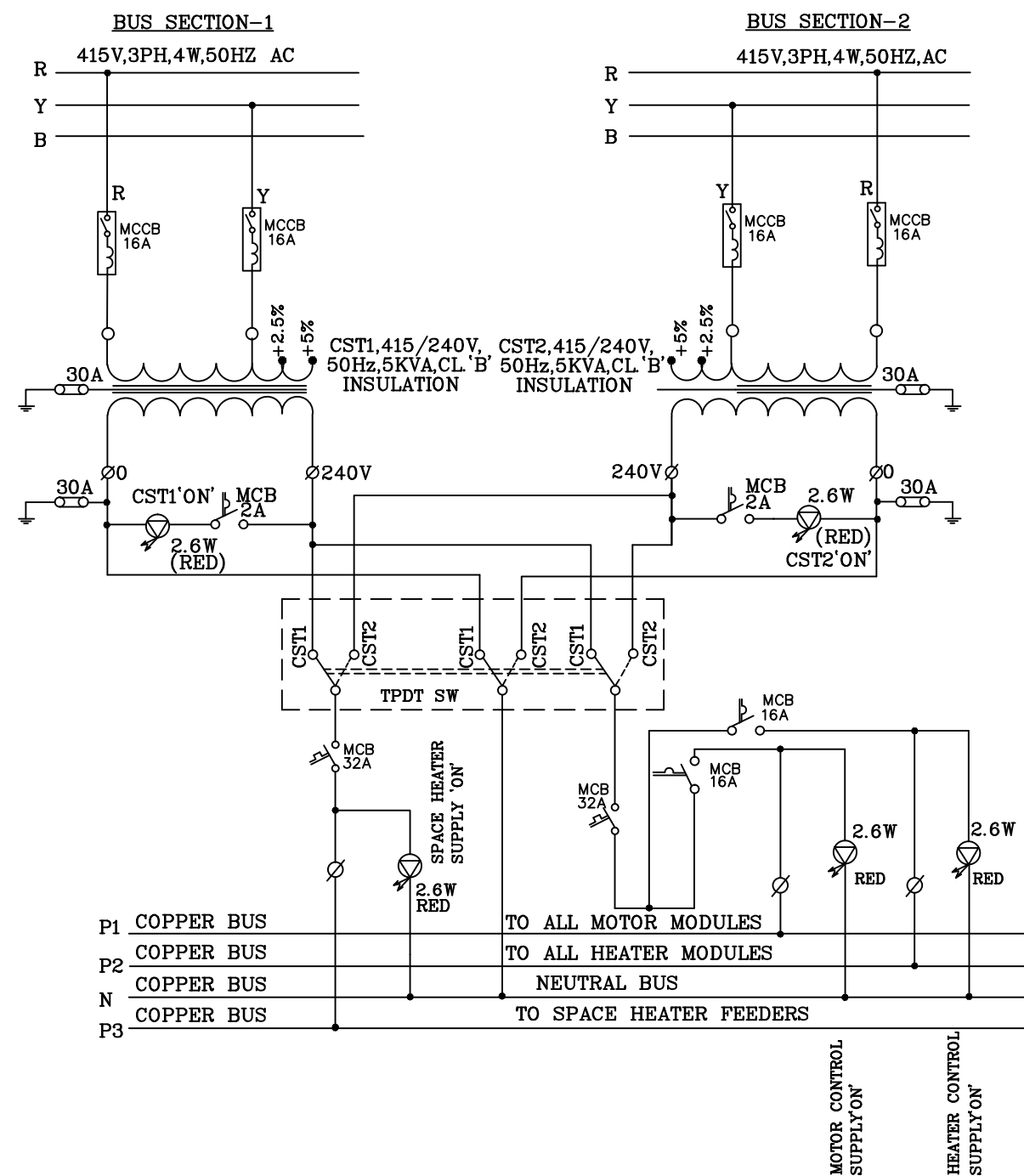


AIR CIRCUIT BREAKER
CONTROL SUPPLY CIRCUIT
(TYPICAL)

NOTE

- THE ACB SHALL BE THREE POLE ELECTRICALLY OPERATED, DRAW-OUT TYPE WITH ON, OFF & AUTO TRIP LAMP INDICATION, DOOR INTERLOCK, LOCKING IN ISOLATED POSITION.
- INDICATING LAMP SHALL BE PROVIDED FOR THE FOLLOWING.
 - MAINS ON R, Y, B
 - BREAKER ON, OFF, AUTO TRIP
 - BREAKER SPRING CHARGED
 - BREAKER IN TEST POSITION
 - BREAKER IN SERVICE POSITION
 - BREAKER TRIP CIRCUIT HEALTHY
- ALL ACB SHALL BE PROVIDED WITH THE FOLLOWING PROTECTIVE RELAYS IN COMBINED TYPE NUMERICAL RELAY.
 - ANTI-PUMPING RELAY (94)
 - TRIP CIRCUIT SUPERVISION RELAY (74) SELF RESET TYPE.
 - TRIP ANNUNCIATION RELAY (30 A.B) SELF RESET TYPE.
 - LOCK-OUT RELAY (86) - HAND RESET TYPE
- THE ACB SHALL BE SUITABLE FOR 220V DC CONTROL SUPPLY.
- ACB's WILL BE OPERATED LOCALLY FROM THE AUXILIARY CONTROL PANEL AND ALSO FROM DDCMIS.
- TWO NOS INTERPOSING RELAY FOR EACH BREAKER (ONE FOR CLOSING, ONE FOR TRIPPING THE BREAKER SHALL BE SUPPLIED AND WIRED BY THE ACP MANUFACTURER).
- AUTO CHANGE OVER SCHEME SHALL BE PROVIDED FOR INCOMERS AND BUS COUPLER.
- BREAKER CONTROL SWITCH SHALL BE PROVIDED FOR ACB.
- 2NOS 220V DC CONTROL SUPPLY SHALL BE PROVIDED BY BHEL - PEM/CUSTOMER.
- 51-CDG-31, 2 O/C + 1 E/F, O/C-50% TO 200%, E/F-10% TO 40% 1.3 SEC. } NUMERICAL RELAY
- CT TERMINALS SHALL BE DISCONNECTING LINK TYPE RELAY
- THE INCOMERS AND BUS COUPLERS SHALL BE INTERLOCKED ELECTRICALLY, SUCH THAT ONLY TWO BREAKERS WILL BE IN "CLOSE" POSITION AT ANY POINT OF TIME.
- ALL PROTECTION RELAYS (O/C RELAY, E/F RELAY, U/V RELAY, TRIP CIRCUIT SUPERVISION RELAY, LOCK OUT RELAY & MASTER TRIP RELAY) SHALL BE OF NUMERICAL TYPE WITH IEC-61850 PROTOCOL (SAME WILL BE CONFIRMED BY BHEL/ PEM DURING VENDOR DRAWING APPROVAL).

CUSTOMER:	ANDHRA PRADESH POWER DEVELOPMENT CO. LTD ANDHRA PRADESH, INDIA 1x800 MW STAGE-II UNIT#3, KRISHNAPATNAM				
OWNER'S CONSULTANT:	DEVELOPMENT CONSULTANTS PVT. LTD. CONSULTING ENGINEERS KOLKATA MUMBAI CHENNAI NEW DELHI				
	BHARAT HEAVY ELECTRICALS LTD UNIT : BOILER AUXILIARIES PLANT RANIPET-TAMILNADU 632 406				
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DEPT CODE		DRN	NAME P.S.T	SIGN	DATE
M		BESN	P.S.T	-- sdr --	04.04.17
		CHK	N.J.H	-- sdr --	04.04.17
		APPD	N.J.H	-- sdr --	04.04.17
TITLE INCOMER CIRCUIT (TYPICAL)					
		DEPT.	SCALE	N.T.S	DRAWING NO.
		SIGN			3-00-114-39918
				SHEET	1 OF 1
				REV.	00

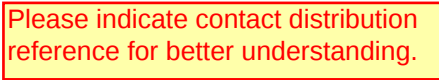


BHEL to Derive single phase supply from the Board itself. No external supply is required

NOTE:

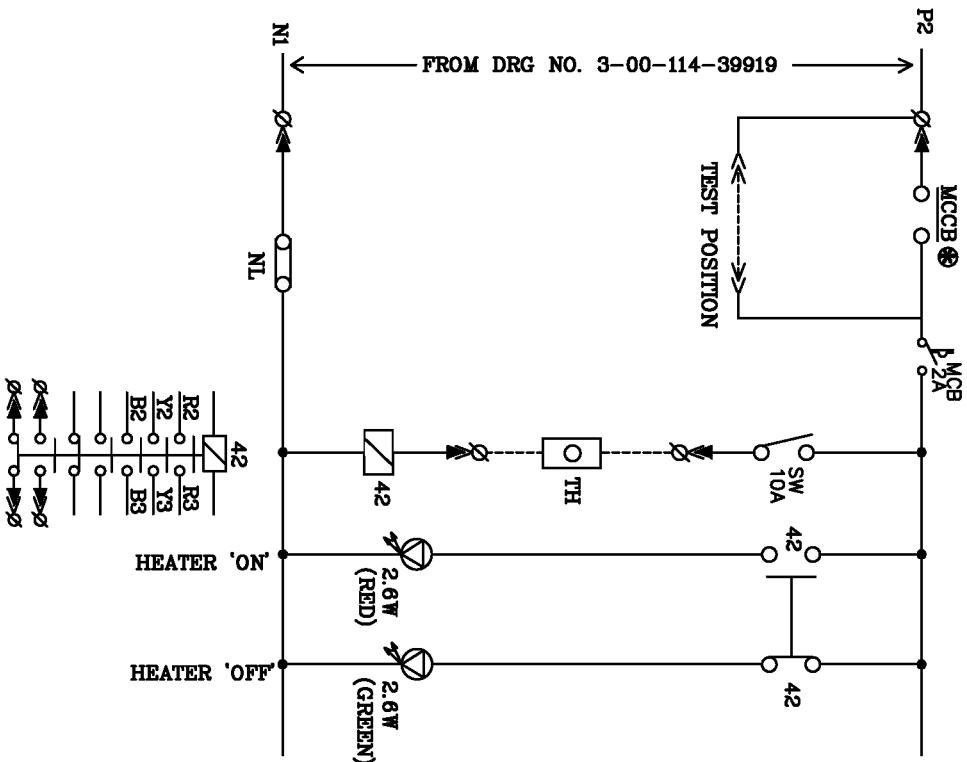
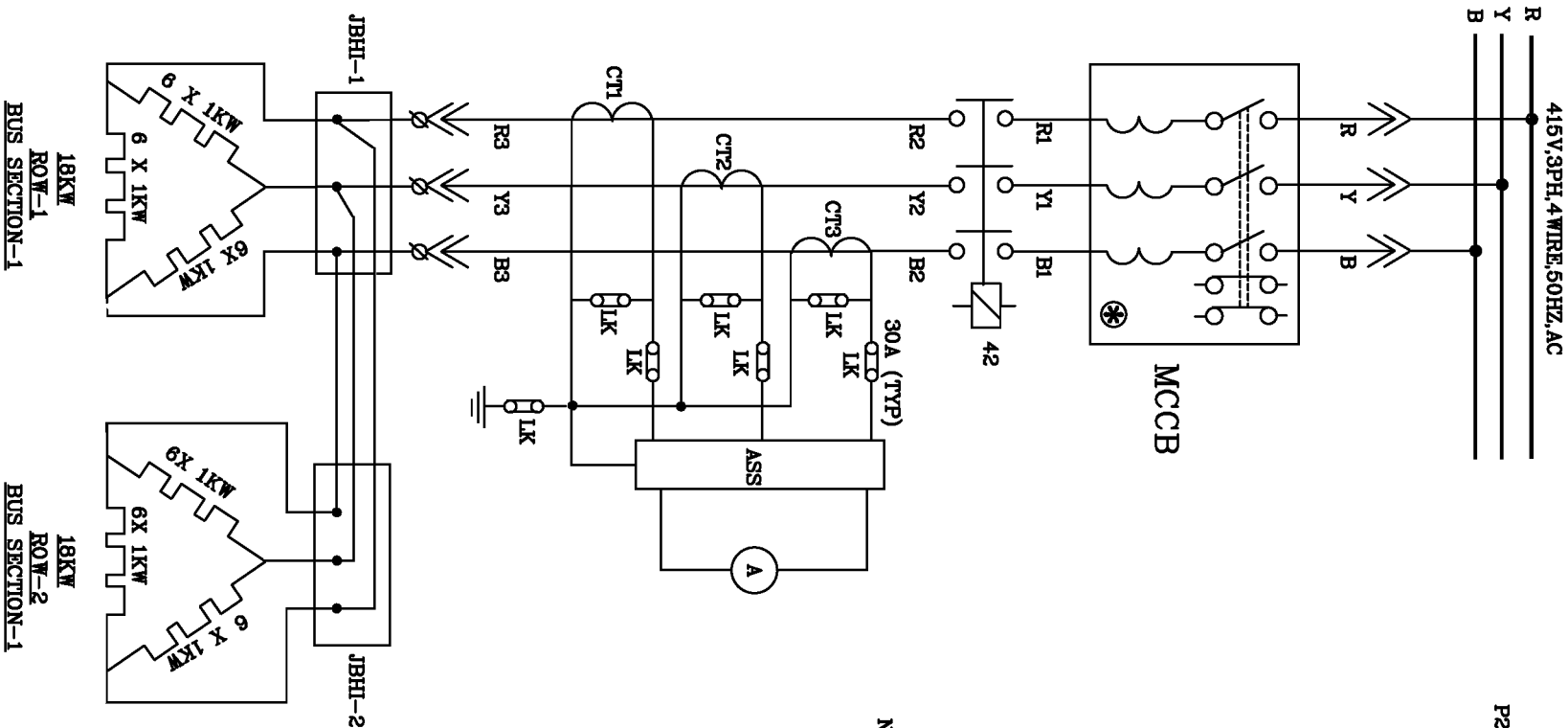
- 01.* 'THE SPACE HEATER CIRCUIT SHOWN IS FOR ONE CABLE ALLEY. NUMBER OF SUCH CIRCUIT DEPENDS UPON THE NUMBER OF CABLE ALLEY.
- 02.Δ 'ONE NO INDUSTRIAL TYPE POWER SUPPLY SOCKET PER PANEL SHALL BE LOCATED IN THE MIDDLE PANEL CABLE ALLEY.

CUSTOMER:	ANDHRA PRADESH POWER DEVELOPMENT CO. LTD ANDHRA PRADESH, INDIA 1x800 MW STAGE-II UNIT#3, KRISHNAPATNAM
OWNER'S CONSULTANT:	DEVELOPMENT CONSULTANTS PVT. LTD. CONSULTING ENGINEERS KOLKATA MUMBAI CHENNAI NEW DELHI
	BHARAT HEAVY ELECTRICALS LTD UNIT : BOILER AUXILIARIES PLANT RANIPET-TAMILNADU 632 406
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TITLE	CONTROL SUPPLY TRANSFORMER AND SPACE HEATER CIRCUIT (TYPICAL)
DEPT. CODE	SCALE N.T.S.
DESIGN	DRAWING NO.
CHECK	3-00-114-39919
APPD	SHEET 1 OF 1 REV. 00



- M/s BHEL to confirm that, where these items will be fixed (Show in GA) and also BHEL to confirm the Auxiliary supply required for these items

CUSTOMER:		ANDHRA PRADESH POWER DEVELOPMENT CO. LTD ANDHRA PRADESH, INDIA 1x800 MW STAGE-II UNIT#3, KRISHNAPATNAM					
OWNER'S CONSULTANT:		DEVELOPMENT CONSULTANTS PVT. LTD. CONSULTING ENGINEERS KOLKATA MUMBAI CHENNAI NEW DELHI					
		BHARAT HEAVY ELECTRICALS LTD UNIT : BOILER AUXILIARIES PLANT RANIPET-TAMILNADU 632 406					
							
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		DEPT CODE M		DRN	NAME	SIGN	DATE
				P.S.T	-- sd	04.04.17	
				DESN	P.S.T	-- sd	04.04.17
				CHD	M.J.M	-- sd	04.04.17
				APPD	M.J.M	-- sd	04.04.17
TITLE							
P&C CIRCUIT FOR RAPPING MOTOR (TYPICAL)							
		DEPT.		SCALE		M.T.S	
		SIGN				DRAWING NO.	
						3-00-114-39921	
				SHEET 1 OF 1		REV. 00	



LEGEND

<< >> CLOSE IN SERVICE POSITION ONLY

➡ ➡ CLOSE IN BOTH SERVICE AND TEST POSITION

ITEM	CABLE SIZE	QTY/ACP
SUPPORT INSULATOR HEATER THERMOSTAT	1X3C-2.5	2

CUSTOMER:	ANDHRA PRADESH POWER DEVELOPMENT CO. LTD
ANDHRA PRADESH, INDIA	
1800 MW STAGE-II UNIT#3, KRISHNAPATNAM	
CONSULTANT:	DEVELOPMENT CONSULTANTS PVT. LTD.
CONSULTING ENGINEERS	
KOKATA MUMBAI CHENNAI NEW DELHI	
CLIENT:	BHARAT HEAVY ELECTRICALS LTD
UNIT : BOILER AUXILIARIES PLANT	
RANIPET-TAMILNADU 632 406	

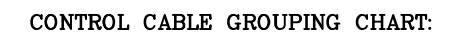
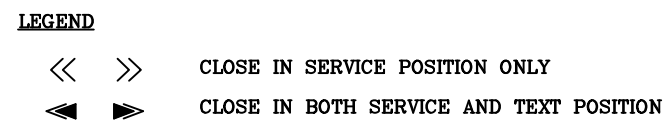
DATE	BY	CHKD	APPD	DATE	BY	CHKD	APPD	DATE	BY	CHKD	APPD

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TITLE P & C CIRCUIT FOR SUPPORT INSULATOR

HEATER (TYPICAL)

SCALE	1:1	DRAWING NO.	3-00-114-39922
SHEET	1 OF 1	REV.	00

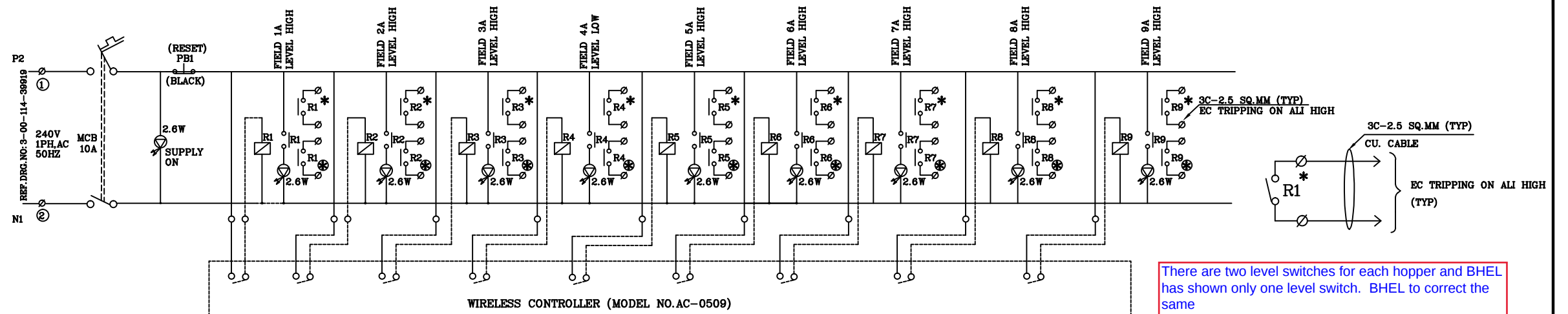


ITEM	CABLE SIZE	QTY/ACP
OPACITY MONITOR CONTROL SUPPLY	2X3C-2.5	1

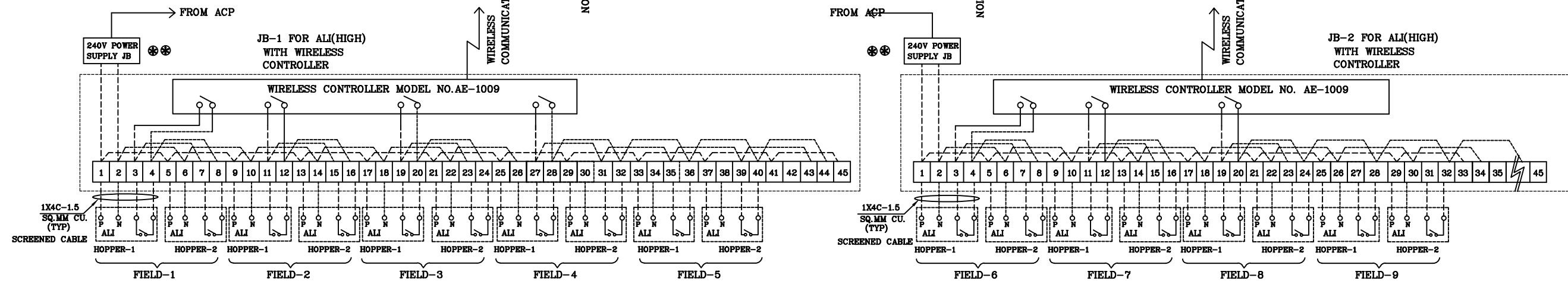
TO OPACITY MONITOR
(CONTROL SUPPLY)
240 V

BHEL to confirm that, there will be 4 nos Opacity systems in ESP also apart from one in Stack. BHEL is requested to confirm the supply sources along with ratings

CUSTOMER:	ANDHRA PRADESH POWER DEVELOPMENT CO. LTD ANDHRA PRADESH, INDIA 1x800 MW STAGE-II UNIT#3, KRISHNAPATNAM			
OWNER'S CONSULTANT:	DEVELOPMENT CONSULTANTS PVT. LTD. CONSULTING ENGINEERS KOLKATA MUMBAI CHENNAI NEW DELHI			
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TITLE				
P&C CIRCUIT FOR OPACITY MONITOR (TYPICAL)				
	DEPT.	SCALE	DRAWING NO.	DATE
	SIGN		3-00-114-99923	
			SHEET 1 OF 3	REV 00



There are two level switches for each hopper and BHEL has shown only one level switch. BHEL to correct the same



NOTE :

01. THE JUNCTION BOXES WITH WIRELESS CONTROLLER SHALL BE SUPPLIED BY THE PANEL MANUFACTURER ALONG WITH THE PANEL WIRELESS CONTROLLER MODEL NO.AE 1009 OF M/S.SECO MAKE / M/S. CISCO AND SHALL BE HOUSED IN THE JB SUITABLY. WIRELESS CONTROL MODEL NO. AC-0509 SHALL BE FITTED IN ACP AND SUPPLIED.
02. THE ALI ARE SUPPLIED DIRECTLY TO SITE BY BHEL/RANIPET AND THE SAME ARE NOT IN THE PANEL MANUFACTURER'S SCOPE.
- *03. CONTACT TO TRIP EC PANEL (CABLE SIZE 3C-2.5 SQ.MM CU. CABLE).
04. TOTALLY 9 AUXILIARY CONTACTORS AND 10 LAMPS APPLICABLE FOR EACH MODULE.
05. THE NUMBER OF ALI HIGH FOR ONE ESP IS 18.
06. CONTACTS MARKED ⊗ THUS FROM R1 TO R9 ARE TO BE USED FOR ASH HANDLING PLANT.
- ⊗07. SHALL BE CONNECTED IN FIELD LOCAL POWER SUPPLY JUNCTION BOX.
08. ABOVE SCHEME SHOWN IS FOR ALI HIGH BUS SECTION-1 OF ESP SAME IS SIMILAR FOR ALI HIGH BUS SECTION-2 & ALI LOW BUS SECTION - 1 & 2 OF ESP

M/s BHEL to provide potential free contacts of both level switches for usage by BOP vendor for showing in AHP System. BHEL is requested to confirm the methodology for the TPL terminations also.

CUSTOMER:	ANDHRA PRADESH POWER DEVELOPMENT CO. LTD ANDHRA PRADESH, INDIA 1x800 MW STAGE-II UNIT#3, KRISHNAPATNAM				
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	BHARAT HEAVY ELECTRICALS LTD UNIT : BOILER AUXILIARIES PLANT RANIPET-TAMILNADU 632 406				
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		CODE	DRN	P.S.T	04.04.17
		M	DESIGN	P.S.T	04.04.17
			CHKD	M.J.M	04.04.17
			APPRO	M.J.M	04.04.17
TITLE ASH LEVEL INDICATOR- HIGH OF BUS SECTION-1					
		DEPT.	SCALE	N.T.S	DRAWING NO.
		SIGN			3-00-114-39925
		SHEET 1 OF 1		REV.	00

MAKE OF COMPONENTS FOR AUXILIARY CONTROL PANEL/LT MAIN SWITCH BOARD.

ALL DIMENSIONS ARE IN MILLIMETRES

01. FUSE SWITCH UNIT	L & T / SIEMENS / CONTROLS & SWITCHGEAR(STROMBERG)/ SCHENIDER / GE /SPACEAGE SWITCH GEAR
02. POWER SWITCH	L & T / SIEMENS / CONTROLS & SWITCHGEAR / SCHENIDER / GE /SPACEAGE SWITCH GEAR
03. CONTROL SWITCH	L & T(SALZER) / SIEMENS / KAYCEE / CONTROLS & SWITCHGEAR / SCHENIDER / GE
04. SELECTOR SWITCH	L & T(SALZER) / SIEMENS / KAYCEE/ SCHENIDER / GE
05. POWER FUSE	L & T / SIEMENS / CONTROLS & SWITCHGEAR / BUSMAN / GE
06. CONTROL FUSE & FUSE BASE	L & T / SIEMENS / CONTROLS & SWITCHGEAR/ BUSMAN / GE
07. POWER CONTACTORS	L & T / SIEMENS / TELEMECHANIQUE(SCHNEIDER) / CONTROLS & SWITCHGEAR(TC) / GE
08. AUXILIARY CONTACTOR	L & T / SIEMENS / TELEMECHANIQUE(SCHNEIDER) / CONTROLS & SWITCHGEAR(TC) / GE
09. BIMETAL OVERLOAD RELAYS WITH BASE	L & T / SIEMENS / TELEMECHANIQUE(SCHNEIDER) / CONTROLS & SWITCHGEAR(TC) / GE
10. FUSE CARRIERS	L & T / SIEMENS / CANDS / CONTROLS & SWITCHGEAR/ BUSMAN / GE
11. PUSH BUTTON	L & T / SIEMENS / BCH / TEKNIC / CONTROLS & SWITCHGEAR(RAAS CONTROLS)/ SCHENIDER
12. INDICATING LAMP (LED CLUSTERED TYPE)	L & T / RAAS CONTROLS / BINAY / TEKNIC/ SCHENIDER / SECO / GE
13. INDICATING METERS	A.E / IMP / RISHAB/ L&T / MECO
14. CURRENT TRANSFORMER	A.E / KAPPA / IND COIL / PRAYAG / PARGATI / AVK – SEG & CONTROLS(CONTROLS & SWITCHGEAR) / PRECISE / SOUTHERN ELECTRICAL
15. CONTROL & AUXILIARY TRANSFORMER	A.E / KAPPA / IND COIL / PRECISE / SOUTHERN ELETRICAL / KALPA
16. TERMINAL BLOCK	ELMEX / TOSHA / CONTROLS & SWITCHGEAR / CONNECTWELL / WAGO / PHONEX / ESSEN
17. WIRES	ISI CERTIFIED
18. CABLE GLANDS	COMET / SIEMENS / SUNIL&CO / BRACCO / CONTROLS & SWITCHGEAR/ SCHENIDER / DIAMOND / COSMOS / SMI
19. CABLE LUGS	DOWELLS / JAINSON / 3D / LOTUS
20. NEUTRAL LINK	CANDS / CONTROLS & SWITCHGEAR/ L & T / SIEMENS/ SCHENIDER
21. SWITCH PLUGS / SOCKETS	CROMPTON GREAVES / ANCHOR / BEST & CROMPTON / BCH
22. KWH METER / KW	BHEL / SIMCO / GEC / IMP / M & I / L & T / SECURE METERS
23. SPACE HEATER	CANDS / VILECO / PYROSYSTEM/CONTROLS & SWGR / SOPHIA / CROMPTON GREAVES / KS INSTRUMENTS
24. THERMOSTAT	TEMPROL / VIKAS ELECTRIC / AI / RENUTROL / ANCO
25. AIR CIRCUIT BREAKER	L & T / SIEMENS / CONTROLS & SWITCHGEAR(STROMBERG)/ SCHENIDER(MERLINGERIN) / GE / SPACEAGE SWITCH GEAR
26. PROTECTION RELAYS(NUMERICAL TYPE)	SIEMENS / ABB / ALSTHOM / EASSUN REYROLLE / AREVA / SCHENIDER
27. TIMERS	TELEMECHANIQUE(SCHNEIDER) / CONTROLS & SWITCHGEAR(TC) / L & T / S
28. POTENTIAL TRANSFORMER	G & M / AE / KAPPA / IND COIL / PRAYAG / PRAGATI / LOGICSTAT / PRECISE /
29. BREAKER CONTROL SWITCH	ALSTHOM(AREVA) / KAYCEE / L & T / SEIMENS/ SCHENIDER/ GE
30. OTHER ITEMS	AS PER BHEL STANDARD
31. TRANSDUCERS	ABB / AE / SOUTHERN TRANSDUCERS
32. INTERPOSSING RELAY	RISHAB INSTRUMENTS / TRANS MEASUREMENT/ SCHENIDER / AREVA / ELSTER
	JHOTHI/OEN

As for 11 kV & 3.3 kV, switchgear, BHEL/Bhopal has finalised the vendor Schneider for Numerical relays. BHEL/RPT is requested to consider the same vendor and make for easy maintenance and spare inventory also.

NOTE: –

THE PANEL MANUFACTURER CAN USE ANY ONE OF THE MAKES INDICATED AGAINST EACH ITEM. HOWEVER FOR THE SUPPLY OF PANEL TO ONE SITE, ONLY ONE MAKE SHALL BE USED AGAINST EACH ITEM, ie, NO MIX-UP IN MAKES AGAINST EACH ITEM IS ALLOWED.

CUSTOMER:	ANDHRA PRADESH POWER DEVELOPMENT CO. LTD ANDHRA PRADESH, INDIA 1x800 MW STAGE-II UNIT#3, KRISHNAPATNAM			
OWNER'S CONSULTANT:	DEVELOPMENT CONSULTANTS PVT. LTD. CONSULTING ENGINEERS KOLKATA MUMBAI CHENNAI NEW DELHI			
	BHARAT HEAVY ELECTRICALS LTD UNIT : BOILER AUXILIARIES PLANT RANIPET-TAMILNADU 632 406			
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DRN	P.S.T	--	sd	04.04.17
CHD	M.J.H	--	sd	04.04.17
APPD	M.J.H	--	sd	04.04.17
TITLE MAKE OF COMPONENTS FOR ACP/LTMSB (TYPICAL)				
DEPT. SCALE N.T.S		DRAWING NO.		
SIGN		3-00-114-39928		
		SHEET 1 OF 1 REV. 00		

LTMSB & ACP MANDATORY SPARES LIST FOR KRISHNAPATNAM 1X800MW

Sl.no	LTMSB SPARES	UNIT	TOTAL QUANTITY	REMARKS
	Air Circuit Breaker			
1	Trip Coil	NO	20	20 No's for 3200A breaker
2	Closing Coil	NO	21	21 No's for 3200A breaker
3	Spring Charging Motor	NO	5	10 No's for 3200A breaker
4	Spring Charging Motor with complete Mechanisim	NO	5	10 No's for 3200A breaker
5	Spring Charged Limit Switch	NO	10	10 No's for 3200A breaker
6	Thermal Overload for Spring Charging Motor	NO	5	5 No's for 3200A breaker
	Breaker Contact			
7	Main Contact (Fixed and moving) assembly	ST	2	2Sets for 3200A ACB
8	Arcing Contact (Fixed and moving) assembly	ST	2	2Sets for 3200A ACB
9	Breaker Jaw Contact (Bus-end & Breaker- end) assembly	ST	2	2Sets for 3200A ACB
10	Sliding Contact (Fixed & Moving)	ST	5	5sets
11	Breaker Auxiliary Contact Block	NO	5	5No's
12	Arcing Chute	ST	5	5Sets for ACB Incommer
13	Plug Socket with Prefab cable	NO	5	5No's
14	Position Limit Switch	NO	10	10No's for ACB incommer
	Indicating Lamps complete assembly			
15	Red	NO	30	
16	Amber	NO	30	
17	Green	NO	30	
18	White	NO	30	
19	Blue	NO	30	
20	CT	NO	2	Total=2 No's (Each 3200/1A-1No for Metering) & (3200/1A-1No for protection))
21	Transducer	NO	10	Total=10no's offered (CTD--5NO'S & VTD--5NO'S)
	Breaker Control Switch			
22	Trip / Neutral / close Switch	NO	10	
23	Sw.gear / Trial / Normal Switch (Local/Remote)	NO	10	
24	AC Supply On / Off Switch	NO	10	
25	DC Supply On / Off Switch	NO	10	
26	Motor Heater On /Off Switch	NO	10	
27	DC Supply Source Selector Switch (3-position)	NO	3	
28	Ammeter Selector Switch	NO	1	
29	Voltmeter Selector Switch	NO	1	
30	Voltmeter	NO	1	(0-500V)--1No
31	Ammeter	NO	2	(0-3200A)--2no's
	Auxiliary Control Contactor			
32	Auxiliary Control Contactor DC complete	NO	25	
33	Auxiliary Control Contactor DC spare kits	NO	25	
34	Auxiliary Control Contactor DC Coils	NO	25	
SL.NO	ACP SPARES	UNIT	TOTAL QUANTITY	REMARKS
	Contactor			
1	Power Contactor (AC)			
2	Power Contactor Complete Assembly	NO	8	2No's each type and rating
3	Power Contactor spare kits	NO	8	2No's each type and rating
4	Power Contactor AC Coils	NO	8	2No's each type and rating
	Auxiliary Control Contactor (AC)			
5	Auxiliary Control Contactor Complete Assembly	NO	80	20No's each type and rating
6	Auxiliary Control Contactor spare kits	NO	160	40No's each type and rating
7	Auxiliary Control Contactor AC Coils	NO	100	25No's each type and rating
8	MCCB (Power Circuit)	NO	15	5No's each type and rating
9	MCB (Control Circuit)	NO	40	20No's each type and rating
	Switch			
10	Local / Remote Selector Switch	NO	5	
11	MCCB Status (On/off) Monitoring Switch/Contact	NO	5	
12	Trial / Normal /MCC Selector Switch	NO	10	
13	MCC module Service Position Limit Switch	NO	5	
14	Thermal Overload Relay	NO	10	5No's each type and rating
15	Sliding Contact (Fixed & Moving)	NO	12	12No's For 630A ACB
16	Bus bar to MCC module Lira Contact Assembly (Bus-end & MCC Module-end)	ST	5	
	Indicating Lamps complete assembly			
17	Red	NO	30	
18	Amber	NO	30	
19	Green	NO	30	
20	Push Button (On/Off) Complete Assembly	NO	20	

21	CT	NO	5	Total=5 No's ((1set consist of Each 630/1A-1No 80/1A-1No's 50/1A-1No's, 25/1A-1No's for Metering) & (630/1A-1No for protection)
22	Ammeter	NO	4	1 No each type & rating
23	Control Transformer	NO	1	
24	Switch Fuse Unit	NO	5	Total=5No's (6A=1 No's, 10A=1 No's, 16A=1 No's 50=1 No's, 63A=1 No's)
25	Terminal Block			
26	Power Terminal Block	NO	10	
27	Control Terminal Block	NO	100	
28	End Plate for Power & Control Terminal Block	NO	50	total=50no's (all types each 25no's)
29	PT	NO	1	415/110V--1No

MODULEWISE BOM KRISHNAPATNAM LTMSB & ACP					
	LTMSB-3200A			ACP -630A	
INCOMER	I/C	B/C	O/G	I/C	B/C
3200A ACB EDO	QTY				
3200A ACB EDO 3POLE W/O Releases	1	1			
630A ACB EDO 3POLE W/O Releases			1	1	1
MET.CTs 3200/1A cl.0.5,15VA	3				
MET.CTs 630/1A cl.1.0,15VA				3	
PROT.CTs 3200/1A ,5P20,20VA	3	3	3		
PROT.CTs 3200/1A ,CL-PS,5P10,15VA	3				
PROT.CTs 630/1A ,5P20,15VA				3	3
MFM WITH COMM.	1			1	
A+ASS	1				
V+VSS	1				
Current Transducer	2				
Voltage Transducer	2				
Metrosil+Stablizer	1				
POT.T/Fs 415/3/110V/3(ROOT),100VA CL.1.0	0			6	
POT.T/Fs 415/3/110V/3(ROOT),100VA CL.0.5	3				
Numerical relay	1	1		1	1
Numerical relay			1		
Anti pumping Relay-94	0	0	0	0	0
TCS Relay-95/74 Self Reset	0	0	0	0	0
Lock out Relay Hand Reset - with Blue Lamp-86	1	1	1	1	1
Breaker contact multiplication relay-52X	1	1	1	1	1
Annunciation Relay	0	0	0	0	0
Interposing Relay	2	2	2	2	2
Aux. contactors,220V DC 3 no+ 1 nc	7	6	4	5	3

I/Ls	15	10	10	15	10
CT Shorting Links	21	7	7	14	7
TRIP SEL. S/W		1			1
L/R SEL.SWITCH	1	1	1	1	1
Limit switch	0	2	3		
A/M Switch		1			1
Sync. Sel switch		1			1
BCS SWITCH	1	1	1	1	1
DC DP SWITCH	0	5			5
Timer		1			1
Diodes	2	4			4
415V MPCB	1	6			6
2A SP MCB				12	
2Pole MCB	8	11	5	12	11
W+L+T	1	1	1	1	1
TOTAL					
	EC				
	Qty				
400A DP MCCB (T-M Releases) +RHOM	1				
I/L	2				

MCB	2				
N.Link	1				
GLANDS & LUGS	1				
	EOH -63A	TILATII ON-			
3P MCCB (T-M Releases) +RHOM	Qty	Qty			
400A		1			
63A	1				
I/L	3	3			
MCB	2	3			
N.Link	1	1			
GLANDS & LUGS	1	1			
	RM-0.37KV	PM-1.1KW			
O/G FEEDRES	Qty.	Qty.			
1.6A MPCB	1				
4A MPCB		1			
9A Power Contactor	1				
18A Power Contactor		1			
OLR - (0.9 - 1.5)A	1				
OLR - (2.5-4)A		1			
I/L	3	4			
A/M Sel. Switch	1				
Aux. Contactor 2 no+ 2nc	2	1			
SIC	3				
PBs	2				
2A SP MCB	1	2			
10A SWITCH		1			
NL	1	2			
GLANDS & LUGS	1	1			

	HEATER(HH)	RT HEATER	HEATER(HS)		
	Qty.	Qty.	Qty.		
3P MCCB (T-M Releases) +RHOM					
100A		1			
32A	1		1		
Power Contactor					
80A		1			
32A	1		1		
MET.CTs cl.1.0,15VA					
80A/1A		3			
25A/1A	3		3		
A+ASS	1	1	1		
I/L	2	2	2		
Aux. Contactor					
A/M Sel.Switch					
2A SP MCB	2	1	1		
10A SWITCH		1	1		
NL	1	1	1		
GLANDS& LUGS	1	1	1		
	ALI (H)	ALI (L)			
	Qty	Qty			
10A DP MCB	1	1			
Aux. Contactor	9	9			
I/L	10	10			
SP MCB	3	3			
Push Button	1	1			
N.Link	1	1			
GLANDS & LUGS	1	1			
BUS VT		ACP			
POT.T/Fs 415/3/110V/3(ROOT),100VA CL.1.0	3				

VOLT METER+VSS	1				
Voltage Transducer	1				
Numrerical relay	1				
415V MPCB	1				
SP MCB	3				
SH CST	1.5KVA with 2	CST- 5KVA	CST- 250VA		
	Qty	Qty	Qty		
16A TP MPCB	1	1	1		
Control fuse base					
250VA CST 415/24V			1		
1.5KVA CST 415/240V	1				
5KVA CST 415/110V		1			
40A TPDT Sw.	1	1			
2A SP MCB		1			
32A SP MCB		2	1		
16A Power Contactor	1				
6A MCB	1				
I/Ls	1	3	1		
Panel space heater ckt.					
16A SP ON / OFF Sw.	1				
6A MCB	1				
N.Link	1				
Space Heater	1				
Thermostat	1				
Indicating Lamp	1				
Plug & Socket	1				

LTMSB & ACP FOR KRISHNAPATNAM			
BOARDWISE FEEDER BOM			
		LTMSB	ACP
		QTY	QTY
DESCRIPTION			
INCOMER			
3200A 3P ACB for LTMSB		2	
630A 3P ACB for ACP			2
BUS COUPLER			
3200A 3P ACB for LTMSB		1	
630A 3P ACB for ACP			1
O/G FEEDERS			
RM - 0.37KW			46
Hopper Heater (HH) - 12KW			22
Support Heater (HI) - 36KW			3
Shaft Heater (HS) - 9KW			3
OPM-1.1KW			2
ALI High			2
ALI Low			2
Electronic Controller - 400A		22	
Auxiliary Control Panel-630A		3	
Electrically Operated Hoist - 63A		2	
A/C - 400A		2	
CST - 5KVA			2
CST - 1.5KVA		2	
CST -250VA			2
Marshalling Panel			4
Bus PT - LTMSB		2	
Bus PT - ACP			2
Ethernet Switch		1	1
Wiring for Areca module			2



Bharat Heavy Electricals Limited
Electroporcelains Division, Bangalore – 560 012
Control Panel Business Group
PRICE FORMAT

PROJECTS: 1X800MW VIJAYAWADA THERMAL POWER PLANT
1X800MW KRISHNAPATNAM THERMAL POWER PLANT
MATERIAL: DRAWOUT PANELS FOR APGENCO PROJECT REQUIREMENT

sl.no	MATL.CODE	DESCRIPTION	UNIT	QTY	UNIT PRICE	TOTAL
1	ELSBMCCSDST01	SBMCC FOR KRISHNAPATNAM	EA	1		
2	ELSBMCCVTPS01	SBMCC FOR VIJAYAWADA	EA	1		
3	ELLTMSBSDST01	LTMSB FOR KRISHNAPATNAM	EA	4		
4	ELACPSDST01	ACP FOR KRISHNAPATNAM	EA	4		
5	ELLTMSBVTPS01	LTMSB FOR VIJAYAWADA	EA	4		
6	ELACPVTPS01	ACP FOR VIJAYAWADA	EA	4		
7	ELCOMSPRVTP001	COMMISSIONING SPARES FOR VIJAYAWADA	LOT	1		
8	ELCOMSPRKR001	COMMISSIONING SPARES FOR krishnapatnam	LOT	1		
9	ELBLWVTPS01	BLOWER MCC FOR VIJAYAWADA	EA	1		
10	ELBLWKRP01	BLOWER MCC FOR KRISHNAPATNAM	EA	1		
11	ELCOMSPRAP001	COMMISSIONING SPARES FOR BLOWER MCC,AP	LOT	1		

NOTES:

- SUMMATION OF ALL UNIT RATES OF MODULES SHALL BE EQUIVALENT TO TOTAL BOARD COST QUOTED, VARIANCE OF +/- 5% IS ACCEPTABLE. BEYOND 5% OFFER WILL NOT BE CONSIDER AS VALID OFFER. IN UNIT ADDITION-DELETION PRICES, PRICES QUOTED FOR COMPONENTS SHALL BE AS PER LIST PRICE OF CONCERNED MANUFACTURES. IF ANY ABNORMAL PRICES ON HIGHER SIDE OBSERVED OFFER MAY BE REJECTED.
- ALL BOARDS SHALL BE SUPPLIED ALONGWITH THE INTEGRAL BASE FRAMES, FOUNDATION BOLTS, CABLE GLANDS & LUGS . ALL FIXING NUTS & BOLTS TOGETHER WITH FOUNDATION BOLTS SHALL ALSO BE SUPPLIED. PRICES FOR THE BASE FRAME SHALL BE BUILT IN THE SWITCHBOARD PRICE.
- ITEM WISE PRICES WITH DESCRIPTION AND RATING OF EACH ITEM COMPLYING TO LIST FURNISHED IN THE SCHEDULE OF UNIT PRICES SHALL BE FURNISHED IN SCHEDULE OF UNIT PRICE.
- ADDITION/DELETION OF QUANTITIES SHALL BE APPLICABLE AT THE QUOTED PRICE.THE UNIT RATE OF SUPPLY OF ALL EQUIPMENTS & SERVICES QUOTED BY THE BIDDER SHALL BE FIRM FOR A VARIATION OF QUANTITIES , WHICH MAY BE TO THE EXTENT OF $\pm 30\%$ OF THE TOTAL ORDERED QUANTITY. SUM OF INDIVIDUAL MODULE SHALL EQUAL TO BOARD PRICE.
- THE MAKE OF COMPONENTS SHALL BE SUBJECT TO CUSTOMER APPROVAL.

TECHNICAL DEVIATION SHEET

SI No.	Document Title	Clause No.	NIT requirement	Bidders Deviation

Total Number of Deviation(s):

(Both in figures & Words)

BIDDER’S STAMP & SIGNATURE

TECHNICAL SPECIFICATION FOR
LTMSB_ACP
PROJECT: 1X800MW VIJAYAWADA
CUSTOMER: APGENCO

SPEC REF NO.: EP-LTMSB_ACP-VTP-01 REV 00



BHARAT HEAVY ELECTRICALS LIMITED
ELECTROPORCELAINS DIVISION
BANGALORE – 560012



**TECHNICAL SPECIFICATION
FOR
LTMSB & ACP**

SPECIFICATION NO.: EP-LTMSB_ACP-VTP-01

VOLUME

SECTION -

REVISION 0

DATE: 18.09.2017

CONTENTS

<u>S. NO.</u>	<u>DESCRIPTION</u>
1.0	COVER PAGE
2.0	CONTENTS
3.0	INSTRUCTIONS FOR BIDDERS
4.0	TECHNICAL SPECIFICATION & DRAWINGS
5.0	PRICE SCHEDULE
6.0	UNIT PRICE SCHEDULE
7.0	DEVIATION SHEET

**IT IS CONFIRMED THAT OUR TECHNICAL OFFER COMPLIES WITH THE SPECIFICATION IN TOTO, & THAT
THERE ARE NO TECHNICAL DEVIATIONS.**

BIDDER'S STAMP & SIGNATURE
(REFER INSTRUCTION NO. 1 OF 'INSTRUCTIONS TO BIDDERS')



**TECHNICAL SPECIFICATION
FOR
LTMSB & ACP**

SPECIFICATION NO.:EP-LTMSB_ACP-VTP-01

VOLUME NO. :

SECTION :

REV NO. : 00 DATE: 18-09-2017

SHEET : 1 OF 1

INSTRUCTIONS TO BIDDERS FOR PREPARING TECHNICAL OFFERS

1. Two signed and stamped copies of the following shall be furnished by all bidders as technical offer:
 - a) Complete technical specification.
 - b) Un-priced copy of PRICE FORMAT, duly stamped and signed by the bidder.
 - c) Complete dimension of all the boards including no. of panels, dimensions of each type of panels, module size of each type of feeders and minimum clearances required on all sides for each type of panels.
 - d) **No. of Vertical consider by vendor for each boards are to be compulsory given along with offer.**
 - e) A copy of the sheet "Instructions to Bidders for Preparing Technical Offer" duly stamped and signed by the bidder.
 - f) Technical deviation/ clarification, if any
 - g) No. of MCC panels, Weight & Dimensions of LTMSB & ACP.
2. No technical submittal such as copies of type test certificates, data Sheets, write-up, drawing, technical literature, etc. is required during tender stage. Any such submission, even if made, shall not be considered as part of offer.
3. Confirmations/ comments (if any) regarding delivery schedules shall be furnished as part of the commercial offer. Any reference elsewhere/ covering letter of technical offer shall not be considered by BHEL.
4. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder's covering letter shall not be considered by BHEL, and bidder's offer shall be construed to be in conformance with the specification.
5. Any changes made by the bidder in the price schedule with respect to the Item description/ quantities, notes etc. from those given in annexure-A of specification shall not be considered (i.e., technical description, quantities, notes etc. as per specification shall prevail).
6. Bidders to quote for all items/sub items.
7. In case of any ambiguity in specification between various sections and end customer specification vendor should clearly brought out in technical deviations failing in which BHEL will have choice to prefer which ever it suits at later stage for which vendor should accept.
8. In case bidder is having any queries regarding technical parameters same shall get clarified before quoting, in case if any technical deviations are observed during scrutiny wrt to NIT bidder shall meet the technical requirements without any price implication.
9. Vendor should bring out clearly in deviation sheet if any.
10. Vendor to complete the panel in all respect and dispatch to BHEL. Numerical relay is in BHEL scope and same shall be fitted by BHEL in BHEL Premises. Vendor to do the relay wiring up to relay with proper ferruling and lugs terminals.



**TECHNICAL SPECIFICATION
FOR
LTMSB & ACP**

SPECIFICATION NO.:EP-LTMSB_ACP-VTP-01

VOLUME NO. :

SECTION :

REV NO. : 00 DATE: 18-09-2017

SHEET : 1 OF 1

11. The panel shall be tested at BHEL-EPD after fixing of relay. In case any wiring mistake observed during testing at BHEL-EPD, vendor has to depute their representative/service engineer at BHEL-EPD to modify the same without any commercial implication. The representative shall be deputed within 2 working days from the date of intimation by BHEL-EPD.
12. Panel will be dispatched in the name of BHEL EPD as manufacturer, BHEL may conduct the type test at CPRI/ERDA on same panel as manufacturer.

BIDDER'S STAMP & SIGNATURE

LTMSB & ACP			
BOARDWISE FEEDER BOM			
		LTMSB	ACP
		QTY	QTY
DESCRIPTION			
INCOMER			
3200A 3P ACB for LTMSB		2	
630A 3P ACB for ACP			2
BUS COUPLER			
3200A 3P ACB for LTMSB		1	
630A 3P ACB for ACP			1
O/G FEEDERS			
RM - 0.37KW			46
Hopper Heater (HH) - 12KW			22
Support Heater (HI) - 36KW			3
Shaft Heater (HS) - 9KW			3
OPM-1.1KW			2
ALI High			2
ALI Low			2
Electronic Controller - 400A		22	
Auxiliary Control Panel-630A		3	
Electrically Operated Hoist - 63A		2	
A/C - 400A		2	
CST - 5KVA			2
CST - 1.5KVA		2	
CST -250VA			2
Marshalling Panel			4
Bus PT - LTMSB		2	
Bus PT - ACP			2
Ethernet Switch		1	1
Wiring for Areca module			2

MODULEWISE BOM					
	LTMSB-3200A			ACP -630A	
INCOMER	I/C	B/C	O/G	I/C	B/C
3200A ACB EDO	QTY				
3200A ACB EDO 3POLE W/O Releases	1	1			
630A ACB EDO 3POLE W/O Releases			1	1	1
MET.CTs 3200/1A cl.0.5,15VA	3				
MET.CTs 630/1A cl.1.0,15VA				3	
PROT.CTs 3200/1A ,5P20,20VA	3	3	3		
PROT.CTs 3200/1A ,CL-PS,5P10,15VA	3				
PROT.CTs 630/1A ,5P20,15VA				3	3
MFM WITH COMM.	1			1	
A+ASS	1				
V+VSS	1				
Current Transducer	2				
Voltage Transducer	2				
Metrosil+Stablizer	1				
POT.T/Fs 415/3/110V/3(ROOT),100VA CL.1.0	0			6	
POT.T/Fs 415/3/110V/3(ROOT),100VA CL.0.5	3				
Numerical relay	1	1		1	1
Numerical relay			1		
Anti pumping Relay-94	0	0	0	0	0
TCS Relay-95/74 Self Reset	0	0	0	0	0
Lock out Relay Hand Reset - with Blue Lamp-86	1	1	1	1	1
Breaker contact multiplication relay-52X	1	1	1	1	1
Annunciation Relay	0	0	0	0	0
Interposing Relay	2	2	2	2	2
Aux. contactors,220V DC 3 no+ 1 nc	7	6	4	5	3

I/Ls	15	10	10	15	10
CT Shorting Links	21	7	7	14	7
TRIP SEL. S/W		1			1
L/R SEL.SWITCH	1	1	1	1	1
Limit switch	0	2	3		
A/M Switch		1			1
Sync. Sel switch		1			1
BCS SWITCH	1	1	1	1	1
DC DP SWITCH	0	5			5
Timer		1			1
Diodes	2	4			4
415V MPCB	1	6			6
2A SP MCB				12	
2Pole MCB	8	11	5	12	11
W+L+T	1	1	1	1	1
TOTAL					
	EC				
	Qty				
400A DP MCCB (T-M Releases) +RHOM	1				
I/L	2				

MCB	2				
N.Link	1				
GLANDS & LUGS	1				
	EOH -63A	TILATII ON-			
3P MCCB (T-M Releases) +RHOM	Qty	Qty			
400A		1			
63A	1				
I/L	3	3			
MCB	2	3			
N.Link	1	1			
GLANDS & LUGS	1	1			
	RM-0.37KV	PM-1.1KW			
O/G FEEDRES	Qty.	Qty.			
1.6A MPCB	1				
4A MPCB		1			
9A Power Contactor	1				
18A Power Contactor		1			
OLR - (0.9 - 1.5)A	1				
OLR - (2.5-4)A		1			
I/L	3	4			
A/M Sel. Switch	1				
Aux. Contactor 2 no+ 2nc	2	1			
SIC	3				
PBs	2				
2A SP MCB	1	2			
10A SWITCH		1			
NL	1	2			
GLANDS & LUGS	1	1			

	HEATER(HH)	RT HEATER	HEATER(HS)		
	Qty.	Qty.	Qty.		
3P MCCB (T-M Releases) +RHOM					
100A		1			
32A	1		1		
Power Contactor					
80A		1			
32A	1		1		
MET.CTs cl.1.0,15VA					
80A/1A		3			
25A/1A	3		3		
A+ASS	1	1	1		
I/L	2	2	2		
Aux. Contactor					
A/M Sel.Switch					
2A SP MCB	2	1	1		
10A SWITCH		1	1		
NL	1	1	1		
GLANDS& LUGS	1	1	1		
	ALI (H)	ALI (L)			
	Qty	Qty			
10A DP MCB	1	1			
Aux. Contactor	9	9			
I/L	10	10			
SP MCB	3	3			
Push Button	1	1			
N.Link	1	1			
GLANDS & LUGS	1	1			
BUS VT		ACP			
POT.T/Fs 415/3/110V/3(ROOT),100VA CL.1.0	3				

VOLT METER+VSS	1				
Voltage Transducer	1				
Numrerical relay	1				
415V MPCB	1				
SP MCB	3				
SH CST	1.5KVA with 2	CST- 5KVA	CST- 250VA		
	Qty	Qty	Qty		
16A TP MPCB	1	1	1		
Control fuse base					
250VA CST 415/24V			1		
1.5KVA CST 415/240V	1				
5KVA CST 415/110V		1			
40A TPDT Sw.	1	1			
2A SP MCB		1			
32A SP MCB		2	1		
16A Power Contactor	1				
6A MCB	1				
I/Ls	1	3	1		
Panel space heater ckt.					
16A SP ON / OFF Sw.	1				
6A MCB	1				
N.Link	1				
Space Heater	1				
Thermostat	1				
Indicating Lamp	1				
Plug & Socket	1				

**VOLUME :V-A
SECTION-VII
TECHNICAL SPECIFICATION
FOR
415V PMCC/MCC, 415V ACDB AND 220V DCDB**

1.00.00 SCOPE OF SUPPLY

1.01.01 Requisite nos. of following equipment shall be furnished with all accessories :-

- a. Power cum Motor Control Centre (PMCC)
- b. Motor Control Centres (MCC)
- b. A.C. Distribution Board (DB)
- c. D.C. Distribution Board (DB)
- d. D.C. Starters
- e. A.C./D.C. fuse boards

1.01.02 The base channel frame with hardware and lifting angles.

1.01.03 One set of special tools and tackles.

1.01.04 Set of accessories as listed below :

- a) Breaker lifting and handling trolley.
- b) Test cabinet with coupling cables for testing the breaker in drawout position.
- c) Racking in/out handle for breakers.

1.01.05 Mandatory Spare parts.

1.01.06 All relevant drawings, data and instruction manuals.

2.00.00 CODES AND STANDARDS

2.01.01 All equipment and materials shall be designed, manufactured and tested in accordance with the latest applicable Indian Standards (IS) and IEC except where modified and/or supplemented by this specification.

2.01.02 Equipment and material conforming to any other international standard which ensures equal or better quality, may be accepted. In such case, copies of the English version of the standard adopted shall be submitted along with the bid.

2.01.03 The electrical installation shall meet the requirements of Indian Electricity Rules as amended upto date and relevant IS Code of Practice. In addition, other rules and regulations applicable to the work shall be followed.

3.00.00 DESIGN CRITERIA

- 3.01.00 The PMCCs/MCCs/DBs will be used to provide power, control and protection for 415/240V A.C. and 220V D.C. auxiliary services (Motors & Feeders) of generating units.
- 3.02.00 Duty involves direct-on-line starting of large squirrel cage motors below 175kW. The starting current varies from 6 to 8 times rated current at very low power factor.
- 3.03.00 The equipment will be located in a hot, humid and tropical atmosphere, highly polluted at places with coal dust and/or fly ash.
- 3.04.00 For continuous operation at specified ratings, the temperature rise of various equipment/components shall be limited to the permissible values stipulated in relevant standards and/or this specification.
- 3.05.00 Equipment ratings and quantities are detailed in the enclosed drawings and annexure. Equipment shall be furnished in strict compliance with the same.
- 3.06.00 All equipment and components thereof shall be capable of withstanding the mechanical forces and thermal stresses of the short-circuit currents without any damage or deterioration of the materials.
- 3.07.00 The PMCCs/ MCCs / DBs shall have two incomers and one bus-coupler. In addition to electrical interlocks, mechanical castle key interlock shall be provided between the two incomers and the bus-coupler so that any two of the three may be closed at a time.
- 3.08.00 Busbars of PMCCs shall be sized to carry continuously the associated transformer secondary current plus a 20% margin.
- Busbars of MCC/DBs shall be sized to carry continuously the total running load of MCC/DB plus a 20% margin.
- 3.09.00 In cubicle of incomers & bus section breakers/MCCBs shall be identical to the associated busbar rating.
- 3.10.00 For continuous operation at specified ratings, the temperature rise of various equipment/components shall be limited to the permissible values specified in relevant standards and/or this specification.
- 3.11.00 Circuit breakers shall not produce any harmful over voltage during switching off of induction motors. If required, surge protective devices shall be included in the scope of supply to limit over voltages.
- 3.12.00 Incomers, Bus-couplers & outgoing feeders rated upto & including 630A shall be MCCB controlled. Above 630A all incomers, Bus-couplers & outgoing Feeders shall be ACB controlled. For critical loads ACB control feeders shall be provided which will be decided during detailed engineering.
- 3.13.00 All motor rated 110kW & above, below 175kW shall be ACB controlled. Motor rated upto 110kW shall be contactor operated.

- 3.14.00 MCC & PMCC shall have sufficient number of spare modules (at least 20% of various sizes used with a minimum of 1 no. for each rating and type).
- 3.15.00 Outgoing feeders of PMCC shall be limited to minimum number of different sizes so that max. standardization is achieved from MCCB & contactor size point of view.
- 3.16.00 Incomers & bus section breakers of PMCCs/MCCs shall have provisions for remote operation from control room.
- 3.17.00 All breaker operated motor feeder shall be supplied from PMCC.
- 3.18.00 One no. Normal/Emergency switchgear to cater power supply to important emergency load / motors for safe shut-down of unit including 220V battery chargers shall be provided for each unit. The main incoming supply shall be from 415V unit service switchgear. When main incoming supply fails, reserve incoming supply shall be switched ON automatically from 415V station service switchgear. In case of total failure of AC supply of the power station, the supply from DG shall be switched ON automatically.
- 3.19.00 Each switchgear shall be provided with two bus sections, two incomer and a bus coupler rated for 100% of the loads connected to the switchgear.
- 3.20.00 For each auxiliary or load, one feeder shall be provided except for the following cases:
- One feeder for a maximum 2 nos. isolator motor operating mechanism.
- 3.21.00 The switchgears shall be provided with suitable number and type of outgoing feeders for the respective auxiliary loads of the system/area, power supply feeders to various panels, lighting transformer, space heating panels, control cabinets and all other loads encountered in the plant. In addition, following feeders shall be provided in each bus section of each switchgear.
- a) Bus VT module: One (1) no.
 - b) Switchgear test supply module: One (1) no.
 - c) 240V, 1 phase essential supply module with five nos. 1 phase outlets: One (1) no.
Necessary 415V/240V dry type transformer shall be provided.
 - d) Alarm module for common alarm for outgoing feeder fault: One (1) no.
 - e) DC supply alarm module for incomer, bus coupler fault: One (1) no.
- 3.22.00 Each feeder shall be provided with two nos. interposing relays for start & stop. These interposing relays shall be located in separate IPR panel described under C&I specification.

4.00.00 **SPECIFIC REQUIREMENTS**

4.01.00 **Construction**

4.01.01 PMCC / MCC / DB shall be indoor, metal-clad, air insulated and floor mounting type. All MCCs shall be fully draw out type and DBs shall be fixed type. ACB modules of PMCCs/MCCs shall be fully drawout type. MCCB / Switch Fuse modules shall also be fully drawout type. The design and construction shall be such as to allow extension at either end.

4.01.02 All PMCC/MCC shall be of double front construction.

4.01.03 PMCC /MCC/DB enclosure shall be dust and splash proof, conforming to a degree of protection IP-54. All switchboard frames and load bearing members shall be fabricated using suitable mild steel structural sections or pressed and shaped cold rolled sheet steel of thickness 2.0mm. Frames shall be enclosed in cold rolled sheet steel of thickness 1.6 mm. Doors and covers shall also be of cold rolled sheet steel thickness 1.6 mm. Stiffeners shall be provided wherever necessary. The gland plate thickness shall be 3.0 mm for hot/cold rolled sheet steel and 4.0 mm for non-magnetic material.

4.01.04 PMCC / MCC / DB assembly shall comprise a continuous line up of dead front, free-standing vertical sections, housing the control modules in multi tier formation.

4.01.05 The design shall be fully compartmentalized with metal/insulating partitions between compartments. **Operating height shall be as per drawings**

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4.01.06 Each control module shall be housed in a separate compartment, complete with an individual front access door having sufficient opening with concealed type hinges. Each vertical section shall have a removal back cover. All doors and covers shall be gasketed.

4.01.07 All push buttons, lamps, indicating instruments shall be flush / semi-flush mounted on respective module compartment.

4.01.08 A full height vertical cable chamber with cable supports shall be provided in each section to facilitate unit wiring. The chamber shall be liberally sized to accommodate all cables and shall have removable cover at the front for access.

4.01.09 A horizontal wireway, extending the entire length, shall be provided at the top of each PMCC / MCC / DB for inter panel wiring.

4.01.10 The width of the cable alley shall not be less than 250 mm.

4.02.00 **Bus and Bus Taps**

4.02.01 All PMCCs/MCCs/DBs shall be provided with three phase & neutral bus bars . All DCDBs shall be provided with two busbars. All busbar compartments shall be completely enclosed.

- 4.02.02 The main buses and connections shall be of high conductivity Aluminium / Aluminium alloy, sized for specified current ratings with maximum temperature limited to 85°C (i.e., 35°C rise over 50°C ambient).
- 4.02.03 Vertical busbars shall be designed for minimum current rating of 200A. Separate vertical busbars shall be provided for each vertical panel.
- 4.02.04 All bus connections shall be silver plated. Adequate contact pressure shall be ensured by means of two-bolt connection with plain and spring washers and locknuts.
- Bimetallic connector shall be furnished for connection between dissimilar metals.
- 4.02.05 Busbars and connections shall be fully insulated for working voltage with adequate phase/ground clearances. Insulating sleeves for busbars and shrouds for joints and tap-off points shall be provided.
- Bus insulators shall be flame retardant, non-hygroscopic track-resistant type with high creepage surface.
- 4.02.06 Busbars shall be supported and braced to withstand the stresses due to maximum short circuit current and also to take care of any thermal expansion.
- 4.02.07 Busbars shall be colour coded for easy identification and so located that the sequence R-Y-B shall be from left to right, top to bottom or front to rear when viewed from the front of the assembly.
- 4.03.00 **Control Modules**
- 4.03.01 Draw-out type control module shall have self-aligning power/control disconnects. All disconnects shall be silver plated to ensure good contacts.
- 4.03.02 The design shall be such as to permit easy withdrawal/reinsertion of the unit with guide rails to ensure correct alignment.
- 4.03.03 Control Module shall house the control components for a circuit such as switch fuse / MCCB, contactors, relays, push buttons, lamps etc. as per requirement of the control circuit.
- 4.03.04 The equipment layout shall provide sufficient working space in between the components and subject to Owner's approval.
- 4.03.05 Various module/compartments sizes shall be multiple of one basic unit to facilitate modifications at site. Suitable provision for this purpose should also be incorporated in the vertical bus bars.
- 4.03.06 Draw-out type control modules of same size and type shall be electrically and physically interchangeable.
- 4.04.00 **Air Circuit Breaker**
- 4.04.01 Circuit breaker shall be provided on the incomer having minimum interrupting capacity equal to the 50kA(r.m.s) fault level.

- 4.04.02 Circuit breaker shall be three pole, single throw, air-break type with independent manual spring closing, trip-free mechanism and shunt trip. However Incomer and bus coupler breakers (ACB) shall be four pole type.
- 4.04.03 Circuit breaker shall be draw-out type, having service, test & isolated position with positive indication for each position.
- 4.04.04 Circuit breakers of identical rating shall be physically and electrically interchangeable.
- 4.04.05 Each breaker shall be provided with microprocessor based protection unit having three overload protection with adjustable current and time, three short circuit protection with adjustable current and time and three instantaneous short circuit protection. The operating characteristic shall be suitable for co-ordination with down-stream fuses.
- 4.04.06 Circuit breakers shall be provided with motor wound spring charging mechanism. Spring charging shall take place automatically after each breaker closing operation. One open-close-open operation of the circuit breaker shall be possible after failure of power supply to the motor. In addition, facility for manual charging of spring shall be provided.
- 4.04.07 Mechanical safety interlock shall be provided to prevent the circuit breaker from being racked in or out of the service position when the breaker is closed. It shall not be possible to open the circuit breaker door cubicle unless the breaker is in 'OFF' position.
- 4.04.08 Automatic safety shutters shall be provided to cover up the stationary disconnects when the breaker is withdrawn.
- 4.04.09 Each breaker shall be provided with an emergency manual trip, mechanical ON-OFF indicator, an operation counter and spring mechanism charge/discharge indicator, and electrical anti-pumping feature.
- 4.04.10 In addition to the auxiliary contacts required for normal breaker operation and indication, each breaker shall be provided with the following for interlocking purpose :-
- a. Position/Cell switch with 4 NO + 4 NC contacts.
 - b. Auxiliary switch, with minimum 6NO + 6NC contacts,
- 4.04.11 Spring charge limit switch shall be provided for breakers with motor wound spring charging mechanism. These limit switches shall be provided with minimum 2NO + 2NC contact.
- 4.04.12 Limit/auxiliary switches shall be convertible type, that is, suitable for changing N.O. contact to N.C. and vice-versa.
- 4.04.13 Each breakers operated feeder shall be provided with protective devices as specified in Annexure–B.

4.05.00 Switches

4.05.01 Switches shall be triple pole, air break, AC23 motor duty for motor feeders and AC22 heavy duty for other feeders.

Motors duty switches shall be capable of safely making and breaking the locked rotor current of the associated motor circuit.

4.05.02 The switch shall have a quick-make, quick-break mechanism operated by a suitable external handle, complete with position indicator. This handle shall have provision for padlocking in ON and OFF position.

4.05.03 The compartment door shall be interlocked mechanically with the switch such that the door cannot be opened unless the switch is in OFF position. Means shall be provided for releasing this interlock at any time.

4.05.04 Switches shall be capable of withstanding the let-through fault current of back-up fuses or circuit breakers.

4.05.05 Wherever two incoming switches and one bus-section switch are provided for an assembly, these shall be mechanically/key interlocked to ensure that only two out of the three can be closed at time.

Wherever two incoming switches are provided for an assembly, these shall be mechanically/key interlocked to ensure that one of the two can be closed at time.

4.05.06 All incoming and outgoing feeders shall be provided with bolted disconnect link for isolation of neutral if necessary.

4.06.00 Fuses

4.06.01 Fuses shall be HRC, preferably link type, with a minimum interrupting capacity equal to the short circuit current of the LT system. Fuses shall be mounted on insulated fuse carriers, which are mounted on fuse bases. Wherever it is not possible to mount fuses on carriers, fuses shall be directly mounted on plug-in type of base. In such cases, one set of insulated fuse pulling handles shall be supplied with each board.

4.06.02 Fuses shall be furnished complete with fuse bases and fittings of such design as to permit easy and safe replacement of fuse element.

Visible indication shall be provided on blowing of the fuse.

4.06.03 Motor fuse characteristics and ratings shall be chosen to ride over starting period without blowing. The fuse on incoming feeder wherever provided, shall be chosen to provide discrimination with motor/feeder fuses.

4.07.00 Moulded Case Circuit Breaker (MCCB)

4.07.01 The MCCBs shall be of drawout type with trip-free operating mechanism of quick make & quick break type. Each MCCB shall be equipped with thermal release for thermal overload and magnetic release for short circuit protection on each pole.

- 4.07.02 MCCBs / MPCBs shall be suitable for manual closing and opening and also automatic trip on overload and short circuit. MCCB shall have intermediate position to indicate trip condition.
- 4.07.03 The MCCBs shall be provided with mechanical ON-OFF indicator at the front panel. The MCCB handles, after the breaker tripped due to faults, shall occupy a mean position indicating trip condition.
- 4.07.04 The compartment door shall be interlocked mechanically with the MCCB such that the door cannot be opened unless the MCCB is in OFF position. Means shall be provided for releasing this interlock at any time.
- 4.07.05 All feeders of PMCC / MCC rated up to & including 630 Amp shall be provided with MCCB. Air circuit breaker shall be provided for feeders rated above 630 Amp. For critical loads ACB control feeders shall be provided which will be decided during detailed engineering.
- 4.07.06 Motors rating above 110 KW will be operated by Air circuit breaker and protected by consolidated numerical motor protection relay.
- 4.08.00 **A.C. Starter**
- 4.08.01 Contactors
- a. The contactors shall be three pole, air break type designed for duty class III - Category AC3 (for unidirectional motor) with non-bouncing silver/ silver alloy contacts. Contacts for reversible motors will be of AC4 duty.
 - b. Each contactor shall be provided with minimum two (2) normally open and two (2) normally closed auxiliary contacts rated 10 A at 240V A.C.
 - c. Reversing contacts shall be electrically and mechanically interlocked.
 - d. Contactors with delayed dropout feature shall be provided for some essential auxiliaries. These contactors shall not dropout on power failure if the voltage is restored within 3 seconds.
- 4.08.02 **Protection**
- a. Thermal overload relays shall be three element, positive acting, ambient temperature compensated with adjustable settings.
 - b. Single phase preventor relay shall be provided, preferably as an inbuilt feature of thermal overload relay.
 - c. Relays shall be manual reset type with two changeover potential-free contacts. Resetting of relays shall be possible with compartment door closed. Colour of the resetting button shall be BLACK.
 - d. Relays may be direct acting or C.T. operated, depending on current rating. C.T.s shall be included in the scope of supply.
 - e. Motor starters shall have type '2' co-ordination according to IEC 947-4.

- f. Earth fault relays with adjustable settings and time delays fed from core balance CT shall be provided.
- g. Numerical / Digital Motor protection relay with short circuit, over load, earth fault, locked rotor and unbalance (NPS) load protection functions shall be provided for motor rated above 90 kW.

4.09.00 Control Transformer

4.09.01 LT Switchboard control supply

The Bidder shall provide one (1) no. adequately rated 415V/110V Control Transformer in each bus section with necessary taps and auto changeover facility for providing control power supply to various modules of the board. The sizing of control transformer shall be carried out by the Bidder considering the actual load of power contactors, auxiliary contactors, indicating lamps and other equipment in the module circuit. An additional load of 15watts shall be considered for each module for remote auxiliary relays and lamps to be connected in the control circuit of modules. Bidder shall also ensure that control transformer are adequately designed for meeting the momentary loading requirements and the voltage drop during this condition shall not be more than 5%. Each transformer shall be sized for catering to control supply of both bus sections.

4.09.02 LT Switchboard space heater supply

The Bidder shall provide one (1) no. adequately rated 415V/240V Control Transformer in each bus section with necessary taps and auto changeover facility for providing power supply to panel space heater, Motor space heater of motor rated 30 KW & above, Panel Illumination & Socket. The supply of these two (2) nos. control transformer are tapped from incoming supply of 415V PMCC/MCC before the incoming breaker. Incoming circuit to the space heater auxiliary bus shall be through isolating switch HRC fuse and neutral link of suitable rating. The supply of different modules shall be tapped individually from the auxiliary bus bars. Control supply healthy indication shall be provided. Each transformer shall be sized for catering to space heater supply of both bus sections.

4.10.00 D.C. Starters

4.10.01 D.C. Starter for emergency oil pump shall be fixed resistance type, designed to provide fast acceleration during starting.

4.10.02 DC starters shall be complete with switch-fuse units, contactors, resistors, relays, meters, push-buttons, lamps, etc.

4.10.03 Starters shall be furnished in totally enclosed floor-mounting, sheet steel cubicles complete with a hinged front access door. Minimum thickness of sheet steel shall be 2mm.

4.10.04 The cubicle enclosure shall provide dust and humidity protection, the degree of protection being not less than IP-54.

The resistor enclosure shall be provided with ventilating louvers and wire mesh guard and shall have a degree of protection IP-23.

4.10.05 Cubicle space heater shall be provided to maintain internal temperature above dew point. Heater shall be furnished with switch-fuse unit and thermostat control.

4.11.00 **Relays**

4.11.01 All incoming and bus-coupler circuits and circuit breaker operated outgoing feeders shall be provided with numerical relays. Breaker operated motor feeders shall be provided with numerical motor protection relay.

4.11.02 The numerical relays shall have provisions for interfacing with Plant DDCMIS / PLC.

4.11.03 Relays shall be of drawout design with built-in testing facilities. Small auxiliary relays may be in non-drawout execution.

4.11.04 All protective relays, auxiliary relays, and timers shall be provided with hand reset operation indicator (flag).

4.11.05 Relays shall be rated for operation on 110V secondary voltage and 5 A or 1 A. Number and rating of relay contacts shall suit the job requirements.

4.12.00 **Control and Indication**

4.12.01 Circuit breakers shall be wired up for local and remote operation. Each breaker cubicle shall be equipped with the following :

- i) One (1) TEST-NORMAL-TRIAL selector switch with pistol grip handle and key interlock for breakers with motor wound spring charging mechanism.
- ii) On-Off control switches shall have three positions (T-N-C) and shall be spring return to 'Neutral' from close and trip positions. They shall have two contacts closing in close position and two contacts closing in trip positions, and shall have Pistol Grip handles. Lost motion feature shall be provided wherever required.
- iii) Following indicating lamps on the front of the compartment:

Breaker open	-	GREEN
Breaker closed	-	RED
Breaker tripped	-	AMBER
Spring charged	-	WHITE
Trip Ckt. Healthy	-	BLUE

Motor Space heater 'ON' for motor circuit - YELLOW

4.12.02 Push button shall be heavy duty, oil tight, push to actuate type with integral escutcheon plate marked with its function.

- 4.12.03 Each push button shall have minimum two (2) nos. normally open and two (2) nos. normally closed contacts rated 10 A at 240 V.
- 4.12.04 One (1) NORMAL-TRIAL selector switch shall be provided for all motor feeders.
- 4.12.05 Selectors switches shall be stay-put, rotary type with escutcheon plates marked to indicate the function and positions, and shall be lockable in each position. Selector switch contacts shall be rated for 10A at 240 V A.C.
- 4.12.06 Selector switches shall be provided with minimum three (3) contact blocks of 1 NO + 1 NC each.
- The exact requirements of contacts shall be decided by the Tenderers taking into account the scheme requirement and spares.
- 4.12.07 Lamps shall be clustered LED type with series resistor and coloured lens. Lens and lamps shall be replaceable from the front. Lamps shall be located just above the associated push button/control switch
- 4.12.08 The general scheme of connections for control, interlock and protection is shown in the enclosed drawings. Detailed requirements of individual circuits will be intimated later to the successful bidder, who shall develop and furnish the schemes accordingly.
- 4.13.00 **Meters**
- 4.13.01 All indicating instruments (96 x 96 mm) shall be switchboard type, with 250° scale, anti-glare glass and accuracy class of $\pm 2\%$ full scale. Each meter shall have zero adjuster on the front.
- 4.13.02 Motor ammeter shall be suitable to indicate starting current (6 to 8 times full load current) for DOL starting of motor.
- Motor ammeter shall be provided for motor rated 30 kW and above and for critical drives, to be finalized during detail engineering.
- 4.13.03 All incomers, tie feeders, circuit breaker operated motor feeders shall be provided with 3-phase multifunction meter with pulse output and communication port for interfacing with Plant DDCMIS / PLC.
- 4.13.04 Meter selector switches shall be maintained contact, stay-put type, with knob handle. Ammeter and voltmeter selector switches shall be four position type. Ammeter selector switches shall have made before break contacts, to prevent open circuiting of CT secondary.
- 4.14.00 **Current Transformer**
- 4.14.01 Current Transformer, shall be cast resin type rated 10 VA. All secondary connections shall be brought out to terminal blocks where wye or delta connection will be made.
- 4.14.02 Accuracy class of the current transformers shall be:
- a) Class PS for REF

- b) Class 5P20 for other relaying.
- c) Class 1.0 ISF < 5 for metering.
- d) Class 0.5 ISF < 5 for metering (Incomer & Bus coupler of PMCC)

Other CT particulars like ratio, burden, knee point, excitation current & secondary resistance shall be decided by the bidder.

4.14.03 CT secondary shall be rated for 1A for metering & either 5A or 1A for protection.

4.15.00 Voltage Transformer

4.15.01 Voltage transformers shall be cast-resin, drawout type and shall have an accuracy class of 1.0. Voltage transformer mounted on breaker carriage is not acceptable. For Incomer and bus coupler of PMCC accuracy class of voltage transformer shall be 0.5.

4.15.02 High voltage windings of voltage transformer shall be protected by current limiting fuses. The voltage transformer and fuses shall be completely disconnected and visibly grounded in fully draw out position.

4.15.03 Secondary winding MCBs, sized to prevent overload shall be installed in all ungrounded secondary leads. MCBs shall be suitably located to permit easy replacement while the switchgear/PMCC is energized.

4.15.04 Both primary side & secondary side fuse failure / voltage loss monitoring system of VT shall be provided.

4.16.00 Transducers

4.16.01 Transducer for conversion of AC electrical quantities such as voltage, current, KW etc. shall be supplied as required for remote connection to Plant DDCMIS / PLC. All transducers shall be dual output type.

4.16.02 The transducers for indicating type instruments shall be of very low burden type having 4-20 mA DC linear, galvanically isolated output, compatible with secondary instruments and Plant DDCMIS system.

4.17.00 Secondary Wiring

4.17.01 The PMCC/MCC/DB shall be fully wired at the factory to ensure proper functioning of control, protection and interlocking schemes.

4.17.02 Fuse and links shall be provided to permit individual circuit isolation from bus wires without disturbing other circuits. All spare contacts of relays, push buttons and other devices shall be wired upto terminal blocks.

4.17.03 Wiring shall be done with flexible, 650V grade, fire resistance PVC insulated switchboard wires with stranded Copper conductors of 2.5 mm² for control & current circuits and 1.5 mm² for voltage circuits.

- 4.17.04 Each wire shall be identified, at both ends, with permanent markers bearing wire numbers as per Contractor's wiring diagrams.
- 4.17.05 Wire terminations shall be made with crimping type connector with insulating sleeves. Wires shall not be spliced between terminals. Separate colour code shall be used for AC & DC circuit wiring for easy identification.
- 4.18.00 **Terminal Blocks**
- 4.18.01 Terminal blocks shall be 650V grade box-clamp type with marking strips similar to ELMEX 10 mm² or equal. Terminals for C.T. secondary leads shall have provision for shorting.
- 4.18.02 Terminal blocks used for interface with DDCMIS / PLC via termination cabinet shall be suitably sized to facilitate proper termination of interconnecting cables.
- 4.18.03 Not more than two wires shall be connected to any terminal. Spare terminals equal in number to 20% active terminals shall be furnished.
- 4.18.04 Terminal blocks shall be located to allow easy access. Wiring shall be so arranged that individual wires of an external cable can be connected to consecutive terminals.
- 4.19.00 **Cable Terminations**
- 4.19.01 PMCC shall be designed for cable entry from bottom. MCC/DB shall be designed for cable entry both from top and bottom. Actual configuration shall be intimated later sufficient space shall be provided for ease of termination and connection.
- 4.19.02 Power cables shall be 1100V, Copper/Aluminum conductor, XLPE insulated, armoured, FRLS PVC overall sheathed.
- Control cables shall be 1100V, PVC insulated, armoured, PVC overall sheathed with 2.5 mm² stranded Copper conductor.
- 4.19.03 All provisions and accessories shall be furnished for termination and connection of cables, including removable gland plates, cable supports, crimp type tinned Copper/Aluminium lugs, brass compression glands with tapered washer (Power Cables only) and Terminal blocks.
- 4.19.04 Sufficient space shall be provided between the lower most power cable termination and gland plate for easy cable connection.
- 4.20.00 **Bus Duct Connection**
- 4.20.01 Bus duct connections shall be furnished along with transition panel, if required. Unless mentioned otherwise bus duct connections shall generally be from the top.

- 4.20.02 All connecting bus work shall have the same continuous current rating as associated PMCC bus and shall be fully braced for the LT system short circuit current.
- 4.20.03 All provisions such as matching flange and other accessories shall be furnished for connection to bus duct.
- 4.21.00 **Ground Bus**
- 4.21.01 A Cu / Al ground bus rated to carry the maximum fault current, shall extend full length of the MCC/DB.
- 4.21.02 The ground bus shall be provided with two-bolt drilling with G.I. bolts & nuts at each end to receive 50 x 6 mm G.I. flats.
- 4.21.03 All stationary structures shall be directly connected to the ground bus for effective grounding.
- 4.21.04 The frame of draw out module shall be grounded at all times except when the power disconnects are separated by a safe distance.
- 4.21.05 All hinged doors shall be earthed through flexible copper braid wire.
- 4.22.00 **Nameplate**
- 4.22.01 Nameplate of approved design shall be provided for each control compartment and also at the top of each PMCC / MCC / DB.
- 4.22.02 The material of the name plate shall be anodized aluminium / lamicaid or approved equal, 3 mm thick, with white letter on black background. Name plates shall be minimum 20 x 75 mm for instrument / devices and 40 x 150 mm for panels.
- 4.22.03 Caution notice on suitable metal plate shall be affixed at the back of each vertical panel.
- 4.23.00 **Space Heater**
- 4.23.01 Panel and motor space heater shall be fed from separate AC auxiliary busbars running throughout the switchboard. The space heater bus shall be fed from control transformer described earlier. Suitable terminals shall also be provided to facilitate energisation of the control transformer from outside during long shutdown of the board.
- 4.23.02 Each vertical section of the PMCC / MCC / DB shall be furnished with thermostat controlled space heater and 5A, 5 pin plug socket.
- 4.23.03 In addition, motor feeders 30 KW and above shall be wired up for feeding motor space heater through starter auxiliary 'OFF' contacts.
- 4.23.04 Cubicle heater, Motor heater and plug socket circuit shall be provided with individual MCB/switch fuse units.

4.24.00 A.C./D.C. Power Supplies

4.24.01 Necessary 415V AC and 220V DC power supplies as required for control and service shall be arranged by the contractor. Single feeder shall be arranged for A.C. supply and duplicate feeder shall be arranged for D.C. supply.

4.24.02 Isolating switch fuse units shall be provided at each switchgear for the incoming supplies, 4-pole, single throw for A.C. and 2-pole, double throw for D.C. Molded case circuit breaker (MCCB) shall also be accepted as an alternative.

4.24.03 Bus-wires of adequate capacity shall be provided to distribute the incoming supplies to different cubicles. Isolating switch fuse units / MCCB shall be provided at each cubicle for A.C/D.C. supplies.

4.24.04 A.C. load shall be so distributed as to present a balanced loading on three-phase supply system.

4.25.00 Tropical Protection

All equipment, accessories and wiring shall have fungus protection, involving special treatment of insulation and metal against fungus, insects & corrosion.

Screens of corrosion resistant material shall be furnished on all ventilating louvers to prevent the entrance of insects.

4.26.00 Painting

4.26.01 All steel surfaces shall be sand blasted, grounded and pickled as required to produce a smooth, clean surface free of scale, grease & rust.

4.26.02 After cleaning, the surfaces shall be given a phosphate coating followed by two coats of high quality primer and stoved after each coat.

4.26.03 For paint shade of finish coat, refer clause no.1.16.00 of Section E1, Volume V-A.

4.26.04 Sufficient quantity of touch-up paint shall be furnished for application at site.

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

5.00.00 TESTS

5.01.00 All equipment shall be completely assembled, wired, adjusted and tested at the factory as per the relevant standards.

5.02.00 Routine Test

The tests shall include but not necessarily be limited to the following :-

- a. Operation under simulated service condition to ensure accuracy of wiring, correctness of control scheme and proper functioning of the equipment.

- b. All wiring and current carrying part shall be given appropriate High Voltage Test.
- c. Primary current & voltages shall be applied to all instrument transformers.
- d. Routine test shall be carried out on all equipment such as circuit breakers, switch - fuse, contactors, relays, meters etc.

5.03.00 Type Tests

All the Type Tests (as per IS- 8623/IEC) should have been carried out on an identical & similar type of switchgear for each rating involved in the project with ACB mounted in service condition inside the switchgear panel.

Bidder has to submit ACB type test reports for test sequence 1 and combined test sequence and Type 2 co-ordination test reports of any 3 ratings of starter ratings involved.

Type test certificates of any equipment shall be furnished if so designed by the purchaser/ owner. Otherwise the equipment shall have to be type tested free of charge, to prove the design. Type test performed before five (5) years are not acceptable.

6.00.00 DRAWINGS, DATA & MANUALS

6.01.00 Drawings, Data & Manuals shall be submitted in triplicate with the bid and in quantities and procedures as specified in General Conditions of Contract and/or elsewhere in the specification for approval and subsequent distribution after the issue of 'Letter of Intent'.

6.02.00 To be submitted with the bid :-

- a. General arrangement drawing showing constructional features, space required in front for withdrawals, power & control cable entry points etc.
- b. Typical foundation plan
- c. Typical control schematic
- d. Bill of materials
- e. Type test reports on circuit breaker
- f. Technical leaflets on :-
 - i) Circuit breaker
 - ii) Switch-fuse units
 - iii) Contactors
 - iv) Relays, meters, push buttons, selector switches etc.
 - v) Glands/terminals blocks

6.03.00 To be submitted for Owner / Purchaser's Approval and Distribution

All relevant drawings and data pertaining to the equipment like GTP, GA drawing, foundation plan, BOM, control & schematics, QAP, etc. shall be submitted by the Bidder for approval of Owner/Owner's consultant. Also refer clause no. 1.19.02(u) of Section-I of Volume – V-A: Technical Specifications for Electrical Equipment & Accessories.

ANNEXURE-A

RATINGS AND REQUIREMENTS

1.0 General

Type	:	ACB Modules - Drawout type MCCB Modules – Drawout type
Service	:	Indoor
Enclosure	:	IP52

2.0 System

		AC	DC
Voltage	:	415V ± 10%	220V (187-242V)
Phase	:	3-phase, 4-wire	2- wire
Frequency	:	50 Hz +3% to - 5%	
Combined voltage and Frequency variation	:	10% (absolute sum)	
System grounding	:	Solidly grounded	Ungrounded

3.0 Rating

Rated current	:	To be decided by the tenderers.
Design Ambient Temperature	:	50°C
Short Circuit Current Symm.	:	50 KA 25* KA

* Indicative only, the actual value will be decided by the tenderers.

S/C Withstand Time	:	----- 1 second -----
High voltage test for 1 minute	:	2.5 kV 1.5 kV

4.0 Duty

Circuit Breaker	:	0-3'-CO-3'-0
Contactor (AC)	:	Class III - Category AC3 for unidirectional drives and AC4 for bi- directional / inching duty drives
Contactor (DC)	:	Class I – category DC2
MCCB / Switch Duty for		AC DC
Motor Feeder	:	AC23 DC22

	Other Feeder	:	AC22	DC22
5.0	A.C. / D.C. Power Supply			
	Control Voltage for Circuit breaker	:	220V DC +10% to -15%	
	Control voltage for MCCB modules	:	110V AC $\pm$ 10%, 1Ph, 50Hz +3% to - 5%	
	Service voltage	:	240V AC $\pm$ 10%, 1Ph, 50Hz +3% to - 5%	

ANNEXURE-B

PROTECTIONS

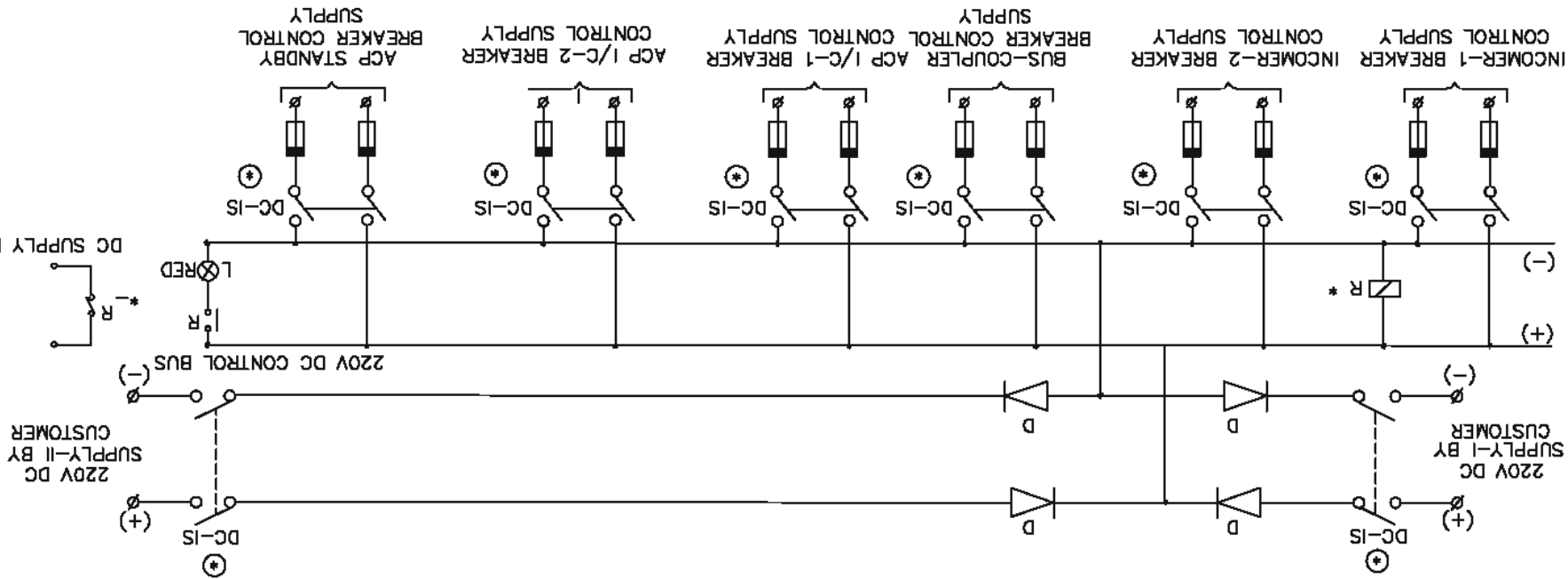
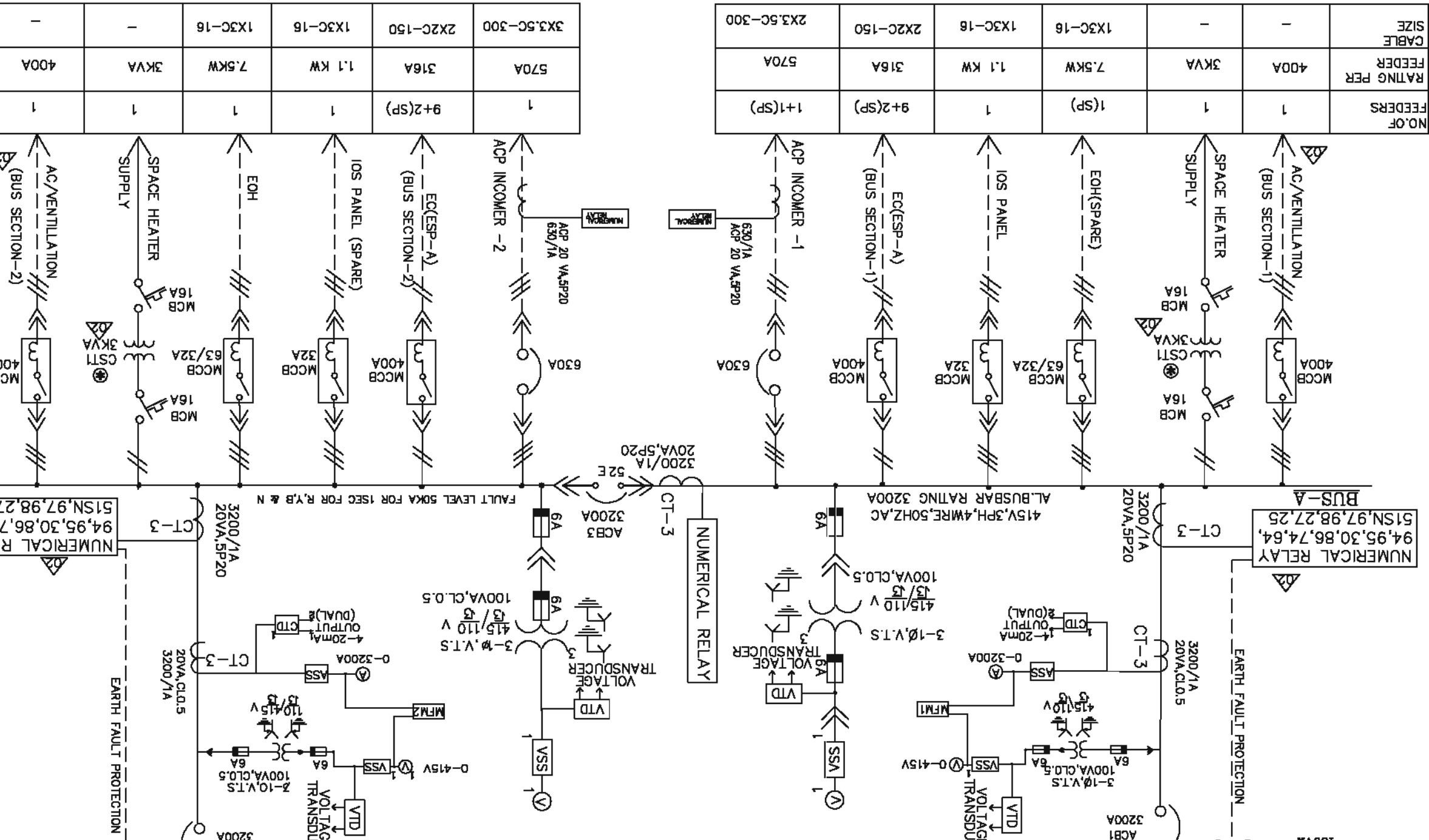
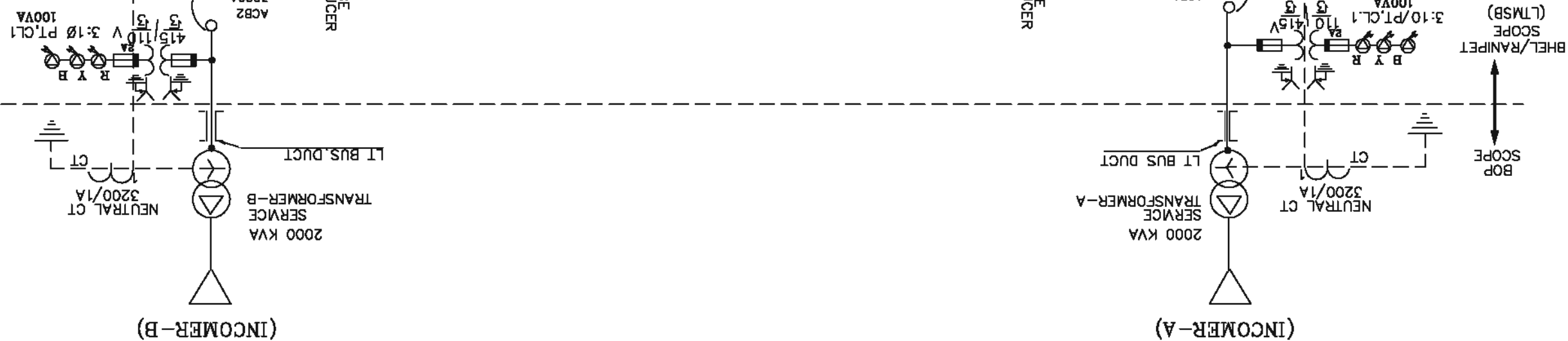
- 1.0 All Protective relays shall be microprocessor based numerical type having communication facility with Plant DDCMIS system / PLC.
- 2.0 The minimum protections to be provided for different types of circuits are listed below:
 - a. Incoming Feeder & Bus-coupler with ACB:
 - 3 - inverse time O/C relays (51) for phase fault.
 - 1 - Inverse time O/C relay (51N) for Earth fault.
 - 3 - Under Voltage (27), Range : 40-80% with timer
 - b. Motor Feeder with ACB: (above 110 kW)
 - 1 - Composite Motor protection relay (99) for protection against
 - Thermal overload
 - Phase faults
 - Unbalance (negative sequence)
 - Locked rotor
 - Excessive Start-up time and Start-Stop.
 - Earth fault
 - c. Outgoing Feeder : with ACB
 - 3 - Inverse time O/C relays (51) for phase fault.
 - 1 - Inverse time O/C relay (51N) for Earth fault.
- 3.0 Apart from protection relays, each electrically operated breaker shall be provided with anti-pumping (94), trip annunciation (30), lockout (86) and trip circuit supervision (74) relays. Lockout relay shall be hand reset type.
- 4.0 Both primary side & secondary side fuse failure / voltage loss monitoring system of VT shall be provided..
- 5.0 For Auto-bus change-over as well as live bus change-over through synchronization refer enclosed Control Schematic drawings.
- 6.0 Each incomer shall be provided with three (3) nos. Bus Energised indicating lamps – Red/Yellow/Blue for each phase.

ANNEXURE-C

FITTINGS & ACCESSORIES

Each switchboard shall be furnished complete with fittings and accessories as listed below: -

1. Operating mechanism complete with all accessories, fittings and tripping coil and closing coil, pole discrepancy feature etc. as required.
2. Base frame and anchor bolts and nuts.
3. Auxiliary contacts and relays.
4. LOCAL/REMOTE Selector switch, TRIP/CLOSE Push Buttons.
5. Manual tripping devices with protective flap.
6. Mechanical ON-OFF indicator.
7. Operation counters.
8. Set of switch fuse units/MCCB for A.C. and D.C. supply.
9. Space heater with thermostat and ON-OFF switch.
10. Cubicle illumination lamp with ON-OFF switch.
11. 3 Pin 5A Socket with ON-OFF Switch.
12. Terminal blocks and internal wiring - lot as required.
13. Other standard accessories which are not specifically mentioned but supplied with breakers of similar type and rating for efficient and trouble-free operation.
14. Bimetallic terminal connectors.



BREAKER CONTROL SUPPLY(DC) SCHEME

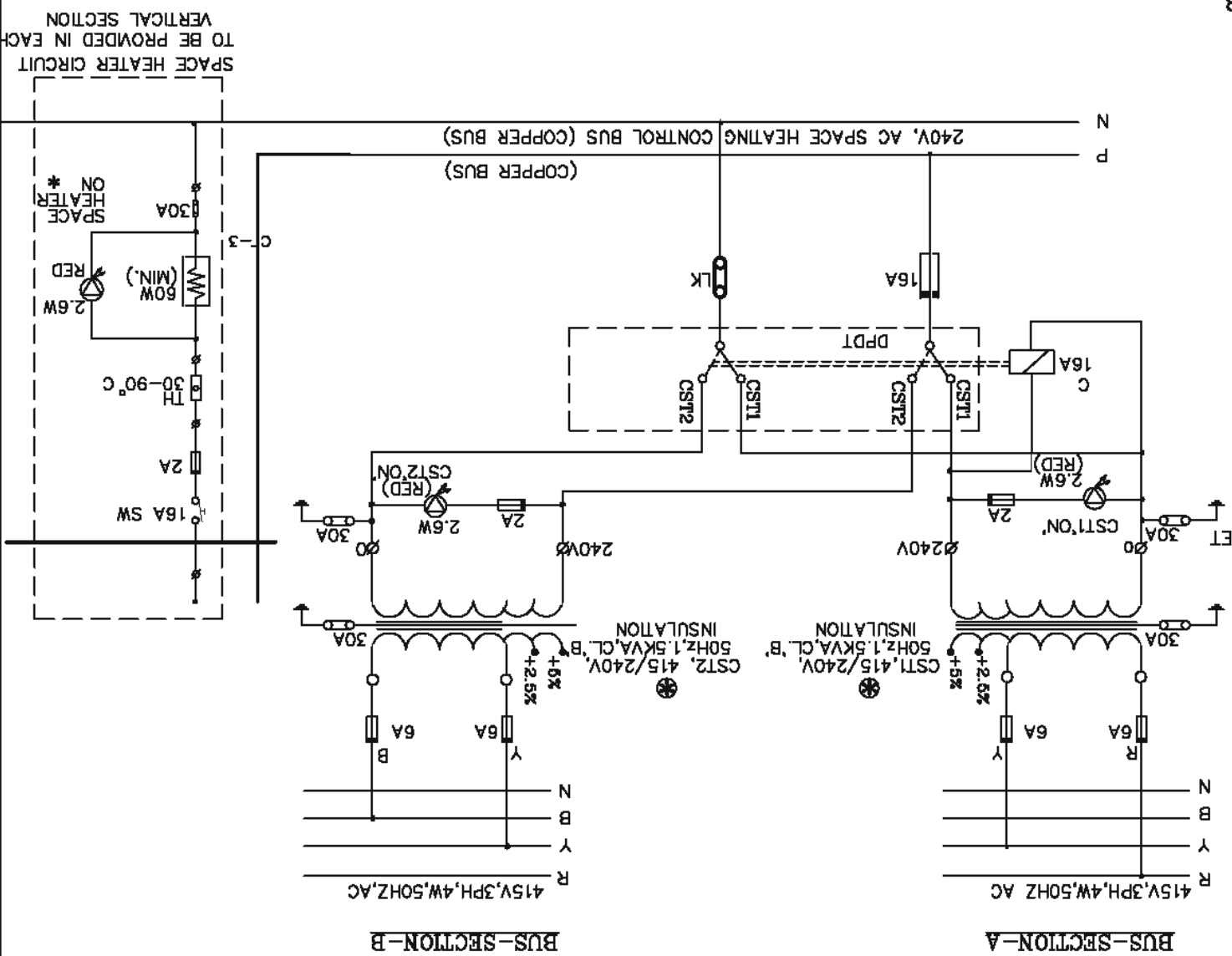
NOTES: -

01. NUMBER OF LTMSB PER ESP	: 1 NO.
02. NUMBER OF LTMSB PER BOILER	: 4 NOS.

1A13	2A13	3A13	4A13	5A13	6A13	7A13	8A13	9A13	1A23
1B13	2B13	3B13	4B13	5B13	6B13	7B13	8B13	9B13	1B23
1C13	2C13	3C13	4C13	5C13	6C13	7C13	8C13	9C13	1C23
1D13	2D13	3D13	4D13	5D13	6D13	7D13	8D13	9D13	1D23

FLOW
←
GAS

THIS DRAWING SHALL BE READ ALONG WITH BHET
SPACE HEATER SUPPLY TRANSFORMER CIRCUIT
DRG.NOS:2-00-114-30052 & 2-00-114-30053



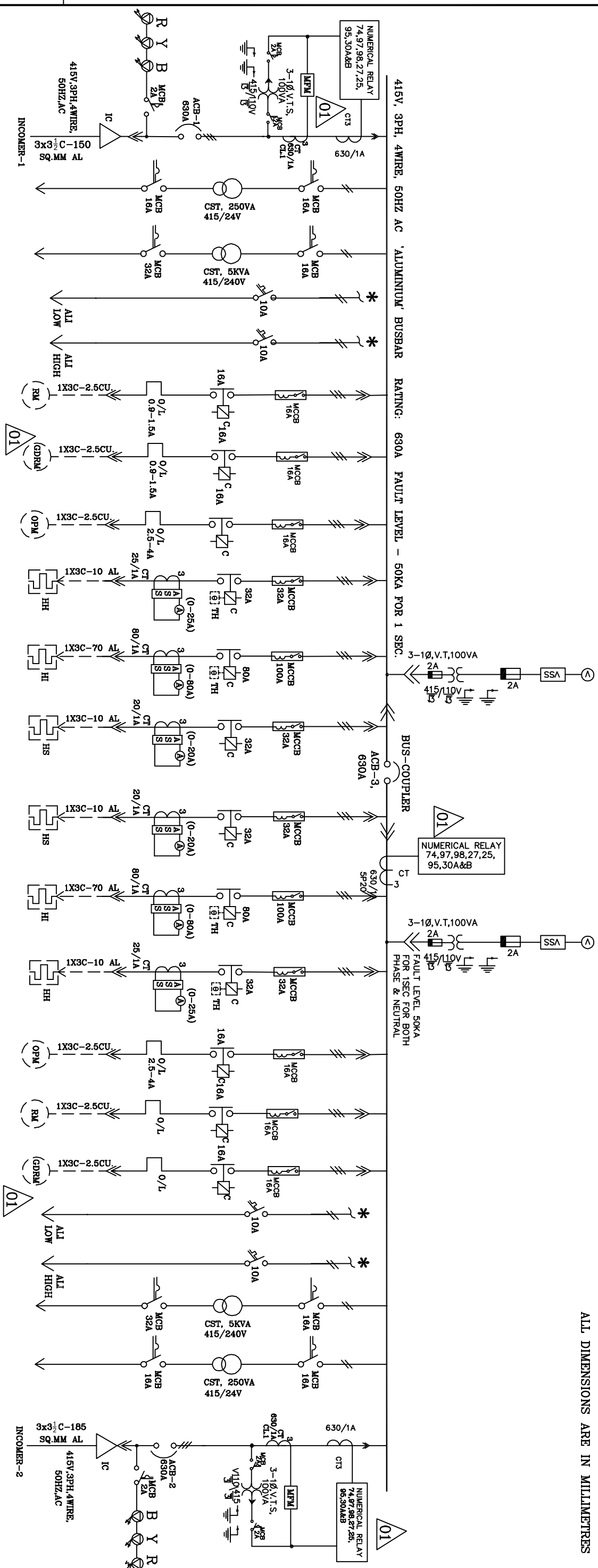
ESP SIZE : 4XFAA-9X45M-2X108150-2

CUSTOMER		ANDHRA PRADESH POWER GENERATION CORPORATION LTD (APGENCO)	
		1800 MW DR NTTPS STAGE-V UNIT@S. VAYATWADA	
		BHARAT HEAVY ELECTRICALS LTD	
		UNIT : BOILER AUXILIARIES PLANT	
		RAMJET-TAMILNADU 632 406	
		CONSULTING ENGINEERS	
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S.NO	DRAWING DESCRIPTION	DRAWING NUMBER	REV
01	LIST OF DRAWINGS FOR ACP	3-00-114-39588	00
02	SINGLE LINE DIAGRAM FOR ACP (TYPICAL)	3-00-114-39589	01
03	NOTES AND LEGENDS FOR ACP (TYPICAL)	3-00-114-39590	01
04	INCOMER CIRCUIT (TYPICAL)	3-00-114-39591	01
05	CONTROL SUPPLY TRANSFORMER AND SPACE HEATER CIRCUIT (TYPICAL)	3-00-114-39592	01
06	P&C CIRCUIT FOR HOPPER HEATER (TYPICAL)	3-00-114-39593	00
07	P&C CIRCUIT FOR RAPPING MOTOR (TYPICAL)	3-00-114-39594	00
08	P & C CIRCUIT FOR SUPPORT INSULATOR HEATER (TYPICAL)	3-00-114-39595	00
09	P&C CIRCUIT FOR OPACITY MONITOR (TYPICAL)	3-00-114-39596	00
10	P&C CIRCUIT FOR SHAFT INSULATOR HEATER	3-00-114-39597	00
11	TB ARRANGEMENT FOR 'ON' COMMAND, 'ON' FEEDBACK TO EC PANEL (BUS-SEC-1)(TYPICAL)	3-00-114-39598	00
12	TB ARRANGEMENT FOR 'ON' COMMAND, 'ON' FEEDBACK TO EC PANEL (BUS-SEC-1)(TYPICAL)	3-00-114-39599	00
13	TB ARRANGEMENT FOR 'ON' COMMAND, 'ON' FEEDBACK TO EC PANEL (BUS-SEC-2)(TYPICAL)	3-00-114-39600	00
14	MAKE OF COMPONENTS FOR ACP/LTMSB (TYPICAL)	3-00-114-39601	01

	CUSTOMER: ANDHRA PRADESH POWER GENERATION CORPORATION LTD 1x800 MW DR NTPS STAGE-V UNIT#8, VIJAYAWADA (BTG PACKAGE)																									
	OWNER'S CONSULTANT: DEVELOPMENT CONSULTANTS PVT. LTD. CONSULTING ENGINEERS KOLKATA MUMBAI CHENNAI NEW DELHI																									
	BHARAT HEAVY ELECTRICALS LTD BOILER AUXILIARIES PALNT RANIPET - 632 406																									
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<table><tr><td>DEPT</td><td>CODE</td><td>NAME</td><td>SIGN</td><td>DATE</td></tr><tr><td>DRN</td><td>M.VLB</td><td>M.VLB</td><td></td><td>05.04.17</td></tr><tr><td>DES</td><td>M.VLB</td><td>M.VLB</td><td></td><td>05.04.17</td></tr><tr><td>CHD</td><td>M.J.M</td><td>M.J.M</td><td></td><td>05.04.17</td></tr><tr><td>APPD</td><td>M.J.M</td><td>M.J.M</td><td></td><td>05.04.17</td></tr></table>		DEPT	CODE	NAME	SIGN	DATE	DRN	M.VLB	M.VLB		05.04.17	DES	M.VLB	M.VLB		05.04.17	CHD	M.J.M	M.J.M		05.04.17	APPD	M.J.M	M.J.M		05.04.17
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<table><tr><td>DEPT.</td><td>SCALE</td><td>DRAWING NO.</td></tr><tr><td>SIGN</td><td></td><td>3-00-114-39588</td></tr><tr><td>SHEET</td><td>1</td><td>REV. 01</td></tr></table>		DEPT.	SCALE	DRAWING NO.	SIGN		3-00-114-39588	SHEET	1	REV. 01																
DEPT.	SCALE	DRAWING NO.																								
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SIZE-A3																										

ALL DIMENSIONS ARE IN MILLIMETRES



NO.OF FEEDERS	1	1	1	-	-	18+4(SP)	1	1	9+2(SP)	1+1(SP)	1+1(SP)	1	1	9+2(SP)	1(SP)	18+4(SP)	1	-	-	1	1	1
FEEDER RATING	570A	250VA	5KVA	-	-	0.37KW	0.37KW	1.1KW	12KW	36KW	9KW	9KW	36KW	12KW	1.1KW	0.37KW	0.37KW	-	-	5KVA	250VA	570A

01

ESP SIZE : 4XFAA-9X45M-2X108150-2

LEGEND

R	—	RED
G	—	GREEN
A	—	AMBER
Y	—	YELLOW
B	—	BLUE

NOTE

01. NUMBER OF AUXILIARY CONTROL PANEL PER BOILER IS FOUR..

CUSTOMER:	 ANDHRA PRADESH POWER GENERATION CORPORATION LTD 1x800 MW DR NTDS STAGE-V UNIT#8, VIJAYAWADA (BTG PACKAGE)					
OWNER'S CONSULTANT:	 DEVELOPMENT CONSULTANTS PVT. LTD. CONSULTING ENGINEERS KOLKATA MUMBAI CHENNAI NEW DELHI					
	 BHARTI HEAVY ELECTRICALS LTD BOILER AUXILIARIES PLANT RANIPET-632 406					
COPY RIGHT AND CONFIDENTIAL.		REF ID:	NAME	SIGN	DATE	
The information on this document is the property of BHARTI HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company.		DRAWN	MAYUJI	MAYUJI	05.04.17	
		DESIGN	MAYUJI	MAYUJI	05.04.17	
		CHECK	M.L.M	M.L.M	05.04.17	
		APPD	M.L.M	M.L.M	05.04.17	

SINGLE LINE DIAGRAM FOR ACP (TYPICAL)

[illegible]

SIZE-A3

NOTE:

01. CONSTRUCTION : SINGLE FRONT FOR ACB AND DOUBLE FRONT FOR OTHER

OUTGOING FEEDERS, DRAW-OUT FOR INCOMER AND OUTGOING FEEDERS, EXCEPT CST, ALL AND MARSHALLING COMPARTMENTS.

02. NO.OF AUXILIARY CONTROL PANEL : FOUR NUMBER PER BOILER.

03. ACP SHALL BE SUITABLE FOR 3PH, 4WIRE, 415V, 50HZ SUPPLY.

04. ALL POWER, CONTROL SWITCHES AND RESET PUSH BUTTONS SHALL BE MOUNTED ON MODULE DOORS. ALL INSTRUMENTS AND SWITCHES SHALL BE FLUSH MOUNTED.

05. DOUBLE COMPRESSION TYPE BRASS CABLE GLANDS AND HEAVY DUTY ANNEALED TINNED COPPER(ATC) LUGS ARE ENVISAGED FOR ALL MODULES AND THE SAME SHALL BE SUPPLIED BY THE ACP PANEL MANUFACTURER.

06. DOOR INTERLOCK SHALL BE SUCH THAT THE DOOR CAN NOT BE OPENED WITH THE BREAKER AND FSU IN 'ON' POSITION.

07. TWO SET OF OPERATION AND MAINTNANCE MANUAL WILL BE SUPPLIED BY PANEL MANUFACTURER ALONG WITH THE PANEL.

08. PANEL CONTROL WIRING 1100V GRADE PVC INSULATED COPPER 2.5SQMM FOR CT/PT AND 2.5SQMM FOR OTHER CONTROL WIRING.

09. ALL INSTRUMENTS AND SWITCHES SHALL BE FLUSH MOUNTED.

10. OVERLOAD RELAYS SHALL BE WITH BUILT-IN SINGLE PHASING PROTECTION.

11. INDICATION LAMPS SHALL BE OF CLUSTERED LED TYPE.

12. THE CIRCUIT IS DRAWN FOR THE FOLLOWING CONDITIONS:

i). POWER AND CONTROL SUPPLY OFF.

ii). ALL CONTACTORS IN DE-ENERGISED CONDITION.

13. EQUIPMENTS SHOWN IN DOTTED LINES IN DETAILED SCHEMES ARE EXTERNAL TO THE PANEL.

14. OPERATING HEIGHT (HANDLE/PUSH BUTTON POSITION) SHALL BE RESTRICTED BETWEEN 250MM AND 1900MM FROM THE FLOOR LEVEL.

15. CABLE ENTRY SHALL BE FROM THE BOTTOM.

16. CT(METERING) ACCURACY SHALL BE CLASS-1.

17. PANEL COLOUR SHALL BE AS PER IS 631.

18. DEGREE OF PROTECTION : IP-54 AS PER IS-13947.

19. ALL SPARE CONTACTS SHALL BE WIRED UP TO TB.

20. THE ACP SHALL BE EXTENDABLE AT BOTH ENDS WITH OUTGOING FEEDERS.

21. ALL INSTRUMENTS SHALL HAVE ACCURACY CLASS OF 1.

22. THE CONTROL BUS SHALL BE MADE OF COPPER.

23. THE ACP MANUFACTURER SHALL PROVIDE 4 NOS. MARSHALLING COMPARTMENTS IN EACH ACP (TWO NUMBERS ON EACH BUS-SECTION), AT DIFFERENT VERTICAL SECTIONS, FOR HOUSING RAPPING MOTOR& HOPPER THERMOSTAT WIRELESS MASTER MODULE. 20% SPARE TB SHALL BE PROVIDED.

24. MINIMUM MODULE HEIGHT SHALL BE 300mm.

25. THE THICKNESS OF PANEL LOAD BEARING - 2MM (MIN) (CRCA)

NON LOAD BEARING - 1.6MM (MIN) (CRCA)

GIAND PLATE - 3MM (CRCA)

26. INDICATING METER SHALL BE OF SIZE 96X96 SQ. MM.

27. TWO NUMBERS INTERPOSING RELAYS FOR EACH BREAKERS (ONE FOR CLOSING, ONE FOR TRIPPING THE BREAKERS) SHALL BE SUPPLIED AND WIRED BY THE ACP PANEL MANUFACTURER.

28. EARTHING BUS-BAR SHALL BE OF COPPER OF SIZE 50X6MM SHALL BE PROVIDED.

29. ALL PROTECTION RELAYS (O/C RELAY, E/F RELAY, U/V RELAY, TRIP CIRCUIT SUPER VISION RELAY, LOCK OUT RELAY& MASTER TRIP RELAY) SHALL BE OF NEUMERICAL TYPE WITH IEC-61850 PROTOCOL (SAME WILL BE CONFIRMED DURING VENDOR DRAWING APPROVAL STAGE).

30. ALL WIRELESS CONTROLLER SYSTEM SHALL BE FITTED IN THE ACP MARSHALLING COMPARTMENT /SUITABLE LOCAL FRP JUNCTION BOXES AND THAT SHALL BE SUPPLIED BY BHEL/RANIPET AS A FREE ISSUE ITEMS.THE FRP JUNCTION BOX SHALL BE PAINTED WITH SHADE 631 OF IS-6 AND SHALL BE SUITABLE FOR OUTDOOR & IP-66 DEGREE OF PROTECTION.THE WIRELESS MASTER CONTROLLER SHALL BE SUITABLY FITTED IN THE MARSHALLING MODULE AND SHALL BE WIRED SUITABLY.

31. TRIP CIRCUIT SUPERVISION RELAY (74), POWER SUPPLY HEALTHY RELAY, FUSE FAILURE RELAY SHALL BE PROVIDED FOR EACH ABC FEEDERS.

32. NECESSARY RELAYS AND TIMERS SHALL BE PROVIDED IN ALL BREAKERS.

33. PAINT SHADE SHALL BE EXTERIOR-OPALINE GREEN, INTERIOR SHOLD BE SEMI GLOSSY WHITE

LEGEND:-

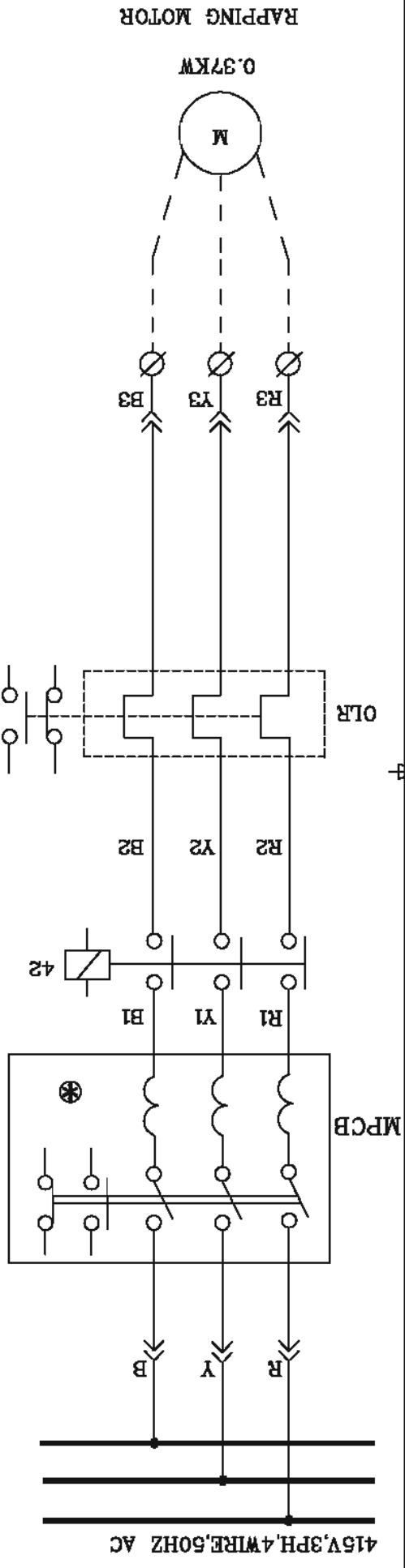
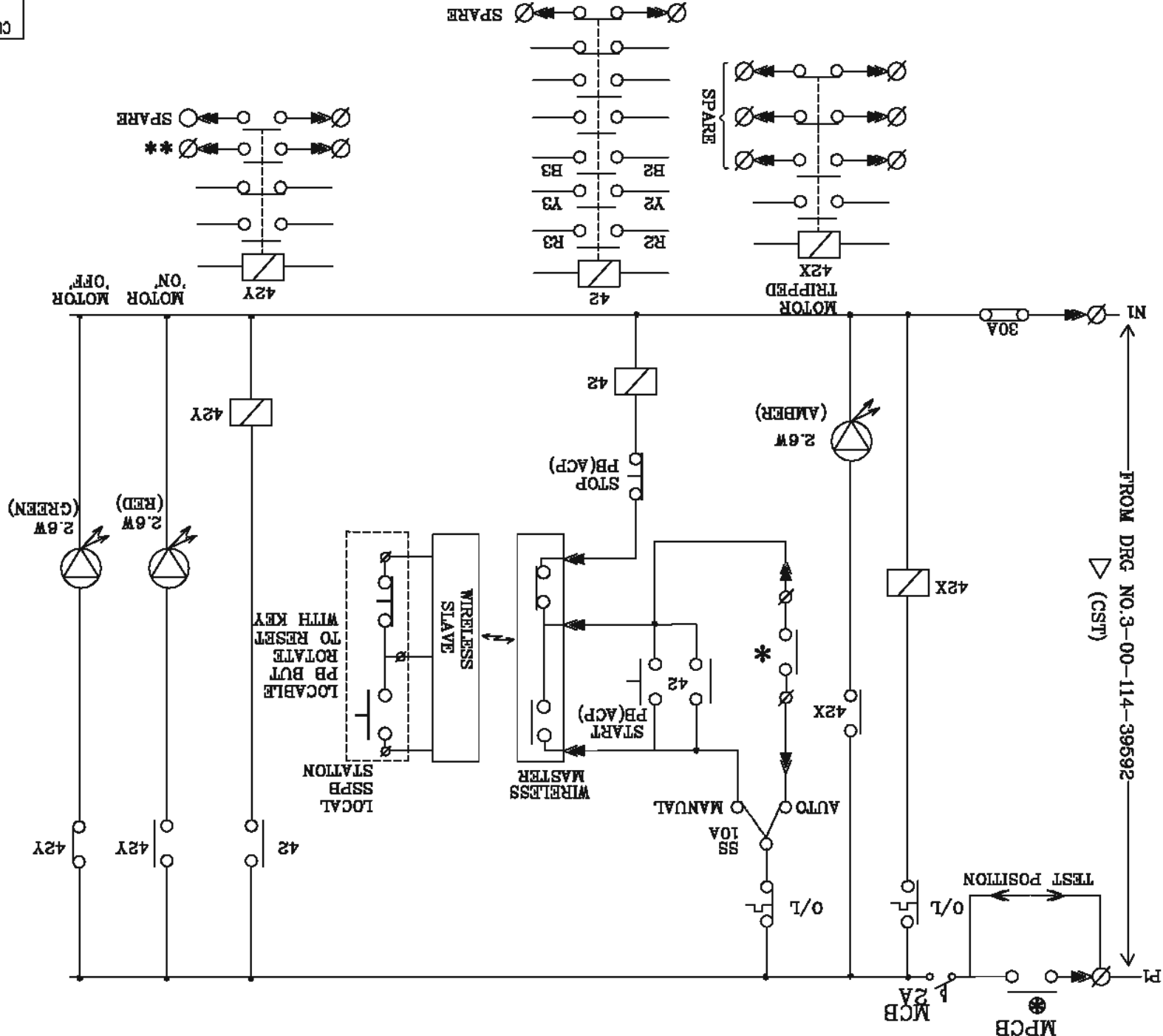
A AMMETER
V VOLTMETER
ASS AMMETER SELECTOR SWITCH
RM RAPPING MOTOR
IS ISOLATING SWITCH
CT CURRENT TRANSFORMER
HH HOPPER HEATER
HI SUPPORT INSULATOR HEATER
HS SHAFT INSULATOR HEATER
C CONTACTOR
TH THERMOSTAT
TPDT TRIPPLE POLE DOUBLE THROW SWITCH
GDRM GAS DISTRIBUTION RAPPING MOTOR
CERM COLLECTING ELECTRODE RAPPING MOTOR
EERM EMITTING ELECTRODE RAPPING MOTOR
SSPB START STOP PUSH BUTTON STATION
ACB AIR CIRCUIT BREAKER
MCB MINATURE CIRCUIT BREKER
MCCB MOULDED CASE CIRCUIT BREAKER
MPCB MOTOR PROTECTION CIRCUIT BREAKER
MFM MULTIFUNCTION METER
JB JUNCTION BOX
SS SELECTOR SWITCH
CST CONTROL SUPPLY TRANSFORMER
ACP AUXILIARY CONTROL PANEL
EC ELECTRONIC CONTROLLER
SW CONTROL SWITCH
PB PUSH BUTTON

0/L THERMAL OVERLOAD RELAY
FIXED TERMINAL
LINK
EXTERNAL TO THE PANEL
DRAWOUT TERMINAL
INDICATION LAMP(LED TYPE)

01 34. ALL BREAKERS SHALL BE 4 POLE OPERATED AS THE ACP IS 3 PHASE 4 WIRE
01 35. THE INCOMER MODULE SHALL BE INTERLOCKED WITH THEIR UPSTREAM BREAKER SUCH THAT THEY CAN BE CLOSED ONLY WHEN UPSTREAM BREAKER IS CLOSED AND TRIP AUTOMATICALLY WHEN UPSTREAM BREAKER IS TRIPPED OR FAULTED
01 36. POTENTIAL FREE CONTACTS SHALL BE PROVIDED FOR THE FOLLOWING
a) BREAKER AUTO TRIPPED, LOCKOUT RELAY OPERATED
b) BUS UNDER VOLTAGE
c) SOURCES PARALLELED BEYOND PRESET TIME
d) INCOMING 220V DC CONTROL SUPPLY FAILED
e) BUS PT NOT IN SERVICE
f) BUS PT FUSE FAILED

CUSTOMER:		OWNERS CONSULTANT:		BHARAT HEAVY ELECTRICALS LTD		KOKATA MUMBAI CHENNAI NEW DELHI	
ANDHRA PRADESH POWER DEVELOPMENT CO. LTD		DEVELOPMENT CONSULTANTS PVT. LTD.		CONSUULTING ENGINEERS		UNIT : BOILER AUXILIARIES PLANT	
RANIPET--TAMILNADU 632 406		COPY RIGHT AND CONFIDENTIAL		THIS INFORMATION IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED IT MUST NOT BE USED OR REPRODUCED IN ANY MANNER WITHOUT THE WRITTEN PERMISSION OF THE COMPANY.		DRAWING NO.	
3-00-114-39590		SHEET 1 OF 1		REV. 01		Size A3	

1. OUTGOING TERMINALS FOR SSPB CONTROL TO BE LOCATED AT SEPARATE MARSHALLING COMPARTMENT WHERE THE WIRELESS CONTROLLER IS FITTED.
2. THE WIRELESS CONTROLLERS LIKE MASTER,SLAVE AND REPEATERS WILL BE SUPPLIED BY BHEL/RANIPET AS A FREE ISSUE ITEMS.
3. THE WIRELESS MASTER SHALL BE FLUSH MOUNTED TYPE AND SUITABLY FITTED & WIRED BY PANEL MANUFACTURER.
4. THE FOLLOWING COMPONENTS ARE TO BE FITTED IN THE MARSHALLING MODULE FOR WIRELESS CONTROL SYSTEM FOR ESP RAPPING MOTOR & HOPPER HEATERS.
5. ZIGBEE DONGLE (150MM(B) X110MM(H)X40MM(D)).CUTOUT FOR THE ZIGBEE DONGLE TO BE PROVIDED IN THE PANEL FOR A SIZE OF 90MM X 106MM.
6. THE SIZE OF THE CUTOUT WILL BE FINALISED DURING DRAWING APPROVAL STAGE.

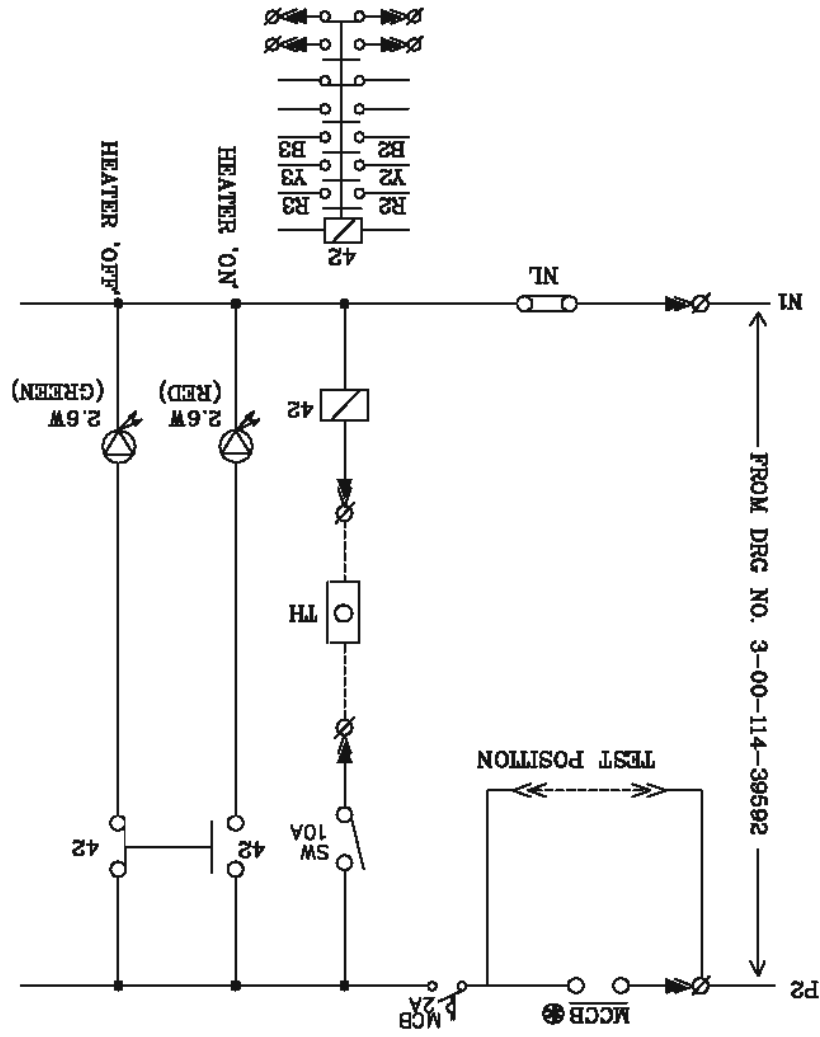
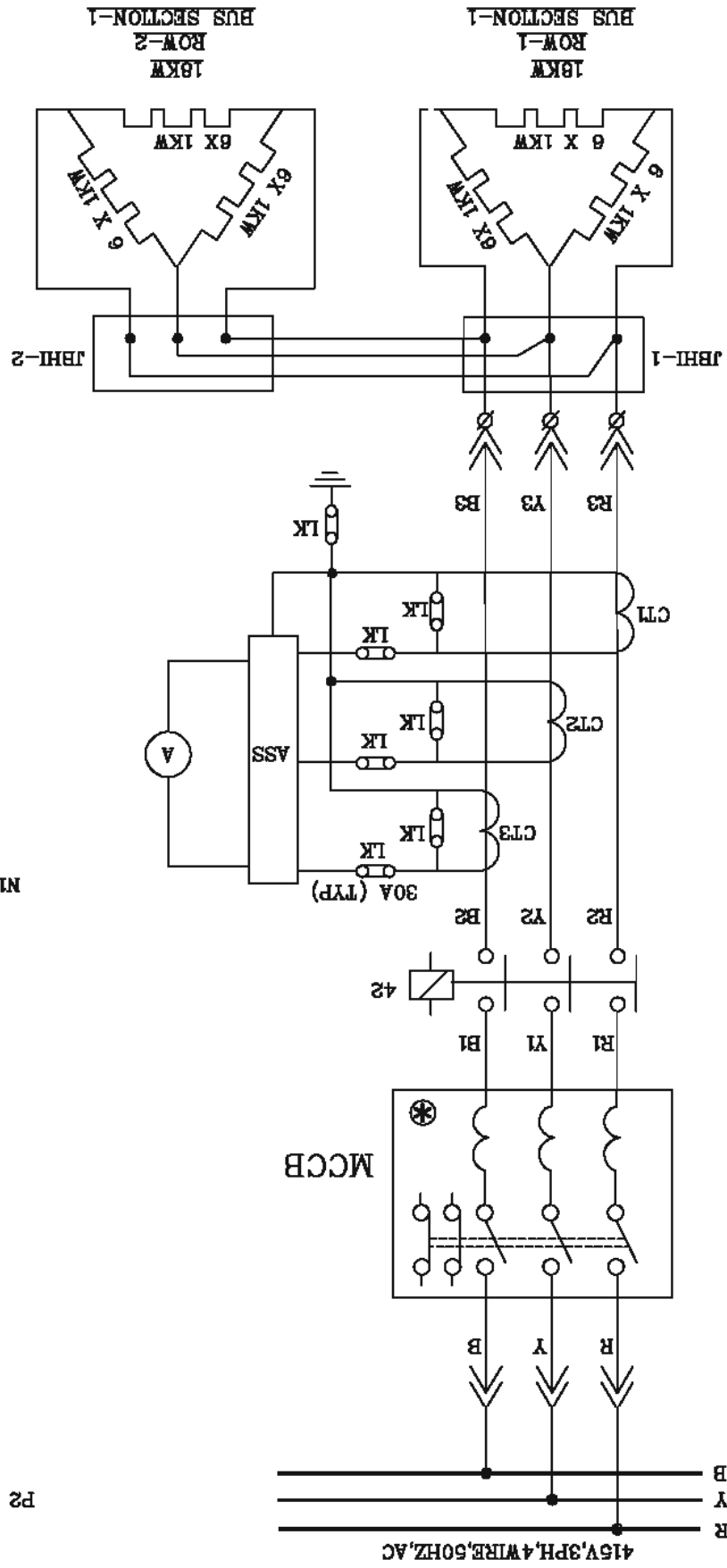


LEGEND

>> >> CLOSE IN SERVICE POSITION ONLY
 << << CLOSE IN BOTH SERVICE AND TEXT POSITION
 << << ** - CONTACT FOR 'ON' FEEDBACK FROM MARSHALLING MODULE (BUFFER CARD)
 << << * - CONTACT FOR 'ON' COMMAND FROM MARSHALLING MODULE (RELAY CARD)

NOTE AUTO/MANUAL SELECTOR SWITCH SHALL BE LOCATED INSIDE THE PANEL.

CUSTOMER: ANDHRA PRADESH POWER GENERATION CORPORATION LTD (BTR PACKAGE) 1800 MW DR NTPS STAGE-V UNIT#6, VIJAYAWADA		OWNER'S CONSULTANT: DEVELOPMENT CONSULTANTS PVT. LTD. KOLKATA MUMBAI CHENNAI NEW DELHI		BHARAT HEAVY ELECTRICALS LTD BOILER AUXILIARIES PLANT RANIPET - 632 406	
DEPT: NAME: DATE: 05.04.17		DESIGN: NAME: DATE: 05.04.17		CHECK: NAME: DATE: 05.04.17	
COPY RIGHT AND CONFIDENTIAL		The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company.		M	
TITLE: P&C CIRCUIT FOR RAPPING MOTOR (TYPICAL)		DRAWING NO. 3-00-114-39594		SHEET 1 OF 1 REV. 02	
SIZE-A3		12		11	



ITEM	CABLE SIZE	QTY/ACP
SUPPORT INSULATOR HEATER THERMOSTAT	1X3C-2.5	2

SECRET

◀ ▶

CLOSE IN BOTH SERVICE AND TEXT POSITION

CLOSE IN SERVICE POSITION ONLY

CLOSE IN BOTH SERVICE AND TEXT POSITION

CUSTOMER:



ANDHRA PRADESH POWER GENERATION CORPORATION LTD
1x800 MW DR NTTPS STAGE-V UNIT#8, VIJAYAWADA
(BTG PACKAGE)
DEVELOPMENT CONSULTANTS PVT. LT
CONSULTING ENGINEERS
KOLKATA MUMBAI CHENNAI NEW DELHI
BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

37111

P & C CIRCUIT FOR SUPPORT INSULATOR HEATER (TYPICAL)

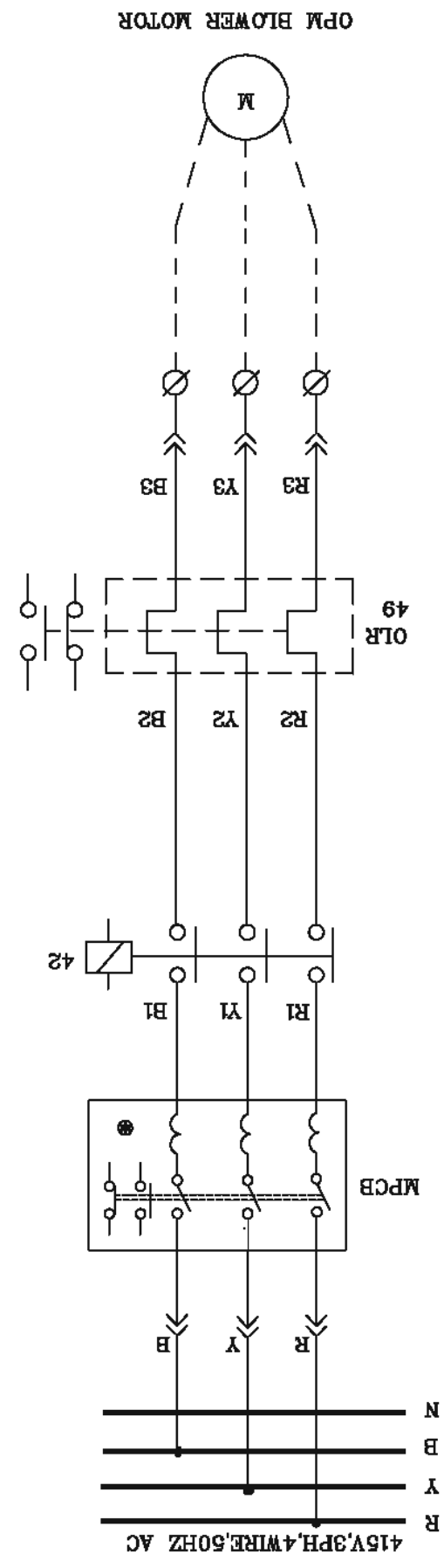
The information on this document is the property of
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 indirectly in any way detrimental to the interest of the company.

DEPT	CODE	M
DRN	M.V.I	
DESN	M.V.I	
CHD	M.V.I	
APPD	M.V.I	
	DATE	

DRAWING NO.	3-00-114-39595
SHEET 1 OF 1	REV. 00

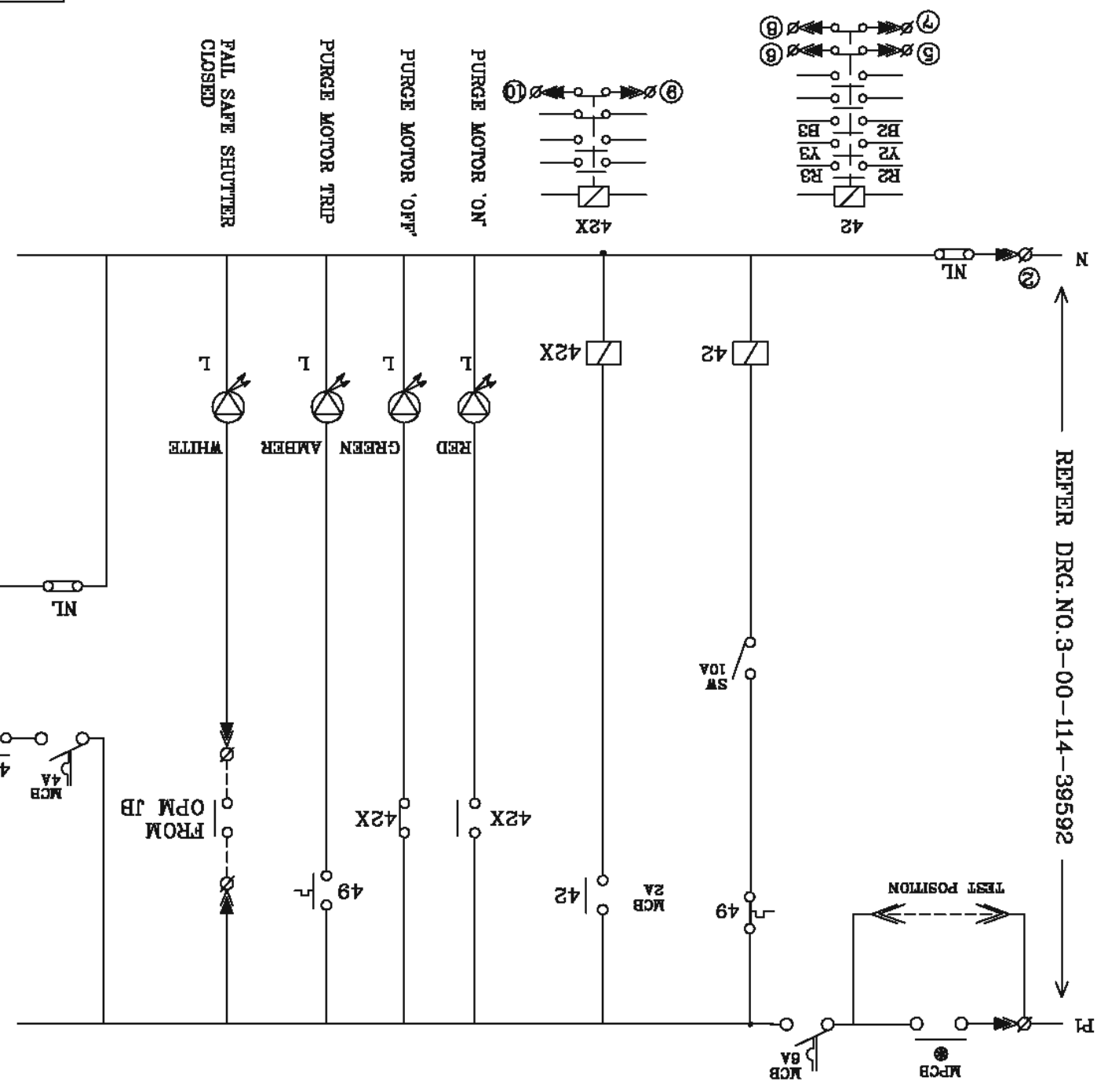
SIZE-A3

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LEGEND

CLOSE IN BOTH SERVICE AND TEST POSITION
 CLOSE IN SERVICE POSITION ONLY



CUSTOMER:
TELANGANA STATE POWER GENERATION CORPORATION LTD
TELANGANA STATE, INDIA
1x800 MW KOTHAGUDAM TPS STAGE-VII UNIT#12, PALONCHA

OWNER'S CONSULTANT:
DEVELOPMENT CONSULTANTS PVT. LTD.
CONSULTING ENGINEERS
KOLKATA MUMBAI CHENNAI NEW DELHI

BOILER AUXILIARIES PALNT
BHARAT HEAVY ELECTRICALS LTD
RANIPET- 632 406

DEPT: NAME: SIGN: DATE: 05.04.17

CODE: DESN: NAME: SIGN: DATE: 05.04.17

APPD: NAME: SIGN: DATE: 05.04.17

CHKD: NAME: SIGN: DATE: 05.04.17

DATE: 05.04.17

TITLE
P&C CIRCUIT FOR OPACITY MONITOR (TYPICAL)

DRAWING NO. 3-00-114-39596

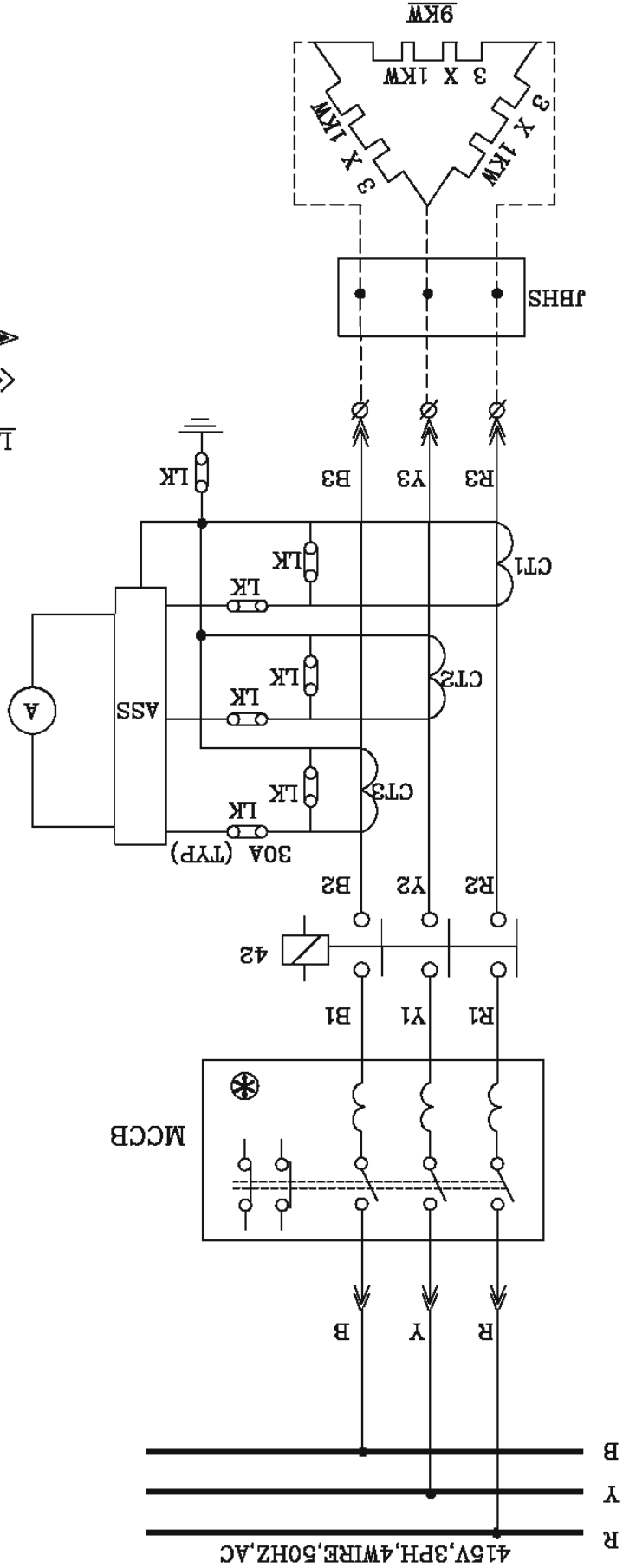
SHEET 1 OF REV. 00

SIZE-A3

CONTROL CABLE GROUPING CHART

ITEM	CABLE SIZE	QTY/ACP
OPACITY MONITOR 2X3C-2.5		1

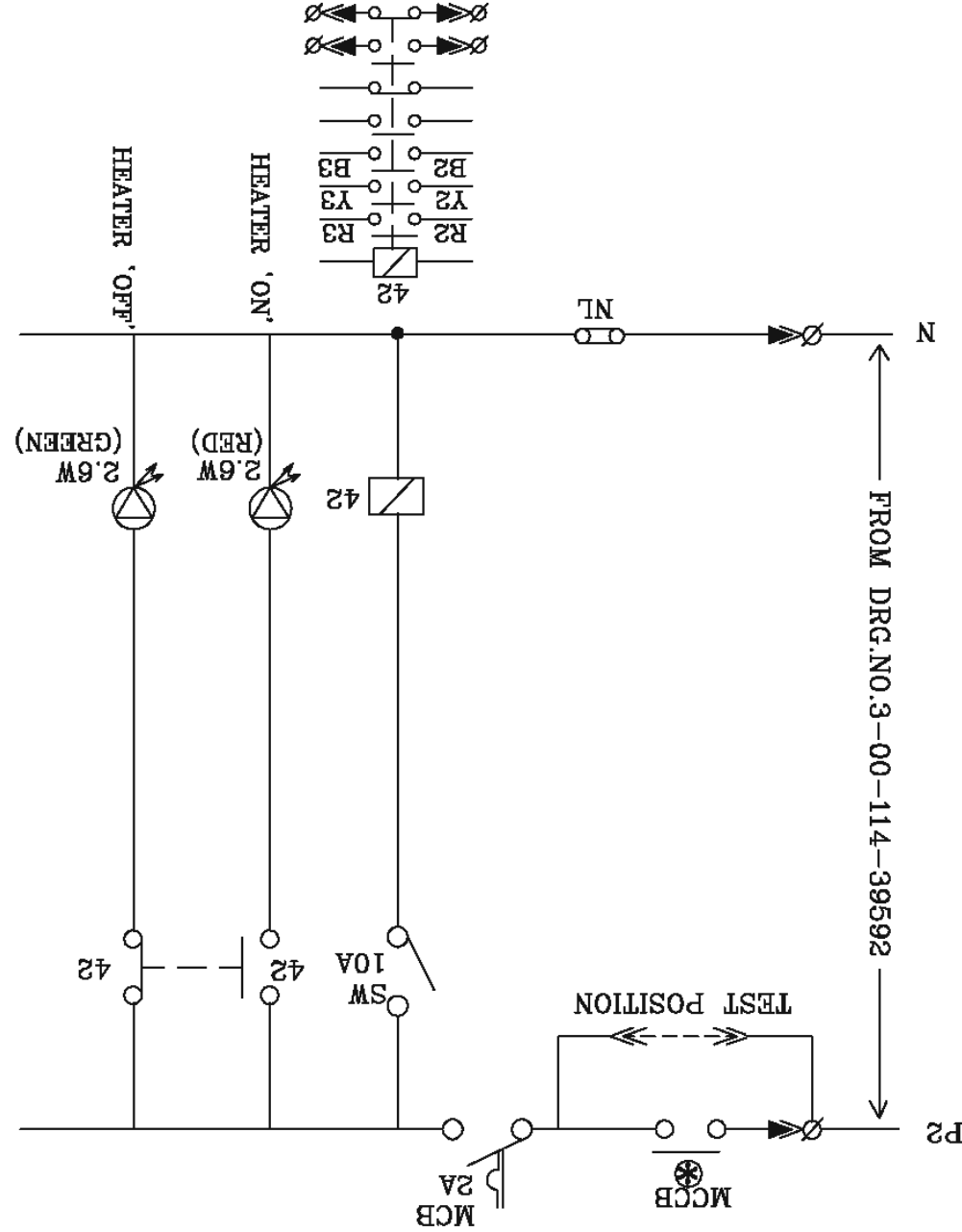
TO OPACITY MONITOR
(CONTROL SUPPLY)
240 V



LEGEND

>> >> CLOSE IN SERVICE POSITION ONLY

>> >> CLOSE IN BOTH SERVICE AND TEXT POSITION



CUSTOMER:		ANDHRA PRADESH POWER GENERATION CORPORATION LTD 1x800 MW DR NTPS STAGE-V UNIT#8, VIJAYAWADA (BTG PACKAGE)		DEVELOPMENT CONSULTANTS PVT. LTD. CONSULTING ENGINEERS KOLKATA MUMBAI CHENNAI NEW DELHI		BHARAT HEAVY ELECTRICALS LTD BOILER AUXILIARIES PLANT RANIPET - 632 406	
OWNER'S CONSULTANT:				BHARAT HEAVY ELECTRICALS LTD			
DEPT		NAME		SIGN		DATE	
CODE		DRN		M.V.I.I		05.04.17	
M		CHD		M.J.M		05.04.17	
APPD		M.J.M		M.V.I.I		05.04.17	
TITLE		P&C CIRCUIT FOR SHAFT INSULATOR HEATER					
DRAWING NO.		3-00-114-39597					
SHEET 1 OF 1		REV. 00		SIZE-A3			

ALL DIMENSIONS ARE IN MILLIMETRES

- THE PANEL MANUFACTURER CAN USE ANY ONE OF THE MAKES INDICATED AGAINST EACH ITEM. HOWEVER FOR THE SUPPLY OF PANEL TO ONE SITE, ONLY ONE MAKE SHALL BE USED AGAINST EACH ITEM, i.e., NO MIX-UP IN MAKES AGAINST EACH ITEM IS ALLOWED.

THE PANEL MANUFACTURER CAN USE ANY ONE OF THE MAKES INDICATED AGAINST EACH ITEM. HOWEVER FOR THE SUPPLY OF PANEL TO ONE SITE, ONLY ONE MAKE SHALL BE USED AGAINST EACH ITEM, i.e., NO MIX-UP IN MAKES AGAINST EACH ITEM IS ALLOWED.

ANDHRA PRADESH POWER GENERATION CORPORATION LTD	1600 MW DR NTTS STAGE-A UNIT#8, VAYATAMADA (BIG PACKAGE)	DEVELOPMENT CONSULTING PVT. LTD.	KOLKATA MUMBAI CHENNAI NEW DELHI CONSULTING ENGINEERS	BHARAT HEAVY ELECTRICALS LTD BOILER AUXILIARIES PATENT	MANIPET - B32 408	
						

LTMSB & ACP MANDATORY SPARES LIST

Sl.no	LTMSB SPARES	UNIT	TOTAL QUANTITY	REMARKS
	Air Circuit Breaker			
1	Trip Coil	NO	20	20 No's for 3200A breaker
2	Closing Coil	NO	21	21 No's for 3200A breaker
3	Spring Charging Motor	NO	5	10 No's for 3200A breaker
4	Spring Charging Motor with complete Mechanisim	NO	5	10 No's for 3200A breaker
5	Spring Charged Limit Switch	NO	10	10 No's for 3200A breaker
6	Thermal Overload for Spring Charging Motor	NO	5	5 No's for 3200A breaker
	Breaker Contact			
7	Main Contact (Fixed and moving) assembly	ST	2	2Sets for 3200A ACB
8	Arcing Contact (Fixed and moving) assembly	ST	2	2Sets for 3200A ACB
9	Breaker Jaw Contact (Bus-end & Breaker- end) assembly	ST	2	2Sets for 3200A ACB
10	Sliding Contact (Fixed & Moving)	ST	5	5sets
11	Breaker Auxiliary Contact Block	NO	5	5No's
12	Arcing Chute	ST	5	5Sets for ACB Incommer
13	Plug Socket with Prefab cable	NO	5	5No's
14	Position Limit Switch	NO	10	10No's for ACB incommer
	Indicating Lamps complete assembly			
15	Red	NO	30	
16	Amber	NO	30	
17	Green	NO	30	
18	White	NO	30	
19	Blue	NO	30	
20	CT	NO	2	Total=2 No's (Each 3200/1A-1No for Metering) & (3200/1A-1No for protection))
21	Transducer	NO	10	Total=10no's offered (CTD--5NO'S & VTD--5NO'S)
	Breaker Control Switch			
22	Trip / Neutral / close Switch	NO	10	
23	Sw.gear / Trial / Normal Switch (Local/Remote)	NO	10	
24	AC Supply On / Off Switch	NO	10	
25	DC Supply On / Off Switch	NO	10	
26	Motor Heater On /Off Switch	NO	10	
27	DC Supply Source Selector Switch (3-position)	NO	3	
28	Ammeter Selector Switch	NO	1	
29	Voltmeter Selector Switch	NO	1	
30	Voltmeter	NO	1	(0-500V)--1No
31	Ammeter	NO	2	(0-3200A)--2no's
	Auxiliary Control Contactor			
32	Auxiliary Control Contactor DC complete	NO	25	
33	Auxiliary Control Contactor DC spare kits	NO	25	
34	Auxiliary Control Contactor DC Coils	NO	25	
SL.NO	ACP SPARES	UNIT	TOTAL QUANTITY	REMARKS
	Contactor			
1	Power Contactor (AC)			
2	Power Contactor Complete Assembly	NO	8	2No's each type and rating
3	Power Contactor spare kits	NO	8	2No's each type and rating
4	Power Contactor AC Coils	NO	8	2No's each type and rating
	Auxiliary Control Contactor (AC)			
5	Auxiliary Control Contactor Complete Assembly	NO	80	20No's each type and rating
6	Auxiliary Control Contactor spare kits	NO	160	40No's each type and rating
7	Auxiliary Control Contactor AC Coils	NO	100	25No's each type and rating
8	MCCB (Power Circuit)	NO	15	5No's each type and rating
9	MCB (Control Circuit)	NO	40	20No's each type and rating
	Switch			
10	Local / Remote Selector Switch	NO	5	
11	MCCB Status (On/off) Monitoring Switch/Contact	NO	5	
12	Trial / Normal /MCC Selector Switch	NO	10	
13	MCC module Service Position Limit Switch	NO	5	
14	Thermal Overload Relay	NO	10	5No's each type and rating
15	Sliding Contact (Fixed & Moving)	NO	12	12No's For 630A ACB
16	Bus bar to MCC module Lira Contact Assembly (Bus-end & MCC Module-end)	ST	5	
	Indicating Lamps complete assembly			
17	Red	NO	30	
18	Amber	NO	30	
19	Green	NO	30	
20	Push Button (On/Off) Complete Assembly	NO	20	

21	CT	NO	5	Total=5 No's ((1set consist of Each 630/1A-1No 80/1A-1No's 50/1A-1No's, 25/1A-1No's for Metering) & (630/1A-1No for protection)
22	Ammeter	NO	4	1 No each type & rating
23	Control Transformer	NO	1	
24	Switch Fuse Unit	NO	5	Total=5No's (6A=1 No's, 10A=1 No's, 16A=1 No's 50=1 No's, 63A=1 No's)
25	Terminal Block			
26	Power Terminal Block	NO	10	
27	Control Terminal Block	NO	100	
28	End Plate for Power & Control Terminal Block	NO	50	total=50no's (all types each 25no's)
29	PT	NO	1	415/110V--1No



Bharat Heavy Electricals Limited
Electroporcelains Division, Bangalore – 560 012
Control Panel Business Group
PRICE FORMAT

PROJECTS: 1X800MW VIJAYAWADA THERMAL POWER PLANT
1X800MW KRISHNAPATNAM THERMAL POWER PLANT
MATERIAL: DRAWOUT PANELS FOR APGENCO PROJECT REQUIREMENT

sl.no	MATL.CODE	DESCRIPTION	UNIT	QTY	UNIT PRICE	TOTAL
1	ELSBMCCSDST01	SBMCC FOR KRISHNAPATNAM	EA	1		
2	ELSBMCCVTPS01	SBMCC FOR VIJAYAWADA	EA	1		
3	ELLTMSBSDST01	LTMSB FOR KRISHNAPATNAM	EA	4		
4	ELACPSDST01	ACP FOR KRISHNAPATNAM	EA	4		
5	ELLTMSBVTPS01	LTMSB FOR VIJAYAWADA	EA	4		
6	ELACPVTPS01	ACP FOR VIJAYAWADA	EA	4		
7	ELCOMSPRVTP001	COMMISSIONING SPARES FOR VIJAYAWADA	LOT	1		
8	ELCOMSPRKR001	COMMISSIONING SPARES FOR krishnapatnam	LOT	1		
9	ELBLWVTPS01	BLOWER MCC FOR VIJAYAWADA	EA	1		
10	ELBLWKRP01	BLOWER MCC FOR KRISHNAPATNAM	EA	1		
11	ELCOMSPRAP001	COMMISSIONING SPARES FOR BLOWER MCC,AP	LOT	1		

NOTES:

- SUMMATION OF ALL UNIT RATES OF MODULES SHALL BE EQUIVALENT TO TOTAL BOARD COST QUOTED, VARIANCE OF +/- 5% IS ACCEPTABLE. BEYOND 5% OFFER WILL NOT BE CONSIDER AS VALID OFFER. IN UNIT ADDITION-DELETION PRICES, PRICES QUOTED FOR COMPONENTS SHALL BE AS PER LIST PRICE OF CONCERNED MANUFACTURES. IF ANY ABNORMAL PRICES ON HIGHER SIDE OBSERVED OFFER MAY BE REJECTED.
- ALL BOARDS SHALL BE SUPPLIED ALONGWITH THE INTEGRAL BASE FRAMES, FOUNDATION BOLTS, CABLE GLANDS & LUGS . ALL FIXING NUTS & BOLTS TOGETHER WITH FOUNDATION BOLTS SHALL ALSO BE SUPPLIED. PRICES FOR THE BASE FRAME SHALL BE BUILT IN THE SWITCHBOARD PRICE.
- ITEM WISE PRICES WITH DESCRIPTION AND RATING OF EACH ITEM COMPLYING TO LIST FURNISHED IN THE SCHEDULE OF UNIT PRICES SHALL BE FURNISHED IN SCHEDULE OF UNIT PRICE.
- ADDITION/DELETION OF QUANTITIES SHALL BE APPLICABLE AT THE QUOTED PRICE.THE UNIT RATE OF SUPPLY OF ALL EQUIPMENTS & SERVICES QUOTED BY THE BIDDER SHALL BE FIRM FOR A VARIATION OF QUANTITIES , WHICH MAY BE TO THE EXTENT OF $\pm 30\%$ OF THE TOTAL ORDERED QUANTITY. SUM OF INDIVIDUAL MODULE SHALL EQUAL TO BOARD PRICE.
- THE MAKE OF COMPONENTS SHALL BE SUBJECT TO CUSTOMER APPROVAL.

ADDITION/ DELETION LIST LTMSB

SL. NO	COMPONENT DESCRIPTION	RATING	UNIT PRICE
1	ACB OF EACH TYPE AND RATING		
2	MCCB(EACH TYPE AND RATING)		
3	AUXILIARY CONTACTOR (EACH RATING AND TYPE)		
4	PROTECTION RELAY (EACH RATING AND TYPE)		
5	INDICATION LAMP (EACH RATING AND TYPE)		
6	PUSH BUTTON (EACH RATING AND TYPE)		
7	CONTROL TRANSFORMER (EACH RATING AND TYPE)		
8	CURRENT TRANSFORMER (EACH RATING AND TYPE)		
9	VOLTMETER(EACH RATING AND TYPE)		
10	AMMETER (EACH RATING AND TYPE)		
11	NEUTRAL LINK (EACH RATING AND TYPE)		
12	CONTROL SWITCHES (EACH RATING AND TYPE)		
13	CONTROL/POWER TERMINAL (EACH RATING AND TYPE)		
14	DFDO ENCLOSURE (EACH RATING AND TYPE)		
15	MODULES OF EACH TYPE AND RATING		

2. i. Vendor to give UNIT price for addition/ deletion of all COMPONENTS for all rating as indicated in the BOM. Also vendor to give option price for addition/ deletion of ENCLOSURE.

ii. The cost price of Individual items related to this project should match to total price .

TECHNICAL DEVIATION SHEET

SI No.	Document Title	Clause No.	NIT requirement	Bidders Deviation

Total Number of Deviation(s):

(Both in figures & Words)

BIDDER’S STAMP & SIGNATURE

TECHNICAL SPECIFICATION FOR
SOOT BLOWER MCC
PROJECT: 1X800MW KRISHNAPATNAM
CUSTOMER: APPDCL

SPEC REF NO.: EP-SBMCC-KRP-01 REV 00



BHARAT HEAVY ELECTRICALS LIMITED
ELECTROPORCELAINS DIVISION
BANGALORE – 560012



**TECHNICAL SPECIFICATION
FOR
SOOT BLOWER MCC**

SPECIFICATION NO. : EP-SBMCC-KRP-01

VOLUME

SECTION -

REVISION 0

DATE: 18.09.2017

CONTENTS

<u>S. NO.</u>	<u>DESCRIPTION</u>
1.0	COVER PAGE
2.0	CONTENTS
3.0	INSTRUCTIONS FOR BIDDERS
4.0	TECHNICAL SPECIFICATION & DRAWINGS
5.0	PRICE SCHEDULE
6.0	UNIT PRICE SCHEDULE
7.0	DEVIATION SHEET

**IT IS CONFIRMED THAT OUR TECHNICAL OFFER COMPLIES WITH THE SPECIFICATION IN TOTO, & THAT
THERE ARE NO TECHNICAL DEVIATIONS.**

BIDDER'S STAMP & SIGNATURE
(REFER INSTRUCTION NO. 1 OF 'INSTRUCTIONS TO BIDDERS')



**TECHNICAL SPECIFICATION
FOR
SOOT BLOWER MCC**

SPECIFICATION NO. : EP-SBMCC-KRP-01

VOLUME NO. :

SECTION :

REV NO. : 00 DATE: 18-09-2017

SHEET : 1 OF 1

INSTRUCTIONS TO BIDDERS FOR PREPARING TECHNICAL OFFERS

1. Two signed and stamped copies of the following shall be furnished by all bidders as technical offer:
 - a) Complete technical specification.
 - b) Un-priced copy of PRICE FORMAT, duly stamped and signed by the bidder.
 - c) Complete dimension of all the boards including no. of panels, dimensions of each type of panels, module size of each type of feeders and minimum clearances required on all sides for each type of panels.
 - d) **No. of Vertical consider by vendor for each boards are to be compulsory given along with offer.**
 - e) A copy of the sheet "Instructions to Bidders for Preparing Technical Offer" duly stamped and signed by the bidder.
 - f) Technical deviation/ clarification, if any
 - g) No. of MCC panels, Weight & Dimensions of SBMCC.
2. No technical submittal such as copies of type test certificates, data Sheets, write-up, drawing, technical literature, etc. is required during tender stage. Any such submission, even if made, shall not be considered as part of offer.
3. Confirmations/ comments (if any) regarding delivery schedules shall be furnished as part of the commercial offer. Any reference elsewhere/ covering letter of technical offer shall not be considered by BHEL.
4. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder's covering letter shall not be considered by BHEL, and bidder's offer shall be construed to be in conformance with the specification.
5. Any changes made by the bidder in the price schedule with respect to the Item description/ quantities, notes etc. from those given in annexure-A of specification shall not be considered (i.e., technical description, quantities, notes etc. as per specification shall prevail).
6. Bidders to quote for all items/sub items.
7. In case of any ambiguity in specification between various sections and end customer specification vendor should clearly brought out in technical deviations failing in which BHEL will have choice to prefer which ever it suits at later stage for which vendor should accept.
8. In case bidder is having any queries regarding technical parameters same shall get clarified before quoting, in case if any technical deviations are observed during scrutiny wrt to NIT bidder shall meet the technical requirements without any price implication.
9. Vendor should bring out clearly in deviation sheet if any.

BIDDER'S STAMP & SIGNATURE

**VOLUME :V-A
SECTION-VII
TECHNICAL SPECIFICATION
FOR
415V PMCC/MCC, 415V ACDB AND 220V DCDB**

1.00.00 SCOPE OF SUPPLY

1.01.01 Requisite nos. of following equipment shall be furnished with all accessories :-

- a. Power cum Motor Control Centre (PMCC)
- b. Motor Control Centres (MCC)
- b. A.C. Distribution Board (DB)
- c. D.C. Distribution Board (DB)
- d. D.C. Starters
- e. A.C./D.C. fuse boards

1.01.02 The base channel frame with hardware and lifting angles.

1.01.03 One set of special tools and tackles.

- 1. One spanner Set.
- 2. Module Rack in Rack out Handles.

1.01.05 Mandatory Spare as per list furnished.

1.01.06 All relevant drawings, data and instruction manuals.

2.00.00 CODES AND STANDARDS

2.01.01 All equipment and materials shall be designed, manufactured and tested in accordance with the latest applicable Indian Standards (IS) and IEC except where modified and/or supplemented by this specification.

2.01.02 Equipment and material conforming to any other international standard which ensures equal or better quality, may be accepted. In such case, copies of the English version of the standard adopted shall be submitted along with the bid.

2.01.03 The electrical installation shall meet the requirements of Indian Electricity Rules as amended upto date and relevant IS Code of Practice. In addition, other rules and regulations applicable to the work shall be followed.

3.00.00 DESIGN CRITERIA

- 3.01.00 The PMCCs/MCCs/DBs will be used to provide power, control and protection for 415/240V A.C. and 220V D.C. auxiliary services (Motors & Feeders) of generating units.
- 3.02.00 Duty involves direct-on-line starting of large squirrel cage motors below 175kW. The starting current varies from 6 to 8 times rated current at very low power factor.
- 3.03.00 The equipment will be located in a hot, humid and tropical atmosphere, highly polluted at places with coal dust and/or fly ash.
- 3.04.00 For continuous operation at specified ratings, the temperature rise of various equipment/components shall be limited to the permissible values stipulated in relevant standards and/or this specification.
- 3.05.00 Equipment ratings and quantities are detailed in the enclosed drawings and annexure. Equipment shall be furnished in strict compliance with the same.
- 3.06.00 All equipment and components thereof shall be capable of withstanding the mechanical forces and thermal stresses of the short-circuit currents without any damage or deterioration of the materials.
- 3.07.00 The PMCCs/ MCCs / DBs shall have two incomers and one bus-coupler. In addition to electrical interlocks, mechanical castle key interlock shall be provided between the two incomers and the bus-coupler so that any two of the three may be closed at a time.
- 3.08.00 Busbars of PMCCs shall be sized to carry continuously the associated transformer secondary current plus a 20% margin.
- Busbars of MCC/DBs shall be sized to carry continuously the total running load of MCC/DB plus a 20% margin.
- 3.09.00 In cubicle of incomers & bus section breakers/MCCBs shall be identical to the associated busbar rating.
- 3.10.00 For continuous operation at specified ratings, the temperature rise of various equipment/components shall be limited to the permissible values specified in relevant standards and/or this specification.
- 3.11.00 Circuit breakers shall not produce any harmful over voltage during switching off of induction motors. If required, surge protective devices shall be included in the scope of supply to limit over voltages.
- 3.12.00 Incomers, Bus-couplers & outgoing feeders rated upto & including 630A shall be MCCB controlled. Above 630A all incomers, Bus-couplers & outgoing Feeders shall be ACB controlled. For critical loads ACB control feeders shall be provided which will be decided during detailed engineering.
- 3.13.00 All motor rated 110kW & above, below 175kW shall be ACB controlled. Motor rated upto 110kW shall be contactor operated.

- 3.14.00 MCC & PMCC shall have sufficient number of spare modules (at least 20% of various sizes used with a minimum of 1 no. for each rating and type).
- 3.15.00 Outgoing feeders of PMCC shall be limited to minimum number of different sizes so that max. standardization is achieved from MCCB & contactor size point of view.
- 3.16.00 Incomers & bus section breakers of PMCCs/MCCs shall have provisions for remote operation from control room.
- 3.17.00 All breaker operated motor feeder shall be supplied from PMCC.
- 3.18.00 One no. Normal/Emergency switchgear to cater power supply to important emergency load / motors for safe shut-down of unit including 220V battery chargers shall be provided for each unit. The main incoming supply shall be from 415V unit service switchgear. When main incoming supply fails, reserve incoming supply shall be switched ON automatically from 415V station service switchgear. In case of total failure of AC supply of the power station, the supply from DG shall be switched ON automatically.
- 3.19.00 Each switchgear shall be provided with two bus sections, two incomer and a bus coupler rated for 100% of the loads connected to the switchgear.
- 3.20.00 For each auxiliary or load, one feeder shall be provided except for the following cases:
- One feeder for a maximum 2 nos. isolator motor operating mechanism.
- 3.21.00 The switchgears shall be provided with suitable number and type of outgoing feeders for the respective auxiliary loads of the system/area, power supply feeders to various panels, lighting transformer, space heating panels, control cabinets and all other loads encountered in the plant. In addition, following feeders shall be provided in each bus section of each switchgear.
- a) Bus VT module: One (1) no.
- 3.22.00 Each feeder shall be provided with two nos. interposing relays for start & stop. These interposing relays shall be located in separate IPR panel described under C&I specification.

4.00.00 **SPECIFIC REQUIREMENTS**

4.01.00 **Construction**

4.01.01 PMCC / MCC / DB shall be indoor, metal-clad, air insulated and floor mounting type. All MCCs shall be fully draw out type and DBs shall be fixed type. ACB modules of PMCCs/MCCs shall be fully drawout type. MCCB / Switch Fuse modules shall also be fully drawout type. The design and construction shall be such as to allow extension at either end.

4.01.02 All PMCC/MCC shall be of double front construction.

4.01.03 PMCC /MCC/DB enclosure shall be dust and splash proof, conforming to a degree of protection IP-54. All switchboard frames and load bearing members shall be fabricated using suitable mild steel structural sections or pressed and shaped cold rolled sheet steel of thickness 2.0mm. Frames shall be enclosed in cold rolled sheet steel of thickness 1.6 mm. Doors and covers shall also be of cold rolled sheet steel thickness 1.6 mm. Stiffeners shall be provided wherever necessary. The gland plate thickness shall be 3.0 mm for hot/cold rolled sheet steel and 4.0 mm for non-magnetic material.

4.01.04 PMCC / MCC / DB assembly shall comprise a continuous line up of dead front, free-standing vertical sections, housing the control modules in multi tier formation.

4.01.05 The design shall be fully compartmentalized with metal/insulating partitions between compartments.

4.01.06 Each control module shall be housed in a separate compartment, complete with an individual front access door having sufficient opening with concealed type hinges. Each vertical section shall have a removal back cover. All doors and covers shall be gasketed.

4.01.07 All push buttons, lamps, indicating instruments shall be flush / semi-flush mounted on respective module compartment.

4.01.08 A full height vertical cable chamber with cable supports shall be provided in each section to facilitate unit wiring. The chamber shall be liberally sized to accommodate all cables and shall have removable cover at the front for access.

4.01.09 A horizontal wireway, extending the entire length, shall be provided at the top of each PMCC / MCC / DB for inter panel wiring.

4.01.10 The width of the cable alley shall not be less than 250 mm.

4.02.00 **Bus and Bus Taps**

4.02.01 All PMCCs/MCCs/DBs shall be provided with three phase & neutral bus bars . All DCDBs shall be provided with two busbars. All busbar compartments shall be completely enclosed.

- 4.02.02 The main buses and connections shall be of high conductivity Aluminium / Aluminium alloy, sized for specified current ratings with maximum temperature limited to 85°C (i.e., 35°C rise over 50°C ambient).
- 4.02.03 Vertical busbars shall be designed for minimum current rating of 200A. Separate vertical busbars shall be provided for each vertical panel.
- 4.02.04 All bus connections shall be silver plated. Adequate contact pressure shall be ensured by means of two-bolt connection with plain and spring washers and locknuts.
- Bimetallic connector shall be furnished for connection between dissimilar metals.
- 4.02.05 Busbars and connections shall be fully insulated for working voltage with adequate phase/ground clearances. Insulating sleeves for busbars and shrouds for joints and tap-off points shall be provided.
- Bus insulators shall be flame retardant, non-hygroscopic track-resistant type with high creepage surface.
- 4.02.06 Busbars shall be supported and braced to withstand the stresses due to maximum short circuit current and also to take care of any thermal expansion.
- 4.02.07 Busbars shall be colour coded for easy identification and so located that the sequence R-Y-B shall be from left to right, top to bottom or front to rear when viewed from the front of the assembly.
- 4.03.00 **Control Modules**
- 4.03.01 Draw-out type control module shall have self-aligning power/control disconnects. All disconnects shall be silver plated to ensure good contacts.
- 4.03.02 The design shall be such as to permit easy withdrawal/reinsertion of the unit with guide rails to ensure correct alignment.
- 4.03.03 Control Module shall house the control components for a circuit such as switch fuse / MCCB, contactors, relays, push buttons, lamps etc. as per requirement of the control circuit.
- 4.03.04 The equipment layout shall provide sufficient working space in between the components and subject to Owner's approval.
- 4.03.05 Various module/compartment sizes shall be multiple of one basic unit to facilitate modifications at site. Suitable provision for this purpose should also be incorporated in the vertical bus bars.
- 4.03.06 Draw-out type control modules of same size and type shall be electrically and physically interchangeable.
- 4.04.00 **Air Circuit Breaker**
- 4.04.01 Circuit breaker shall be provided on the incomer having minimum interrupting capacity equal to the 50kA(r.m.s) fault level.

- 4.04.02 Circuit breaker shall be three pole, single throw, air-break type with independent manual spring closing, trip-free mechanism and shunt trip. However Incomer and bus coupler breakers (ACB) shall be four pole type.
- 4.04.03 Circuit breaker shall be draw-out type, having service, test & isolated position with positive indication for each position.
- 4.04.04 Circuit breakers of identical rating shall be physically and electrically interchangeable.
- 4.04.05 Each breaker shall be provided with microprocessor based protection unit having three overload protection with adjustable current and time, three short circuit protection with adjustable current and time and three instantaneous short circuit protection. The operating characteristic shall be suitable for co-ordination with down-stream fuses.
- 4.04.06 Circuit breakers shall be provided with motor wound spring charging mechanism. Spring charging shall take place automatically after each breaker closing operation. One open-close-open operation of the circuit breaker shall be possible after failure of power supply to the motor. In addition, facility for manual charging of spring shall be provided.
- 4.04.07 Mechanical safety interlock shall be provided to prevent the circuit breaker from being racked in or out of the service position when the breaker is closed. It shall not be possible to open the circuit breaker door cubicle unless the breaker is in 'OFF' position.
- 4.04.08 Automatic safety shutters shall be provided to cover up the stationary disconnects when the breaker is withdrawn.
- 4.04.09 Each breaker shall be provided with an emergency manual trip, mechanical ON-OFF indicator, an operation counter and spring mechanism charge/discharge indicator, and electrical anti-pumping feature.
- 4.04.10 In addition to the auxiliary contacts required for normal breaker operation and indication, each breaker shall be provided with the following for interlocking purpose :-
- a. Position/Cell switch with 4 NO + 4 NC contacts.
 - b. Auxiliary switch, with minimum 6NO + 6NC contacts,
- 4.04.11 Spring charge limit switch shall be provided for breakers with motor wound spring charging mechanism. These limit switches shall be provided with minimum 2NO + 2NC contact.
- 4.04.12 Limit/auxiliary switches shall be convertible type, that is, suitable for changing N.O. contact to N.C. and vice-versa.
- 4.04.13 Each breakers operated feeder shall be provided with protective devices as specified in Annexure–B.

4.05.00 Switches

- 4.05.01 Switches shall be triple pole, air break, AC23 motor duty for motor feeders and AC22 heavy duty for other feeders.
- Motors duty switches shall be capable of safely making and breaking the locked rotor current of the associated motor circuit.
- 4.05.02 The switch shall have a quick-make, quick-break mechanism operated by a suitable external handle, complete with position indicator. This handle shall have provision for padlocking in ON and OFF position.
- 4.05.03 The compartment door shall be interlocked mechanically with the switch such that the door cannot be opened unless the switch is in OFF position. Means shall be provided for releasing this interlock at any time.
- 4.05.04 Switches shall be capable of withstanding the let-through fault current of back-up fuses or circuit breakers.
- 4.05.05 Wherever two incoming switches and one bus-section switch are provided for an assembly, these shall be mechanically/key interlocked to ensure that only two out of the three can be closed at time.
- Wherever two incoming switches are provided for an assembly, these shall be mechanically/key interlocked to ensure that one of the two can be closed at time.
- 4.05.06 All incoming and outgoing feeders shall be provided with bolted disconnect link for isolation of neutral if necessary.

4.06.00 Fuses

- 4.06.01 Fuses shall be HRC, preferably link type, with a minimum interrupting capacity equal to the short circuit current of the LT system. Fuses shall be mounted on insulated fuse carriers, which are mounted on fuse bases. Wherever it is not possible to mount fuses on carriers, fuses shall be directly mounted on plug-in type of base. In such cases, one set of insulated fuse pulling handles shall be supplied with each board.
- 4.06.02 Fuses shall be furnished complete with fuse bases and fittings of such design as to permit easy and safe replacement of fuse element.
- Visible indication shall be provided on blowing of the fuse.
- 4.06.03 Motor fuse characteristics and ratings shall be chosen to ride over starting period without blowing. The fuse on incoming feeder wherever provided, shall be chosen to provide discrimination with motor/feeder fuses.

4.07.00 Moulded Case Circuit Breaker (MCCB)

- 4.07.01 The MCCBs shall be of drawout type with trip-free operating mechanism of quick make & quick break type. Each MCCB shall be equipped with thermal release for thermal overload and magnetic release for short circuit protection on each pole.

- 4.07.02 MCCBs / MPCBs shall be suitable for manual closing and opening and also automatic trip on overload and short circuit. MCCB shall have intermediate position to indicate trip condition.
- 4.07.03 The MCCBs shall be provided with mechanical ON-OFF indicator at the front panel. The MCCB handles, after the breaker tripped due to faults, shall occupy a mean position indicating trip condition.
- 4.07.04 The compartment door shall be interlocked mechanically with the MCCB such that the door cannot be opened unless the MCCB is in OFF position. Means shall be provided for releasing this interlock at any time.
- 4.07.05 All feeders of PMCC / MCC rated up to & including 630 Amp shall be provided with MCCB. Air circuit breaker shall be provided for feeders rated above 630 Amp. For critical loads ACB control feeders shall be provided which will be decided during detailed engineering.
- 4.07.06 Motors rating above 110 KW will be operated by Air circuit breaker and protected by consolidated numerical motor protection relay.
- 4.08.00 **A.C. Starter**
- 4.08.01 Contactors
- a. The contactors shall be three pole, air break type designed for duty class III - Category AC3 (for unidirectional motor) with non-bouncing silver/ silver alloy contacts. Contacts for reversible motors will be of AC4 duty.
 - b. Each contactor shall be provided with minimum two (2) normally open and two (2) normally closed auxiliary contacts rated 10 A at 240V A.C.
 - c. Reversing contacts shall be electrically and mechanically interlocked.
 - d. Contactors with delayed dropout feature shall be provided for some essential auxiliaries. These contactors shall not dropout on power failure if the voltage is restored within 3 seconds.
- 4.08.02 **Protection**
- a. Thermal overload relays shall be three element, positive acting, ambient temperature compensated with adjustable settings.
 - b. Single phase preventor relay shall be provided, preferably as an inbuilt feature of thermal overload relay.
 - c. Relays shall be manual reset type with two changeover potential-free contacts. Resetting of relays shall be possible with compartment door closed. Colour of the resetting button shall be BLACK.
 - d. Relays may be direct acting or C.T. operated, depending on current rating. C.T.s shall be included in the scope of supply.
 - e. Motor starters shall have type '2' co-ordination according to IEC 947-4.

- f. Earth fault relays with adjustable settings and time delays fed from core balance CT shall be provided.
- g. Numerical / Digital Motor protection relay with short circuit, over load, earth fault, locked rotor and unbalance (NPS) load protection functions shall be provided for motor rated above 90 kW.

4.09.00 Control Transformer

4.09.01 LT Switchboard control supply

The Bidder shall provide one (1) no. adequately rated 415V/110V Control Transformer in each bus section with necessary taps and auto changeover facility for providing control power supply to various modules of the board. The sizing of control transformer shall be carried out by the Bidder considering the actual load of power contactors, auxiliary contactors, indicating lamps and other equipment in the module circuit. An additional load of 15watts shall be considered for each module for remote auxiliary relays and lamps to be connected in the control circuit of modules. Bidder shall also ensure that control transformer are adequately designed for meeting the momentary loading requirements and the voltage drop during this condition shall not be more than 5%. Each transformer shall be sized for catering to control supply of both bus sections.

4.09.02 LT Switchboard space heater supply

The Bidder shall provide one (1) no. adequately rated 415V/240V Control Transformer in each bus section with necessary taps and auto changeover facility for providing power supply to panel space heater, Motor space heater of motor rated 30 KW & above, Panel Illumination & Socket. The supply of these two (2) nos. control transformer are tapped from incoming supply of 415V PMCC/MCC before the incoming breaker. Incoming circuit to the space heater auxiliary bus shall be through isolating switch HRC fuse and neutral link of suitable rating. The supply of different modules shall be tapped individually from the auxiliary bus bars. Control supply healthy indication shall be provided. Each transformer shall be sized for catering to space heater supply of both bus sections.

4.10.00 D.C. Starters

4.10.01 D.C. Starter for emergency oil pump shall be fixed resistance type, designed to provide fast acceleration during starting.

4.10.02 DC starters shall be complete with switch-fuse units, contactors, resistors, relays, meters, push-buttons, lamps, etc.

4.10.03 Starters shall be furnished in totally enclosed floor-mounting, sheet steel cubicles complete with a hinged front access door. Minimum thickness of sheet steel shall be 2mm.

4.10.04 The cubicle enclosure shall provide dust and humidity protection, the degree of protection being not less than IP-54.

The resistor enclosure shall be provided with ventilating louvers and wire mesh guard and shall have a degree of protection IP-23.

- 4.10.05 Cubicle space heater shall be provided to maintain internal temperature above dew point. Heater shall be furnished with switch-fuse unit and thermostat control.
- 4.11.00 **Relays**
- 4.11.01 All incoming and bus-coupler circuits and circuit breaker operated outgoing feeders shall be provided with numerical relays. Breaker operated motor feeders shall be provided with numerical motor protection relay.
- 4.11.02 The numerical relays shall have provisions for interfacing with Plant DDCMIS / PLC.
- 4.11.03 Relays shall be of drawout design with built-in testing facilities. Small auxiliary relays may be in non-drawout execution.
- 4.11.04 All protective relays, auxiliary relays, and timers shall be provided with hand reset operation indicator (flag).
- 4.11.05 Relays shall be rated for operation on 110V secondary voltage and 5 A or 1 A. Number and rating of relay contacts shall suit the job requirements.
- 4.12.00 **Control and Indication**
- 4.12.01 Circuit breakers shall be wired up for local and remote operation. Each breaker cubicle shall be equipped with the following :
- i) One (1) TEST-NORMAL-TRIAL selector switch with pistol grip handle and key interlock for breakers with motor wound spring charging mechanism.
 - ii) On-Off control switches shall have three positions (T-N-C) and shall be spring return to 'Neutral' from close and trip positions. They shall have two contacts closing in close position and two contacts closing in trip positions, and shall have Pistol Grip handles. Lost motion feature shall be provided wherever required.
 - iii) Following indicating lamps on the front of the compartment:

Breaker open	-	GREEN
Breaker closed	-	RED
Breaker tripped	-	AMBER
Spring charged	-	WHITE
Trip Ckt. Healthy	-	BLUE
Motor Space heater 'ON' for motor circuit - YELLOW		
- 4.12.02 Push button shall be heavy duty, oil tight, push to actuate type with integral escutcheon plate marked with its function.

- 4.12.03 Each push button shall have minimum two (2) nos. normally open and two (2) nos. normally closed contacts rated 10 A at 240 V.
- 4.12.04 One (1) NORMAL-TRIAL selector switch shall be provided for all motor feeders.
- 4.12.05 Selectors switches shall be stay-put, rotary type with escutcheon plates marked to indicate the function and positions, and shall be lockable in each position. Selector switch contacts shall be rated for 10A at 240 V A.C.
- 4.12.06 Selector switches shall be provided with minimum three (3) contact blocks of 1 NO + 1 NC each.
- The exact requirements of contacts shall be decided by the Tenderers taking into account the scheme requirement and spares.
- 4.12.07 Lamps shall be clustered LED type with series resistor and coloured lens. Lens and lamps shall be replaceable from the front. Lamps shall be located just above the associated push button/control switch
- 4.12.08 The general scheme of connections for control, interlock and protection is shown in the enclosed drawings. Detailed requirements of individual circuits will be intimated later to the successful bidder, who shall develop and furnish the schemes accordingly.
- 4.13.00 **Meters**
- 4.13.01 All indicating instruments (96 x 96 mm) shall be switchboard type, with 250` scale, anti-glare glass and accuracy class of $\pm 2\%$ full scale. Each meter shall have zero adjuster on the front.
- 4.13.02 Motor ammeter shall be suitable to indicate starting current (6 to 8 times full load current) for DOL starting of motor.
- Motor ammeter shall be provided for motor rated 30 kW and above and for critical drives, to be finalized during detail engineering.
- 4.13.03 All incomers, tie feeders, circuit breaker operated motor feeders shall be provided with 3-phase multifunction meter with pulse output and communication port for interfacing with Plant DDCMIS / PLC.
- 4.13.04 Meter selector switches shall be maintained contact, stay-put type, with knob handle. Ammeter and voltmeter selector switches shall be four position type. Ammeter selector switches shall have made before break contacts, to prevent open circuiting of CT secondary.
- 4.14.00 **Current Transformer**
- 4.14.01 Current Transformer, shall be cast resin type rated 10 VA. All secondary connections shall be bought out to terminal blocks where wye or delta connection will be made.
- 4.14.02 Accuracy class of the current transformers shall be:
- a) Class PS for REF

- b) Class 5P20 for other relaying.
- c) Class 1.0 ISF < 5 for metering.
- d) Class 0.5 ISF < 5 for metering (Incomer & Bus coupler of PMCC)

Other CT particulars like ratio, burden, knee point, excitation current & secondary resistance shall be decided by the bidder.

4.14.03 CT secondary shall be rated for 1A for metering & either 5A or 1A for protection.

4.15.00 Voltage Transformer

4.15.01 Voltage transformers shall be cast-resin, drawout type and shall have an accuracy class of 1.0. Voltage transformer mounted on breaker carriage is not acceptable. For Incomer and bus coupler of PMCC accuracy class of voltage transformer shall be 0.5.

4.15.02 High voltage windings of voltage transformer shall be protected by current limiting fuses. The voltage transformer and fuses shall be completely disconnected and visibly grounded in fully draw out position.

4.15.03 Secondary winding MCBs, sized to prevent overload shall be installed in all ungrounded secondary leads. MCBs shall be suitably located to permit easy replacement while the switchgear/PMCC is energized.

4.15.04 Both primary side & secondary side fuse failure / voltage loss monitoring system of VT shall be provided.

4.16.00 Transducers

4.16.01 Transducer for conversion of AC electrical quantities such as voltage, current, KW etc. shall be supplied as required for remote connection to Plant DDCMIS / PLC. All transducers shall be dual output type.

4.16.02 The transducers for indicating type instruments shall be of very low burden type having 4-20 mA DC linear, galvanically isolated output, compatible with secondary instruments and Plant DDCMIS system.

4.17.00 Secondary Wiring

4.17.01 The PMCC/MCC/DB shall be fully wired at the factory to ensure proper functioning of control, protection and interlocking schemes.

4.17.02 Fuse and links shall be provided to permit individual circuit isolation from bus wires without disturbing other circuits. All spare contacts of relays, push buttons and other devices shall be wired upto terminal blocks.

4.17.03 Wiring shall be done with flexible, 650V grade, fire resistance PVC insulated switchboard wires with stranded Copper conductors of 2.5 mm² for control & current circuits and 1.5 mm² for voltage circuits.

- 4.17.04 Each wire shall be identified, at both ends, with permanent markers bearing wire numbers as per Contractor's wiring diagrams.
- 4.17.05 Wire terminations shall be made with crimping type connector with insulating sleeves. Wires shall not be spliced between terminals. Separate colour code shall be used for AC & DC circuit wiring for easy identification.
- 4.18.00 **Terminal Blocks**
- 4.18.01 Terminal blocks shall be 650V grade box-clamp type with marking strips similar to ELMEX 10 mm² or equal. Terminals for C.T. secondary leads shall have provision for shorting.
- 4.18.02 Terminal blocks used for interface with DDCMIS / PLC via termination cabinet shall be suitably sized to facilitate proper termination of interconnecting cables.
- 4.18.03 Not more than two wires shall be connected to any terminal. Spare terminals equal in number to 20% active terminals shall be furnished.
- 4.18.04 Terminal blocks shall be located to allow easy access. Wiring shall be so arranged that individual wires of an external cable can be connected to consecutive terminals.
- 4.19.00 **Cable Terminations**
- 4.19.01 PMCC shall be designed for cable entry from bottom. MCC/DB shall be designed for cable entry both from top and bottom. Actual configuration shall be intimated later sufficient space shall be provided for ease of termination and connection.
- 4.19.02 Power cables shall be 1100V, Copper/Aluminum conductor, XLPE insulated, armoured, FRLS PVC overall sheathed.
- Control cables shall be 1100V, PVC insulated, armoured, PVC overall sheathed with 2.5 mm² stranded Copper conductor.
- 4.19.03 All provisions and accessories shall be furnished for termination and connection of cables, including removable gland plates, cable supports, crimp type tinned Copper/Aluminium lugs, brass compression glands with tapered washer (Power Cables only) and Terminal blocks.
- 4.19.04 Sufficient space shall be provided between the lower most power cable termination and gland plate for easy cable connection.
- 4.20.00 **Bus Duct Connection**
- 4.20.01 Bus duct connections shall be furnished along with transition panel, if required. Unless mentioned otherwise bus duct connections shall generally be from the top.

- 4.20.02 All connecting bus work shall have the same continuous current rating as associated PMCC bus and shall be fully braced for the LT system short circuit current.
- 4.20.03 All provisions such as matching flange and other accessories shall be furnished for connection to bus duct.
- 4.21.00 **Ground Bus**
- 4.21.01 A Cu / Al ground bus rated to carry the maximum fault current, shall extend full length of the MCC/DB.
- 4.21.02 The ground bus shall be provided with two-bolt drilling with G.I. bolts & nuts at each end to receive 50 x 6 mm G.I. flats.
- 4.21.03 All stationary structures shall be directly connected to the ground bus for effective grounding.
- 4.21.04 The frame of draw out module shall be grounded at all times except when the power disconnects are separated by a safe distance.
- 4.21.05 All hinged doors shall be earthed through flexible copper braid wire.
- 4.22.00 **Nameplate**
- 4.22.01 Nameplate of approved design shall be provided for each control compartment and also at the top of each PMCC / MCC / DB.
- 4.22.02 The material of the name plate shall be anodized aluminium / lamicaid or approved equal, 3 mm thick, with white letter on black background. Name plates shall be minimum 20 x 75 mm for instrument / devices and 40 x 150 mm for panels.
- 4.22.03 Caution notice on suitable metal plate shall be affixed at the back of each vertical panel.
- 4.23.00 **Space Heater**
- 4.23.01 Panel and motor space heater shall be fed from separate AC auxiliary busbars running throughout the switchboard. The space heater bus shall be fed from control transformer described earlier. Suitable terminals shall also be provided to facilitate energisation of the control transformer from outside during long shutdown of the board.
- 4.23.02 Each vertical section of the PMCC / MCC / DB shall be furnished with thermostat controlled space heater and 5A, 5 pin plug socket.
- 4.23.03 In addition, motor feeders 30 KW and above shall be wired up for feeding motor space heater through starter auxiliary 'OFF' contacts.
- 4.23.04 Cubicle heater, Motor heater and plug socket circuit shall be provided with individual MCB/switch fuse units.

4.24.00 A.C./D.C. Power Supplies

4.24.01 Necessary 415V AC and 220V DC power supplies as required for control and service shall be arranged by the contractor. Single feeder shall be arranged for A.C. supply and duplicate feeder shall be arranged for D.C. supply.

4.24.02 Isolating switch fuse units shall be provided at each switchgear for the incoming supplies, 4-pole, single throw for A.C. and 2-pole, double throw for D.C. Molded case circuit breaker (MCCB) shall also be accepted as an alternative.

4.24.03 Bus-wires of adequate capacity shall be provided to distribute the incoming supplies to different cubicles. Isolating switch fuse units / MCCB shall be provided at each cubicle for A.C/D.C. supplies.

4.24.04 A.C. load shall be so distributed as to present a balanced loading on three-phase supply system.

4.25.00 Tropical Protection

All equipment, accessories and wiring shall have fungus protection, involving special treatment of insulation and metal against fungus, insects & corrosion.

Screens of corrosion resistant material shall be furnished on all ventilating louvers to prevent the entrance of insects.

4.26.00 Painting

4.26.01 All steel surfaces shall be sand blasted, grounded and pickled as required to produce a smooth, clean surface free of scale, grease & rust.

4.26.02 After cleaning, the surfaces shall be given a phosphate coating followed by two coats of high quality primer and stoved after each coat.

4.26.03 For paint shade of finish coat, refer clause no.1.16.00 of Section E1, Volume V-A.

4.26.04 Sufficient quantity of touch-up paint shall be furnished for application at site.

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

5.00.00 TESTS

5.01.00 All equipment shall be completely assembled, wired, adjusted and tested at the factory as per the relevant standards.

5.02.00 Routine Test

The tests shall include but not necessarily be limited to the following :-

- a. Operation under simulated service condition to ensure accuracy of wiring, correctness of control scheme and proper functioning of the equipment.

- b. All wiring and current carrying part shall be given appropriate High Voltage Test.
- c. Primary current & voltages shall be applied to all instrument transformers.
- d. Routine test shall be carried out on all equipment such as circuit breakers, switch - fuse, contactors, relays, meters etc.

5.03.00 Type Tests

All the Type Tests (as per IS- 8623/IEC) should have been carried out on an identical & similar type of switchgear for each rating involved in the project with ACB mounted in service condition inside the switchgear panel.

Bidder has to submit ACB type test reports for test sequence 1 and combined test sequence and Type 2 co-ordination test reports of any 3 ratings of starter ratings involved.

Type test certificates of any equipment shall be furnished if so designed by the purchaser/ owner. Otherwise the equipment shall have to be type tested free of charge, to prove the design. Type test performed before five (5) years are not acceptable.

6.00.00 DRAWINGS, DATA & MANUALS

6.01.00 Drawings, Data & Manuals shall be submitted in triplicate with the bid and in quantities and procedures as specified in General Conditions of Contract and/or elsewhere in the specification for approval and subsequent distribution after the issue of 'Letter of Intent'.

6.02.00 To be submitted with the bid :-

- a. General arrangement drawing showing constructional features, space required in front for withdrawals, power & control cable entry points etc.
- b. Typical foundation plan
- c. Typical control schematic
- d. Bill of materials
- e. Type test reports on circuit breaker
- f. Technical leaflets on :-
 - i) Circuit breaker
 - ii) Switch-fuse units
 - iii) Contactors
 - iv) Relays, meters, push buttons, selector switches etc.
 - v) Glands/terminals blocks

6.03.00 To be submitted for Owner / Purchaser's Approval and Distribution

All relevant drawings and data pertaining to the equipment like GTP, GA drawing, foundation plan, BOM, control & schematics, QAP, etc. shall be submitted by the Bidder for approval of Owner/Owner's consultant. Also refer clause no. 1.19.02(u) of Section-I of Volume – V-A: Technical Specifications for Electrical Equipment & Accessories.

ANNEXURE-A

RATINGS AND REQUIREMENTS

1.0 General

Type : ACB Modules - Drawout type
MCCB Modules – Drawout type

Service : Indoor

Enclosure : IP52

2.0 System

AC DC

Voltage : 415V $\pm$ 10% 220V (187-242V)

Phase : 3-phase, 4-wire 2- wire

Frequency : 50 Hz +3% to - 5%

Combined voltage and
Frequency variation : 10% (absolute sum)

System grounding : Solidly grounded Ungrounded

3.0 Rating

Rated current : To be decided by the tenderers.

Design Ambient Temperature : 50°C

Short Circuit Current Symm. : 50 KA 25* KA

* Indicative only, the actual value will be decided by the tenderers.

S/C Withstand Time : ----- 1 second -----

High voltage test for 1 minute : 2.5 kV 1.5 kV

4.0 Duty

Circuit Breaker : 0-3'-CO-3'-0

Contactor (AC) : Class III - Category AC3 for
unidirectional drives and AC4 for bi-
directional / inching duty drives

Contactor (DC) : Class I – category DC2

MCCB / Switch Duty for AC DC

Motor Feeder : AC23 DC22

	Other Feeder	:	AC22	DC22
5.0	A.C. / D.C. Power Supply			
	Control Voltage for Circuit breaker	:	220V DC +10% to -15%	
	Control voltage for MCCB modules	:	110V AC $\pm$ 10%, 1Ph, 50Hz +3% to - 5%	
	Service voltage	:	240V AC $\pm$ 10%, 1Ph, 50Hz +3% to - 5%	

ANNEXURE-B

PROTECTIONS

- 1.0 All Protective relays shall be microprocessor based numerical type having communication facility with Plant DDCMIS system / PLC.
- 2.0 The minimum protections to be provided for different types of circuits are listed below:
- a. Incoming Feeder & Bus-coupler with ACB:
 - 3 - inverse time O/C relays (51) for phase fault.
 - 1 - Inverse time O/C relay (51N) for Earth fault.
 - 3 - Under Voltage (27), Range : 40-80% with timer
 - b. Motor Feeder with ACB: (above 110 kW)
 - 1 - Composite Motor protection relay (99) for protection against
 - Thermal overload
 - Phase faults
 - Unbalance (negative sequence)
 - Locked rotor
 - Excessive Start-up time and Start-Stop.
 - Earth fault
 - c. Outgoing Feeder : with ACB
 - 3 - Inverse time O/C relays (51) for phase fault.
 - 1 - Inverse time O/C relay (51N) for Earth fault.
- 3.0 Apart from protection relays, each electrically operated breaker shall be provided with anti-pumping (94), trip annunciation (30), lockout (86) and trip circuit supervision (74) relays. Lockout relay shall be hand reset type.
- 4.0 Both primary side & secondary side fuse failure / voltage loss monitoring system of VT shall be provided..
- 5.0 For Auto-bus change-over as well as live bus change-over through synchronization refer enclosed Control Schematic drawings.
- 6.0 Each incomer shall be provided with three (3) nos. Bus Energised indicating lamps – Red/Yellow/Blue for each phase.

ANNEXURE-C

FITTINGS & ACCESSORIES

Each switchboard shall be furnished complete with fittings and accessories as listed below: -

1. Operating mechanism complete with all accessories, fittings and tripping coil and closing coil, pole discrepancy feature etc. as required.
2. Base frame and anchor bolts and nuts.
3. Auxiliary contacts and relays.
4. LOCAL/REMOTE Selector switch, TRIP/CLOSE Push Buttons.
5. Manual tripping devices with protective flap.
6. Mechanical ON-OFF indicator.
7. Operation counters.
8. Set of switch fuse units/MCCB for A.C. and D.C. supply.
9. Space heater with thermostat and ON-OFF switch.
10. Cubicle illumination lamp with ON-OFF switch.
11. 3 Pin 5A Socket with ON-OFF Switch.
12. Terminal blocks and internal wiring - lot as required.
13. Other standard accessories which are not specifically mentioned but supplied with breakers of similar type and rating for efficient and trouble-free operation.
14. Bimetallic terminal connectors.

3-96-186-15391

DRAWING NO:

SHEET No.	DRAWING No.	Rev.	DESCRIPTION
SHEET-01	3-96-186-15391	02	SOOT BLOWER MCC - LIST OF DRAWINGS
SHEET-02	3-96-186-15392	01	SOOT BLOWER SINGLE LINE DIAGRAM-NOTES
SHEET-03	3-96-186-15393	02	SOOT BLOWER SINGLE LINE DIAGRAM
SHEET-04	3-96-186-15394	02	SOOT BLOWER SINGLE LINE DIAGRAM
SHEET-05	3-96-186-15395	00	WALL BLOWER CONTROL SCHEME DIAGRAM
SHEET-06	3-96-186-15396	00	WALL BLOWER INTERCONNECTION DIAGRAM
SHEET-07	3-96-186-15397	00	LR BLOWER CONTROL SCHEME DIAGRAM
SHEET-08	3-96-186-15398	00	LR BLOWER INTERCONNECTION DIAGRAM
SHEET-09	3-96-186-15399	00	AIR HEATER BLOWER CONTROL SCHEME DIAGRAM
SHEET-10	3-96-186-15400	00	AIR HEATER BLOWER INTERCONNECTION DIAGRAM
SHEET-11	- - - - -	-	VOID
SHEET-12	- - - - -	-	VOID
SHEET-13	3-96-186-15401	00	INTER COMPARTMENT WIRING DIAGRAM IN SB MCC
SHEET-14	3-96-186-15402	00	INTER COMPARTMENT WIRING DIAGRAM IN SB MCC
SHEET-15	3-96-186-15403	01	INTER COMPARTMENT WIRING DIAGRAM IN SB MCC

REFERENCE DRAWINGS

1. SOOT BLOWER P&ID : 0-00-047-49127 TO 49128.

		DEVELOPMENT CONSULTANTS PVT. LIMITED.	
Reviewed only for general conformance with contract drawings and specifications. Contractor to be responsible for any errors and for fulfillment of detailed requirements of contract documents.			
ACTION 3		DATE 02.08.2017	
DISTRIBUTED BY: KS			
1 Distributed	4	Approved except as noted. Resubmission required	
2 Approved	5	Disapproved see accompanying letter	
3 Approved except as noted. Forward final drawings	6	For information only	
SEE COVERING LETTER			
LETTER REF NO. 0685		DATE. 02.08.2017	

Please refer CRS sheet for reply.

REV	DATE	ALTERED : 080717	REV	DATE	ALTERED : 281116
02	080717	CHD. / APPD. :	01	281116	CHD. / APPD. : Sd.\SR-KB/AKP
ZONE	REVISED AS PER CUSTOMER LETTER REF.NO. 0478 DATED 23-05-2017		ZONE	REVISED TO CHANGE NO. OF BLOWERS IN LINE WITH LATEST SOOTBLOWER P & ID / REV. 02	

CAUTION: The information on this document is the property of BHARAT HEAVY ELECTRICALS LTD. It must not be used directly or indirectly in any way detrimental to the interest of the company.

CUSTOMER :				ANDHRA PRADESH POWER DEVELOPMENT COMPANY LIMITED (APPDCL)	
				Sri DAMODARAM SANJEEVAIAH THERMAL POWER STATION, KRISHNAPATNAM	
				1 x 800 MW, STAGE - II, UNIT-3, Cust. No. 1816, (BTG PACKAGE)	
CONSULTANT :				DEVELOPMENT CONSULTANT PRIVATE LIMITED KOLKATA	
		Bharat Heavy Electricals Ltd		NAME A. Thambu Raj	
UNIT: HIGH PRESSURE BOILER PLANT		TIRUCHIRAPALLI - 620014		SIGNATURE 200716	
DEPT.-C & I		SCALE NTS		WEIGHT (Kg)	
CODE - 392				REF TO ASSY / OLD DWG	
TITLE		SOOT BLOWER MCC LIST OF DRAWINGS		CARD CODE U 01	
		Sheet 01 of 15		DRAWING NO : 3-96-186-15391	
				REV 02	

NOTE

- MCC SHALL BE SUITABLE FOR IP 54 DEGREE OF PROTECTION.
- ALL SB MCC SHALL BE OF COMPARTMENTAL DRAWOUT TYPE AND DOUBLE FRONT EXECUTION SUITABLE FOR BOTTOM CABLE ENTRY. HOWEVER, CONTROL SUPPLY TRANSFORMER, JAMMING RELAY AND INCOMER MODULES WILL BE NON-DRAWOUT TYPE (FIXED). MCC SHALL BE DUST & VERMIN PROOF.
- MCC SHALL BE FABRICATED BY CRCA SHEET STEEL OF FOLLOWING THICKNESS
 - LOAD BEARING MEMBER - 2.0 mm
 - GLAND PLATE - 3 mm C) OTHERS - 1.6 mm
- THE BUSBARS SHALL BE 600 SQ.MM SUITABLE FOR 50 KA FAULT LEVEL FOR 1 SEC. & SHALL BE OF HIGH CONDUCTIVITY ALUMINIUM ALLOY.
- POWER CONTACTORS SHALL HAVE 2NO + 2NC AUX. CONTACTS AND UTILISATION CATEGORY AC-4 FOR RDOL AND AC-3 FOR DOL STARTERS.
- OVER LOAD RELAYS SHALL BE MANUAL RESET TYPE WITH TWO CHANGE OVER POTENTIAL FREE CONTACTS. RESETTNG OF RELAYS SHALL BE POSSIBLE WITH COMPARTMENTAL DOOR CLOSED. THE RANGE OF OVER LOAD RELAYS MAY DIFFER SLIGHTLY ACCORDING TO THE MAKE OF THERMAL OVER LOAD RELAYS USED IN THE MCC. OLR SHALL BE WITH BUILT-IN SINGLE PHASE PREVENTOR.
- MCC SHALL BE PAINTED WITH OPALINE GREEN FOR EXTERIOR (SEMI GLOSSY FINISH) AND INTERIOR AS PER VENDOR STANDARD COMPONENT MOUNTING PLATE SHALL BE ZINC PASSIVATED.
- THE WIRING SHALL BE CARRIED OUT WITH 1100 V GRADE HR PVC INSULATED STRANDED COPPER CONDUCTOR OF SIZE 2.5 SQ. MM FOR POWER, CONTROL, CURRENT.
- CONTROL AND SELECTOR SWITCHES SHALL BE OF ROTARY TYPE.
- UNDRILLED CABLE GLAND PLATES SHALL BE SUPPLIED ALONG WITH THE PANEL.
- SPARES ARE INDICATED ONLY FOR ELECTRICAL FEEDER.
- AN EARTH BUS OF GI FLAT SIZE NOT LESS THAN 50 x 6 SQ. mm SUITABLE FOR SPECIFIED FAULT LEVEL SHALL BE PROVIDED AT THE BOTTOM THROUGHOUT THE LENGTH OF THE MCC. PROVIDED IN ALL VERTICAL SECTIONS.
- SEPARATE VERTICAL BUSBARS FOR FRONT AND REAR OF MINIMUM 200A SHALL BE PROVIDED. BUS BARS SHALL BE PVC SLEEVED, COLOUR CODED AT REGULAR INTERVALS.
- TINNED COPPER LUGS FOR EXTERNAL CONNECTION ARE TO BE SUPPLIED ALONG WITH THE PANEL
- INDICATING LAMPS WILL BE OF CLUSTER LED TYPE.
- MCCB'S AT TWO INCOMER AND ONE BUS COUPLER SHALL BE MECHANICALLY INTERLOCKED USING CASTLE KEYS SO THAT ONLY TWO OF THESE CAN BE TURNED ON AT A TIME.
- MINIMUM AIR CLEARANCE IN AIR BETWEEN PHASES AND PHASE-EARTH SHALL BE 19mm FOR BUSBARS AND CABLE TERMINATIONS.
- FOUNDATION BOLTS & NUTS, IF REQUIRED SHALL BE SUPPLIED ALONG WITH SBMCC.
- OPERATING HEIGHT SHALL BE 200mm TO 2000mm FROM THE BOTTOM & BASE FRAME OF MCC.
- ALL MODULES/COMPONENTS SHALL BE IDENTIFIED BY LABELS ENGRAVED IN WHITE COLOUR ON THE BLACK COLOUR BACKGROUND.
- THE WIDTH OF CABLE ALLEY SHALL NOT BE LESS THAN 250mm.
- 12 KV RUBBER MATS SHALL BE PROVIDED BOTH AT FRONT AND REAR OF MCC.

As commented earlier, Interior paint shall be glossy white and exterior paint shall be opaline green with semi glossy finish.

LEGEND

74	AUXILIARY CONTACTOR
49R	THERMAL OVER LOAD RELAY ROTARY
49T	THERMAL OVER LOAD RELAY TRAVERSE
A	AMMETER
ASS	AMMETER SELECTOR SWITCH
AT	CURRENT TRANSDUCER
CC	CONTACTOR FOR CLOSE
CF	CONTACTOR FOR FORWARD
CO	CONTACTOR FOR OPEN
CR	CONTACTOR FOR REVERSE
CRO	CONTACTOR FOR ROTARY
CS	CONTROL SUPPLY HEALTHY CONTACTOR
CT	CURRENT TRANSFORMER
CX	AUXILIARY CONTACTOR
FF	CONTROL FUSE
LRPB	LOCAL RETRACT PUSH BUTTON
LS1	LRB/AHB FORWARD END POSITION LIMIT SWITCH
LS2	LRB/AHB HOME POSITION LIMIT SWITCH
LSPB	LOCAL START PUSH BUTTON
LSTE	WALL BLOWER HOME POSITION LIMITSWITCH
LSTR	WALL BLOWER ROTARY LIMIT SWITCH
LSTS	WALL BLOWER FORWARD END POSITION LIMIT SWITCH
MC	AUX. CONTACTOR OF MCCB
MCB	MINIATURE CIRCUIT BREAKER
MCCB	MOULDED CASE CIRCUIT BREAKER
MPCB	MOTOR PROTECTION CIRCUIT BREAKER
OCR	OVER CURRENT RELAY
PF	POWER FUSE
PT	VOLTAGE TRANSFORMER
RC	AUXILIARY CONTACTOR
RR	REMOTE RETRACT CONTACTOR
SV	SOLENOID VALVE
V	VOLT METER
VSS	VOLTMETER SELECTOR SWITCH
VT	VOLTAGE TRANSDUCER

LEGEND

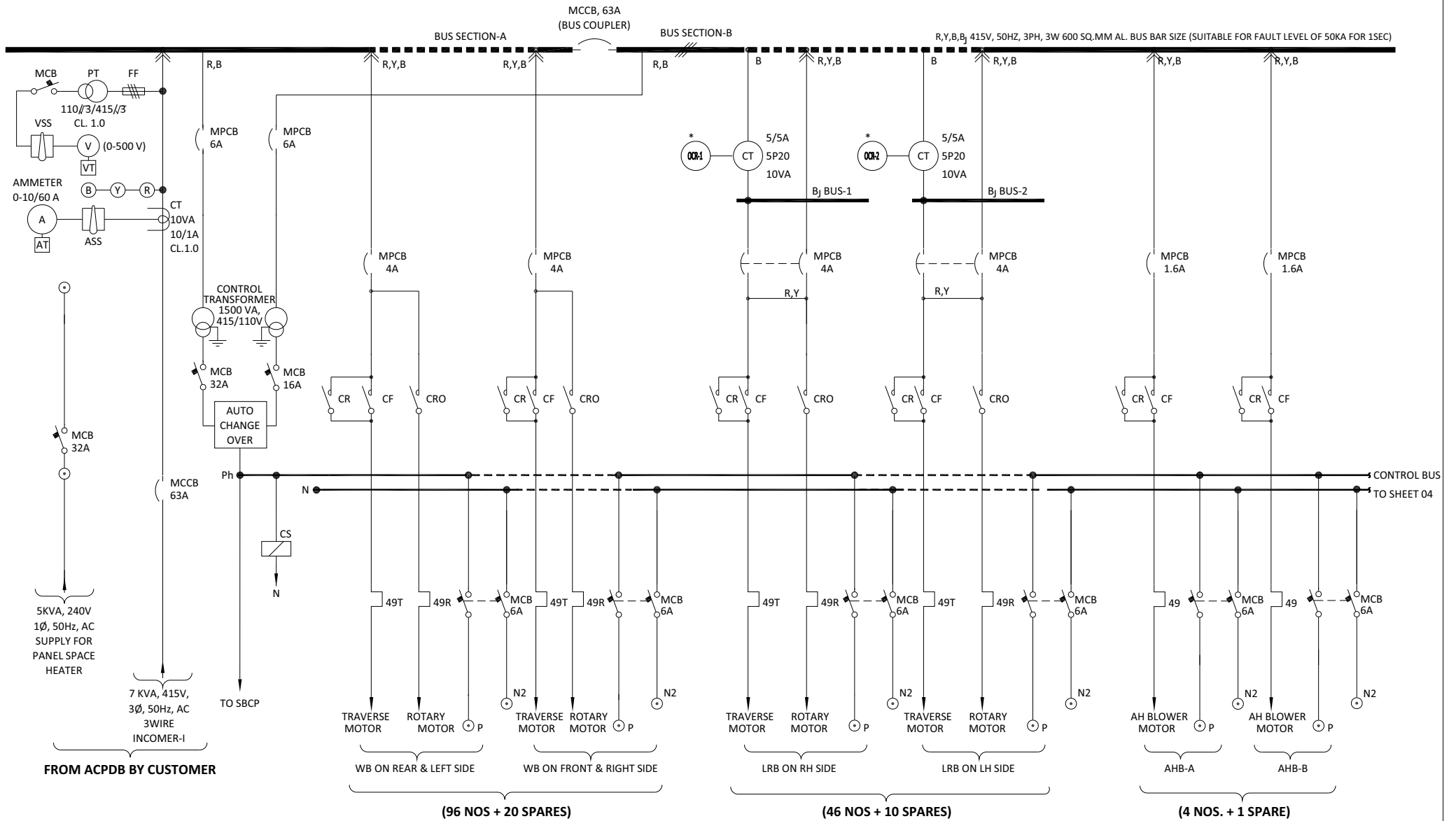
	DRAWOUT TYPE TERMINALS
	FUSE SWITCH THREE USE LINK
	INDICATING LAMP (A-AMBER) (B-BLUE)
	LIMIT SWITCH CONTACT
	MCCB
	MCCB / MPCB
	NC CONTACT OF CONTACTOR
	NO CONTACT OF CONTACTOR
	NO CONTACT OF TIMER
	OFF DELAY TIMER
	POWER / AUX. CONTACTOR
	SWITCH
	TERMINALS IN LOCAL
	TERMINALS IN SB CP
	TERMINALS IN SB MCC

NOTE

- ALL CONTROL TERMINALS WILL BE SUITABLE FOR RECEIVING ATLEAST 2 NOS. OF 2.5 SQ.MM. COPPER WIRE ON EACH SIDE.
- POWER TERMINALS WILL BE SUITABLE FOR RECEIVING 6 SQ.MM. COPPER WIRE.
- CIRCUIT IS DRAWN FOR INITIAL CONDITIONS.
- EQUIPMENT SHOWN INSIDE DOTTED LINES ARE AT LOCAL.
- INTER COMPARTMENT LOOPING TO BE DONE BY MCC SUPPLIER
- LOCAL START AND RETRACT PUSH BUTTONS ARE MOUNTED ON THE BLOWER TERMINAL BOX AS AN INTEGRAL PORTION OF WALL, LR & AH BLOWER.
- SBMCC INCOMER CAN RECEIVE MAXIMUM SIZE OF 3C X 10 SQ.MM (AL) POWER CABLE.
- CONTROL SUPPLY TRANSFORMER SHALL BE 2x100% FOR EACH BUS SECTION.

REV	DATE	ALTERED :
01	080717	CHD./APPD. :
REVISED AS PER CUSTOMER LETTER REF.NO. 0478 DATED 23-05-2017		

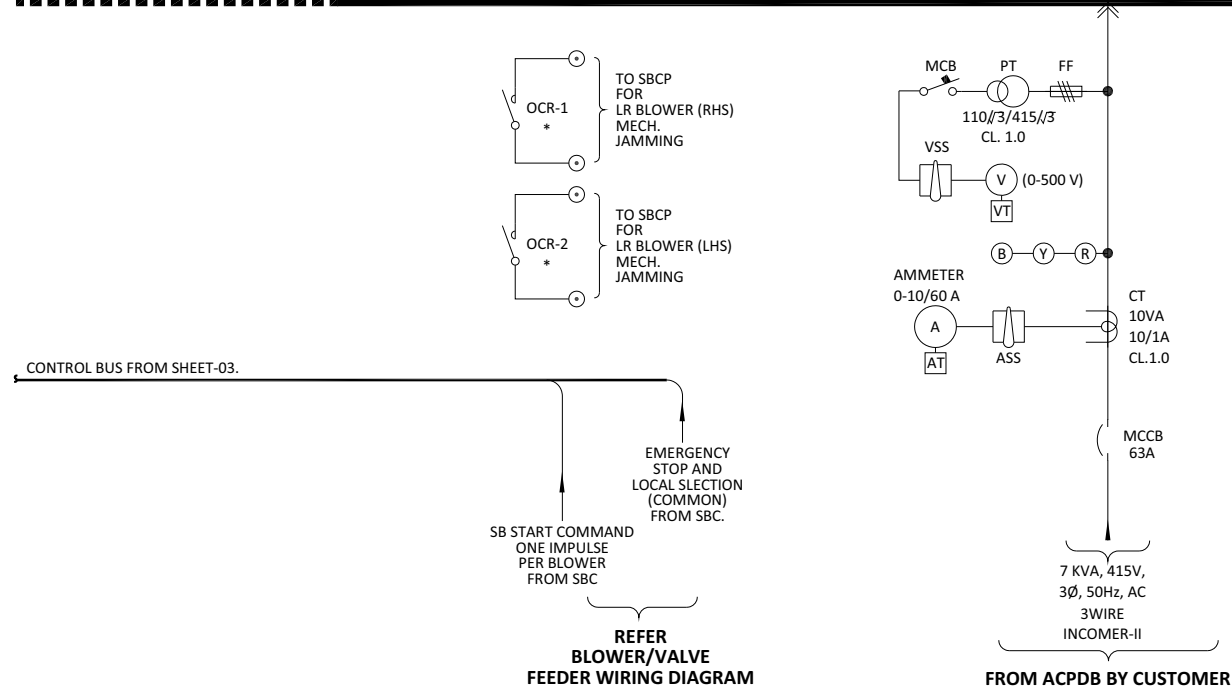
बी एच ई एल  TIRUCHIRAPPALLI	ANDHRA PRADESH POWER DEVELOPMENT COMPANY LIMITED		DRN.	NAME	SIGNATURE	DATE	SCALE	
	Sri DAMODARAM SANJEEVAIAH TPS, KRISHNAPATNAM		CHD.	SR / KB	Sd. / SR-KB	20-07-16	NTS	
	1 x 800 MW, STAGE - II, UNIT-3, Cust. No. 1816, (BTG PACKAGE)		APPD.	A.K.Panda	Sd. / AKP	20-07-16		
DEPT. : C & I	TITLE		SHEET NO.	DRAWING NO:			REV	
CODE : 392	SOOT BLOWER SINGLE LINE DIAGRAM-NOTES		02/15		3-96-186-15392			01



REV	DATE	ALTERED :
02	080717	CHD./APPD. :
REVISED AS PER CUSTOMER LETTER REF.NO. 0478 DATED 23-05-2017		

REV	DATE	ALTERED :
01	281116	CHD./APPD. : Sd./SR-KB/AKP
REVISED TO CHANGE NO. OF BLOWERS IN LINE WITH LATEST SOOTBLOWER P & ID / REV. 02		

ANDHRA PRADESH POWER DEVELOPMENT COMPANY LIMITED Sri DAMODARAM SANJEEVAIAH TPS, KRISHNAPATNAM 1 x 800 MW, STAGE - II, UNIT-3, Cust. No. 1816, (BTG PACKAGE) TIRUCHIRAPPALLI DEPT. : C & I CODE : 392	DRN.	NAME A. Thambu Raj	SIGNATURE A. Thambu Raj	DATE 20-07-16	SCALE
	CHD.	SR / KB	Sd. / SR-KB	20-07-16	N T S
	APPD.	A.K.Panda	Sd. / AKP	20-07-16	
	SHEET N.O. 03/15	DRAWING NO: 3-96-186-15393			REV 02



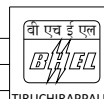
DESCRIPTION	INCOMER FOR SPACE HEATER	INCOMER-I	INCOMER-II	WALL BLOWERS		LR BLOWERS		AH BLOWER
FEEDER NO. DETAILS	1	1	1	96 + 20 SPARES		46 + 10 SPARES		4 NOS. + 1 SPARE
DRIVE DETAILS	-	-	-	TRAVERSE	ROTARY	TRAVERSE	ROTARY	
MOTOR CAPACITY IN KW	5.0 KVA	7.0 KVA	7.0 KVA	0.56	0.09	0.56	0.736	0.18
FULL LOAD CURRENT IN AMPS	-	-	-	1.36	0.64	1.4	1.65	0.56
O/L RELAY RANGE IN AMPS	-	-	-	0.9-1.5	0.45-0.75	0.9-1.5	1.0-2.0	0.45-0.75
MCCB/MPCB IN AMPS	32A	63A	63A	4A	4A	4A	4A	1.6A
POWER CONTACTOR	-	-	-	16	16	16	16	16
FUSE RATING IN AMPS PF/FF	-	-	-	-	-	-	-	-
CABLE SIZE	3CX6SQ.MM(AL) PC	3CX10SQ.MM(AL) PC	3CX10SQ.MM(AL) PC	3CX2.5SQ.MM(CU) PC 9CX2.5SQMM(CU) CC 8PX0.5SQ.MM MSC (FROM SBMCC TO SBCP)		3CX2.5SQ.MM(CU) PC 7CX2.5SQMM(CU) CC 8PX0.5SQ.MM MSC (FROM SBMCC TO SBCP)		3CX2.5SQ.MM(CU) PC 9CX2.5SQMM(CU) CC 8PX0.5SQ.MM MSC (FROM SBMCC TO SBCP)

REV 02 DATE 080717
 ALTERED : 080717
 CHD./APPD. :

REVISED AS PER CUSTOMER LETTER
 REF.NO. 0478 DATED 23-05-2017

REV 01 DATE 281116
 ALTERED : 281116
 CHD./APPD. : Sd./SR-KB/AKP

REVISED TO CHANGE NO. OF
 BLOWERS IN LINE WITH LATEST
 SOOTBLOWER P & ID / REV. 02



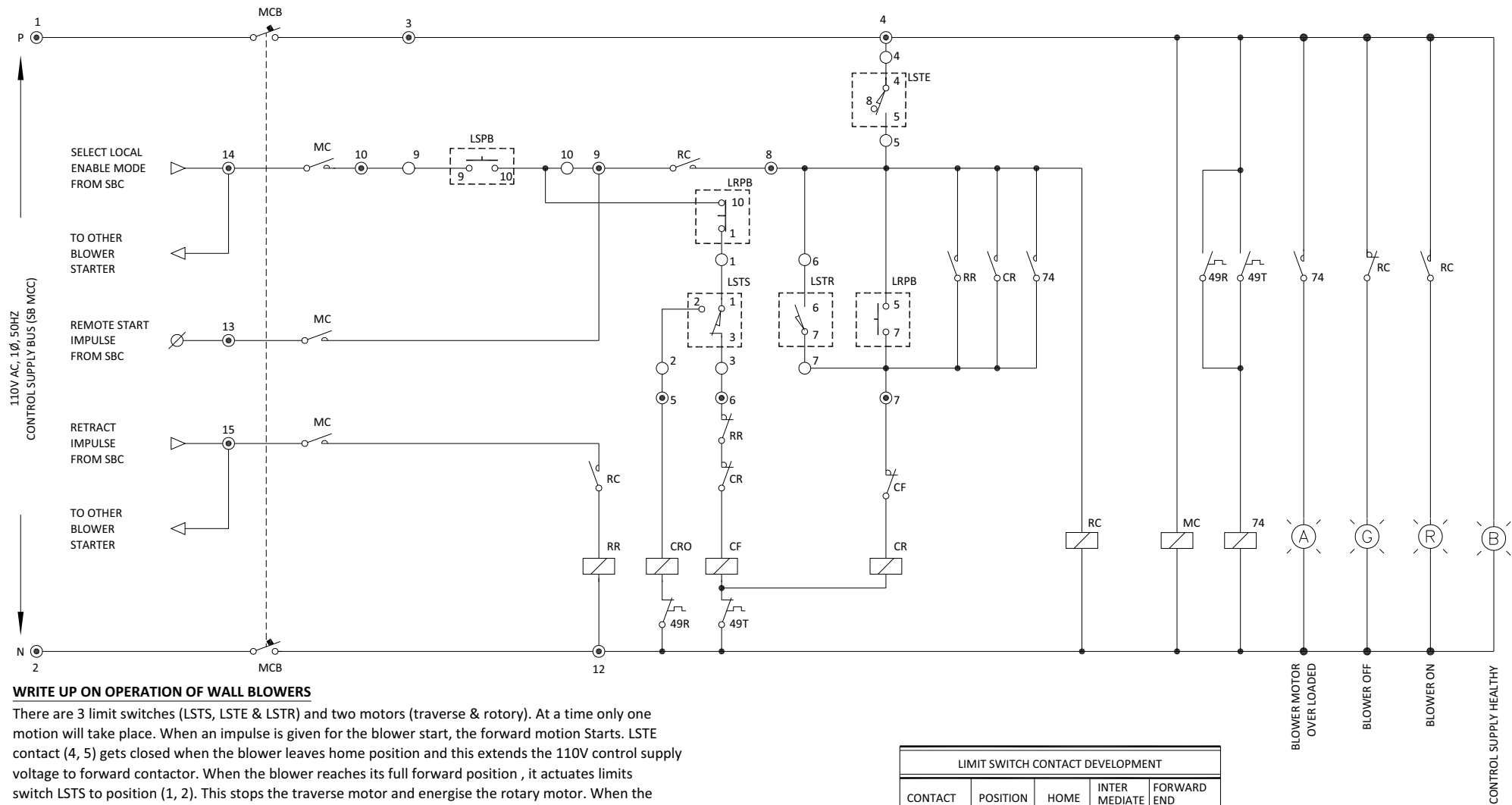
ANDHRA PRADESH POWER DEVELOPMENT COMPANY LIMITED
 Sri DAMODARAM SANJEEVAIAH TPS, KRISHNAPATNAM
 1 x 800 MW, STAGE - II, UNIT-3, Cust. No. 1816, (BTG PACKAGE)

TIRUCHIRAPPALLI
 DEPT. : C & I
 CODE : 392

TITLE
 SOOT BLOWER
 SINGLE LINE DIAGRAM

DR.N. NAME A.ThambuRaj
 CH.D. SR / KB
 APP.D. A.K.Panda
 SIGNATURE 200716
 DATE 20-07-16
 SCALE NTS

SHEET NO. 04/15
 DRAWING NO: 3-96-186-15394
 REV 02



WRITE UP ON OPERATION OF WALL BLOWERS

There are 3 limit switches (LSTS, LSTE & LSTR) and two motors (traverse & rotary). At a time only one motion will take place. When an impulse is given for the blower start, the forward motion Starts. LSTE contact (4, 5) gets closed when the blower leaves home position and this extends the 110V control supply voltage to forward contactor. When the blower reaches its full forward position, it actuates limits switch LSTS to position (1, 2). This stops the traverse motor and energise the rotary motor. When the blower completes its rotary motion, it actuates limit switch LSTR position (6, 7). This gives an impulse for the blower to retract by energising the reverse contactor in the starter. As soon as the blower leaves the forward end position, LSTS resets to position (1, 3) and rotary motor is tripped. Reverse contactor seals through its own contact after LSTR is reset and blower continues to retract. When it reaches its home position, it resets limit switch LSTE and blower stops.

NOTE;

LIMIT SWITCHES & PUSH BUTTONS ARE PART OF BLOWER.

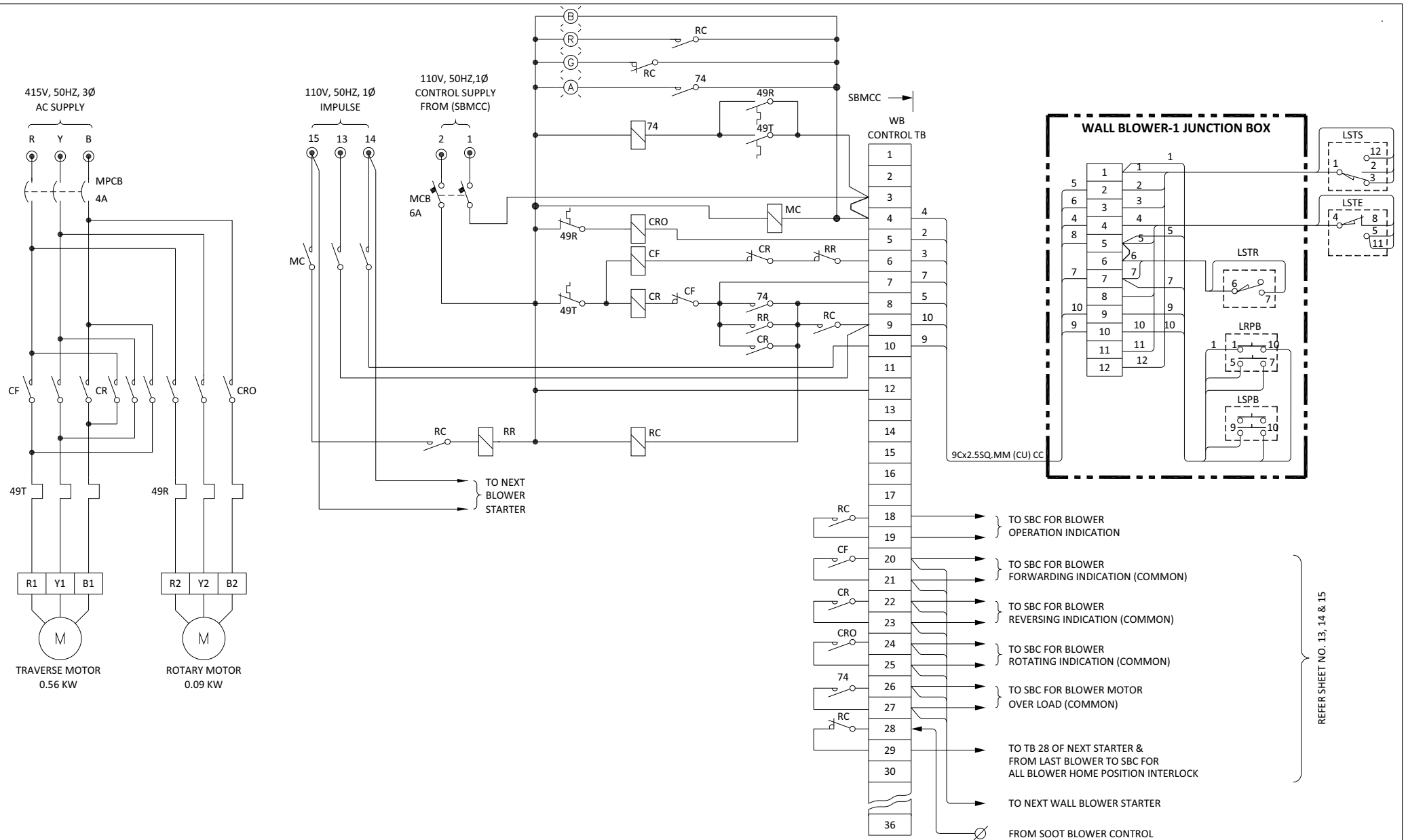
LIMIT SWITCH CONTACT DEVELOPMENT				
CONTACT	POSITION	HOME	INTER MEDIATE	FORWARD END
LSTS	1-2	-	-	X
	1-3	X	X	-
	4-5	-	X	X
LSTE	4-8	X	-	-
	6-7	-	-	MAKES AFTER 1 Rev.
X CONTACT CLOSED, - CONTACT OPEN				

REV	DATE	ALTERED :
		CHD./APPD. :

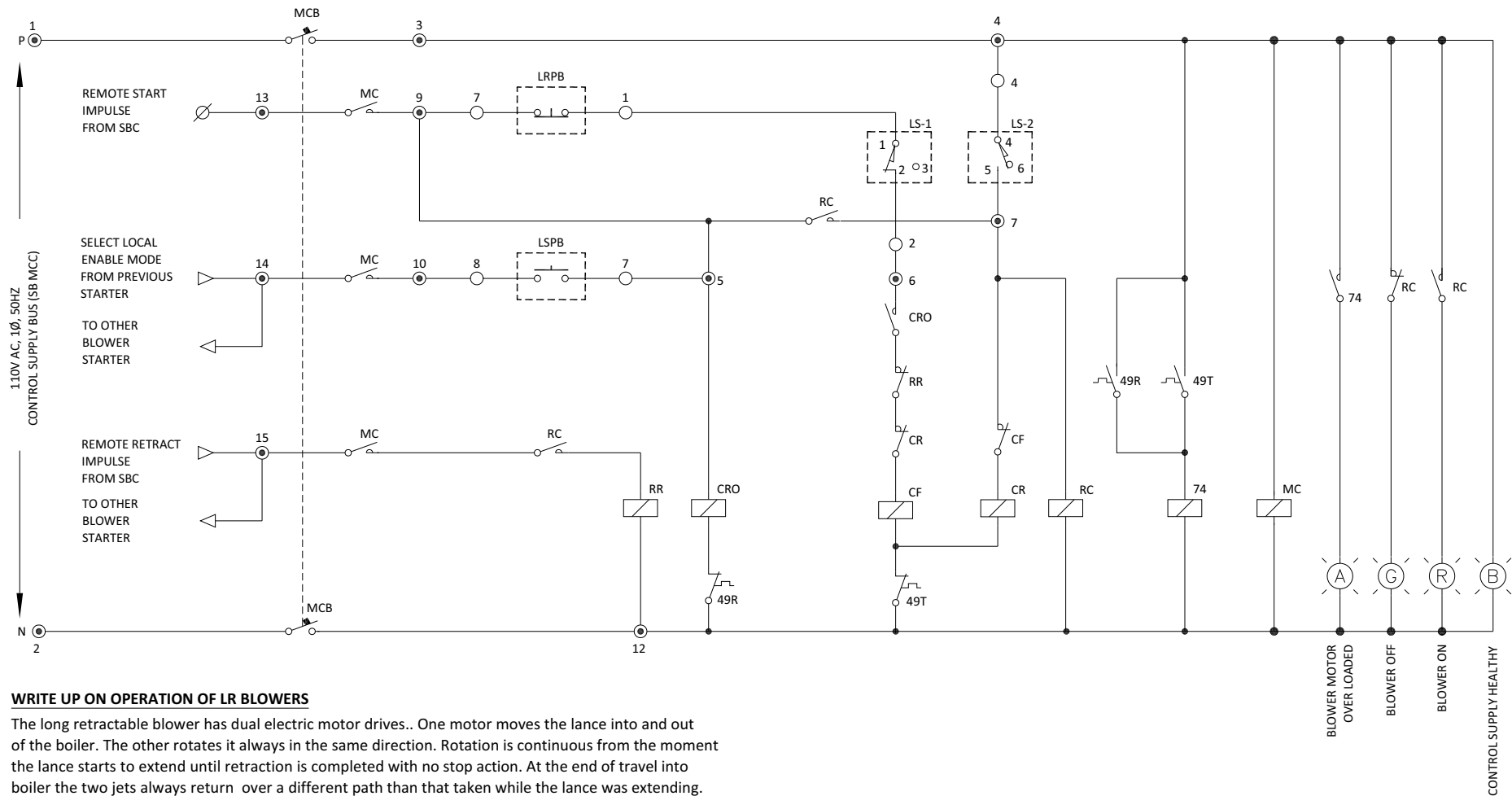
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BRITEL
TIRUCHIRAPPALLI
DEPT. : C&I
CODE : 392

ANDHRA PRADESH POWER DEVELOPMENT COMPANY LIMITED	
Sri DAMODARAM SANJEEVAIAH TPS, KRISHNAPATNAM	
1 x 800 MW, STAGE - II, UNIT-3, Cust. No. 1816, (BTG PACKAGE)	
TITLE	
WALL BLOWER	
CONTROL SCHEME DIAGRAM	

DR.N.	NAME	SIGNATURE	DATE	SCALE
CH.D.	A. ThambuRaj	200716	20-07-16	NTS
APP.D.	A.K.Panda		20-07-16	
SHEET NO.	DRAWING NO:		REV	
05/15	3-96-186-15395		00	



REV	DATE	ALTERED :	CHD./APPD. :	ANDHRA PRADESH POWER DEVELOPMENT COMPANY LIMITED Sri DAMODARAM SANJEEVAIAH TPS, KRISHNAPATNAM 1 x 800 MW, STAGE - II, UNIT-3, Cust. No. 1816, (BTG PACKAGE)	DR.N.	NAME A. Thambu Raj	SIGNATURE 200716	DATE 20-07-16	SCALE NTS
					CH.D.	SR / KB		20-07-16	
					APP.D.	A.K.Panda		20-07-16	
				DEPT. : C&I CODE : 392	SHEET N.O. 06/15		DRAWING NO: 3-96-186-15396		REV 00



WRITE UP ON OPERATION OF LR BLOWERS

The long retractable blower has dual electric motor drives.. One motor moves the lance into and out of the boiler. The other rotates it always in the same direction. Rotation is continuous from the moment the lance starts to extend until retraction is completed with no stop action. At the end of travel into boiler the two jets always return over a different path than that taken while the lance was extending. Whenever a pulse is given to start the LR blower, First the rotary motor gets supply and starts rotating. The "NO" contact of contactor "CRO" for rotary motor closes and the traverse motor starts and holds through limit switches LS-2 (4,5). The blower moves forward. At the end of the forward motion limit switch LS-1 opens (contacts 1,2) and the blower retracts. When the blower reaches the home position limit switch LS-2 (contact 4,5) opens and the blower stops.

NOTE;

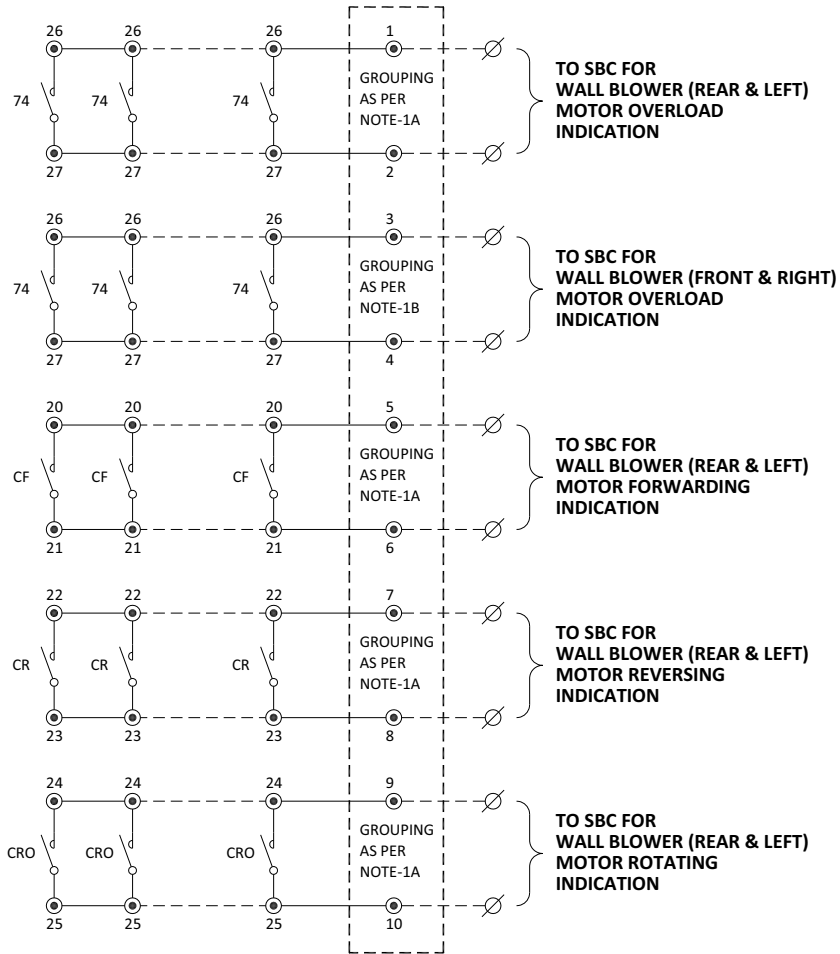
LIMIT SWITCHES & PUSH BUTTONS ARE PART OF BLOWER.

LIMIT SWITCH CONTACT DEVELOPMENT				
CONTACT	POSITION	HOME	INTER MEDIATE	FORWARD END
LS-1	1-2	X	X	-
	4-5	-	X	X
LS-2	4-6	X	-	-
X CONTACT CLOSED, - CONTACT OPEN				

REV	DATE	ALTERED :	CHD./APPD. :	DRN.	NAME	SIGNATURE	DATE	SCALE
					A. Thambu Raj		20-07-16	
					SR / KB		20-07-16	NTS
					A.K.Panda		20-07-16	
TIRUCHIRAPPALLI				SHEET NO. 07/15				REV
DEPT. : C&I				DRAWING NO: 3-96-186-15397				00
CODE : 392				DRAWING NO: 3-96-186-15397				00

ANDHRA PRADESH POWER DEVELOPMENT COMPANY LIMITED				SHEET NO. 07/15				REV
Sri DAMODARAM SANJEEVAIAH TPS, KRISHNAPATNAM				DRAWING NO: 3-96-186-15397				00
1 x 800 MW, STAGE - II, UNIT-3, Cust. No. 1816, (BTG PACKAGE)				DRAWING NO: 3-96-186-15397				00
TITLE				DRAWING NO: 3-96-186-15397				00
LONG RETRACTABLE BLOWER				DRAWING NO: 3-96-186-15397				00
CONTROL SCHEME DIAGRAM				DRAWING NO: 3-96-186-15397				00

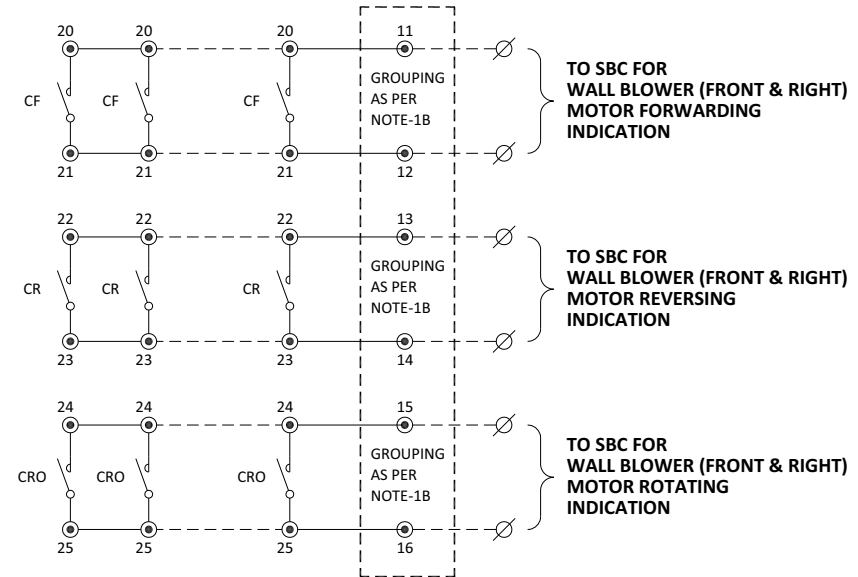
TB AT COMMON COMPARTMENT



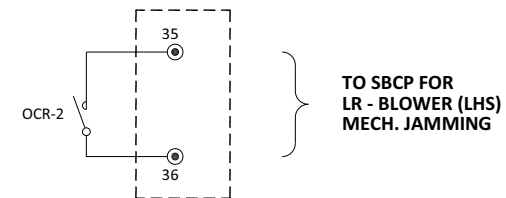
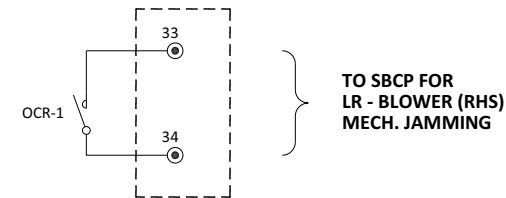
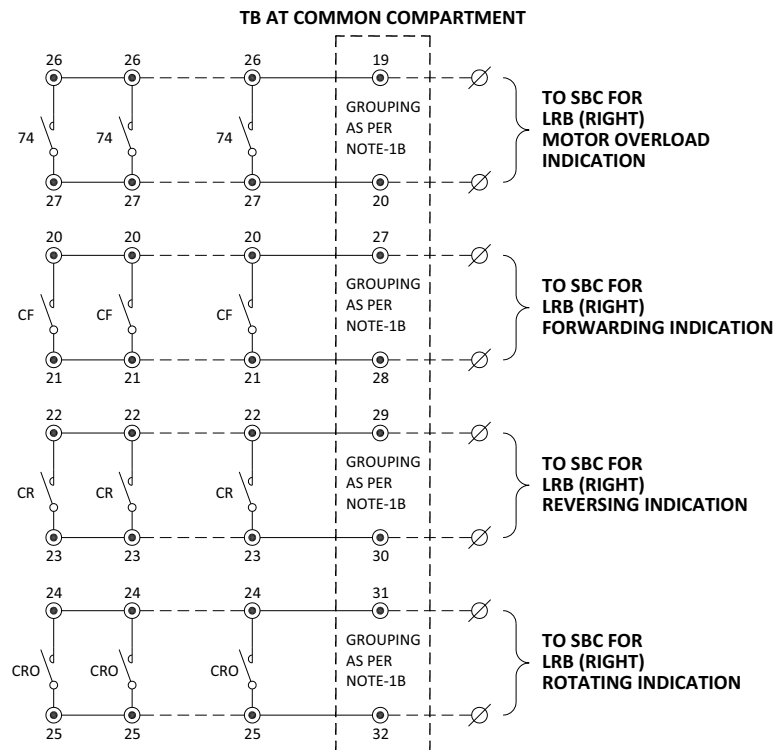
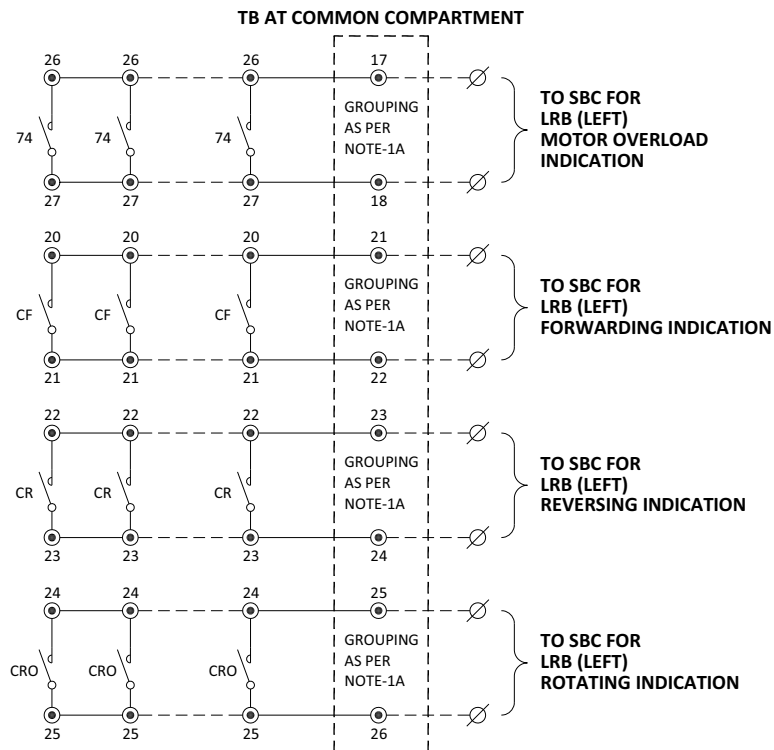
NOTE

- N/O CONTACT OF CONTACTOR "74"/CF/CR/CRO OF ALL WALL BLOWER SHALL BE PARALLELED AS FOLLOWS.
 - REAR & LEFT WALL BLOWER (13 TO 24, 38 TO 50, 64 TO 76, 90 TO 102)
 - FRONT & RIGHT WALL BLOWER (1 TO 12, 25 TO 37, 51 TO 63, 77 TO 89)

TB AT COMMON COMPARTMENT



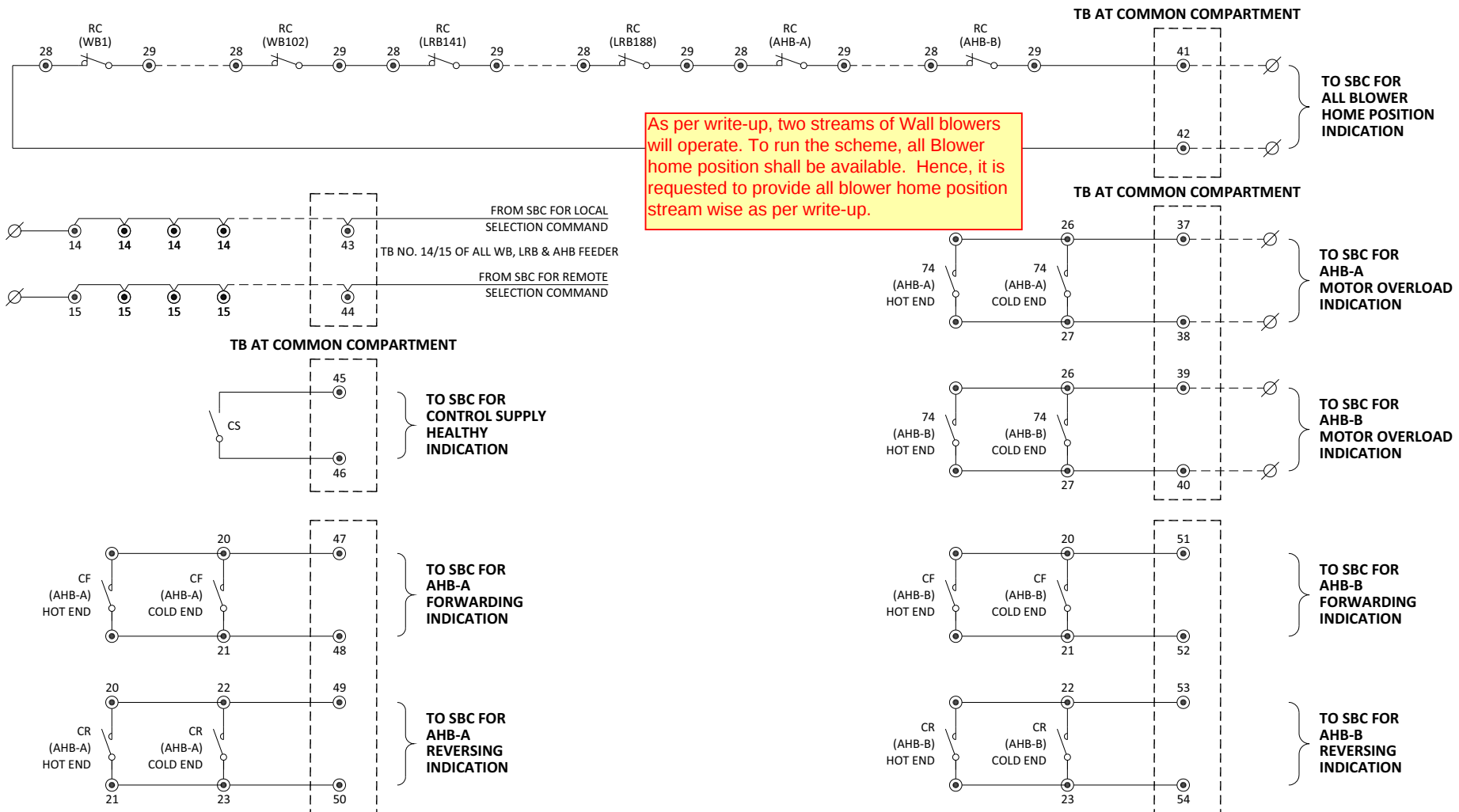
REV	DATE	ALTERED :	CHD./APPD. :	ANDHRA PRADESH POWER DEVELOPMENT COMPANY LIMITED Sri DAMODARAM SANJEEVAIAH TPS, KRISHNAPATNAM 1 x 800 MW, STAGE - II, UNIT-3, Cust. No. 1816, (BTG PACKAGE)	DRN.	NAME A. Thambu Raj	SIGNATURE A. Thambu Raj	DATE 20-07-16	SCALE NTS
				DEPT. : C & I	CHD.	SR / KB		20-07-16	
				CODE : 392	APPD.	A.K.Panda		20-07-16	
				TIRUCHIRAPPALLI	SHEET NO.	13/15	DRAWING NO: 3-96-186-15401	REV 00	



NOTE

- N/O CONTACT OF CONTACTOR "74"/CF/CR/CRO OF ALL LR BLOWER SHALL BE PARALLELED AS FOLLOWS.
 - LEFT LR BLOWER (142, 144, 146, 148, 150, 152, 154, 156, 158, 160, 162, 164, 166, 168, 170, 172, 174, 176, 178, 180, 182, 184, 186, 188)
 - RIGHT LR BLOWER (141, 143, 145, 147, 149, 151, 153, 155, 157, 159, 161, 163, 165, 167, 169, 171, 173, 175, 177, 179, 181, 183, 185, 187)

REV	DATE	ALTERED :	CHD./APPD. :	DRN.	NAME	SIGNATURE	DATE	SCALE
					A. ThambuRaj		20-07-16	NTS
					SR / KB		20-07-16	
					A.K.Panda		20-07-16	
				DEPT. : C&I	TITLE	SHEET NO.	DRAWING NO:	REV
				CODE : 392	INTER COMPARTMENT WIRING DIAGRAM IN SB MCC	14/15	3-96-186-15402	00



NOTE

- N/O CONTACT OF CONTACTOR "74" FOR AHB STARTER SHALL BE PARALLELED AS FOLLOWS
 - AHB-A
 - AHB-B
- TB NO. 14/15 OF ALL WB, LRB & AHB SHALL BE LOOPED.
- N/C CONTACT OF "RC" CONTACTOR OF ALL WB, LRB & AHB FEEDERS SHALL BE CONNECTED IN SERIES.

Please provide the all blower home position group wise.

REV	DATE	ALTERED :  080717	ANDHRA PRADESH POWER DEVELOPMENT COMPANY LIMITED	DRN.	NAME	SIGNATURE	DATE	SCALE
01	080717	CHD./APPD. :	Sri DAMODARAM SANJEEVAIAH TPS, KRISHNAPATNAM	CH.D.	SR / KB	 200716	20-07-16	NTS
TIRUCHIRAPPALLI			1 x 800 MW, STAGE - II, UNIT-3, Cust. No. 1816, (BTG PACKAGE)	APP.D.	A.K.Panda	Sd. / AKP	20-07-16	
REVISED AS PER CUSTOMER LETTER REF.NO. 0478 DATED 23-05-2017			DEPT. : C & I	SHEET NO.		DRAWING NO:		REV
			CODE : 392	INTER COMPARTMENT WIRING DIAGRAM IN SB MCC		3-96-186-15403		01
				15/15				



BHARAT HEAVY ELECTRICALS LIMITED
ELECTROPORECELAIS DIVISION

ANNEXURE-B

PROJECT :	1X800MW KRISHNAPATNAM TPS	Document No :	EP-4-BM-SBM
CUSTOMER :	APPDCL	Rev	00
ITEM :	SOOT BLOWER MCC (SBMCC)		

MODULE WISE BILL OF MATERIAL					
SL. NO.	ITEM DESCRIPTION	RATING	SPECIFICATION	QTY/ MODULE	QTY/ SBMCC
INCOMER					2
1	MCCB	63A	3-Pole, AC	1	2
2	MCCB RHOM	63A	Extended	1	2
3	FUSE BASE	32A	1-Pole	9	18
4	FUSE LINK	2A	HRC Fuse link	9	18
5	CURRENT TRANSDUCER		i/p : 1A, Aux: 110V AC	3	6
6	VOLTAGE TRANSDUCER		i/p : 63.5V AC, Aux: 110V AC	3	6
7	KILOWATT TRANSDUCER		i/p : 63.5V AC, i/p : 1A, Aux: 110V AC	1	2
8	KILOWATT HOUR TRANSDUCER		i/p : 63.5V AC, i/p : 1A, Aux: 110V AC	1	2
9	CT	10/1A	CL-1, 15VA	3	6
10	PT	(415/RT(3)) / (110/RT(3))	1-PH, CL-1, 50VA	3	6
11	MFM		A,V, KW, KWH, Hz	1	2
12	INDICATING LAMP	63.5V AC	RED	1	2
13	INDICATING LAMP	63.5V AC	YELLOW	1	2
14	INDICATING LAMP	63.5V AC	BLUE	1	2
15	CTTB	10A	Disconnecting Type	7	14
16	Neutral Link	20A		2	4
17	Terminal Block	4sq.mm		36	72
18	Terminal Block End Plate	4sq.mm		2	4
BUS COUPLER					1
1	MCCB	63A	3-Pole, AC	1	1
2	MCCB RHOM	63A	Extended	1	1
3	Castle Key arrangement	3Lock + 2Key		1	1
CONTROL SUPPLY					2
1	FUSE BASE	32A	1-Pole	10	20
	FUSE LINK	4A		6	12
	FUSE LINK	16A		4	8
2	Power Contactor	18A	Coil Voltage : 110V AC	2	4
3	Add-on block for Power Contactor	2NO+2NC		1	2
4	Auxilliary Contactor	2NO+2NC	Coil Voltage : 110V AC	1	2
7	Timer	On-delay	0-1Sec, 1NO contact	1	2
8	Indicating lamp	RED	110V AC	1	2
9	Control Supply Transformer	415/110V	1.5KVA	2	4
10	Neutral link	30A		1	2
11	Terminal Block	4sq.mm		14	28
12	Terminal Block End Plate	4sq.mm		2	4
JAMMING RELAY					2
1	Jamming Relay	CTR : 5/5A		1	2
2	CT	5/5A	CI-5P20, 10VA	1	2
3	CTTB	10A	Disconnecting type	4	8
4	Terminal Block	4sq.mm		6	12
5	Terminal Block End Plate	4sq.mm		2	4
WALL BLOWER					116
1	MPCB WITH SC ONLY	4A	415V AC, 3P	1	116
2	Extended RHOM	4A, TP		1	116
3	Power Contactor	18A	Coil Voltage : 110V AC	3	348
4	ADD-ON block for Power Contactor	2NO+2NC		2	232
5	OLR	1.0-1.6A	415V AC	1	116
6	OLR	0.63-1.0A	415V AC	1	116
7	Mounting Kit			2	232
8	Reset Chord	400mm		2	232
9	Auxilliary Contactor	2NO+2NC	Coil Voltage : 110V AC	1	116
10	Interposing Relays	1C/O	24V DC, 4A	3	348
11	MCB	6A, 2P	415V AC	1	116
13	LED	RED, GREEN, AMBER	110V AC	3	348
14	LED	Blue	110V AC	1	116
15	Terminal Block	4sq.mm		36	4176
16	Terminal Block End Plate	4sq.mm		4	464

LONG RETRACTABLE BLOWER					56
1	MCCB SC ONLY	4A	415V AC, 4P	1	56
2	Extended RHOM	4A, TP		1	56
4	Power Contactor	18A	Coil Voltage : 110V AC	3	168
5	ADD-ON block for Power Contactor	2NO+2NC		3	168
6	OLR	1.0-1.6A	415V AC	1	56
7	OLR	1.6-2.5A	415V AC	1	56
8	Mounting Kit			2	112
9	Reset Chord	400mm		2	112
10	Auxilliary Contactor	2NO+2NC	Coil Voltage : 110V AC	1	56
11	Interposing Relays	1C/O	24V DC, 4A	3	168
12	MCB	6A, 2P	415V AC	1	56
13	LED	RED, GREEN, AMBER	110V AC	3	168
14	LED	Blue	110V AC	1	56
15	Terminal Block	4sq.mm		36	2016
16	Terminal Block End Plate	4sq.mm		4	224
AIR HEATER BLOWER					5
1	MPCB	4A	415V AC	1	5
2	Extended RHOM	4A, TP		1	5
3	Power Contactor	18A	Coil Voltage : 110V AC	2	10
4	ADD-ON block for Power Contactor	2NO+2NC		2	10
5	OLR	0.4-0.63A	415V AC	1	5
6	Mounting Kit			1	5
7	Reset Chord	400mm		1	5
8	Auxilliary Contactor	2NO+2NC	Coil Voltage : 110V AC	1	5
9	Interposing Relays	1C/O	24V DC, 4A	2	10
10	MCB	6A, 2P	415V AC	1	5
11	Fuse Base	32A		2	10
12	Fuse link	4A		2	10
13	LED	RED, GREEN, AMBER	110V AC	3	15
14	LED	Blue	110V AC	1	5
15	Terminal Block	4sq.mm		36	180
16	Terminal Block End Plate	4sq.mm		4	20
SPACE HEATER					1
1	MCB	32A	415V AC	1	1
2	Terminal Block	4sq.mm		6	6
CABLE ALLEY					As per Vendor design
1	MCB	6A, 2P	415V AC	1	
2	LED	RED	240V AC	1	
3	Thermostat	30-90deg C	240V AC	1	
4	Spaceheater	60W	240V AC	1	
5	Door limit Switch	NC	240V AC	1	
6	CFL	11W	240V AC	1	
1	MCB	6A, 2P	240V AC	1	
2	Power Socket	5A	240V AC	1	
3	Terminal Block	4sq.mm		3	
4	Terminal Block End Plate	4sq.mm		2	
7	Terminal Block	4sq.mm		5	
8	Terminal Block End Plate	4sq.mm		2	

ABOVE BILL OF MATERAIL IS INDICATIVE BIDDER SHALL STRICTLY COMPLY ALL DRAWING REQUIREMENTS AND FINALIZE THE BILL OF MATERIAL.

MANDATORY SPARES TO BE SUPPLIED ALONG WITH BOARD				
Purch.Req.	Material	Short Text	Quantity	
116789173	R61181600015	Red-Indicating Lamp complete assembly	30.000	
116789174	R61181600016	Amber-Indicating Lamps complete assembly	30.000	
116789175	R61181600017	Green-Indicating Lamps complete assembly	30.000	
116789176	R61181600018	White-Indicating Lamps complete assembly	30.000	
116789177	R61181600019	Blue-Indicating Lamps complete assembly	30.000	
116789178	R61181600020	CT for each type and Rating for SBMCC	1.000	
116789179	R61181600021	Transducer for each type & Rat for SBMCC	5.000	
116789182	R61181600024	AC Supply On / Off Switch-ea ty & Rating	10.000	
116789186	R61181600028	Ammeter Selector Switch-each ty & Rating	1.000	
116789187	R61181600029	Voltmeter Selector Switch-ea ty & Rating	1.000	
116789188	R61181600030	Voltmeter-each type& Rating for BTG Area	1.000	
116789189	R61181600031	Ammeter-each type & Rating for BTG Area	2.000	

ADDITION/ DELETION LIST SOOT BLOWER MCC

SL. NO	COMPONENT DESCRIPTION	RATING	UNIT PRICE
1	MPCB (EACH TYPE AND RATING)		
2	MCB(EACH TYPE AND RATING)		
3	POWER CONTACTOR (EACH RATING AND TYPE)		
4	OVER LOAD RELAY (EACH RATING AND TYPE)		
5	AUXILIARY CONTACTOR (EACH RATING AND TYPE)		
6	PROTECTION RELAY (EACH RATING AND TYPE)		
7	INDICATION LAMP (EACH RATING AND TYPE)		
8	PUSH BUTTON (EACH RATING AND TYPE)		
9	CONTROL TRANSFORMER (EACH RATING AND TYPE)		
10	CURRENT TRANSFORMER (EACH RATING AND TYPE)		
11	VOLTMETER(EACH RATING AND TYPE)		
12	AMMETER (EACH RATING AND TYPE)		
13	NEUTRAL LINK (EACH RATING AND TYPE)		
14	CONTROL SWITCHES (EACH RATING AND TYPE)		
15	CONTROL/POWER TERMINAL (EACH RATING AND TYPE)		
16	DFDO ENCLOSURE (EACH RATING AND TYPE)		
17	INCOMER MODULE 32A		
18	INCOMER MODULE 63A		
19	LR BLOWER COMPLETE MODULE		
20	WALL BLOWER COMPLETE MODULE		
21	AH BLOWER COMPLETE MODULE		
22	SB FEEDER COMPLETE MODULE		
23	CONTROL TRANSFORMER COMPLETE MODULE		

2. i. Vendor to give UNIT price for addition/ deletion of all COMPONENTS for all rating as indicated in the BOM. Also vendor to give option price for addition/ deletion of ENCLOSURE.

ii. The cost price of Individual items related to this project should match to total price .

TECHNICAL SPECIFICATION FOR
SOOT BLOWER MCC
PROJECT: 1X800MW VIJAYAWADA
CUSTOMER: APGENCO

SPEC REF NO.: EP-SBMCC-VTP-01 REV 00



BHARAT HEAVY ELECTRICALS LIMITED
ELECTROPORCELAINS DIVISION
BANGALORE – 560012



**TECHNICAL SPECIFICATION
FOR
SOOT BLOWER MCC**

SPECIFICATION NO. : EP-SBMCC-VTP-01

VOLUME

SECTION -

REVISION 0

DATE: 18.09.2017

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4.0	TECHNICAL SPECIFICATION & DRAWINGS
5.0	PRICE SCHEDULE
6.0	UNIT PRICE SCHEDULE
7.0	DEVIATION SHEET

IT IS CONFIRMED THAT OUR TECHNICAL OFFER COMPLIES WITH THE SPECIFICATION IN TOTO, & THAT THERE ARE NO TECHNICAL DEVIATIONS.

BIDDER'S STAMP & SIGNATURE
(REFER INSTRUCTION NO. 1 OF 'INSTRUCTIONS TO BIDDERS')



**TECHNICAL SPECIFICATION
FOR
SOOT BLOWER MCC**

SPECIFICATION NO. : EP-SBMCC-VTP-01

VOLUME NO. :

SECTION :

REV NO. : 00 DATE: 18-09-2017

SHEET : 1 OF 1

INSTRUCTIONS TO BIDDERS FOR PREPARING TECHNICAL OFFERS

1. Two signed and stamped copies of the following shall be furnished by all bidders as technical offer:
 - a) Complete technical specification.
 - b) Un-priced copy of PRICE FORMAT, duly stamped and signed by the bidder.
 - c) Complete dimension of all the boards including no. of panels, dimensions of each type of panels, module size of each type of feeders and minimum clearances required on all sides for each type of panels.
 - d) **No. of Vertical consider by vendor for each boards are to be compulsory given along with offer.**
 - e) A copy of the sheet "Instructions to Bidders for Preparing Technical Offer" duly stamped and signed by the bidder.
 - f) Technical deviation/ clarification, if any
 - g) No. of MCC panels, Weight & Dimensions of SBMCC.
2. No technical submittal such as copies of type test certificates, data Sheets, write-up, drawing, technical literature, etc. is required during tender stage. Any such submission, even if made, shall not be considered as part of offer.
3. Confirmations/ comments (if any) regarding delivery schedules shall be furnished as part of the commercial offer. Any reference elsewhere/ covering letter of technical offer shall not be considered by BHEL.
4. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder's covering letter shall not be considered by BHEL, and bidder's offer shall be construed to be in conformance with the specification.
5. Any changes made by the bidder in the price schedule with respect to the Item description/ quantities, notes etc. from those given in annexure-A of specification shall not be considered (i.e., technical description, quantities, notes etc. as per specification shall prevail).
6. Bidders to quote for all items/sub items.
7. In case of any ambiguity in specification between various sections and end customer specification vendor should clearly brought out in technical deviations failing in which BHEL will have choice to prefer which ever it suits at later stage for which vendor should accept.
8. In case bidder is having any queries regarding technical parameters same shall get clarified before quoting, in case if any technical deviations are observed during scrutiny wrt to NIT bidder shall meet the technical requirements without any price implication.
9. Vendor should bring out clearly in deviation sheet if any.

BIDDER'S STAMP & SIGNATURE

**VOLUME :V-A
SECTION-VII
TECHNICAL SPECIFICATION
FOR
415V PMCC/MCC, 415V ACDB AND 220V DCDB**

1.00.00 SCOPE OF SUPPLY

1.01.01 Requisite nos. of following equipment shall be furnished with all accessories :-

- a. Power cum Motor Control Centre (PMCC)
- b. Motor Control Centres (MCC)
- b. A.C. Distribution Board (DB)
- c. D.C. Distribution Board (DB)
- d. D.C. Starters
- e. A.C./D.C. fuse boards

1.01.02 The base channel frame with hardware and lifting angles.

1.01.03 One set of special tools and tackles.

- 1. One spanner Set.
- 2. Module Rack in Rack out Handles.

1.01.05 Mandatory Spare as per list furnished.

1.01.06 All relevant drawings, data and instruction manuals.

2.00.00 CODES AND STANDARDS

2.01.01 All equipment and materials shall be designed, manufactured and tested in accordance with the latest applicable Indian Standards (IS) and IEC except where modified and/or supplemented by this specification.

2.01.02 Equipment and material conforming to any other international standard which ensures equal or better quality, may be accepted. In such case, copies of the English version of the standard adopted shall be submitted along with the bid.

2.01.03 The electrical installation shall meet the requirements of Indian Electricity Rules as amended upto date and relevant IS Code of Practice. In addition, other rules and regulations applicable to the work shall be followed.

3.00.00 DESIGN CRITERIA

- 3.01.00 The PMCCs/MCCs/DBs will be used to provide power, control and protection for 415/240V A.C. and 220V D.C. auxiliary services (Motors & Feeders) of generating units.
- 3.02.00 Duty involves direct-on-line starting of large squirrel cage motors below 175kW. The starting current varies from 6 to 8 times rated current at very low power factor.
- 3.03.00 The equipment will be located in a hot, humid and tropical atmosphere, highly polluted at places with coal dust and/or fly ash.
- 3.04.00 For continuous operation at specified ratings, the temperature rise of various equipment/components shall be limited to the permissible values stipulated in relevant standards and/or this specification.
- 3.05.00 Equipment ratings and quantities are detailed in the enclosed drawings and annexure. Equipment shall be furnished in strict compliance with the same.
- 3.06.00 All equipment and components thereof shall be capable of withstanding the mechanical forces and thermal stresses of the short-circuit currents without any damage or deterioration of the materials.
- 3.07.00 The PMCCs/ MCCs / DBs shall have two incomers and one bus-coupler. In addition to electrical interlocks, mechanical castle key interlock shall be provided between the two incomers and the bus-coupler so that any two of the three may be closed at a time.
- 3.08.00 Busbars of PMCCs shall be sized to carry continuously the associated transformer secondary current plus a 20% margin.
- Busbars of MCC/DBs shall be sized to carry continuously the total running load of MCC/DB plus a 20% margin.
- 3.09.00 In cubicle of incomers & bus section breakers/MCCBs shall be identical to the associated busbar rating.
- 3.10.00 For continuous operation at specified ratings, the temperature rise of various equipment/components shall be limited to the permissible values specified in relevant standards and/or this specification.
- 3.11.00 Circuit breakers shall not produce any harmful over voltage during switching off of induction motors. If required, surge protective devices shall be included in the scope of supply to limit over voltages.
- 3.12.00 Incomers, Bus-couplers & outgoing feeders rated upto & including 630A shall be MCCB controlled. Above 630A all incomers, Bus-couplers & outgoing Feeders shall be ACB controlled. For critical loads ACB control feeders shall be provided which will be decided during detailed engineering.
- 3.13.00 All motor rated 110kW & above, below 175kW shall be ACB controlled. Motor rated upto 110kW shall be contactor operated.

- 3.14.00 MCC & PMCC shall have sufficient number of spare modules (at least 20% of various sizes used with a minimum of 1 no. for each rating and type).
- 3.15.00 Outgoing feeders of PMCC shall be limited to minimum number of different sizes so that max. standardization is achieved from MCCB & contactor size point of view.
- 3.16.00 Incomers & bus section breakers of PMCCs/MCCs shall have provisions for remote operation from control room.
- 3.17.00 All breaker operated motor feeder shall be supplied from PMCC.
- 3.18.00 One no. Normal/Emergency switchgear to cater power supply to important emergency load / motors for safe shut-down of unit including 220V battery chargers shall be provided for each unit. The main incoming supply shall be from 415V unit service switchgear. When main incoming supply fails, reserve incoming supply shall be switched ON automatically from 415V station service switchgear. In case of total failure of AC supply of the power station, the supply from DG shall be switched ON automatically.
- 3.19.00 Each switchgear shall be provided with two bus sections, two incomer and a bus coupler rated for 100% of the loads connected to the switchgear.
- 3.20.00 For each auxiliary or load, one feeder shall be provided except for the following cases:
- One feeder for a maximum 2 nos. isolator motor operating mechanism.
- 3.21.00 The switchgears shall be provided with suitable number and type of outgoing feeders for the respective auxiliary loads of the system/area, power supply feeders to various panels, lighting transformer, space heating panels, control cabinets and all other loads encountered in the plant. In addition, following feeders shall be provided in each bus section of each switchgear.
- a) Bus VT module: One (1) no.
- 3.22.00 Each feeder shall be provided with two nos. interposing relays for start & stop. These interposing relays shall be located in separate IPR panel described under C&I specification.

4.00.00 **SPECIFIC REQUIREMENTS**

4.01.00 **Construction**

4.01.01 PMCC / MCC / DB shall be indoor, metal-clad, air insulated and floor mounting type. All MCCs shall be fully draw out type and DBs shall be fixed type. ACB modules of PMCCs/MCCs shall be fully drawout type. MCCB / Switch Fuse modules shall also be fully drawout type. The design and construction shall be such as to allow extension at either end.

4.01.02 All PMCC/MCC shall be of double front construction.

4.01.03 PMCC /MCC/DB enclosure shall be dust and splash proof, conforming to a degree of protection IP-54. All switchboard frames and load bearing members shall be fabricated using suitable mild steel structural sections or pressed and shaped cold rolled sheet steel of thickness 2.0mm. Frames shall be enclosed in cold rolled sheet steel of thickness 1.6 mm. Doors and covers shall also be of cold rolled sheet steel thickness 1.6 mm. Stiffeners shall be provided wherever necessary. The gland plate thickness shall be 3.0 mm for hot/cold rolled sheet steel and 4.0 mm for non-magnetic material.

4.01.04 PMCC / MCC / DB assembly shall comprise a continuous line up of dead front, free-standing vertical sections, housing the control modules in multi tier formation.

4.01.05 The design shall be fully compartmentalized with metal/insulating partitions between compartments.

4.01.06 Each control module shall be housed in a separate compartment, complete with an individual front access door having sufficient opening with concealed type hinges. Each vertical section shall have a removal back cover. All doors and covers shall be gasketed.

4.01.07 All push buttons, lamps, indicating instruments shall be flush / semi-flush mounted on respective module compartment.

4.01.08 A full height vertical cable chamber with cable supports shall be provided in each section to facilitate unit wiring. The chamber shall be liberally sized to accommodate all cables and shall have removable cover at the front for access.

4.01.09 A horizontal wireway, extending the entire length, shall be provided at the top of each PMCC / MCC / DB for inter panel wiring.

4.01.10 The width of the cable alley shall not be less than 250 mm.

4.02.00 **Bus and Bus Taps**

4.02.01 All PMCCs/MCCs/DBs shall be provided with three phase & neutral bus bars . All DCDBs shall be provided with two busbars. All busbar compartments shall be completely enclosed.

- 4.02.02 The main buses and connections shall be of high conductivity Aluminium / Aluminium alloy, sized for specified current ratings with maximum temperature limited to 85°C (i.e., 35°C rise over 50°C ambient).
- 4.02.03 Vertical busbars shall be designed for minimum current rating of 200A. Separate vertical busbars shall be provided for each vertical panel.
- 4.02.04 All bus connections shall be silver plated. Adequate contact pressure shall be ensured by means of two-bolt connection with plain and spring washers and locknuts.
- Bimetallic connector shall be furnished for connection between dissimilar metals.
- 4.02.05 Busbars and connections shall be fully insulated for working voltage with adequate phase/ground clearances. Insulating sleeves for busbars and shrouds for joints and tap-off points shall be provided.
- Bus insulators shall be flame retardant, non-hygroscopic track-resistant type with high creepage surface.
- 4.02.06 Busbars shall be supported and braced to withstand the stresses due to maximum short circuit current and also to take care of any thermal expansion.
- 4.02.07 Busbars shall be colour coded for easy identification and so located that the sequence R-Y-B shall be from left to right, top to bottom or front to rear when viewed from the front of the assembly.
- 4.03.00 **Control Modules**
- 4.03.01 Draw-out type control module shall have self-aligning power/control disconnects. All disconnects shall be silver plated to ensure good contacts.
- 4.03.02 The design shall be such as to permit easy withdrawal/reinsertion of the unit with guide rails to ensure correct alignment.
- 4.03.03 Control Module shall house the control components for a circuit such as switch fuse / MCCB, contactors, relays, push buttons, lamps etc. as per requirement of the control circuit.
- 4.03.04 The equipment layout shall provide sufficient working space in between the components and subject to Owner's approval.
- 4.03.05 Various module/compartment sizes shall be multiple of one basic unit to facilitate modifications at site. Suitable provision for this purpose should also be incorporated in the vertical bus bars.
- 4.03.06 Draw-out type control modules of same size and type shall be electrically and physically interchangeable.
- 4.04.00 **Air Circuit Breaker**
- 4.04.01 Circuit breaker shall be provided on the incomer having minimum interrupting capacity equal to the 50kA(r.m.s) fault level.

- 4.04.02 Circuit breaker shall be three pole, single throw, air-break type with independent manual spring closing, trip-free mechanism and shunt trip. However Incomer and bus coupler breakers (ACB) shall be four pole type.
- 4.04.03 Circuit breaker shall be draw-out type, having service, test & isolated position with positive indication for each position.
- 4.04.04 Circuit breakers of identical rating shall be physically and electrically interchangeable.
- 4.04.05 Each breaker shall be provided with microprocessor based protection unit having three overload protection with adjustable current and time, three short circuit protection with adjustable current and time and three instantaneous short circuit protection. The operating characteristic shall be suitable for co-ordination with down-stream fuses.
- 4.04.06 Circuit breakers shall be provided with motor wound spring charging mechanism. Spring charging shall take place automatically after each breaker closing operation. One open-close-open operation of the circuit breaker shall be possible after failure of power supply to the motor. In addition, facility for manual charging of spring shall be provided.
- 4.04.07 Mechanical safety interlock shall be provided to prevent the circuit breaker from being racked in or out of the service position when the breaker is closed. It shall not be possible to open the circuit breaker door cubicle unless the breaker is in 'OFF' position.
- 4.04.08 Automatic safety shutters shall be provided to cover up the stationary disconnects when the breaker is withdrawn.
- 4.04.09 Each breaker shall be provided with an emergency manual trip, mechanical ON-OFF indicator, an operation counter and spring mechanism charge/discharge indicator, and electrical anti-pumping feature.
- 4.04.10 In addition to the auxiliary contacts required for normal breaker operation and indication, each breaker shall be provided with the following for interlocking purpose :-
- a. Position/Cell switch with 4 NO + 4 NC contacts.
 - b. Auxiliary switch, with minimum 6NO + 6NC contacts,
- 4.04.11 Spring charge limit switch shall be provided for breakers with motor wound spring charging mechanism. These limit switches shall be provided with minimum 2NO + 2NC contact.
- 4.04.12 Limit/auxiliary switches shall be convertible type, that is, suitable for changing N.O. contact to N.C. and vice-versa.
- 4.04.13 Each breakers operated feeder shall be provided with protective devices as specified in Annexure–B.

4.05.00 Switches

- 4.05.01 Switches shall be triple pole, air break, AC23 motor duty for motor feeders and AC22 heavy duty for other feeders.
- Motors duty switches shall be capable of safely making and breaking the locked rotor current of the associated motor circuit.
- 4.05.02 The switch shall have a quick-make, quick-break mechanism operated by a suitable external handle, complete with position indicator. This handle shall have provision for padlocking in ON and OFF position.
- 4.05.03 The compartment door shall be interlocked mechanically with the switch such that the door cannot be opened unless the switch is in OFF position. Means shall be provided for releasing this interlock at any time.
- 4.05.04 Switches shall be capable of withstanding the let-through fault current of back-up fuses or circuit breakers.
- 4.05.05 Wherever two incoming switches and one bus-section switch are provided for an assembly, these shall be mechanically/key interlocked to ensure that only two out of the three can be closed at time.
- Wherever two incoming switches are provided for an assembly, these shall be mechanically/key interlocked to ensure that one of the two can be closed at time.
- 4.05.06 All incoming and outgoing feeders shall be provided with bolted disconnect link for isolation of neutral if necessary.

4.06.00 Fuses

- 4.06.01 Fuses shall be HRC, preferably link type, with a minimum interrupting capacity equal to the short circuit current of the LT system. Fuses shall be mounted on insulated fuse carriers, which are mounted on fuse bases. Wherever it is not possible to mount fuses on carriers, fuses shall be directly mounted on plug-in type of base. In such cases, one set of insulated fuse pulling handles shall be supplied with each board.
- 4.06.02 Fuses shall be furnished complete with fuse bases and fittings of such design as to permit easy and safe replacement of fuse element.
- Visible indication shall be provided on blowing of the fuse.
- 4.06.03 Motor fuse characteristics and ratings shall be chosen to ride over starting period without blowing. The fuse on incoming feeder wherever provided, shall be chosen to provide discrimination with motor/feeder fuses.

4.07.00 Moulded Case Circuit Breaker (MCCB)

- 4.07.01 The MCCBs shall be of drawout type with trip-free operating mechanism of quick make & quick break type. Each MCCB shall be equipped with thermal release for thermal overload and magnetic release for short circuit protection on each pole.

- 4.07.02 MCCBs / MPCBs shall be suitable for manual closing and opening and also automatic trip on overload and short circuit. MCCB shall have intermediate position to indicate trip condition.
- 4.07.03 The MCCBs shall be provided with mechanical ON-OFF indicator at the front panel. The MCCB handles, after the breaker tripped due to faults, shall occupy a mean position indicating trip condition.
- 4.07.04 The compartment door shall be interlocked mechanically with the MCCB such that the door cannot be opened unless the MCCB is in OFF position. Means shall be provided for releasing this interlock at any time.
- 4.07.05 All feeders of PMCC / MCC rated up to & including 630 Amp shall be provided with MCCB. Air circuit breaker shall be provided for feeders rated above 630 Amp. For critical loads ACB control feeders shall be provided which will be decided during detailed engineering.
- 4.07.06 Motors rating above 110 KW will be operated by Air circuit breaker and protected by consolidated numerical motor protection relay.
- 4.08.00 **A.C. Starter**
- 4.08.01 Contactors
- a. The contactors shall be three pole, air break type designed for duty class III - Category AC3 (for unidirectional motor) with non-bouncing silver/ silver alloy contacts. Contacts for reversible motors will be of AC4 duty.
 - b. Each contactor shall be provided with minimum two (2) normally open and two (2) normally closed auxiliary contacts rated 10 A at 240V A.C.
 - c. Reversing contacts shall be electrically and mechanically interlocked.
 - d. Contactors with delayed dropout feature shall be provided for some essential auxiliaries. These contactors shall not dropout on power failure if the voltage is restored within 3 seconds.
- 4.08.02 **Protection**
- a. Thermal overload relays shall be three element, positive acting, ambient temperature compensated with adjustable settings.
 - b. Single phase preventor relay shall be provided, preferably as an inbuilt feature of thermal overload relay.
 - c. Relays shall be manual reset type with two changeover potential-free contacts. Resetting of relays shall be possible with compartment door closed. Colour of the resetting button shall be BLACK.
 - d. Relays may be direct acting or C.T. operated, depending on current rating. C.T.s shall be included in the scope of supply.
 - e. Motor starters shall have type '2' co-ordination according to IEC 947-4.

- f. Earth fault relays with adjustable settings and time delays fed from core balance CT shall be provided.
- g. Numerical / Digital Motor protection relay with short circuit, over load, earth fault, locked rotor and unbalance (NPS) load protection functions shall be provided for motor rated above 90 kW.

4.09.00 Control Transformer

4.09.01 LT Switchboard control supply

The Bidder shall provide one (1) no. adequately rated 415V/110V Control Transformer in each bus section with necessary taps and auto changeover facility for providing control power supply to various modules of the board. The sizing of control transformer shall be carried out by the Bidder considering the actual load of power contactors, auxiliary contactors, indicating lamps and other equipment in the module circuit. An additional load of 15watts shall be considered for each module for remote auxiliary relays and lamps to be connected in the control circuit of modules. Bidder shall also ensure that control transformer are adequately designed for meeting the momentary loading requirements and the voltage drop during this condition shall not be more than 5%. Each transformer shall be sized for catering to control supply of both bus sections.

4.09.02 LT Switchboard space heater supply

The Bidder shall provide one (1) no. adequately rated 415V/240V Control Transformer in each bus section with necessary taps and auto changeover facility for providing power supply to panel space heater, Motor space heater of motor rated 30 KW & above, Panel Illumination & Socket. The supply of these two (2) nos. control transformer are tapped from incoming supply of 415V PMCC/MCC before the incoming breaker. Incoming circuit to the space heater auxiliary bus shall be through isolating switch HRC fuse and neutral link of suitable rating. The supply of different modules shall be tapped individually from the auxiliary bus bars. Control supply healthy indication shall be provided. Each transformer shall be sized for catering to space heater supply of both bus sections.

4.10.00 D.C. Starters

4.10.01 D.C. Starter for emergency oil pump shall be fixed resistance type, designed to provide fast acceleration during starting.

4.10.02 DC starters shall be complete with switch-fuse units, contactors, resistors, relays, meters, push-buttons, lamps, etc.

4.10.03 Starters shall be furnished in totally enclosed floor-mounting, sheet steel cubicles complete with a hinged front access door. Minimum thickness of sheet steel shall be 2mm.

4.10.04 The cubicle enclosure shall provide dust and humidity protection, the degree of protection being not less than IP-54.

The resistor enclosure shall be provided with ventilating louvers and wire mesh guard and shall have a degree of protection IP-23.

- 4.10.05 Cubicle space heater shall be provided to maintain internal temperature above dew point. Heater shall be furnished with switch-fuse unit and thermostat control.
- 4.11.00 **Relays**
- 4.11.01 All incoming and bus-coupler circuits and circuit breaker operated outgoing feeders shall be provided with numerical relays. Breaker operated motor feeders shall be provided with numerical motor protection relay.
- 4.11.02 The numerical relays shall have provisions for interfacing with Plant DDCMIS / PLC.
- 4.11.03 Relays shall be of drawout design with built-in testing facilities. Small auxiliary relays may be in non-drawout execution.
- 4.11.04 All protective relays, auxiliary relays, and timers shall be provided with hand reset operation indicator (flag).
- 4.11.05 Relays shall be rated for operation on 110V secondary voltage and 5 A or 1 A. Number and rating of relay contacts shall suit the job requirements.
- 4.12.00 **Control and Indication**
- 4.12.01 Circuit breakers shall be wired up for local and remote operation. Each breaker cubicle shall be equipped with the following :
- i) One (1) TEST-NORMAL-TRIAL selector switch with pistol grip handle and key interlock for breakers with motor wound spring charging mechanism.
 - ii) On-Off control switches shall have three positions (T-N-C) and shall be spring return to 'Neutral' from close and trip positions. They shall have two contacts closing in close position and two contacts closing in trip positions, and shall have Pistol Grip handles. Lost motion feature shall be provided wherever required.
 - iii) Following indicating lamps on the front of the compartment:

Breaker open	-	GREEN
Breaker closed	-	RED
Breaker tripped	-	AMBER
Spring charged	-	WHITE
Trip Ckt. Healthy	-	BLUE
Motor Space heater 'ON' for motor circuit - YELLOW		
- 4.12.02 Push button shall be heavy duty, oil tight, push to actuate type with integral escutcheon plate marked with its function.

- 4.12.03 Each push button shall have minimum two (2) nos. normally open and two (2) nos. normally closed contacts rated 10 A at 240 V.
- 4.12.04 One (1) NORMAL-TRIAL selector switch shall be provided for all motor feeders.
- 4.12.05 Selectors switches shall be stay-put, rotary type with escutcheon plates marked to indicate the function and positions, and shall be lockable in each position. Selector switch contacts shall be rated for 10A at 240 V A.C.
- 4.12.06 Selector switches shall be provided with minimum three (3) contact blocks of 1 NO + 1 NC each.
- The exact requirements of contacts shall be decided by the Tenderers taking into account the scheme requirement and spares.
- 4.12.07 Lamps shall be clustered LED type with series resistor and coloured lens. Lens and lamps shall be replaceable from the front. Lamps shall be located just above the associated push button/control switch
- 4.12.08 The general scheme of connections for control, interlock and protection is shown in the enclosed drawings. Detailed requirements of individual circuits will be intimated later to the successful bidder, who shall develop and furnish the schemes accordingly.
- 4.13.00 **Meters**
- 4.13.01 All indicating instruments (96 x 96 mm) shall be switchboard type, with 250` scale, anti-glare glass and accuracy class of $\pm 2\%$ full scale. Each meter shall have zero adjuster on the front.
- 4.13.02 Motor ammeter shall be suitable to indicate starting current (6 to 8 times full load current) for DOL starting of motor.
- Motor ammeter shall be provided for motor rated 30 kW and above and for critical drives, to be finalized during detail engineering.
- 4.13.03 All incomers, tie feeders, circuit breaker operated motor feeders shall be provided with 3-phase multifunction meter with pulse output and communication port for interfacing with Plant DDCMIS / PLC.
- 4.13.04 Meter selector switches shall be maintained contact, stay-put type, with knob handle. Ammeter and voltmeter selector switches shall be four position type. Ammeter selector switches shall have made before break contacts, to prevent open circuiting of CT secondary.
- 4.14.00 **Current Transformer**
- 4.14.01 Current Transformer, shall be cast resin type rated 10 VA. All secondary connections shall be bought out to terminal blocks where wye or delta connection will be made.
- 4.14.02 Accuracy class of the current transformers shall be:
- a) Class PS for REF

- b) Class 5P20 for other relaying.
- c) Class 1.0 ISF < 5 for metering.
- d) Class 0.5 ISF < 5 for metering (Incomer & Bus coupler of PMCC)

Other CT particulars like ratio, burden, knee point, excitation current & secondary resistance shall be decided by the bidder.

4.14.03 CT secondary shall be rated for 1A for metering & either 5A or 1A for protection.

4.15.00 Voltage Transformer

4.15.01 Voltage transformers shall be cast-resin, drawout type and shall have an accuracy class of 1.0. Voltage transformer mounted on breaker carriage is not acceptable. For Incomer and bus coupler of PMCC accuracy class of voltage transformer shall be 0.5.

4.15.02 High voltage windings of voltage transformer shall be protected by current limiting fuses. The voltage transformer and fuses shall be completely disconnected and visibly grounded in fully draw out position.

4.15.03 Secondary winding MCBs, sized to prevent overload shall be installed in all ungrounded secondary leads. MCBs shall be suitably located to permit easy replacement while the switchgear/PMCC is energized.

4.15.04 Both primary side & secondary side fuse failure / voltage loss monitoring system of VT shall be provided.

4.16.00 Transducers

4.16.01 Transducer for conversion of AC electrical quantities such as voltage, current, KW etc. shall be supplied as required for remote connection to Plant DDCMIS / PLC. All transducers shall be dual output type.

4.16.02 The transducers for indicating type instruments shall be of very low burden type having 4-20 mA DC linear, galvanically isolated output, compatible with secondary instruments and Plant DDCMIS system.

4.17.00 Secondary Wiring

4.17.01 The PMCC/MCC/DB shall be fully wired at the factory to ensure proper functioning of control, protection and interlocking schemes.

4.17.02 Fuse and links shall be provided to permit individual circuit isolation from bus wires without disturbing other circuits. All spare contacts of relays, push buttons and other devices shall be wired upto terminal blocks.

4.17.03 Wiring shall be done with flexible, 650V grade, fire resistance PVC insulated switchboard wires with stranded Copper conductors of 2.5 mm² for control & current circuits and 1.5 mm² for voltage circuits.

- 4.17.04 Each wire shall be identified, at both ends, with permanent markers bearing wire numbers as per Contractor's wiring diagrams.
- 4.17.05 Wire terminations shall be made with crimping type connector with insulating sleeves. Wires shall not be spliced between terminals. Separate colour code shall be used for AC & DC circuit wiring for easy identification.
- 4.18.00 **Terminal Blocks**
- 4.18.01 Terminal blocks shall be 650V grade box-clamp type with marking strips similar to ELMEX 10 mm² or equal. Terminals for C.T. secondary leads shall have provision for shorting.
- 4.18.02 Terminal blocks used for interface with DDCMIS / PLC via termination cabinet shall be suitably sized to facilitate proper termination of interconnecting cables.
- 4.18.03 Not more than two wires shall be connected to any terminal. Spare terminals equal in number to 20% active terminals shall be furnished.
- 4.18.04 Terminal blocks shall be located to allow easy access. Wiring shall be so arranged that individual wires of an external cable can be connected to consecutive terminals.
- 4.19.00 **Cable Terminations**
- 4.19.01 PMCC shall be designed for cable entry from bottom. MCC/DB shall be designed for cable entry both from top and bottom. Actual configuration shall be intimated later sufficient space shall be provided for ease of termination and connection.
- 4.19.02 Power cables shall be 1100V, Copper/Aluminum conductor, XLPE insulated, armoured, FRLS PVC overall sheathed.
- Control cables shall be 1100V, PVC insulated, armoured, PVC overall sheathed with 2.5 mm² stranded Copper conductor.
- 4.19.03 All provisions and accessories shall be furnished for termination and connection of cables, including removable gland plates, cable supports, crimp type tinned Copper/Aluminium lugs, brass compression glands with tapered washer (Power Cables only) and Terminal blocks.
- 4.19.04 Sufficient space shall be provided between the lower most power cable termination and gland plate for easy cable connection.
- 4.20.00 **Bus Duct Connection**
- 4.20.01 Bus duct connections shall be furnished along with transition panel, if required. Unless mentioned otherwise bus duct connections shall generally be from the top.

- 4.20.02 All connecting bus work shall have the same continuous current rating as associated PMCC bus and shall be fully braced for the LT system short circuit current.
- 4.20.03 All provisions such as matching flange and other accessories shall be furnished for connection to bus duct.
- 4.21.00 **Ground Bus**
- 4.21.01 A Cu / Al ground bus rated to carry the maximum fault current, shall extend full length of the MCC/DB.
- 4.21.02 The ground bus shall be provided with two-bolt drilling with G.I. bolts & nuts at each end to receive 50 x 6 mm G.I. flats.
- 4.21.03 All stationary structures shall be directly connected to the ground bus for effective grounding.
- 4.21.04 The frame of draw out module shall be grounded at all times except when the power disconnects are separated by a safe distance.
- 4.21.05 All hinged doors shall be earthed through flexible copper braid wire.
- 4.22.00 **Nameplate**
- 4.22.01 Nameplate of approved design shall be provided for each control compartment and also at the top of each PMCC / MCC / DB.
- 4.22.02 The material of the name plate shall be anodized aluminium / lamicoid or approved equal, 3 mm thick, with white letter on black background. Name plates shall be minimum 20 x 75 mm for instrument / devices and 40 x 150 mm for panels.
- 4.22.03 Caution notice on suitable metal plate shall be affixed at the back of each vertical panel.
- 4.23.00 **Space Heater**
- 4.23.01 Panel and motor space heater shall be fed from separate AC auxiliary busbars running throughout the switchboard. The space heater bus shall be fed from control transformer described earlier. Suitable terminals shall also be provided to facilitate energisation of the control transformer from outside during long shutdown of the board.
- 4.23.02 Each vertical section of the PMCC / MCC / DB shall be furnished with thermostat controlled space heater and 5A, 5 pin plug socket.
- 4.23.03 In addition, motor feeders 30 KW and above shall be wired up for feeding motor space heater through starter auxiliary 'OFF' contacts.
- 4.23.04 Cubicle heater, Motor heater and plug socket circuit shall be provided with individual MCB/switch fuse units.

4.24.00 A.C./D.C. Power Supplies

4.24.01 Necessary 415V AC and 220V DC power supplies as required for control and service shall be arranged by the contractor. Single feeder shall be arranged for A.C. supply and duplicate feeder shall be arranged for D.C. supply.

4.24.02 Isolating switch fuse units shall be provided at each switchgear for the incoming supplies, 4-pole, single throw for A.C. and 2-pole, double throw for D.C. Molded case circuit breaker (MCCB) shall also be accepted as an alternative.

4.24.03 Bus-wires of adequate capacity shall be provided to distribute the incoming supplies to different cubicles. Isolating switch fuse units / MCCB shall be provided at each cubicle for A.C/D.C. supplies.

4.24.04 A.C. load shall be so distributed as to present a balanced loading on three-phase supply system.

4.25.00 Tropical Protection

All equipment, accessories and wiring shall have fungus protection, involving special treatment of insulation and metal against fungus, insects & corrosion.

Screens of corrosion resistant material shall be furnished on all ventilating louvers to prevent the entrance of insects.

4.26.00 Painting

4.26.01 All steel surfaces shall be sand blasted, grounded and pickled as required to produce a smooth, clean surface free of scale, grease & rust.

4.26.02 After cleaning, the surfaces shall be given a phosphate coating followed by two coats of high quality primer and stoved after each coat.

4.26.03 For paint shade of finish coat, refer clause no.1.16.00 of Section E1, Volume V-A.

4.26.04 Sufficient quantity of touch-up paint shall be furnished for application at site.

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

5.00.00 TESTS

5.01.00 All equipment shall be completely assembled, wired, adjusted and tested at the factory as per the relevant standards.

5.02.00 Routine Test

The tests shall include but not necessarily be limited to the following :-

- a. Operation under simulated service condition to ensure accuracy of wiring, correctness of control scheme and proper functioning of the equipment.

- b. All wiring and current carrying part shall be given appropriate High Voltage Test.
- c. Primary current & voltages shall be applied to all instrument transformers.
- d. Routine test shall be carried out on all equipment such as circuit breakers, switch - fuse, contactors, relays, meters etc.

5.03.00 Type Tests

All the Type Tests (as per IS- 8623/IEC) should have been carried out on an identical & similar type of switchgear for each rating involved in the project with ACB mounted in service condition inside the switchgear panel.

Bidder has to submit ACB type test reports for test sequence 1 and combined test sequence and Type 2 co-ordination test reports of any 3 ratings of starter ratings involved.

Type test certificates of any equipment shall be furnished if so designed by the purchaser/ owner. Otherwise the equipment shall have to be type tested free of charge, to prove the design. Type test performed before five (5) years are not acceptable.

6.00.00 DRAWINGS, DATA & MANUALS

6.01.00 Drawings, Data & Manuals shall be submitted in triplicate with the bid and in quantities and procedures as specified in General Conditions of Contract and/or elsewhere in the specification for approval and subsequent distribution after the issue of 'Letter of Intent'.

6.02.00 To be submitted with the bid :-

- a. General arrangement drawing showing constructional features, space required in front for withdrawals, power & control cable entry points etc.
- b. Typical foundation plan
- c. Typical control schematic
- d. Bill of materials
- e. Type test reports on circuit breaker
- f. Technical leaflets on :-
 - i) Circuit breaker
 - ii) Switch-fuse units
 - iii) Contactors
 - iv) Relays, meters, push buttons, selector switches etc.
 - v) Glands/terminals blocks

6.03.00 To be submitted for Owner / Purchaser's Approval and Distribution

All relevant drawings and data pertaining to the equipment like GTP, GA drawing, foundation plan, BOM, control & schematics, QAP, etc. shall be submitted by the Bidder for approval of Owner/Owner's consultant. Also refer clause no. 1.19.02(u) of Section-I of Volume – V-A: Technical Specifications for Electrical Equipment & Accessories.

ANNEXURE-A

RATINGS AND REQUIREMENTS

1.0 General

Type : ACB Modules - Drawout type
MCCB Modules – Drawout type

Service : Indoor

Enclosure : IP52

2.0 System

AC DC

Voltage : 415V $\pm$ 10% 220V (187-242V)

Phase : 3-phase, 4-wire 2- wire

Frequency : 50 Hz +3% to - 5%

Combined voltage and
Frequency variation : 10% (absolute sum)

System grounding : Solidly grounded Ungrounded

3.0 Rating

Rated current : To be decided by the tenderers.

Design Ambient Temperature : 50°C

Short Circuit Current Symm. : 50 KA 25* KA

* Indicative only, the actual value will be decided by the tenderers.

S/C Withstand Time : ----- 1 second -----

High voltage test for 1 minute : 2.5 kV 1.5 kV

4.0 Duty

Circuit Breaker : 0-3'-CO-3'-0

Contactor (AC) : Class III - Category AC3 for
unidirectional drives and AC4 for bi-
directional / inching duty drives

Contactor (DC) : Class I – category DC2

MCCB / Switch Duty for AC DC

Motor Feeder : AC23 DC22

	Other Feeder	:	AC22	DC22
5.0	A.C. / D.C. Power Supply			
	Control Voltage for Circuit breaker	:	220V DC +10% to -15%	
	Control voltage for MCCB modules	:	110V AC $\pm$ 10%, 1Ph, 50Hz +3% to - 5%	
	Service voltage	:	240V AC $\pm$ 10%, 1Ph, 50Hz +3% to - 5%	

ANNEXURE-B

PROTECTIONS

- 1.0 All Protective relays shall be microprocessor based numerical type having communication facility with Plant DDCMIS system / PLC.
- 2.0 The minimum protections to be provided for different types of circuits are listed below:
- | | | | |
|----|---|---|--|
| a. | Incoming Feeder & Bus-coupler with ACB: | 3 | - inverse time O/C relays (51) for phase fault. |
| | | 1 | - Inverse time O/C relay (51N) for Earth fault. |
| | | 3 | - Under Voltage (27), Range : 40-80% with timer |
| b. | Motor Feeder with ACB: (above 110 kW) | 1 | - Composite Motor protection relay (99) for protection against |
| | | | - Thermal overload |
| | | | - Phase faults |
| | | | - Unbalance (negative sequence) |
| | | | - Locked rotor |
| | | | - Excessive Start-up time and Start-Stop. |
| | | | - Earth fault |
| c. | Outgoing Feeder : with ACB | 3 | - Inverse time O/C relays (51) for phase fault. |
| | | 1 | - Inverse time O/C relay (51N) for Earth fault. |
- 3.0 Apart from protection relays, each electrically operated breaker shall be provided with anti-pumping (94), trip annunciation (30), lockout (86) and trip circuit supervision (74) relays. Lockout relay shall be hand reset type.
- 4.0 Both primary side & secondary side fuse failure / voltage loss monitoring system of VT shall be provided..
- 5.0 For Auto-bus change-over as well as live bus change-over through synchronization refer enclosed Control Schematic drawings.
- 6.0 Each incomer shall be provided with three (3) nos. Bus Energised indicating lamps – Red/Yellow/Blue for each phase.

ANNEXURE-C

FITTINGS & ACCESSORIES

Each switchboard shall be furnished complete with fittings and accessories as listed below: -

1. Operating mechanism complete with all accessories, fittings and tripping coil and closing coil, pole discrepancy feature etc. as required.
2. Base frame and anchor bolts and nuts.
3. Auxiliary contacts and relays.
4. LOCAL/REMOTE Selector switch, TRIP/CLOSE Push Buttons.
5. Manual tripping devices with protective flap.
6. Mechanical ON-OFF indicator.
7. Operation counters.
8. Set of switch fuse units/MCCB for A.C. and D.C. supply.
9. Space heater with thermostat and ON-OFF switch.
10. Cubicle illumination lamp with ON-OFF switch.
11. 3 Pin 5A Socket with ON-OFF Switch.
12. Terminal blocks and internal wiring - lot as required.
13. Other standard accessories which are not specifically mentioned but supplied with breakers of similar type and rating for efficient and trouble-free operation.
14. Bimetallic terminal connectors.

REFERENCE DRAWINGS
1. SOOT BLOWER P&ID : 0-00-047-49129 TO 49130

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CUSTOMER :				ANDHRA PRADESH POWER GENERATION CORPORATION LIMITED (APGENCO)					
				Dr NARLA TATA RAO THERMAL POWER STATION , VIJAYAWADA					
				1 x 800 MW, STAGE - V, UNIT-8, Cust. No. 1817, (B T G P A C K A G E)					
CONSULTANT :				DEVELOPMENT CONSULTANT PRIVATE LIMITED					
				KOLKATA					
		Bharat Heavy Electricals Ltd			DRN	NAME A. Thambu Raj	SIGNATURE 	DATE 20-07-16	NO. OF VAR
		UNIT: HIGH PRESSURE BOILER PLANT			CHD	SR / KB	Sd. / SR-KB	20-07-16	—
		TIRUCHIRAPALLI – 620014			APPD	A.K.Panda	Sd. / AKP	20-07-16	
DEPT.-C & I				SCALE NTS	WEIGHT (Kg) _____	REF TO ASSY / OLD DWG _____		ITEM NO _____	No OF ITEMS _____
CODE – 392									
TITLE				SOOT BLOWER MCC LIST OF DRAWINGS		DRAWING NO :		REV	
						3-96-186-15405		02	
				Sheet 01 of 15		U 01			

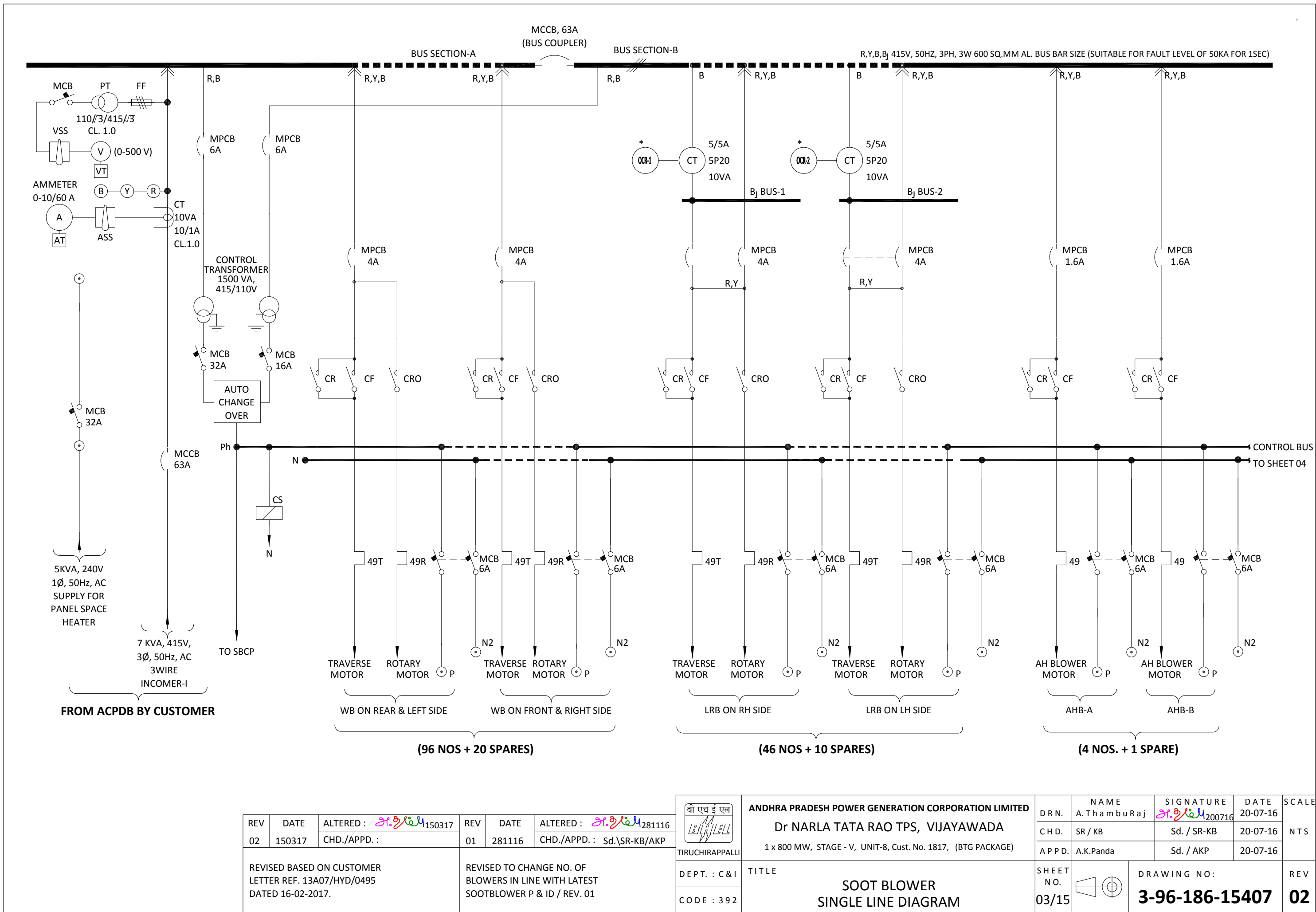
NOTE		
1.	MCC SHALL BE SUITABLE FOR IP 54 DEGREE OF PROTECTION.	
2.	ALL SB MCC SHALL BE OF COMPARTMENTAL DRAWOUT TYPE AND DOUBLE FRONT EXECUTION SUITABLE FOR BOTTOM CABLE ENTRY. HOWEVER, CONTROL SUPPLY TRANSFORMER AND JAMMING RELAY MODULES WILL BE NON-DRAWOUT TYPE (FIXED). MCC SHALL BE DUST & VERMIN PROOF.	
3.	MCC SHALL BE FABRICATED BY CRCA SHEET STEEL OF FOLLOWING THICKNESS a) LOAD BEARING MEMBER - 2.0 mm b) GLAND PLATE - 3 mm C) OTHERS - 1.6 mm	
4.	THE BUSBARS SHALL BE 600 SQ.MM SUITABLE FOR 50 KA FAULT LEVEL FOR 1 SEC. & SHALL BE OF HIGH CONDUCTIVITY ALUMINIUM ALLOY.	
5.	POWER CONTACTORS SHALL HAVE 2NO + 2NC AUX. CONTACTS AND UTILISATION CATEGORY AC-4 FOR RDOL AND AC-3 FOR DOL STARTERS.	
6.	OVER LOAD RELAYS SHALL BE MANUAL RESET TYPE WITH TWO CHANGE OVER POTENTIAL FREE CONTACTS. RESETTNG OF RELAYS SHALL BE POSSIBLE WITH COMPARTMENTAL DOOR CLOSED. THE RANGE OF OVER LOAD RELAYS MAY DIFFER SLIGHTLY ACCORDING TO THE MAKE OF THERMAL OVER LOAD RELAYS USED IN THE MCC. OLR SHALL BE WITH BUILT-IN SINGLE PHASE PREVENTOR.	
7.	MCC SHALL BE PAINTED WITH OPALINE GREEN FOR EXTERIOR & INTERIOR (SEMI GLOSSY FINISH) COMPONENT MOUNTING PLATE SHALL BE ZINC PASSIVATED.	
8.	THE WIRING SHALL BE CARRIED OUT WITH 1100 V GRADE HR PVC INSULATED STRANDED COPPER CONDUCTOR OF SIZE 2.5 SQ. MM FOR POWER, CONTROL, CURRENT.	
9.	CONTROL AND SELECTOR SWITCHES SHALL BE OF ROTARY TYPE.	
10.	UNDRILLED CABLE GLAND PLATES SHALL BE SUPPLIED ALONG WITH THE PANEL.	
11.	SPARES ARE INDICATED ONLY FOR ELECTRICAL FEEDER.	
12.	AN EARTH BUS OF GI FLAT SIZE NOT LESS THAN 50 x 6 SQ. mm SUITABLE FOR SPECIFIED FAULT LEVEL SHALL BE PROVIDED AT THE BOTTOM THROUGHOUT THE LENGTH OF THE MCC. PROVIDED IN ALL VERTICAL SECTIONS.	
13.	SEPARATE VERTICAL BUSBARS FOR FRONT AND REAR OF MINIMUM 200A SHALL BE PROVIDED. BUS BARS SHALL BE PVC SLEEVED, COLOUR CODED AT REGULAR INTERVALS.	
14.	TINNED COPPER LUGS FOR EXTERNAL CONNECTION ARE TO BE SUPPLIED ALONG WITH THE PANEL	
15.	INDICATING LAMPS WILL BE OF CLUSTER LED TYPE.	
16.	MCCB'S AT TWO INCOMER AND ONE BUS COUPLER SHALL BE MECHANICALLY INTERLOCKED USING CASTLE KEYS SO THAT ONLY TWO OF THESE CAN BE TURNED ON AT A TIME.	
17.	MINIMUM AIR CLEARANCE IN AIR BETWEEN PHASES AND PHASE-EARTH SHALL BE 19mm FOR BUSBARS AND CABLE TERMINATIONS.	
18.	FOUNDATION BOLTS & NUTS, IF REQUIRED SHALL BE SUPPLIED ALONG WITH SBMCC.	
19.	OPERATING HEIGHT SHALL BE 200mm TO 2000mm FROM THE BOTTOM & BASE FRAME OF MCC.	
20.	ALL MODULES/COMPONENTS SHALL BE IDENTIFIED BY LABELS ENGRAVED IN WHITE COLOUR ON THE BLACK COLOUR BACKGROUND.	
21.	THE WIDTH OF CABLE ALLEY SHALL NOT BE LESS THAN 250mm.	
22.	12 KV RUBBER MATS SHALL BE PROVIDED BOTH AT FRONT AND REAR OF MCC.	

LEGEND	
74	AUXILIARY CONTACTOR
49R	THERMAL OVER LOAD RELAY ROTARY
49T	THERMAL OVER LOAD RELAY TRAVERSE
A	AMMETER
ASS	AMMETER SELECTOR SWITCH
AT	CURRENT TRANSDUCER
CC	CONTACTOR FOR CLOSE
CF	CONTACTOR FOR FORWARD
CO	CONTACTOR FOR OPEN
CR	CONTACTOR FOR REVERSE
CRO	CONTACTOR FOR ROTARY
CS	CONTROL SUPPLY HEALTHY CONTACTOR
CT	CURRENT TRANSFORMER
CX	AUXILIARY CONTACTOR
FF	CONTROL FUSE
LRPB	LOCAL RETRACT PUSH BUTTON
LS1	LRB/AHB FORWARD END POSITION LIMIT SWITCH
LS2	LRB/AHB HOME POSITION LIMIT SWITCH
LSPB	LOCAL START PUSH BUTTON
LSTE	WALL BLOWER HOME POSITION LIMITSWITCH
LSTR	WALL BLOWER ROTARY LIMIT SWITCH
LSTS	WALL BLOWER FORWARD END POSITION LIMIT SWITCH
MC	AUX. CONTACTOR OF MCCB
MCB	MINIATURE CIRCUIT BREAKER
MCCB	MOULDED CASE CIRCUIT BREAKER
MPCB	MOTOR PROTECTION CIRCUIT BREAKER
OCR	OVER CURRENT RELAY
PF	POWER FUSE
PT	VOLTAGE TRANSFORMER
RC	AUXILIARY CONTACTOR
RR	REMOTE RETRACT CONTACTOR
SV	SOLENOID VALVE
V	VOLT METER
VSS	VOLTMETER SELECTOR SWITCH
VT	VOLTAGE TRANSDUCER

LEGEND	
	DRAWOUT TYPE TERMINALS
	FUSE SWITCH THREE USE LINK
	INDICATING LAMP (A-AMBER) (B-BLUE)
	LIMIT SWITCH CONTACT
	MCB
	MCCB / MPCB
	NC CONTACT OF CONTACTOR
	NO CONTACT OF CONTACTOR
	NO CONTACT OF TIMER
	OFF DELAY TIMER
	POWER / AUX. CONTACTOR
	SWITCH
	TERMINALS IN LOCAL
	TERMINALS IN SB CP
	TERMINALS IN SB MCC

NOTE		
23.	ALL CONTROL TERMINALS WILL BE SUITABLE FOR RECEIVING ATLEAST 2 NOS. OF 2.5 SQ.MM. COPPER WIRE ON EACH SIDE.	
24.	POWER TERMINALS WILL BE SUITABLE FOR RECEIVING 6 SQ.MM. COPPER WIRE.	
25.	CIRCUIT IS DRAWN FOR INITIAL CONDITIONS.	
26.	EQUIPMENT SHOWN INSIDE DOTTED LINES ARE AT LOCAL.	
27.	INTER COMPARTMENT LOOPING TO BE DONE BY MCC SUPPLIER	
28.	LOCAL START AND RETRACT PUSH BUTTONS ARE MOUNTED ON THE BLOWER TERMINAL BOX AS AN INTEGRAL PORTION OF WALL, LR & AH BLOWER.	
29.	SBMCC INCOMER CAN RECEIVE MAXIMUM SIZE OF 3C X 10 SQ.MM (AL) POWER CABLE.	
30.	CONTROL SUPPLY TRANSFORMER SHALL BE 2x100% FOR EACH BUS SECTION.	

REV 01			DATE 150317	ALTERED :  CHD./APPD. :	वी एच ई एल  TIRUCHIRAPPALLI	ANDHRA PRADESH POWER GENERATION CORPORATION LIMITED Dr NARLA TATA RAO TPS, VIJAYAWADA 1 x 800 MW, STAGE - V, UNIT-8, Cust. No. 1817, (BTG PACKAGE)	DRN. CH D. A P P D.	A. Thambu Raj SR / KB A.K.Panda	200716 Sd. / SR-KB Sd. / AKP	DATE 20-07-16 20-07-16 20-07-16	SCALE NTS
REVISED BASED ON CUSTOMER LETTER REF. 13A07/HYD/0495 DATED 16-02-2017.					DEPT. : C & I CODE : 392	TITLE SOOT BLOWER SINGLE LINE DIAGRAM-NOTES	SHEET NO. 02/15		DRAWING NO: 3-96-186-15406	REV 01	



REV	DATE	ALTERED : 281116
02	150317	CHD./APPD. :

REVISED BASED ON CUSTOMER
LETTER REF. 13A07/HYD/0495
DATED 16-02-2017.

REV	DATE	ALTERED : 281116
01	281116	CHD./APPD. : Sd.\SR-KB/AKP

REVISED TO CHANGE NO. OF
BLOWERS IN LINE WITH LATEST
SOOTBLOWER P & ID / REV. 01



TIRUCHIRAPPALLI

DEPT. : C & I

CODE : 392

ANDHRA PRADESH POWER GENERATION CORPORATION LIMITED
Dr NARLA TATA RAO TPS, VIJAYAWADA
1 x 800 MW, STAGE - V, UNIT-8, Cust. No. 1817, (BTG PACKAGE)

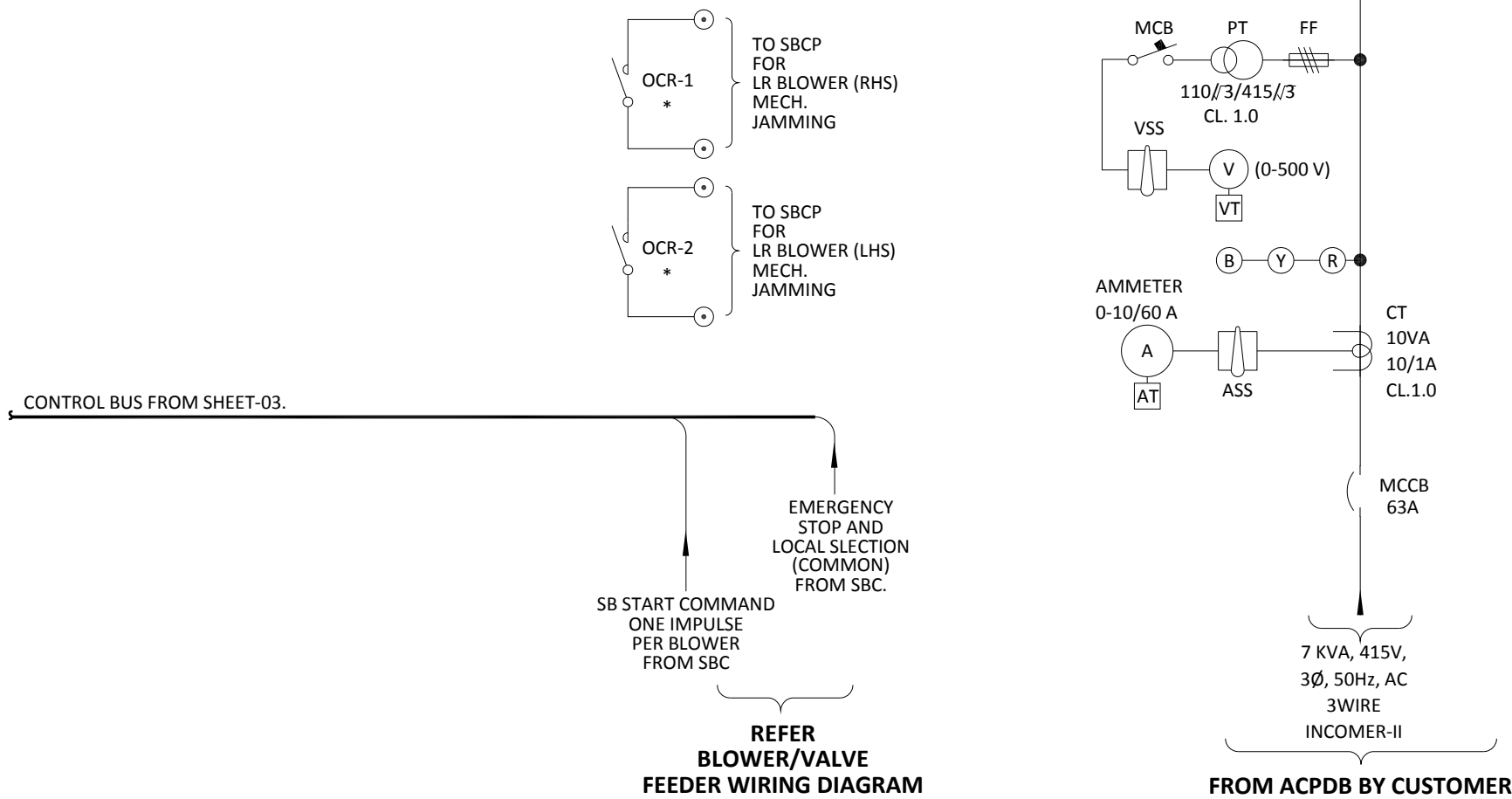
TITLE
SOOT BLOWER
SINGLE LINE DIAGRAM

DRN.	NAME	SIGNATURE	DATE	SCALE
CHD.	A.ThambuRaj	200716	20-07-16	NTS
APPD.	A.K.Panda	Sd. / AKP	20-07-16	

SHEET NO.	DRAWING NO.	REV
03/15	3-96-186-15407	02

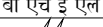
BUS SECTION-B

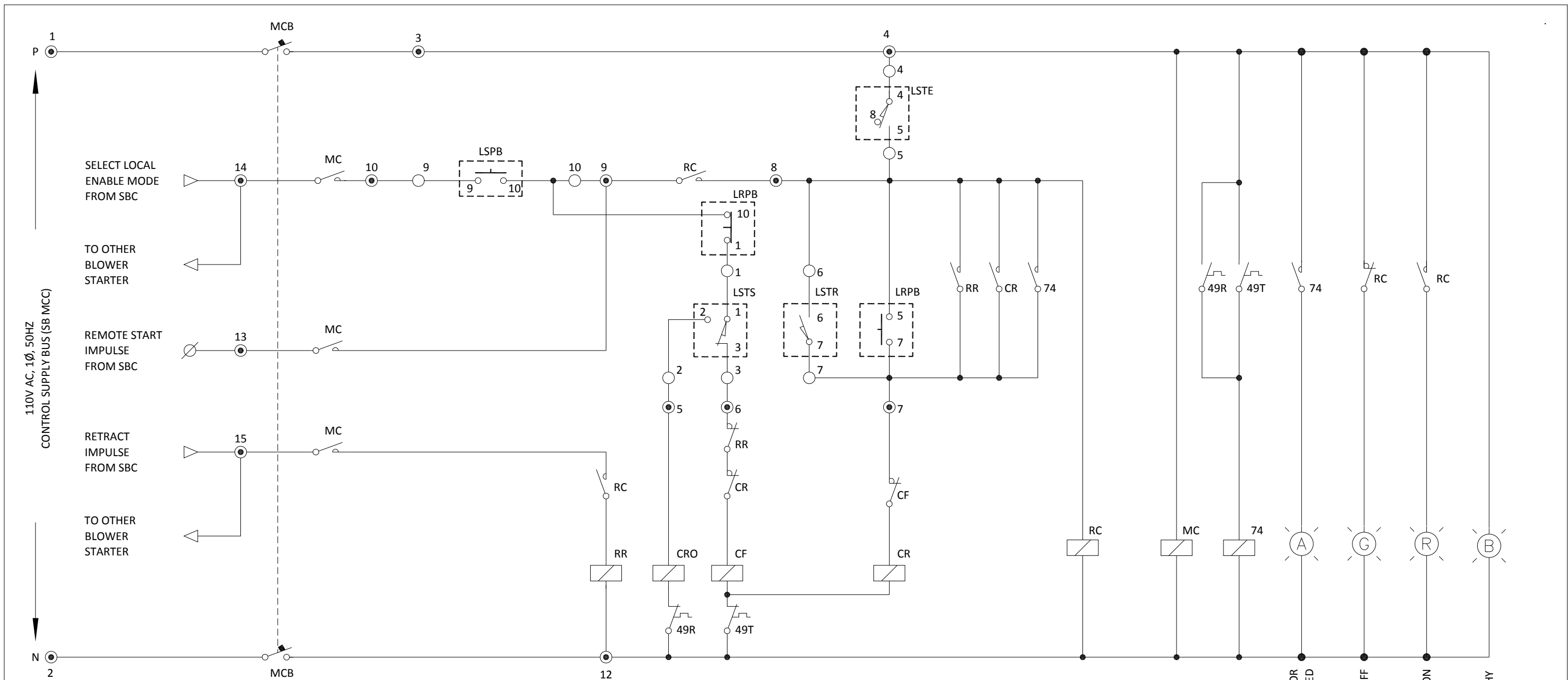
R,Y,B 415V, 50HZ, 3PH, 3W 600 SQ.MM AL. BUS BAR SIZE (SUITABLE FOR FAULT LEVEL OF 50KA FOR 1SEC)



DESCRIPTION	INCOMER FOR SPACE HEATER	INCOMER-I	INCOMER-II	WALL BLOWERS		LR BLOWERS		AH BLOWER
FEEDER NO. DETAILS	1	1	1	96 + 20 SPARES		46 + 10 SPARES		4 NOS. + 1 SPARE
DRIVE DETAILS	-	-	-	TRAVERSE	ROTARY	TRAVERSE	ROTARY	
MOTOR CAPACITY IN KW	5.0 KVA	7.0 KVA	7.0 KVA	0.56	0.09	0.56	0.736	0.18
FULL LOAD CURRENT IN AMPS	-	-	-	1.36	0.64	1.4	1.65	0.56
O/L RELAY RANGE IN AMPS	-	-	-	0.9-1.5	0.45-0.75	0.9-1.5	1.0-2.0	0.45-0.75
MCCB/MPCB IN AMPS	32A	63A	63A	4A	4A	4A	4A	1.6A
POWER CONTACTOR	-	-	-	16	16	16	16	16
FUSE RATING IN AMPS PF/FF	-	-	-	-	-	-	-	-
CABLE SIZE	3CX6SQ.MM(AL) PC	3CX10SQ.MM(AL) PC	3CX10SQ.MM(AL) PC	3CX2.5SQ.MM(CU) PC 9CX2.5SQMM(CU) CC 8PX0.5SQ.MM MSC (FROM SBMCC TO SBCP)		3CX2.5SQ.MM(CU) PC 7CX2.5SQMM(CU) CC 8PX0.5SQ.MM MSC (FROM SBMCC TO SBCP)		3CX2.5SQ.MM(CU) PC 9CX2.5SQMM(CU) CC 8PX0.5SQ.MM MSC (FROM SBMCC TO SBCP)

REV	DATE	ALTERED : 281116	REV	DATE	ALTERED : 281116
02	150317	CHD./APPD. :	01	281116	CHD./APPD. : Sd.\SR-KB/AKP
REVISED BASED ON CUSTOMER LETTER REF. 13A07/HYD/0495 DATED 16-02-2017.			REVISED TO CHANGE NO. OF BLOWERS IN LINE WITH LATEST SOOTBLOWER P & ID / REV. 01		

बी एच ई एल  TIRUCHIRAPPALLI	ANDHRA PRADESH POWER GENERATION CORPORATION LIMITED		DRN.	NAME A.ThambuRaj	SIGNATURE  200716	DATE 20-07-16	SCALE	
	Dr NARLA TATA RAO TPS, VIJAYAWADA		CHD.	SR / KB	Sd. / SR-KB	20-07-16		NTS
	1 x 800 MW, STAGE - V, UNIT-8, Cust. No. 1817, (BTG PACKAGE)		APPD.	A.K.Panda	Sd. / AKP	20-07-16		
DEPT. : C&I	TITLE SOOT BLOWER SINGLE LINE DIAGRAM			SHEET NO. 04/15		DRAWING NO:		REV
CODE : 392				3-96-186-15408		02		



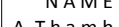
WRITE UP ON OPERATION OF WALL BLOWERS

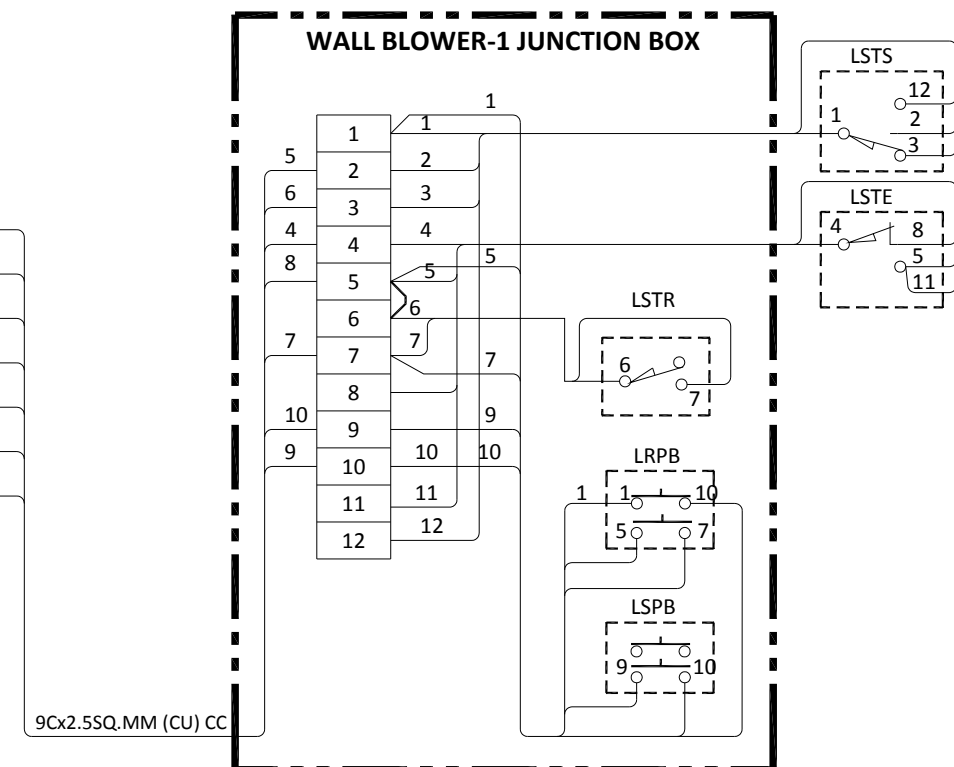
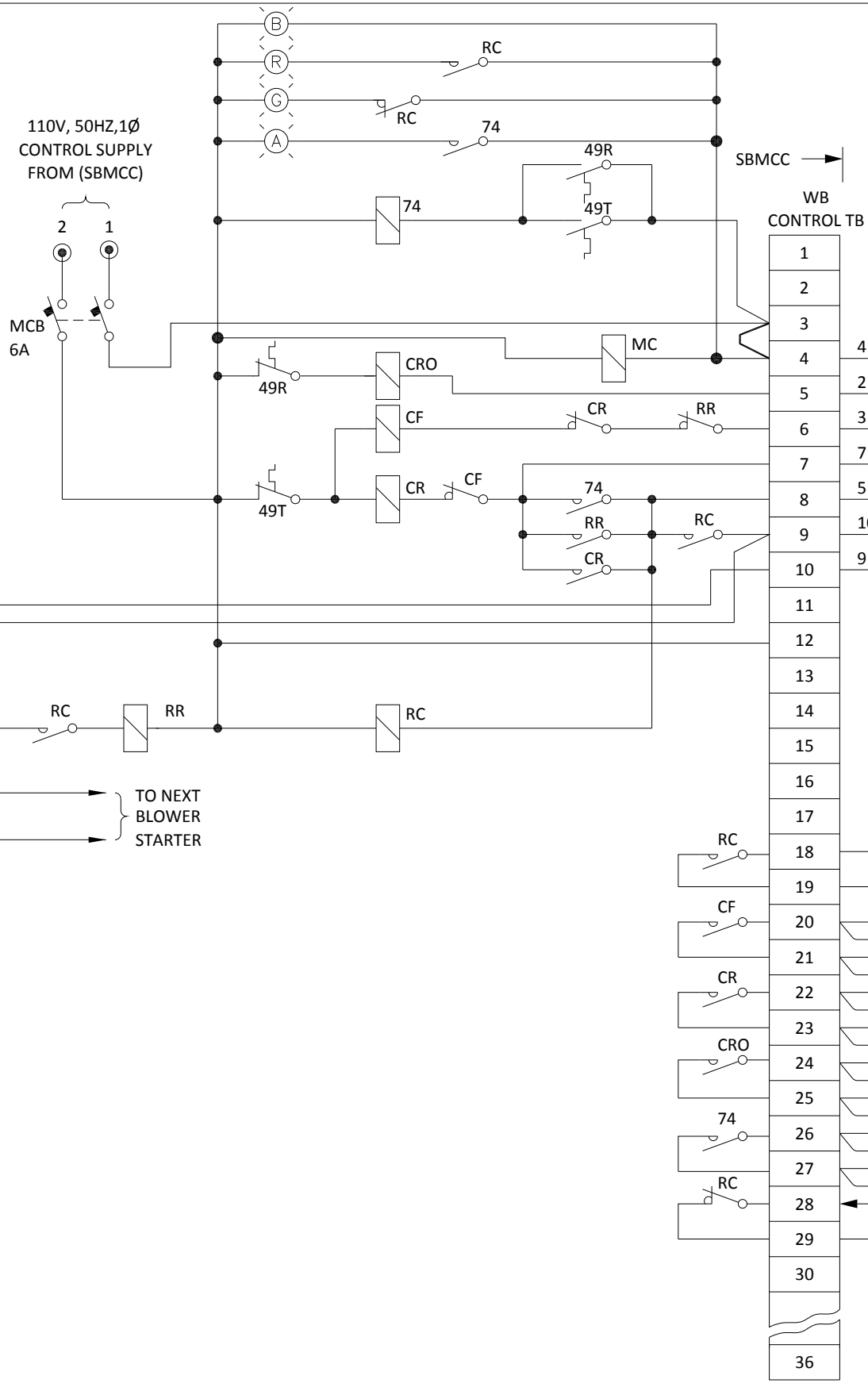
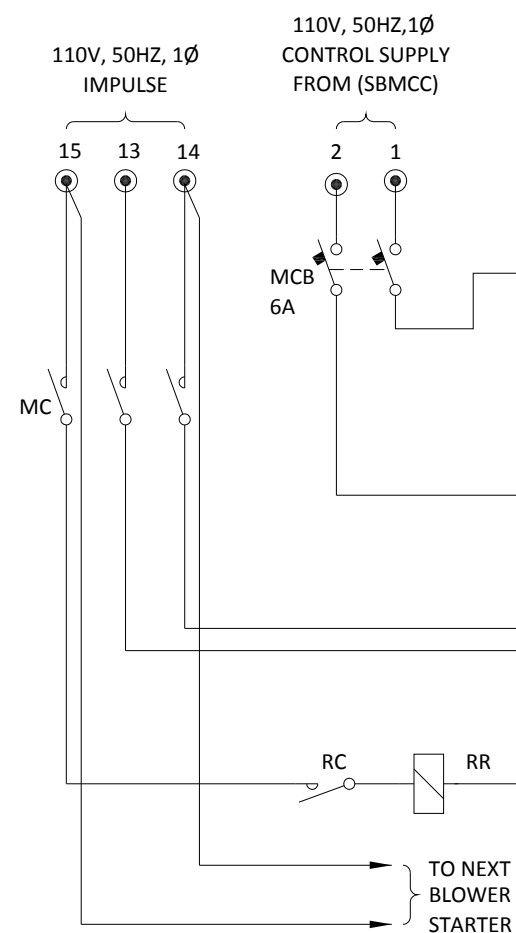
There are 3 limit switches (LSTS, LSTE & LSTR) and two motors (traverse & rotary). At a time only one motion will take place. When an impulse is given for the blower start, the forward motion Starts. LSTE contact (4, 5) gets closed when the blower leaves home position and this extends the 110V control supply voltage to forward contactor. When the blower reaches its full forward position , it actuates limits switch LSTS to position (1, 2). This stops the traverse motor and energise the rotary motor. When the blower completes its rotary motion, it actuates limit switch LSTR position (6, 7). This gives an impulse for the blower to retract by energising the reverse contactor in the starter. As soon as the blower leaves the forward end position, LSTS resets to position (1, 3) and rotary motor is tripped. Reverse contactor seals through its own contact after LSTR is reset and blower continues to retract. When it reaches its home position, it resets limit switch LSTE and blower stops.

NOTE;

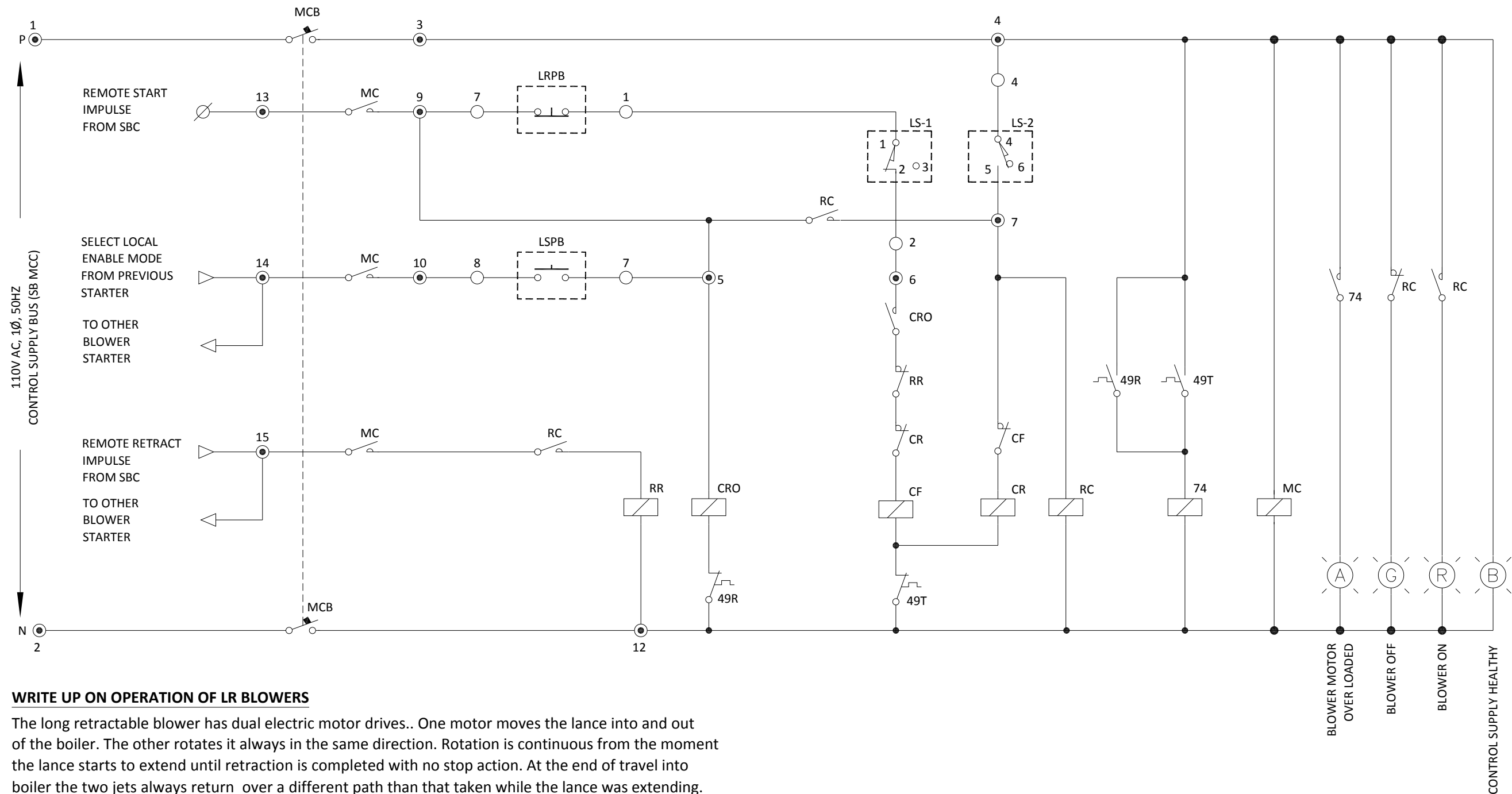
LIMIT SWITCHES & PUSH BUTTONS ARE PART OF BLOWER.

LIMIT SWITCH CONTACT DEVELOPMENT				
CONTACT	POSITION	HOME	INTER MEDIATE	FORWARD END
LSTS	1-2	-	-	X
	1-3	X	X	-
LSTE	4-5	-	X	X
	4-8	X	-	-
LSTR	6-7	-	-	MAKES AFTER 1 Rev.
X CONTACT CLOSED, - CONTACT OPEN				

			वी एच ई एल  ANDHRA PRADESH POWER GENERATION CORPORATION LIMITED Dr NARLA TATA RAO TPS, VIJAYAWADA 1 x 800 MW, STAGE - V, UNIT-8, Cust. No. 1817, (BTG PACKAGE)	DRN.	A.ThambuRaj	 200716	DATE	20-07-16	SCALE		
REV	DATE	ALTERED :		CHD.	SR / KB			20-07-16	NTS		
		CHD./APPD. :		APPD.	A.K.Panda			20-07-16			
			TIRUCHIRAPPALLI								
			DEPT. : C & I	TITLE			SHEET NO.			DRAWING NO:	REV
			CODE : 392	WALL BLOWER CONTROL SCHEME DIAGRAM			05/15				
									3-96-186-15409		00



REV DATE ALTERED : CHD./APPD. :			बी एच ई एल BHEL TIRUCHIRAPPALLI DEPT. : C & I CODE : 392	ANDHRA PRADESH POWER GENERATION CORPORATION LIMITED Dr NARLA TATA RAO TPS, VIJAYAWADA 1 x 800 MW, STAGE - V, UNIT-8, Cust. No. 1817, (BTG PACKAGE)	DRN. CHD. APPD. A.ThambuRaj SR / KB A.K.Panda	SIGNATURE 200716 SHEET NO. 06/15 	DATE 20-07-16 DRAWING NO: 3-96-186-15410	SCALE NTS REV 00
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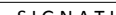
WRITE UP ON OPERATION OF LR BLOWERS

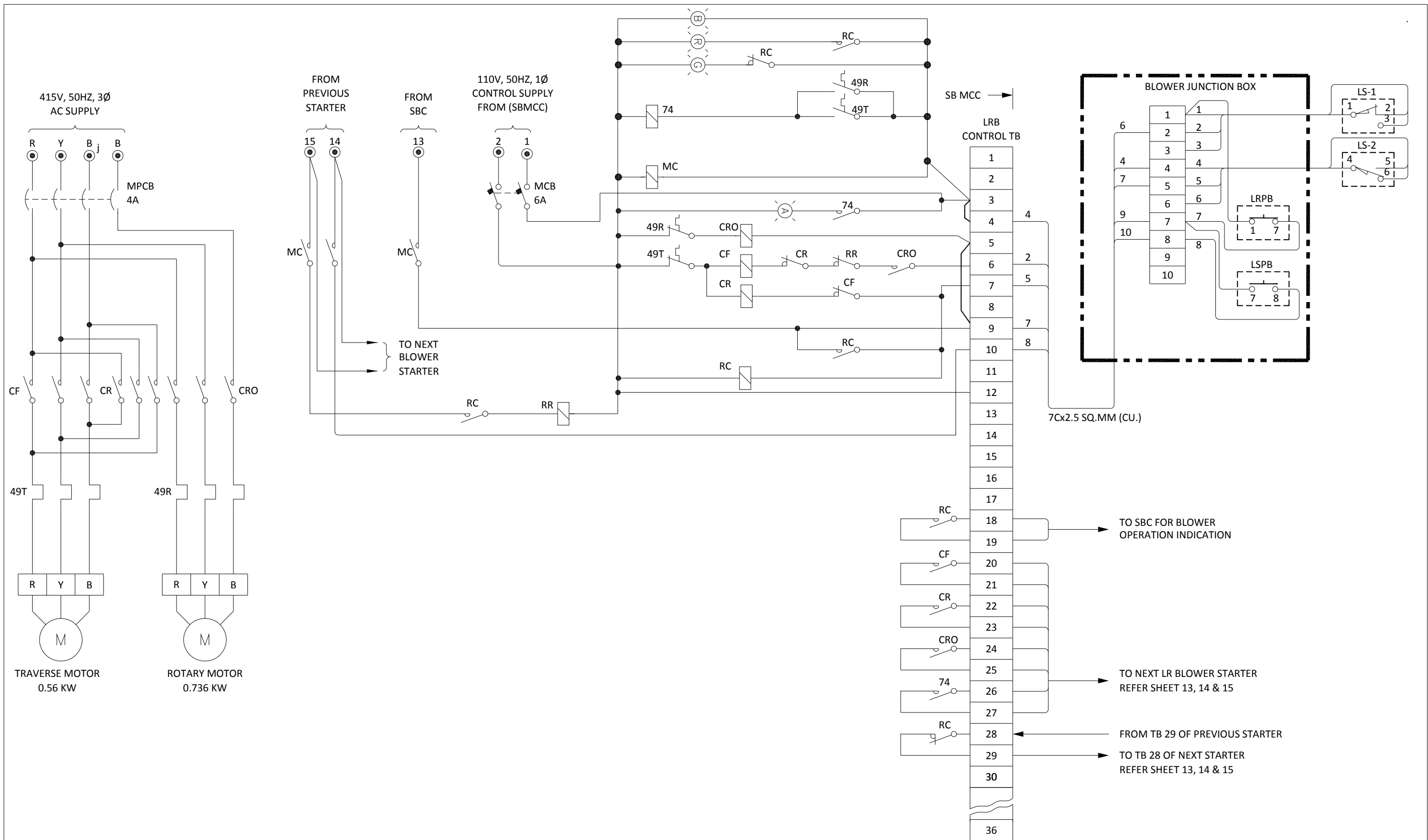
The long retractable blower has dual electric motor drives.. One motor moves the lance into and out of the boiler. The other rotates it always in the same direction. Rotation is continuous from the moment the lance starts to extend until retraction is completed with no stop action. At the end of travel into boiler the two jets always return over a different path than that taken while the lance was extending. Whenever a pulse is given to start the LR blower, First the rotary motor gets supply and starts rotating. The "NO" contact of contactor "CRO" for rotary motor closes and the traverse motor starts and holds through limit switches LS-2 (4,5). The blower moves forward. At the end of the forward motion limit switch LS-1 opens (contacts 1,2) and the blower retracts. When the blower reaches the home position limit switch LS-2 (contact 4,5) opens and the blower stops.

NOTE;

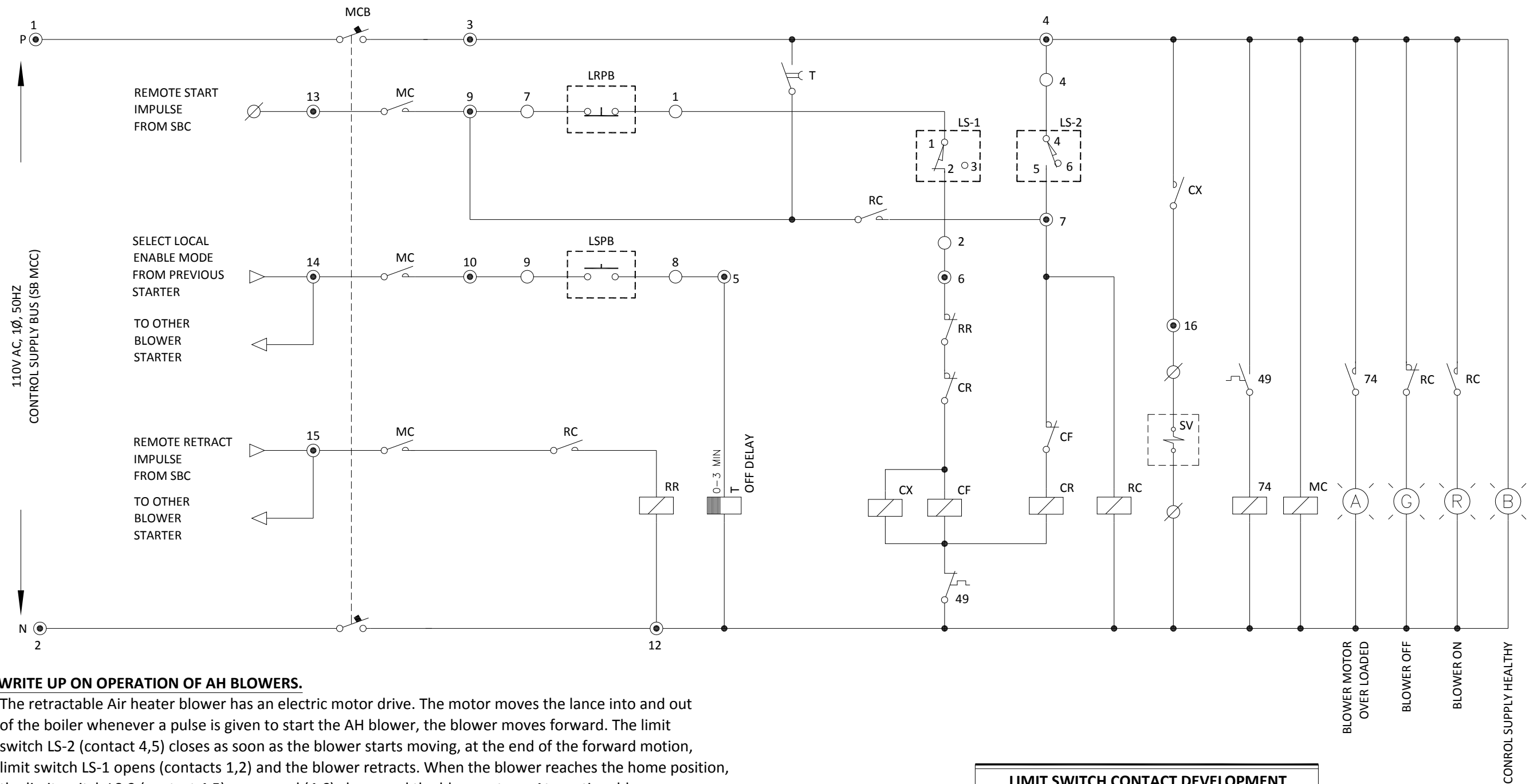
LIMIT SWITCHES & PUSH BUTTONS ARE PART OF BLOWER.

LIMIT SWITCH CONTACT DEVELOPMENT				
CONTACT	POSITION	HOME	INTER MEDIATE	FORWARD END
LS-1	1-2	X	X	-
	4-5	-	X	X
LS-2	4-5	X	-	-
	4-6	X	-	-
X CONTACT CLOSED, - CONTACT OPEN				

REV DATE ALTERED : CHD./APPD. :			वी एच ई एल BHEL TIRUCHIRAPPALLI	ANDHRA PRADESH POWER GENERATION CORPORATION LIMITED Dr NARLA TATA RAO TPS, VIJAYAWADA 1 x 800 MW, STAGE - V, UNIT-8, Cust. No. 1817, (BTG PACKAGE)		DRN. A.ThambuRaj		SIGNATURE 200716		DATE 20-07-16		SCALE NTS		
						CH D. SR / KB				20-07-16				
						A P P D. A.K.Panda				20-07-16				
			DEPT. : C & I CODE : 392		TITLE LONG RETRACTABLE BLOWER CONTROL SCHEME DIAGRAM		SHEET NO. 07/15				DRAWING NO: 3-96-186-15411		REV 00	



REV	DATE	ALTERED :	CHD./APPD. :	TIRUCHIRAPPALLI	DEPT. : C&I	CODE : 392	ANDHRA PRADESH POWER GENERATION CORPORATION LIMITED	DRN.	NAME	SIGNATURE	DATE	SCALE
							Dr NARLA TATA RAO TPS, VIJAYAWADA		A.ThambuRaj		20-07-16	
							1 x 800 MW, STAGE - V, UNIT-8, Cust. No. 1817, (BTG PACKAGE)		SR / KB		20-07-16	NTS
								APPD.	A.K.Panda		20-07-16	
								SHEET NO.		DRAWING NO:		REV
								08/15		3-96-186-15412		00



WRITE UP ON OPERATION OF AH BLOWERS.

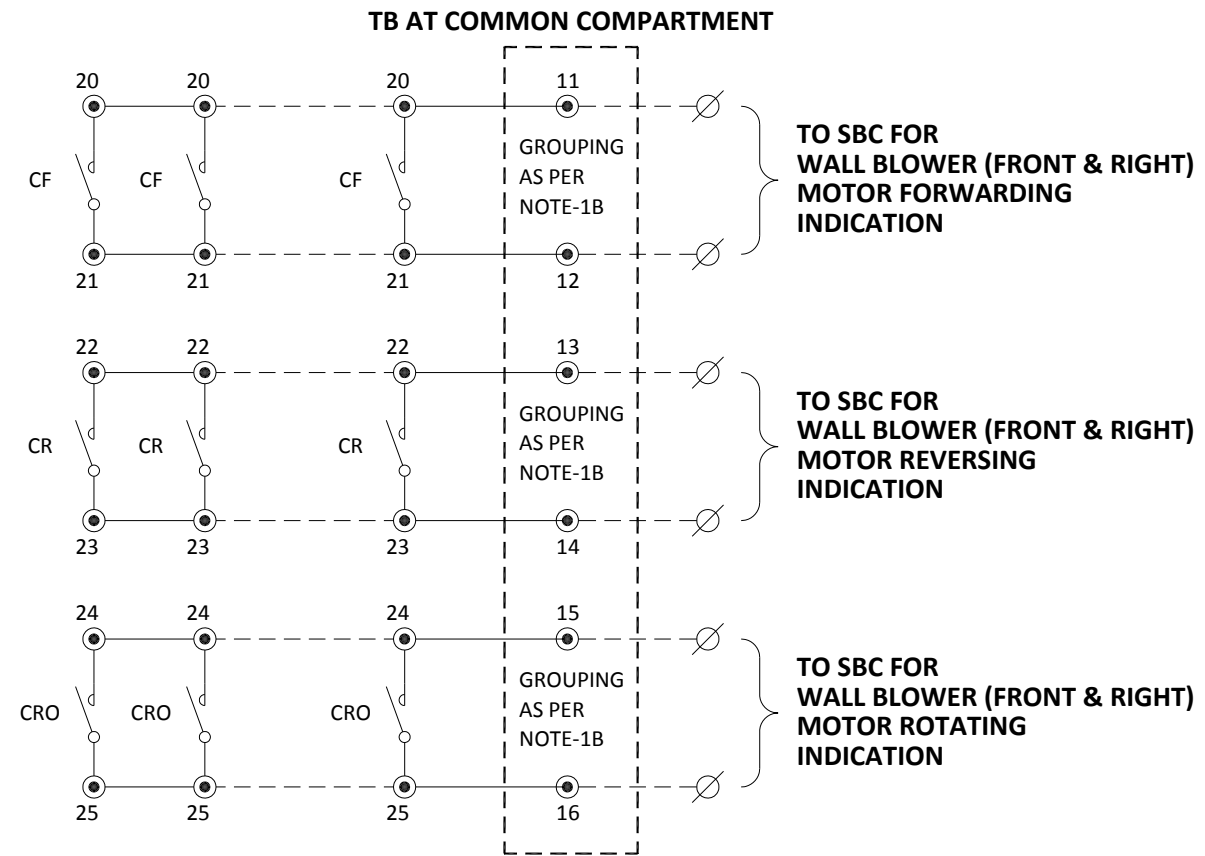
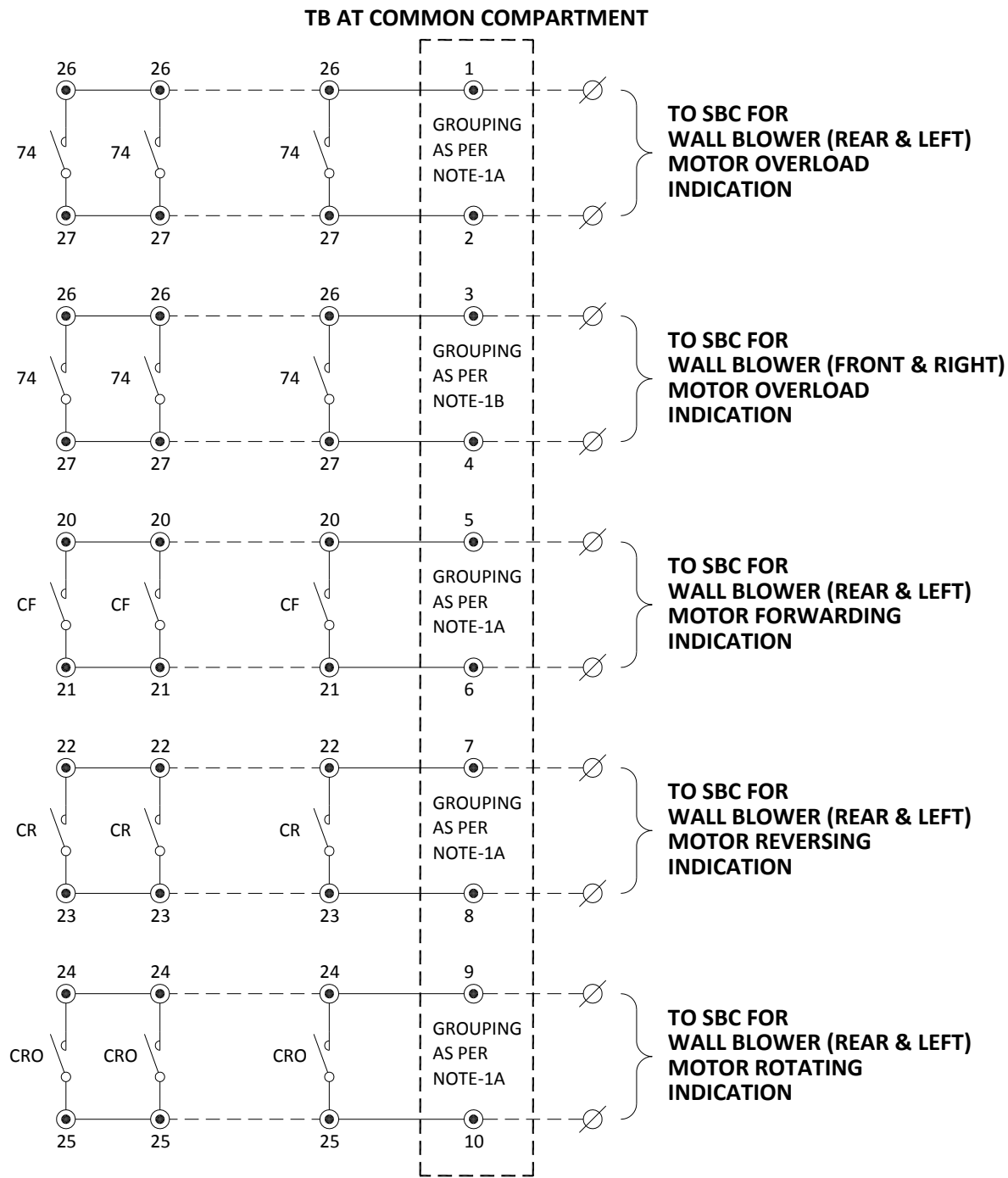
The retractable Air heater blower has an electric motor drive. The motor moves the lance into and out of the boiler whenever a pulse is given to start the AH blower, the blower moves forward. The limit switch LS-2 (contact 4,5) closes as soon as the blower starts moving, at the end of the forward motion, limit switch LS-1 opens (contacts 1,2) and the blower retracts. When the blower reaches the home position, the limit switch LS-2 (contact 4,5) opens and (4,6) closes and the blower stops, At any time blower can be retracted by pressing retract push button from remote pushbutton or local retract push button from the field. Steam blowing is enabled through solenoid operated valve. Solenoid is operated during the forward motion only. There is no blowing during reverse motion. Off delay timer (0-3min) is envisaged to ensure the availability of start command during local enable mode operation from LSPB. the limit switch LS-2 takes longer time to make after the start command is provided to the blower because of the inertia of AH blower. Hence a timer is required to hold the control supply till LS-2 actuates.

NOTE

- 1. SOLENOID VALVE (SV) IS SUPPLIED BY BHEL AT FIELD.
- 2. LIMIT SWITCHES & PUSHBUTTONS ARE PART OF BLOWER.

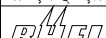
LIMIT SWITCH CONTACT DEVELOPMENT				
CONTACT	POSITION	HOME	INTER MEDIATE	FORWARD END
LS-1	1-2	X	X	-
	4-5	-	X	X
LS-2	4-5	-	X	X
	4-6	X	-	-
X CONTACT CLOSED, - CONTACT OPEN				

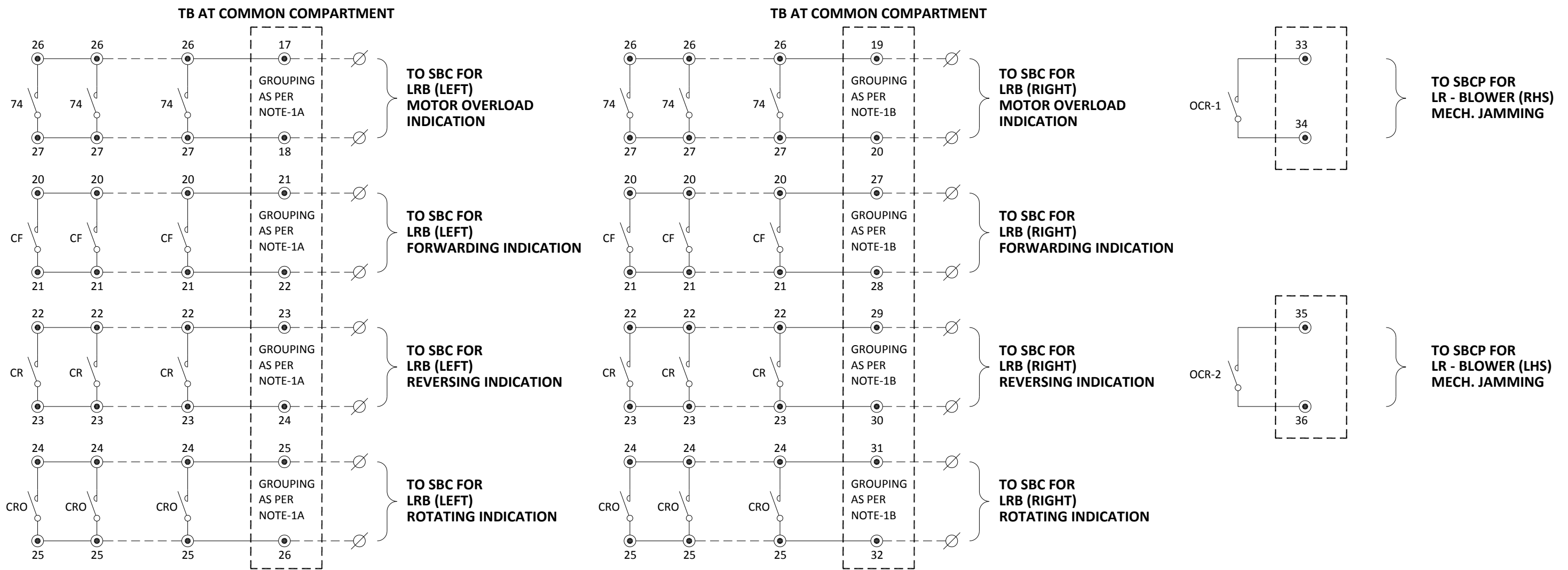
			बी एच ई एल BHEL TIRUCHIRAPPALLI DEPT. : C&I CODE : 392	ANDHRA PRADESH POWER GENERATION CORPORATION LIMITED		DRN.	NAME	SIGNATURE	DATE	SCALE
REV	DATE	ALTERED :		Dr NARLA TATA RAO TPS, VIJAYAWADA	CHD.	A.ThambuRaj	 200716	20-07-16	NTS	
		CHD./APPD. :		1 x 800 MW, STAGE - V, UNIT-8, Cust. No. 1817, (BTG PACKAGE)	A P P D.	SR / KB		20-07-16		
					A.K.Panda			20-07-16		
				TITLE	SHEET NO.	DRAWING NO:		REV		
				AIR HEATER BLOWER CONTROL SCHEME DIAGRAM	09/15		3-96-186-15413		00	



NOTE

- N/O CONTACT OF CONTACTOR "74"/CF/CR/CRO OF ALL WALL BLOWER SHALL BE PARALLELED AS FOLLOWS.
 - REAR & LEFT WALL BLOWER (13 TO 24, 38 TO 50, 64 TO 76, 90 TO 102)
 - FRONT & RIGHT WALL BLOWER (1 TO 12, 25 TO 37, 51 TO 63, 77 TO 89)

REV DATE ALTERED : CHD./APPD. :			वी एच ई एल  TIRUCHIRAPPALLI DEPT. : C & I CODE : 392	ANDHRA PRADESH POWER GENERATION CORPORATION LIMITED Dr NARLA TATA RAO TPS, VIJAYAWADA 1 x 800 MW, STAGE - V, UNIT-8, Cust. No. 1817, (BTG PACKAGE) TITLE INTER COMPARTMENT WIRING DIAGRAM IN SB MCC	DRN. CH D. A P P D. SHEET NO. 13/15	A.ThambuRaj SR / KB A.K.Panda 	SIGNATURE 200716 DRAWING NO: 3-96-186-15415	DATE 20-07-16 20-07-16 20-07-16	SCALE NTS REV 00
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26

74

27

26

74

27

26

74

27

19

20

TO SBC FOR
LRB (RIGHT)
MOTOR OVERLOAD
INDICATION

20

CF

21

20

CF

21

20

CF

21

27

28

TO SBC FOR
LRB (RIGHT)
FORWARDING INDICATION

22

CR

23

22

CR

23

22

CR

23

29

30

TO SBC FOR
LRB (RIGHT)
REVERSING INDICATION

24

CRO

25

24

CRO

25

24

CRO

25

31

32

TO SBC FOR
LRB (RIGHT)
ROTATING INDICATION

33

34

OCR-1

TO SBCP FOR
LR - BLOWER (RHS)
MECH. JAMMING

35

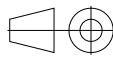
36

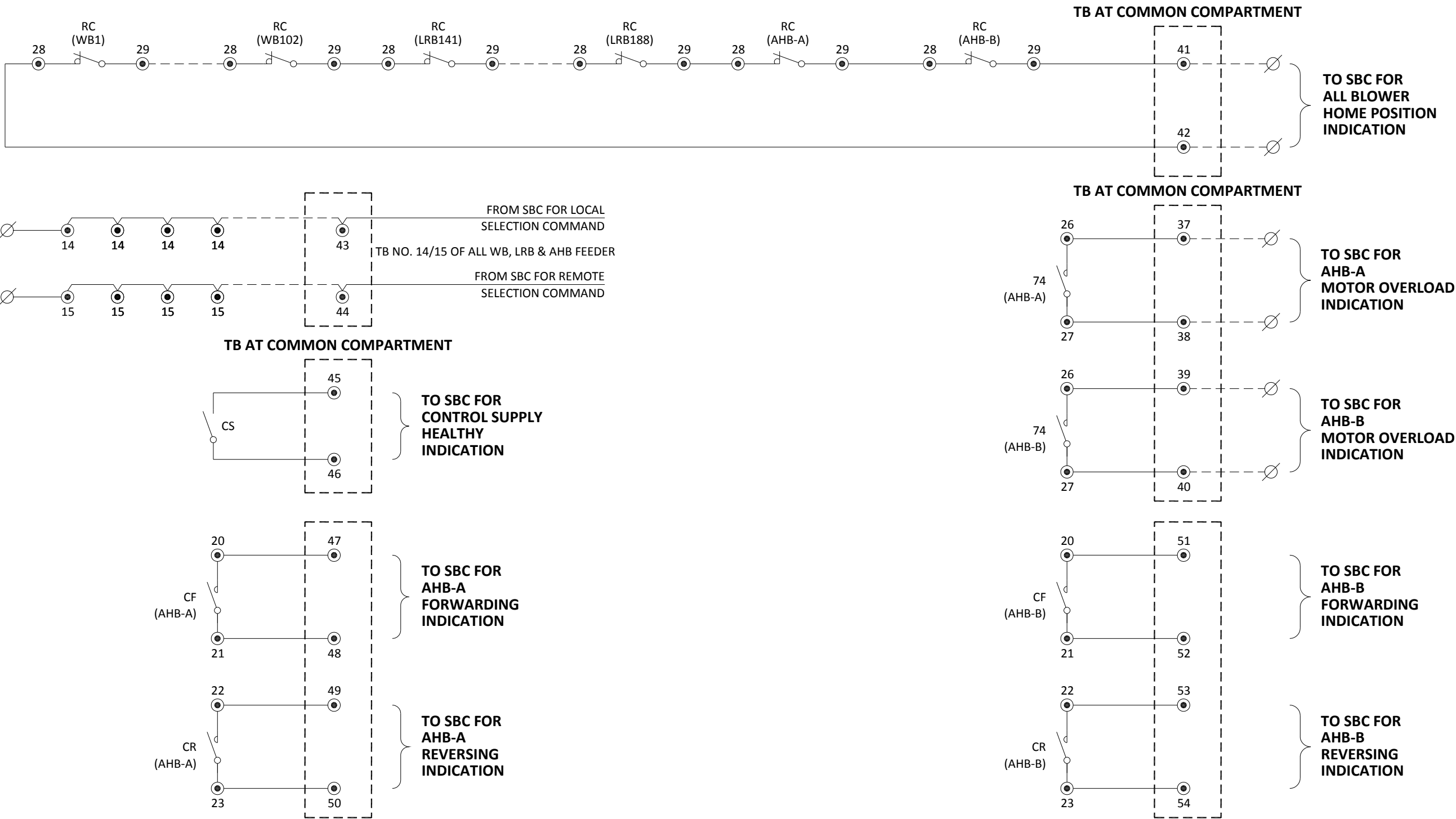
OCR-2

TO SBCP FOR
LR - BLOWER (LHS)
MECH. JAMMING

NOTE

1. N/O CONTACT OF CONTACTOR "74"/CF/CR/CRO OF ALL LR BLOWER SHALL BE PARALLELED AS FOLLOWS.
- A. LEFT LR BLOWER (142, 144, 146, 148, 150, 152, 154, 156, 158, 160, 162, 164, 166, 168, 170, 172, 174, 176, 178, 180, 182, 184, 186, 188)
- B. RIGHT LR BLOWER (141, 143, 145, 147, 149, 151, 153, 155, 157, 159, 161, 163, 165, 167, 169, 171, 173, 175, 177, 179, 181, 183, 185, 187)

			बी एच ई एल BHEL TIRUCHIRAPPALLI DEPT. : C & I CODE : 392	ANDHRA PRADESH POWER GENERATION CORPORATION LIMITED Dr NARLA TATA RAO TPS, VIJAYAWADA 1 x 800 MW, STAGE - V, UNIT-8, Cust. No. 1817, (BTG PACKAGE)	DRN.	NAME A.ThambuRaj	SIGNATURE 	DATE 20-07-16	SCALE
REV	DATE	ALTERED : CHD./APPD. :			CHD.	SR / KB		20-07-16	NTS
					APPD.	A.K.Panda		20-07-16	
				TITLE	SHEET NO. 14/15		DRAWING NO: 3-96-186-15416	REV 00	
				INTER COMPARTMENT WIRING DIAGRAM IN SB MCC					



NOTE

- N/O CONTACT OF CONTACTOR "74" FOR AHB STARTER SHALL BE PARALLELED AS FOLLOWS
 - AHB-A
 - AHB-B
- TB NO. 14/15 OF ALL WB, LRB & AHB SHALL BE LOOPED.
- N/C CONTACT OF "RC" CONTACTOR OF ALL WB, LRB & AHB FEEDERS SHALL BE CONNECTED IN SERIES.

REV	DATE	ALTERED : CHD./APPD. :	TIRUCHIRAPPALLI	DEPT. : C&I	CODE : 392	ANDHRA PRADESH POWER GENERATION CORPORATION LIMITED Dr NARLA TATA RAO TPS, VIJAYAWADA 1 x 800 MW, STAGE - V, UNIT-8, Cust. No. 1817, (BTG PACKAGE)	TITLE INTER COMPARTMENT WIRING DIAGRAM IN SB MCC	DRN. A.ThambuRaj	NAME A.ThambuRaj	SIGNATURE 200716	DATE 20-07-16	SCALE NTS	SHEET NO. 15/15	DRAWING NO. 3-96-186-15417	REV 00
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BHARAT HEAVY ELECTRICALS LIMITED
ELECTROPORECELAIS DIVISION

ANNEXURE-B

PROJECT :	1X800MW VIJAYAWADA TPS	Document No : EP-4-BM-SBMCC-V
CUSTOMER :	APGENCO	Rev 00
ITEM :	SOOT BLOWER MCC (SBMCC)	

MODULE WISE BILL OF MATERIAL					
SL. NO.	ITEM DESCRIPTION	RATING	SPECIFICATION	QTY/ MODULE	QTY/ SBMCC
INCOMER					2
1	MCCB	63A	3-Pole, AC	1	2
2	MCCB RHOM	63A	Extended	1	2
3	FUSE BASE	32A	1-Pole	9	18
4	FUSE LINK	2A	HRC Fuse link	9	18
5	CURRENT TRANSDUCER		i/p : 1A, Aux: 110V AC	3	6
6	VOLTAGE TRANSDUCER		i/p : 63.5V AC, Aux: 110V AC	3	6
7	KILOWATT TRANSDUCER		i/p : 63.5V AC, i/p : 1A, Aux: 110V AC	1	2
8	KILOWATT HOUR TRANSDUCER		i/p : 63.5V AC, i/p : 1A, Aux: 110V AC	1	2
9	CT	10/1A	CL-1, 15VA	3	6
10	PT	(415/RT(3)) / (110/RT(3))	1-PH, CL-1, 50VA	3	6
11	MFM		A,V, KW, KWH, Hz	1	2
12	INDICATING LAMP	63.5V AC	RED	1	2
13	INDICATING LAMP	63.5V AC	YELLOW	1	2
14	INDICATING LAMP	63.5V AC	BLUE	1	2
15	CTTB	10A	Disconnecting Type	7	14
16	Neutral Link	20A		2	4
17	Terminal Block	4sq.mm		36	72
18	Terminal Block End Plate	4sq.mm		2	4
BUS COUPLER					1
1	MCCB	63A	3-Pole, AC	1	1
2	MCCB RHOM	63A	Extended	1	1
3	Castle Key arrangement	3Lock + 2Key		1	1
CONTROL SUPPLY					2
1	FUSE BASE	32A	1-Pole	10	20
	FUSE LINK	4A		6	12
	FUSE LINK	16A		4	8
2	Power Contactor	18A	Coil Voltage : 110V AC	2	4
3	Add-on block for Power Contactor	2NO+2NC		1	2
4	Auxilliary Contactor	2NO+2NC	Coil Voltage : 110V AC	1	2
7	Timer	On-delay	0-1Sec, 1NO contact	1	2
8	Indicating lamp	RED	110V AC	1	2
9	Control Supply Transformer	415/110V	1.5KVA	2	4
10	Neutral link	30A		1	2
11	Terminal Block	4sq.mm		14	28
12	Terminal Block End Plate	4sq.mm		2	4
JAMMING RELAY					2
1	Jamming Relay	CTR : 5/5A		1	2
2	CT	5/5A	CI-5P20, 10VA	1	2
3	CTTB	10A	Disconnecting type	4	8
4	Terminal Block	4sq.mm		6	12
5	Terminal Block End Plate	4sq.mm		2	4
WALL BLOWER					116
1	MPCB WITH SC ONLY	4A	415V AC, 3P	1	116
2	Extended RHOM	4A, TP		1	116
3	Power Contactor	18A	Coil Voltage : 110V AC	3	348
4	ADD-ON block for Power Contactor	2NO+2NC		2	232
5	OLR	1.0-1.6A	415V AC	1	116
6	OLR	0.63-1.0A	415V AC	1	116
7	Mounting Kit			2	232
8	Reset Chord	400mm		2	232
9	Auxilliary Contactor	2NO+2NC	Coil Voltage : 110V AC	1	116
10	Interposing Relays	1C/O	24V DC, 4A	3	348
11	MCB	6A, 2P	415V AC	1	116
13	LED	RED, GREEN, AMBER	110V AC	3	348
14	LED	Blue	110V AC	1	116
15	Terminal Block	4sq.mm		36	4176
16	Terminal Block End Plate	4sq.mm		4	464



**BHARAT HEAVY ELECTRICALS LIMITED
ELECTROPORECELAINS DIVISION**

ANNEXURE-B

LONG RETRACTABLE BLOWER					56
1	MCCB SC ONLY	4A	415V AC, 4P	1	56
2	Extended RHOM	4A, TP		1	56
4	Power Contactor	18A	Coil Voltage : 110V AC	3	168
5	ADD-ON block for Power Contactor	2NO+2NC		3	168
6	OLR	1.0-1.6A	415V AC	1	56
7	OLR	1.6-2.5A	415V AC	1	56
8	Mounting Kit			2	112
9	Reset Chord	400mm		2	112
10	Auxilliary Contactor	2NO+2NC	Coil Voltage : 110V AC	1	56
11	Interposing Relays	1C/O	24V DC, 4A	3	168
12	MCB	6A, 2P	415V AC	1	56
13	LED	RED, GREEN, AMBER	110V AC	3	168
14	LED	Blue	110V AC	1	56
15	Terminal Block	4sq.mm		36	2016
16	Terminal Block End Plate	4sq.mm		4	224
AIR HEATER BLOWER					5
1	MPCB	4A	415V AC	1	5
2	Extended RHOM	4A, TP		1	5
3	Power Contactor	18A	Coil Voltage : 110V AC	2	10
4	ADD-ON block for Power Contactor	2NO+2NC		2	10
5	OLR	0.4-0.63A	415V AC	1	5
6	Mounting Kit			1	5
7	Reset Chord	400mm		1	5
8	Auxilliary Contactor	2NO+2NC	Coil Voltage : 110V AC	1	5
9	Interposing Relays	1C/O	24V DC, 4A	2	10
10	MCB	6A, 2P	415V AC	1	5
11	Fuse Base	32A		2	10
12	Fuse link	4A		2	10
13	LED	RED, GREEN, AMBER	110V AC	3	15
14	LED	Blue	110V AC	1	5
15	Terminal Block	4sq.mm		36	180
16	Terminal Block End Plate	4sq.mm		4	20
SPACE HEATER					1
1	MCB	32A	415V AC	1	1
2	Terminal Block	4sq.mm		6	6
CABLE ALLEY					As per Vendor design
1	MCB	6A, 2P	415V AC	1	
2	LED	RED	240V AC	1	
3	Thermostat	30-90deg C	240V AC	1	
4	Spaceheater	60W	240V AC	1	
5	Door limit Switch	NC	240V AC	1	
6	CFL	11W	240V AC	1	
1	MCB	6A, 2P	240V AC	1	
2	Power Socket	5A	240V AC	1	
3	Terminal Block	4sq.mm		3	
4	Terminal Block End Plate	4sq.mm		2	
7	Terminal Block	4sq.mm		5	
8	Terminal Block End Plate	4sq.mm		2	

ABOVE BILL OF MATERAIL IS INDICATIVE BIDDER SHALL STRICTLY COMPLY ALL DRAWING REQUIREMENTS AND FINALIZE THE BILL OF MATERIAL.

MANDATORY SPARES TO BE SUPPLIED ALONG WITH BOARD				
Purch.Req.	Material	Short Text	Quantity	
116789173	R61181600015	Red-Indicating Lamp complete assembly	30.000	
116789174	R61181600016	Amber-Indicating Lamps complete assembly	30.000	
116789175	R61181600017	Green-Indicating Lamps complete assembly	30.000	
116789176	R61181600018	White-Indicating Lamps complete assembly	30.000	
116789177	R61181600019	Blue-Indicating Lamps complete assembly	30.000	
116789178	R61181600020	CT for each type and Rating for SBMCC	1.000	
116789179	R61181600021	Transducer for each type & Rat for SBMCC	5.000	
116789182	R61181600024	AC Supply On / Off Switch-ea ty & Rating	10.000	
116789186	R61181600028	Ammeter Selector Switch-each ty & Rating	1.000	
116789187	R61181600029	Voltmeter Selector Switch-ea ty & Rating	1.000	
116789188	R61181600030	Voltmeter-each type& Rating for BTG Area	1.000	
116789189	R61181600031	Ammeter-each type & Rating for BTG Area	2.000	

ADDITION/ DELETION LIST SOOT BLOWER MCC

SL. NO	COMPONENT DESCRIPTION	RATING	UNIT PRICE
1	MPCB (EACH TYPE AND RATING)		
2	MCB(EACH TYPE AND RATING)		
3	POWER CONTACTOR (EACH RATING AND TYPE)		
4	OVER LOAD RELAY (EACH RATING AND TYPE)		
5	AUXILIARY CONTACTOR (EACH RATING AND TYPE)		
6	PROTECTION RELAY (EACH RATING AND TYPE)		
7	INDICATION LAMP (EACH RATING AND TYPE)		
8	PUSH BUTTON (EACH RATING AND TYPE)		
9	CONTROL TRANSFORMER (EACH RATING AND TYPE)		
10	CURRENT TRANSFORMER (EACH RATING AND TYPE)		
11	VOLTMETER(EACH RATING AND TYPE)		
12	AMMETER (EACH RATING AND TYPE)		
13	NEUTRAL LINK (EACH RATING AND TYPE)		
14	CONTROL SWITCHES (EACH RATING AND TYPE)		
15	CONTROL/POWER TERMINAL (EACH RATING AND TYPE)		
16	DFDO ENCLOSURE (EACH RATING AND TYPE)		
17	INCOMER MODULE 32A		
18	INCOMER MODULE 63A		
19	LR BLOWER COMPLETE MODULE		
20	WALL BLOWER COMPLETE MODULE		
21	AH BLOWER COMPLETE MODULE		
22	SB FEEDER COMPLETE MODULE		
23	CONTROL TRANSFORMER COMPLETE MODULE		

2. i. Vendor to give UNIT price for addition/ deletion of all COMPONENTS for all rating as indicated in the BOM. Also vendor to give option price for addition/ deletion of ENCLOSURE.

ii. The cost price of Individual items related to this project should match to total price .