

KARNATAKA POWER TRANSMISSION CORPORATION LIMITED

TECHNICAL SPECIFICATION

SECTION -415/240 VOLTS LTAC PANELS

TECHNICAL SPECIFICATION
Section -415/240 Volts LTAC Panels

Clause No.	Particulars
1.0	Scope
2.0	Completeness of supply
3.0	Tropical Protection
4.0	Interchangeability
5.0	Technical particulars of LTAC Boards
6.0	Ventilation
7.0	Void
8.0	Buses switching devices and connections
9.0	Ground Bus
10.0	current transformers
11.0	Space headers and lighting outlets
12.0	Wiring
13.0	Terminal blocks
14.0	Cable Entry
15.0	Control and Indication
16.0	Name and Identity plates
17.0	Earthing
18.0	Indicating 'instruments
19.0	Alarms
20.0	Power Interrupting devices
21.0	Industrial Circuit Breakers
22.0	Over load and earth fault protection of Air
23.0	Heavy duty switch and fuse units
24.0	Neutral connection
25.0	Schedule of equipotent of LTAC switch Board
26.0	Panel
27.0	Outgoing feeders
28.0	Tests
29.0	Test witness

Section - 415/240 Volts LTAC Panels

Technical Specification for 415/240 Volts LTAC Panels

1.0 Scope:

- 1.1 This specification covers the design manufacture, shop testing and supply of 415/240 volts indoor type L.T.AC panels for control of A.C. supply to various auxiliaries in 220 KV stations with all materials and accessories for efficient and trouble free operation.

2.0 Completeness of Supply:

- 2.1 It is not the intent to specify completely herein all details of the equipment. Nevertheless, the equipment shall be complete and operative in all aspects and shall conform to highest standard of engineering and design and workmanship.
- 2.2 Any material or accessory which may not have been specifically mentioned but which is necessary for satisfactory and trouble free operation and maintenance of the equipment shall be supplied without extra charges.
- 2.3 The contractor shall supply all brand new equipment and accessories as specified herein with such modification and alteration as agreed upon in writing, after mutual discussion.

3.0 Tropical Protection:

- 3.1 All equipments, accessories and wiring shall have fungus, protection involving special treatment of insulation & material against fungus insects and corrosion, screens of corrosion resistant material shall be furnished- on all ventilating louvers to prevent the entrance of insects.

4.0 Interchangeability

- 4.1 All similar component parts supplied shall be interchangeable with one another physically and electrically.

5-0 Technical particulars of LTAC Boards:

- 5.1 The switchboard shall consist of completely enclosed self-supporting cubicle - type sheet steel panels. the switch boards shall consists of the required number of sheet steel enclosures for mounting the circuit breakers, relays, instruments and other equipments.

- 5.2 Each panel assembly shall be provided with the back easily removable or shall be provided -with hinged doors at the back .to enable, easy access for inspection and maintenance work.
- 5.3 Cold Rolled Sheet Steel not less than 3 mm thick and structural steel having light sections shall be used and also 2 mm thick sheet shall be used for sides and doors. All fastening between the structural members shall preferably be bolted and not welded, to provide flexibility during installation. The base of switch gear frame shall be suitable for erecting on flush concrete floor by means of evenly spaced grounding bolts projecting through the base channel members of the frame.
- 5.4 The depth of the boards shall be of the order of 500 mm to 1000 mm. The height of the board shall preferably be about 2200 mm and equipment shall be so arranged as to reduce the length of the boards to the minimum possible. The working height shall be limited within 400 mm to 1800 mm from floor level.
- 5.5 The construction of the front of cubicle shall be such that heavy capacity breakers are isolated from, the adjacent breakers by means of suitable barriers. The design and construction shall be such as to allow extension at either end.
- 5.6 The breakers, fuses, bus bars and associated jumps etc, in the L.T.A.C. panel shall be capable of withstanding 31.5 KA for one second. The symmetrical breaking capacity of the breakers should be not less than 31.5 KA.
- 6.0 **Ventilation: -**
- 7.0 Ventilating louvers shall be provided.
- 7.1 All steel surfaces shall be sand blasted , grounded pickled as required to produce a smooth, clean surface free of scale, grease and rust.
- 7.2 After cleaning, the surface shall be given a phosphate coating followed by two coats of high quality primer and stored after each coat.
- 7.3 The finishing coat on the exterior of the panels shall be opaline green corresponding to shade no. 275 of I.S.5 with two coats- of synthetic enamel paint- and colour to the interior surface shall be finished stoved enamel white.
- 8.0 **Buses switching devices and connections:**
- 8.1 All buses, switching device and connections shall be of sufficient size to limits the temperature rise to 45° C over ambient temperature of 45° C (peak) inside the enclosure while carrying full load current

- 8.2 The main buses and connections shall be of type conductivity electrolyte copper. All main bus joints and bus taps shall be silver plated and tightly clamped with through bolts to ensure maximum conductivity.
- 8.3 All buses wherever possible shall be of rigid type. They shall be liberally spaced and so mounted that their expansion and contraction do not subject either the bus bars or the insulating supports to any stresses and should withstand the stresses due to maximum short circuit current. Wherever required suitable expansion joints shall be provided.
- 8.4 All bus work and connection shall be accessible for inspection and maintenance purpose from ends and rear, after first removing the respective enclosing plates.
- 8.5 Bus bars and connections shall be fully insulated for working voltage with adequate phase to phase and phase to ground clearances. Insulating sleeves for bus bars and shrouds for joints shall be provided. Bus insulators shall be flame retardant, track-resistant type with high creepage surface.
- 8.6 Bus bars 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.
- 9.0 **Ground bus:**
- 9.1 For ensuring the rigid connection, the minimum section of the ground bus shall not be less than 160 sq.mm.
- 9.2 The ground bus is to be earthed solidly and connected to the station main earth in system, for which suitable provisions shall be made. The ground bus shall be provided with two bolt drillings with G.I bolts and nuts at each and to receive 50 x 6 mm. G I. flat.
- 9.3 All stationery structures shall be directly connected to the ground bus for effective grounding. The frame of draw out type breakers shall be grounded at all times except when the breaker disconnects are separated by a safe distance.
- 10.0 **Current Transformers:**
- 10.1 The current transformers shall be of cast resin type. Current transformers to be provided shall be mounted in associated circuit breaker housing in a separate accessible compartment. The core lamination shall be of high-grade low loss, silicon steel and the excitation current shall be as low as possible. The Current transformers shall be designed to withstand the thermal and electromagnetic stress resulting from the maximum expected short circuit current. Suitable arrangements shall be made so that secondary of CT shall not be open circuited with primary fully loaded. All secondary connections shall be brought out to terminal blocks where

star or delta connection shall be made. Suitable shorting links shall be provided for shorting the secondary- links shall be provided for shorting the secondary winding of C.T. if necessary. The particulars of C.T. i.e burden, accuracy class is detailed in the feeder wise requirement detailed elsewhere in the specifications.

11.0 Space heaters and lighting outlets:

- 11.1 Thermostat controlled space heaters shall be provided inside to prevent condensation of moisture. The cubicle heater shall be provided with individual switch fuse circuits. All switch boards, cubicles etc., shall be provided with suitably located lighting, outlets. The lighting switch shall be provided inside each entrance door at the back of the panels.

12.0 Wiring:

- 12-1 The LTAC panels shall be fully- wired at the factory to ensure proper functioning of control., protection and inter locking schemes.
- 12.2 Fuse and links shall be provided to permit individual circuit isolation from bus without disturbing other circuits. All spare contacts of relays, push buttons and other devices shall be up to terminal blocks.
- 12. 3 Wiring shall be done with flexible, 1100 V grade, PVC insulated switch board type super flexible multi-stranded tinned annealed copper conductors of 2.5 sq. mm. for control and current circuits and 1.5 sq. mm , for voltage circuits.
- 12.4 Each wire shall be identified at both ends with permanent markers or ferrules bearing wire numbers as per contractors wiring diagrams.
- 12.5 Wire terminations shall be made with crimping type connector with insulating sleeves. Wires shall not be spliced between terminals.

13.0 Terminal Blocks:

- 13.1 Terminal blocks shall be 1100 V grade box- clamp type with marking strips similar to ELMEX 10 sq. mm or equal. Terminals for C.T. secondary leads shall have provision for shunting.
- 13.2 Not more than two wires shall be connected to any terminal. Spare terminals to extent of 20% should be provided.
- 13.3 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.

14.0 Cable entry:

- 14.1 Sufficient space provision shall be made for entry of the cable at bottom of cubicle and sufficient space shall be provided base of termination and connection. Suitable cable glands for lead sheathed cables for feeders of 100A and above and PVC cables for feeders of lower rating shall be provided.
- 14.2 All provisions and accessories shall be furnished for termination and connection of cables including, removable gland plates, cable supports, crimp type tinned copper lugs, brass compression glands with tapered washer (power cables only) and Terminal blocks.
- 14.3 Gland plates shall be minimum of 4 mm thick. The gland plate and supporting arrangement for single core power cables shall be such as to prevent flow of eddy current

15.0 Control and Indication:

- 15.1 Push button shall be heavy duty, oil tight, push to activate type with integral escutcheon plate marked with its function.
- 15.2 The circuit breaker shall be wired up for local operation. Each breaker cubicle shall be equipped with the following:

One (1) test-normal-trial selector switch stay put type with pistol grip handle and key interlock for breaker.

Two (2) heavy duty oil tight push buttons for trip and close. Four (4) indicating lights in front of compartment

Breaker open	-	Green
Breaker closed	-	Red
Breaker Auto - tripped	-	Amber
Breaker spring charged	-	white

- 15.3 Lamps shall be low-watt filament type with series resistor and coloured lens. Lamps and lamps shall be replaceable from the front suitable for connection to 220 volts D.C. shall be used.
- 15.4 The general scheme of connection for control, interlock and protection is shown in the enclosed drawings. Detailed requirements of individual circuits will be intimated later to the successful tenderer who shall develop and furnish the schemes accordingly

16.0 Name and identity plates:

- 16.1 12 mm wide plastic plates bearing suitable identification marks shall be fixed on the exterior of the switch board in a appropriate place to indicate the function of different electrical devices, measuring instruments etc., and circuit labels. All equipments shall be numbered according to ASA code numbers.

17.0 Earthing:

- 17.1 Earthing of dead metallic parts or metallic bodies of the equipment on the panel shall be connected with soft drawn single conductor bare copper, Tail connections shall have minimum area of 14.5 sq.mm and the main earthing connections to the earthing bus bar 65 sq.mm. Those Wires shall be connected to suitable terminals and close junction. Soldered connections shall not be employed. The number of earthing terminals shall be two for the whole assembly of panels.

18.0 Indicating Instruments:

- All instruments shall be of the square switchboard type, back connected, suitable for semi-flush mounting and provided with dust tight cases for tropical use with dull black enamel finish. The dials shall be made of such material as to ensure freedom from warping, fading and de coloring. Marking on scales shall be black on white background. All instruments all have easy laboratory means of adjustment to accuracy. The limits of error shall be those permissible for switchboard instruments as per relevant standards.
- 18.2 The instruments - shall be capable of indicating correctly when operated continuously at any temperatures from 0°C to 50°C instruments shall be able to give correct indication at a temperature of 65 deg C for a period of 16 hours. Necessary test blocks shall be provided.
- 18.3 Indicating instruments shall be of 96 x 96 mm, 90° Scale, antiglare glass and accuracy class of 2% full scale. Each meter shall have zero adjustment on front.
- 18.4 Kilo Watt hour meter class 1.5, accuracy shall be provided with built in test facilities. Alternatively, they may have test block to facilitate testing of meter without disturbing CT or VT secondary connections.

19.0 Alarms:

- 19.1 The main incoming feeder circuits and inter connecting feeder shall have lamp indication and audible alarms for circuit breaker tripping indication.

20.0 Power Interrupting devices:

- 20.1 The 800A feeders (incomers) shall be provided with industrial type air circuit breaker. Circuits of a lower rating may be provided with rotary type Switch fuse units.
- 20.2 The fuses shall be of the high rupturing capacity type with rupturing Capacity of not less than the maximum expected short circuit levels already indicated in the specifications.
- 20.3 All such equipments shall be back connected, equipped with completely fabricated buses and shall be rated as shown in the enclosed drawings for the various switch boards.
- 20.4 All breakers shall be suitable for operation at a voltage 10 % above and 20% below the normal rated voltage 220V D. C.
- 20.5 The blow out or suppression features shall minimize the arc and flame so that no damage will be done to other portions of the circuits breakers arc blow out or suppression features and contacts shall be rated to carry full load continuously.
- 21.0 **Industrial Circuit Breakers:**
- 21.1 The industrial type circuit breakers shall be electrically operated and equipped with a trip free and lock out device which shall prevent the interrupting device from re-closing after it has been tripped due to an overload or short circuit until the device has been reset manually.
- 21.2 Each circuit breaker shall be furnished complete with the necessary operating devices, alarm contacts and direct operated and direct switches as may be required.
- 21.3 Operating cubicle shall operate satisfactorily at 20% below normal operating voltage of 220 V D.C. Breakers shall be of robust design, trip free, shunt trip and on electrical closing, the over load relay coils shall trip all the poles simultaneously.
- 21.4 They shall be of draw out type having service, test and isolated position. Breaker housing shall be flush mounted on the panel operating mechanism shall be arranged for emergency manual operation. Mechanical on / off indicators of the breakers, on operation counters and mechanism charge /discharge indicator shall be provided. The OFF and ON position of the breakers shall also be indicated by means of red and green indicating lamps.
- 21.5 The closing mechanism of the circuit breakers shall have motor operation, designed for 220V D.C. supply For motor wound mechanism spring changing shall take place automatically after each breaker closing operation. One open operation of the circuit breakers should be possible after failure of power supply to the motor.

21.6 Mechanical safety interlock shall be provided to prevent the circuit breakers from being racked in or out of the service position when the breaker is closed.

21.7 Automatic safety shutters shall be provided- to fully cover the female primary disconnects when the breaker is withdrawn and inter-phase barriers to prevent failures. Necessary carriages for drawing out the breakers for servicing should be supplied, as already indicated in clause 9.06 the breaker should have a symmetrical breaking capacity of 31.5 KA and making capacity as per relevant standards.

22.0 Over load and earth fault protection of air circuit breakers.

22.1 Under normal conditions, the breaker shall not be affected by, moderate or momentary over loads like those caused by initial inrush currents in the starting of an appliance motor. However, when such over loads reach dangerous values, the circuits shall be opened by the action of the over current relay with adjustable time delay action. The earth fault relay shall be provided for protection against earth faults. The over current relays shall be provided with instantaneous elements also.

23.0 Heavy duty switch and fuse units:

23.1 Heavy duty switch and fuse units shall be air break type, back of board mounting type and shall comprise of a heavy duty switch and high rupturing capacity fuses. The frame of these shall be suitable for mounting at the back of sheet steel cubicles.

23.2 Suitable interlocks shall be provided such that the doors can not be open until the appropriate switch operating handle is in the 'OFF' position. Similarly, the door opens. Each switch shall preferably be actuated by a powerful mechanism arranged to secure positive closing and quick break opening action, provision shall preferably be made for visibility of either OFF or ON position of operating mechanism. Thus handle shall have provision for pad locking in ON and OFF position. Contacts shall make and break with a definite wiping action and have a high pressure line contact of both heel and toe of the moving contacts. Arc chutes of insulating materials shall be provided forming an effective barrier between the poles preventing the arcing from pole to pole or to the body. High breaking capacity cartridge type fuse links shall be fitted throughout.

23.3 Feeders of capacity 200A and below shall consist of switch fuse units. The switch fuse units shall have the ratings indicated in the clause 26.05.

24.0 Neutral connection:

24.1 All feeders are of three phase four wire type. The switch shall make or break the individual phases. All incoming and outgoing feeders shall be provided with bolted disconnect link for isolation of neutral if necessary.

25.0 Schedule of equipments of LTAC switch board:

- 25.1 Refer drawing for 415V LTAC panel (Typical) for 220 K V station auxiliaries. There will be two independent incoming feeders feeding the two sections of the bus bars as indicated in the drawing. There will be a bus section switch fuse unit of 800 A capacity connecting these two busbars. The breakers of the two incoming feeders and the bus section switch fuse unit shall be interlocked so that no two sources are paralleled on to single bus section.
- 25.2 Each incoming feeder will normally be feeding its own Section of the bus bars and in the event of failure of supply on one of the incoming feeders, the bus section switch fuse unit shall close manually and ensure continuity of supply on this section of the bus bar al so.
- 25.3 In addition one bus section shall be connected to 63 KVA D.G. set as shown in the single line diagram, from which priority load will be fed.

26.0 Panel:

- 26 1 The switch board shall consist of the following equipments. One set of LTAC switch board panels complete with all the equipments listed below with 3 panel copper bus bar system and neutral, cable compartments, self supporting free standing, all steel doors at front and rear, mimic diagram in front of the panel, individual compartments, completely wired and printed, with power outlets, cubicle heating fuses, ON/OFF switch, current transformers, etc., as detailed in the drawing shall be supplied.
- 2 6. 2 Two Nos. of incoming feeders of 800 Amps 3 Phase each comprising of the following components:
- a) one - air circuit breaker 800 Amps. 415 V AC equipped with shunt trip suitable for 220 V.D.C. auxiliary switches, power drive suitable for 220V.D.C. auxiliary with self interrupting device conforming to B.S.S. or equivalent standard, mounted on a carriage which can be drawn out horizontally.
 - b) Four - Indicating lamps for ON/OFF, AUTO TRIP breakers spring charge indications.
 - c) Two - Push buttons ON/OFF.
 - d) Three - current transformer cast resign in type ratio 400-200 /5-5 Amps. Double core, one core with accuracy class 1for metering and another core with accuracy class 10P 10 for protection. The VA burden shall be 15 VA each for metering and protection cores.
 - e) Three - Moving from ammeters size 96x96 mm flush mounting industrial grade conforming to BS 89/ISS 1248 or equivalent standard with suitable scale range of 0-200 Amps.
 - f) One - KW meter suitable for CT ratio 400-200 / 5A, 415 volts AC (flush mounting, size 96 x 96 mm industrial grade conforming to BS 89 / ISS 1248 or equivalent standards.

- g) One -3 elements, KWHR meter accuracy class 1 .5 415 v suitable for CT ratio 400-400/5A conforming to ISS 722 or equivalent standards.
- h) One - voltmeter, range 0-600 V with selector switch, size 96x96mm flush mounting, industrial grade conforming to ISS 1248 or equivalent standards.
- i) Two - single pole over current relay, induction type with inverse characteristics with three seconds minimum time at 10 times the Plug setting. The range of adjustments of induction element should be 50 - 200 of 5 Amps- The relay shall be mounted in a draw out type case with operational indicators conforming to IS:3231 or equivalent standards The relay also shall have on instantaneous element of range 200-800%.
- j) One - Earth fault relay, similar to item (i) above but with setting range of 20 -80%.
- k) Three - under voltage relay with fixed setting with pick up voltage at 90 % and drop of voltage at 80% of the 415 7 L.T. supply.
- l) Seven - cable and boxes suitable for 3 ½ x 400 sq. mm. PILC cables (the size and type of cable will however be conformed at the time of ordering). Necessary test blocks for the instruments transformers for testing relays and meters shall be provided.

26.3 Bus isolator:

- a) One - 3 phase switch fuse unit, 500V, 800A, conforming to relevant standards.
- b) The purpose of the Bus isolator switch is to connect the two bus sections when one of the incomers fails. Normally the two bus sections will be fed from the respective incomers and the bus switch fuse unit will be open.

26.4 Incomer from DG set:

- Incoming from 63 KVA DG set on one bus section, with following equipments shall be housed in bus coupler panel.
- a) One - switch fuse unit of reputed make of 300 A at 415 v A.C. with HRC fuses etc.
 - b) One - 4 pole, 100A, 415 V AC change over switch, conforming to relevant standard.
 - c) One - Cables -gland, for 75 sq. mm. 3 ½ core PVC cable.

26.5 **Outgoing feeders:**

- 1) Two outgoing feeders 200 A 3 phase each consisting of
 - a) One switch fuse unit of reputed make of 200A, at 415 V A-C., fitted with HRC fuses, etc.
 - b) One cable gland suitable for 150 sq. mm 3 ½ core cable. One feeder should be of each section of the bus.
- 2) Eight out going feeder 100 A, 3 phase each consisting of :
 - a) One 100 A 415 Volts AC switch fuse unit of reputed make with suitable HRC fuses.
 - b) One cable gland suitable for 75 sq.mm. 3 1/2 core cable.

- NOTE: Four feeders should be on each section of the bus.
- 3) Four-teen outgoing feeders of 63 A, 3 phase, each consisting of
 - a) One switch fuse unit 63 A, capacity at 415 V AC, with suitable HRC fuses etc.,
 - b) Cable gland suitable for 50 sq. mm. 3 ½ core cable.

NOTE: Seven feeders should be on each section of the bus.

- 4) Twelve outgoing feeders 32 A, 3 phase each consisting of
 - a) One switch fuse unit 32 A, capacity at 415 V AC.
 - b) One cable gland suitable for 25 sq. mm. 3 ½ core cable.

NOTE: Six feeders should be on each side of the bus.

NOTE:

- 1) Necessary wiring, terminals, contacts, bus bars, foundation bolts, keys, control fuses, mimic bus, lighting, frame, plates, circuit labels, device identification numbers, carrier for cable termination and safety earthing shall be provided.
- 2) One insulated fuse puller shall be 'included to take out HRC fuses from switch board.
- 3) Louvers shall be provided 'in cable chamber doors at the rear for ventilation.
- 4) The bus bars and other connection leads shall be of copper.
- 5) One No. 15 A. multi pin power plug outlets shall be provided for each switch board.
- 6) The fuses shall be of high rupturing capacity of not less than the expected short circuit levels already indicated 'in the specification.
- 7) Potential free contacts shall be provided, duly wired upto the control cabinet for the alarms and indication status for SAS. To cater to this requirement, sufficient number of potential free contacts shall be provided.

27.0 The successful bidder shall furnish the following drawings in quanta duplication for purchaser's approval.

- a) Details of construction of cubicles and the complete dimensions diagram cross section drawing of the switch board indicating details of location of switches, indicating instruments relays, bus bars, cable glands and bus supports.
- b) Detailed floor plan and foundations diagram showing necessary floor openings.
- c) Complete details of the air circuit breakers showing operating mechanism, quenching arrangements etc and other constructional details.
- d) Consolidated Bill of materials.
- e) Schematic diagram.
- f) Wiring diagram.
- g) Instruction manual of LTAC panel and "individual equipment. The manual shall clearly indicate the installation method, checkup and tests to be carried out before commissioning of the equipment.

Type tested LTAC panels shall be offered. The type test reports shall not be older than Ten (10) years as on the last date of submission of bid.

a) For LTAC panels manufactured in India:

- i. The type tests on indigenous equipment for which testing facility is available in India, should have been conducted in any independent laboratories approved by the Government or the laboratories accredited by the National accreditation body of the country like Central Power Research Institute (CPRI), Electrical Research and Development Association (ERDA), etc.
- ii. The type tests on indigenous equipment, for which testing facility is not available in India, should have been conducted in a laboratory of foreign country accredited by National accreditation body of that country.
- iii. The type tests conducted in-house by a manufacturer shall also be acceptable provided the laboratory is accredited by National accreditation body of the country and the tests has been conducted in the presence of a representative of NABL accredited laboratory or any of the purchasing utilities or CEA in that order. Such type test reports shall record the details of such witness including the signature/authentication in the type test report.

b) For LTAC panels manufactured Abroad:

- i. Type tests on imported equipment should have been conducted in an Indian Laboratory or foreign laboratory accredited by National accreditation body of the country where the Type test has been conducted.
- ii. The type tests conducted in-house by a manufacturer shall also be acceptable provided the laboratory is accredited by National accreditation body of the country and the tests has been conducted in the presence of a representative of accredited laboratory or any of the purchasing utilities or CEA in that order. Such type test reports shall record the details of such witness including the signature/authentication in the type test report.

In case of in-house type tested imported equipment of foreign OEM, the term “Purchasing Utility” covers the foreign Utility who has purchased that equipment

