

SECTION –VI

CONTROL, METERING AND PROTECTION SYSTEMS

6.1 SCOPE OF SUPPLY AND DESIGN CRITERIA

Design, manufacture, testing, erection & commissioning of control, metering and protection system which includes Electrical protection by conventional relay; manual control and metering of energy generated by the units, energy drawn through individual outgoing LT & HT feeders, and energy consumed in the Power House. The control panel shall also have provision of back up protection of the generating units etc. from faults occurring on main HT outgoing feeders. Manual & automatic synchronization shall be provided. This control panel should be compatible in size and dimensions with the 11 KV breaker control panel. The scope of supply shall also include all parts, accessories, spares etc., which are essential for operation of the whole system even though these are individually stated or enumerated.

6.2 DESIGN CRITERIA

The control panels will have provision for start, stop, manual and automatic synchronizing, protection, metering and emergency stop.

Common tripping relays for similar functions shall be provided with lock-out facilities. All these relays shall have potential free contacts for trip and alarm purposes and externally hand reset type of flag indicators. They should preferably be housed in drawout type of cases with tropical finish.

All the protective equipment will be housed in the Power Plant control room. The details of C.T.'s for all the unit protection and metering shall be subject to approval by purchaser.

C.T.s and P.T. may be mounted on switchgear panels alongwith indicating meters like ammeter, voltmeter and kW meters etc.

6.3. CONSTRUCTIONAL FEATURES

- i) All control panels shall be of standard construction, dimensions, materials and sheet thickness.
- ii) Control panels shall be of simplex types (devices mounted on the front panel and double door on the back side).
- iii) Panels shall be painted by dry electro-static powder coating process.
- iv) All accessories mounted on the front panel shall be flush mounting type.
- v) Each control panel will have mimic diagram painted or embossed on its front.
- vi) Each panel will have arrangements for internal lighting and heating.
- vii) The wires and wiring accessories, terminations etc. shall be as per relevant Indian Standards.

6.4 Details of Switchgear, Control and Relay Panels

Floor mounted, sheet steel simplex type control and relay panels with the following equipment mounted on them shall be supplied for Turbine, Generator Transformer and feeder control and protection.

6.5 Turbine/ Generator Control / Relay panels

Sl. No.	Description of Items
Control Panel for 2 (two) incoming supplies and 1 (one) outgoing feeder each equipped with	
1	415 V ACB of suitable rating with all accessories, electromagnetic trip releases and complete with shunt trip and under voltage coils.
2	Ammeter of appropriate range flush mounting type with 3 way ammeter selector switch having off position.
3	Voltmeter range 0-500 V flush mounting type with 3 way voltmeter selector switch having off position.
4	Power factor meter range 0.5-1-0.5 flush mounting type only in incoming panels
5	Reed type frequency meter range 45-50-55 Hz flush mounting type only on incoming panels
6	Kw meter of suitable range flush mounting type size suitable for 3 phase, 3 wire system
7	Kwh meter flush mounting type suitable for 3 phase, 4 wire system. (Digital Type microprocessor based Trivector meter) on each incoming and outgoing panel.
8	KVAR meter flush mounting type suitable for 3 phase, 4 wire system.
9	Triple pole over current relay & Earth fault relay for protection of alternators, transformers etc.
10	Negative phase sequence relay.
11	Over voltage relay and Under voltage relay.
12	Field failure relay.
13	Reverse power relay.
14	Over speed relay
15	Any other relay necessary for the system protection & operation.
16	16 window annunciation shall be provided for following fault Annunciation System under voltage relay trip, field failure relay trip, Over current relay trip Reverse power trip Over voltage relay trip Negative phase sequence relay trip Over speed trip Governor oil pressure low Emergency shut down Earth fault Relay Trip Spare window (6 Nos.)
17	Arrangement should be made so as to enable the power station to operate in isolated as well as in synchronization with grid.

Controls

The following controls will be provided:

- a) Switches
- b) Emergency push button (mechanical).
- c) Generator anti-condensation heater ON & OFF switch.
- d) Panel heater ON and OFF switch.
- e) Alarm acknowledge push button.
- f) Healthy trip circuit test push button.
- g) Reset push button.
- h) Guide vane opening/ closing switches
- i) Breaker ON/OFF push buttons.
- j) Voltage raise/lower spring return switch.
- k) Any other control as deemed fit.

Indication Lamps

The following indications will be provided on the control panel:

Phase indication lamps on incoming and outgoing panels
 Unit circuit breaker on
 Unit circuit breaker off
 Auto trip-electrical fault
 Auto trip-mechanical fault
 Governor low oil pressure
 Healthy trip circuit
 DC supply fail
 Generator anti-condensation heater ON
 Any other indication

6.6 11 kV Feeder indoor Control Panel for remote operation

Quantity	Description
1 Set	Ammeter Volt meter, kW meter, kWh electronic trivector meter with selection switches etc.
1 Set	Over current, Earth fault relays, Reverse Power Relay and any other relay required to make the system safe
1 Set	Annunciations System
1 No.	Switch ON and OFF of breaker
1 No.	ON and OFF indication of breaker
1 No.	Healthy Trip Circuit indication
1 No.	DC supply fail indication

6.7 Synchronising Bracket

The synchronizing bracket will be mounted on left hand side of the panel and shall be of swinging type and will have following provisions:

Quantity	Description
1	Synchroscope
1	Double voltmeter
1	Double frequency meter
1	Synchronising check relay (25) with guard relay
1	Synchronising selector switch
1 set	Auxiliary relays
1	Synchronising lamp

6.8 415 VOLTS AC DISTRIBUTION BOARD FOR UTILITIES

- i) 1 No. 100 Amps TPN Switch Fuse unit complete with necessary protection through HRC Fuses and all other accessories for receiving incoming supply from main Power Control Panel Board i/c 2 Nos. energy meters (electronic static).
 - ii) 1 No. 100 Amps. 4 Pole Change Over Switch to select incoming power from Turbo Generating Power Control Panel and utility DG Set or any other source.
 - iii) 1 No. MCB distribution board having following arrangement :-
 - (a) 2 Nos. 32 Amps. Outgoing feeders provided with 32 Amp. SPN Motor duty MCBs.
 - (b) 2 Nos. 32 Amps. Outgoing feeders provided with 32 Amp. 4 Pole Motor duty MCBs
 - (c) 6 Nos. 10 Amps. Outgoing feeders provided with 63 Amps. 4 Pole Motor duty MCBs.
 - (d) Necessary indicating and metering instruments including indication lamps.
 - (e) Any other item / equipment required to make the system complete (KW meter, Voltmeter, Ampere meter).
- (a) The distribution board shall be completely wired. The scope of power and control cables is also included.
 - (b) This distribution boards shall be attractive in design, mechanically strong, robust in construction and shall be totally enclosed in a mild steel cabinet of 3 mm. thickness. It shall have specified sets of MCBs and shall be vermin and dust proof complete with double door, lock and key arrangement. The doors shall be properly hinged. Cable entry shall be through suitable conduit pipe. The interior and exterior shall be painted with two coats of red oxide primer after 7 tank treatment and two coats of approved colour paint as per IS: with a minimum thickness of 60 microns. This distribution board shall be suitable to be mounted on concrete wall/columns or it may be mounted inside the wall so that its top surface is flush with the wall as the case may be. Suitable fixing arrangement such as nuts, bolts, washer, anchors shall be provided at suitable places for its proper fixing.
 - (c) The isolator / MCBs units shall be of reputed make only and shall be complete and fully comply with latest edition of IS:2516-1977, IEC 157-1983. The operating handle shall be properly insulated from the live portion of MCCBs/MCBs and shall always be easily accessible. The MCCBs/MCBs used for A.C. supply and D.C. supply shall be designed for a fault level of 10 KA for 1 second. These S.D.B.'s shall be suitable for voltage variations as per latest relevant I.S.S. Suitable earthing arrangement shall also be provided with sub distribution boards.

The above description is a broad outline of the control, metering and protection system.

Drawing of the above control panel showing layout arrangement of various measuring, indicating, protection equipments and annunciation system shall have to be got approval from the Engineer-in-Charge prior to its manufacture. Contractor shall have detailed discussion with the Engineer-in-Charge about the actual functional requirements of the panel board before designing the control panel boards.