

## S.C.A.D.A.

The control Desk must also have the provision of SCADA system for collection of Data of all Equipment including flow Totaliser etc, at clear water Pump Station (CPS) and displaying the same i.e. data / status of all equipment as mentioned below a Remote station using SCADA (Supervisory Control and Data Acquisition) system or Web link/web embedded technology using tele modem. Leased line (P&T) or any other suitable media like mobile connection.

### REMOTE STATION (RS)

Motor winding temperature 3 x 2 nos. (Digital signal for HI & HI-HI temp.)

The Remote Station (RS) is situated at a distance within 1 km from PS. The PC based display/data acquisition technical at RS may be single or multiple units. Tenderer is to quote for every additional unit in addition to the main Terminal with individual password protected access control. The remote station Terminal should have facility to view all alarms generated with real time data. Time stamping and enough memory to store critical data and alarm messages for a period not less than 30 days.

### ADDITIONAL REQUIREMENT

In addition to the above one to active mimic is also required wherein all the Equipments Data pertaining to the RS as mentioned above should be depicted with their On/ Off status etc. along with Flow indication measurements.

### SYSTEM REQUIREMENT & SPECIFICATION

A PLC (100% redundancy) based system should be used for collecting data and MMIC Control as mentioned above. The I/O capacity of PLC should be at least 1024 with a minimum of 32 Kilo Bytes of memory with a provision of future expansion. The I/O terminals should be capable of hot swapping to (Removal of Wiring under power). The requirement at present is as below. Digital input 100, Digital output - 40, Analog Input-2.

The PLC system should also have a web embedded server module with direct connectivity for modem (External) for transmission of data through telephone line leased line from P&T or another suitable through standard web browser like internet Explorer 4 or Netscape Navigator, One no. PC based terminal station is to be provided at RS. Tenderer is to quote for additional terminals which will be connected on LAN network as an option Ethernet LAN should be 1000 MVPS. The Communication Protocol for the PLC should be based on Ethernet TCP/IP.

The tenderer should also provide OVC Server for data logging, Programming Software for PLC should be IEC 1131-3 compliant having at least 4 programming language/editor.

PLC should be housed in an enclosure with a Marshal Rack, power distribution etc. Interface Relay having at least 2 no. + 2 NC should be considered for each digital output for plant MMC Control Specification for Display Terminal/ PC

|   |   |                      |
|---|---|----------------------|
| Intel original Core 2 Core Duo 1.86 GHz | : | CPU/ Processor       |
| Mother Board                            | : | Intel Original 965   |
| 160GB 7200 RPM Sata                     | : | Hard-disk            |
| LG 20X                                  | : | DVD Writer           |
| 1.44 MB                                 | : | FDD                  |
| 1GB zeion RAM, 800 MHz, DDR-II          | : | Random Access Memory |
| 17" TFT Samsung                         | : | Monitor              |

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|              |   |                                  |
|--------------|---|----------------------------------|
| UPS          | : | APC 650 Watt                     |
| Graphic Card | : | PCI Express nvidia 8500G chipset |
| Cabinet      | : | I-ball Premium with 450W SMPS    |
| Speaker      | : | Creative 5.1 Channel             |
| Printers     | : | HP Colour Laser 1600             |
| Scanner      | : | HP Negative Scanner              |
| HP           | : | Individual FAX                   |
| Web Camera   | : | HP                               |
| Modem        | : | D-Link Internal Modem            |
| OS Software  | : | Windows Vista Premium            |

## 2.02 DETAILS

### a) Incoming feeder

Each shall have the following features:

- i) Tri-Vector meter with recording arrange mess,
- ii) Frequency meter,
- iii) Ammeter, Voltmeter with selector switch
- iv) Three phase 3 wire power factor meters.
- v) Indicating lamp (LED type)
- vi) Control switches type TNC
- vii) Over current and earth fault relays (Type CDG 31)
- viii) High speed tripping relays (Type VAJH)
- ix) Trip circuit supervision relays (Type VAX)
- x) Under voltage relay (Type VDQ-13)

### b) Bus coupler

- i) Circuit identification level
- ii) Control switch type TNC
- iii) Trip circuit supervision relays (VAX)
- iv) High speed tripping relays VAJH)
- v) Indicating lamp set.

### c) Out going feeders for motor control

- i) Circuit identification level
- ii) Ammeter with selector switch
- iii) Control switch, with start and stop
- iv) Trip circuit supervision relay (Type-VAX)

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- v) Motor protect on relay (Type MOTPRC/ MICOM, Or any other equivalent.
  - vi) High speed tripping relay (Type VAJH)
  - vii) Indicating lamp (Bunch LED)
  - viii) On/Off rotary switch for heater for motor.
  - ix) Bearing temp, display for motor (DE & NDE)
  - x) For recording winding temperature of motors with display system
- d) **Static Annunciation Scheme with Alarm**  
To indicate all the abnormalities as already specified.
- e) **Spare Breaker Panel**  
The spare breaker panel should be as motor feeder panel, In addition a electrically operated digital type clock is to be provided on the top of the control panel board in a suitable position.
- f) **SCADA System - As specified**

### 3.0 MEDIUM VOLTAGE SWITCH BOARD AT CWPS.

The M. V.S.H shall be 440 volts grade, 3 phase and neutral, 50 HZ, AC distribution switch board sheet steel clad, compartmentalized, cubical pattern, dust and vermin proof, floor mounted free standing type design having 400 ampere mccd with horizontal bus bar at top with facilities for extension on both side. The incoming & outgoing feeder compartments shall be arranged vertically one above the other in multimeter formation in standard sized panels. The height of the panel may be such that oil feeder can be operated from the working floor. Each compartment should be adequately specious for cable termination and maintenance work and fitted with doors interlocked with the respective switches or circuit breakers so that they are not operable in switch/circuit breaker in closed condition. The entire switch board shall be sectionalized in easily transportable sections, each with suitable lifting hooks. The sections should be so designed that they can be easily coupled joined together at site without any special tools or equipment. The entire switch board shall be integrally mounted on a mild steel channel frame base of size ISMC. 75 having grouting holes and anchoring bolts of suitable size and length. The enclosures should be a rigid folded type construction made of M.S. steel. The frame work shall be made of sheet steel of minimum thickness of 3mm and outer shell of steel of minimum thickness of 2mm. All sheet shall be dent free, smooth, straight, and properly annealed, Access of all cable entering the switch board shall be from the bottom through removable screwed gland plate of thickness 3mm Feeders in a multi-meter panel shall have common cable alley on either side for rise of cable. All openings of the control panel including doors, covers & gland plates shall be properly gasketed by soft rubber gasket to make it dust proof.

All bus bars, main and auxiliary risers and interconnections between bus-bars and feeders and also between components of the feeder shall be of electrolytic grade copper conductors. For bus-bars rectangular flat conductor shall be supported on non hydroscopic type mechanical and electrical strength. The bus-bars shall be wrapped by insulated PVC tape or sleeves, the supports should be suitably spaced to give mechanical rigidity for withstanding stress due to system fault level of 50KA for 1 sec. Normal current density in busbars shall not exceed 1.5 Amp. Sq.mm. for interconnection between risers busbars and feeders, flat rectangular conductors may be used for feeders of rating 100 Amp. and above. For Feeders of rating below 100 Amp. PVC insulated standard copper conductor cables of 11 00 volts grade may be used. All control circuit wiring shall be done by 2.5 sq. mm. PVC insulated standard flexible copper conductor cable of 11 00 volt grade. All power circuit and control circuit cable terminations shall be by use of crimped type cable lugs only. All fasteners used shall be cadmium plated passivated terminals for control circuit shall be of pressure clamp type of reputed make, like ELMEX or equivalent. A continuous copper earth bus of size 50 x 6 sq.mm. all along the length of the switch board with termination arrangement at both ends shall be provided with oxidation inhibiting grease/compound shall be used at all joints.

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The switch board shall be finished with two coats each of sine-rich primer paint and synthetic enamel finish paint. Paint drying shall be by stove baking prior to application of pair 1. The steel surface shall be degreased, de-rusted and phosphated, followed by application of nitor cellulose surfacer to achieve a smooth finish.

Type Test certificate for all electrical switch gears and components from respective manufacturer are to be submitted along with routine test certificate of the switch gear on completion of the inspection.

The medium voltage switch board shall have components of following ratings: Two nos. Incomers, one no. bus coupler, M.C.C.'s of 400A, 440 Volt Grade, CTs for incomers and outgoing feeders volt meter for incomers selectors switches, push button and indicating lamp sets etc. TPN SPN switch fuse unit feeders, comprising of 125ATPN-4 nos. 63ATPN-6nos. 32ATPN-18 nos. 32ASPN-I 0 nos. 16ASPN-6 nos. M.C.C.B.s meters, switches shall be front mounting type.

b.  
4.0 CABLE

4.1 H.T. Cables and Jointing

The cables shall be 11 KV grade, XLPE, to be laid in ground masonry trench/metal trays having conductors of high conduction electrolyte aluminum. The core shall be stranded and the insulation shall be suitable for the working condition as obtained in the pump room and manufactured strictly according to relevant ISS. Further the cable shall be suitable for 50 c/s earthed neutral system. The sizes of the cable should be ascertained from the capacity of the motor, transformer, etc. indication of sizes are to be given in the offer some shall be included in the tender process. After the cables have been laid slowly and carefully in a standard way, all cable trenches will be filled up or covered with checkered plate or R.C.C. slab according to the direction of Engineer in Charge and the cost of such installation shall be included in the tender prices. From the incomer structure onwards, it is in scope of bidder.

Where necessary cables shall be supported on clamps of approved type and be properly protected with trays, pipes or other protective coverings.

All electrical joints should be done with socket of suitable size so as to prevent undue heating. All jointing materials, compound and other accessories shall be included in the tender price and all such jointing must be done by the contractor in accordance with the provisions of IE rules. All responsibilities for holding, the statutory. High pressure Test to be conducted/witnessed by the power supply Authorities (ASSAM ELECTRICITY BOARD) and demonstrating the layout/other test to the satisfaction of the Govt. Electrical Inspector before commissioning rest entirely with the contractor Tenderer shall have to make all necessary arrangements for all tests and inspections within the quoted period.

4.2 M.V. Cables and Jointing

M. V. Cables should be 11 KV grade PVC insulated and armoured Al. Conductor 32 core 31 /2 core as required. The core shall be standard and the installation shall be suitable for the working condition. The cable should be laid in under ground trenches 450 mm width x 760 mm average depth with brick protection on the top of the cable with 16 nos. bricks parameter and filling up the trenches with shifted soil, leveling up and restoring the surface to the satisfaction of the Engineer-in-Charge. Where cable is laid in masonry trench/metal trays, the cable, trenches (when applicable) shall be filled up with sand or covered with chequered plate/ RCC slab according to the direction of Engineer- in-Charge. Where necessary cables shall be supported on clamps of approved type and shall be properly protected with G.L conduct or other protective covering as per direction of Engineer Change.

All jointing should be of dry type to be done with hydraulic crimping machine where applicable done in accordance with the provision of LE rules, All jointing materials compound other accessories should be included in the tender price.


4.3 Control cable and jointing

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Control cables shall be PVC insulated at least 100 volts grade multi-copper conductor and armoured of suitable size. The control cable should be terminated with proper glands etc. Name of the manufacturer, details of insulation, armouring overall size of the cable, gross weight of cable per hundred meter run of each core should be mentioned in the tender as per Data Sheet, as follows:

#### 4.4 Data Sheet

##### 1.00 H. T. Cables

1.01 Makes

1.02 Voltage grade & type

1.03 Size and Approx length from various point as per BOC & specification

##### 2.00 MV Cables

2.01 Makes

2.02 Voltage grade & Type

2.03 Size and Approx length from various point as per BOC & specification

##### 3.00 Control Cable

3.01 Makes

3.02 Voltage grade & type

3.03 Size and Approx length from various point as per BOC & specification

##### 4.00 Co axial shielded cable/signal cable

4.01 Makes

4.02 Voltage grade & type

4.03 Size and Approx length from various points as per BOC & specification

#### 5.0 POWER FACTOR IMPROVEMENT CAPACITOR AND 0.2% REACTOR

With each 6.6 KV motor suitable capacity 6.6 KV capacitor bank and for LT loads 415 V capacitor bank with APFCR panel (12 steps) to maintain PF upto 0.95 at respective locations.

#### 5.1 Data Sheet for Capacitors & Reactors

##### A) Capacitors

i) Make

ii) Rating

iii) Whether the Capacitor is capable to improve the power factor of the motor at present phase load condition to 0.95

Yes/ No

iv) Rated Voltage

v) No. of units

vi) Type of internal connections

vii) Type of connection with motor

viii) Rated Current

ix) Cooling system

x) Dielectric

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- xi) Whether discharging resistances have been Provided
- xiv) Standard is which conform

**B) Reactors**

- i) Make
- ii) Rating
- iii) Type of insulation
- iv) Cooling system
- v) Type of connection with capacitor
- vi) Standard to which conform

**6.0 MOTORISED SLUICE VALVES & BUTTERLY VALVES DATA SHEETS**

- Make
- Size
- Quantity offered
- Test pressure & duration of test Body
- Body seat
- Disc
- Disk
- Bonnet
- Back seat
- Spindle
- Disc lock nut Gasket
- Bolts & Nuts Gland packing Gland
- Spindle Nut
- Handle wheel
- Wheel Lock Nut
- Thrust plate
- Cover
- Face Fings
- Yoke
- Stuffing Box
- Steel Ring

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## ELECTRICAL ACTUATOR DATA SHEETS

- Make
- Type
- Capacity with rating of Motors
- Whether provided with limit & Torque Switches, if so, torque limit.
- Protection Group (IP)
- Whether suitable for outdoor & temporary submergence duty/indoor type.
- Whether equipped with suitable component & termination arrangement for transmitting signals for displaying valve opening % indicating in the valve opening indication meters.
- L.S. Standard to which it conforms

## PUMP DISCHARGE VALVE DATA SHEETS

- Make
- Size and Type
- Quantity offered
- Details of :
  - a) Working unit
  - b) Control unit
  - c) Pump unit with motor details
  - d) Control piping
  - e) Electrical Accessories
  - f) Brack and lift cylinder
  - g) Flow control valve
  - h) Radial plunger pump
  - i) Hand pump
  - j) Hydraulic control system
  - k) Local & Remote sensing devices
  - l) Power pack
- Material of construction
  - a) Body
  - b) Disk
  - c) Shaft

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- d) Seat
- e) Seal
- f) IW standard which it confirms.

**9.0 M.S. DISMANTLING JOINT ASSEMBLY**

- Joint size
- Pipe thickness
- Maximum length
- Minimum length
- OD
- P CD
- Thickness
- Flange size
- Flange thickness
- Stud Nos
- Rubber Gasket

**10.0 MS PUDDLE COLLAR**

- Collar size
- OD
- ID
- Thickness of the collar
- Bumber of Hooks

**11.0 PUMP DELIVERY SIDE PIPING AND COMMON DELIVERY MANIFOLD**

The pump individual delivery side piping shall be of suitable diameter made from M.S. or 10 mm thick plates painted both inside and outside by anticorrosive epoxy paints. The pipes shall be of welded joints and shall consist of necessary companion flanges to as to connect the piping with the Valves IS specials of the individual pump delivery branch. The pump individual delivery side piping shall be provided to all flange joints complete with all necessary nuts, bolts, washers etc. The length shall be ascertained from the layout and the exact dimensions of the valves/specials. The tenderer should also provide the necessary arrangements to encounter the horizontal back thrust and the details as per the pump manufactures recommendation shaft be clearly indicated in the layout drawing, Suitable no. of air release Valves (double throat) shall be provided on each pump discharge lines.

The common delivery manifold shall be of suitable diameter to be designed by the successful bidder shall be fabricated from M.S. of 12mm thick plates. The common manifold shall have blank flanges on both sides end. Butterfly valves with electrical actuators are to be installed on the delivery pipe lines within a distance of maximum 5 meters. The valve actuators shall have local mechanical and remote digital display system. The remote display system would be inside the control room. Flow meters, full bore type, are to be installed within a distance of 5m.

The common delivery manifold shall be provided with one no. air release valve (Duo-Jet) suitably placed. The pipe shall be laid underground and shall be painted with anticorrosive paints at the inside

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and outside.

(Necessary surface finish for proper painting and coating shall be made by the contractor and careful laying shall be done so as to prevent damages during laying)

## **BATTERY & BATTERY CHARGING EQUIPMENT**

110 volts M/s. Chloride India Ltd. make Plan : lead acid battery gang consisting of 55 nos. high performance closed top cells complete with positive plate pasted negative plate lids, vent-lugs, buffers, separator bolts nuts and intercell connecting etc.

The capacity of the battery shall be 150 Amp. Hrs, at 10 H/S. rate of discharge to 11.25 volt per cell at 27°C.

Inter row connectors and inter tier connectors shall be provided when necessary. Sufficient quantity of sulphuric acid for first filling shall be included in the offer.

Suitable battery stand of first class teak wood finished with black anti-sulphuric paint and complete with cell number plate and fixing nails shall be provided.

Stand insulator shall be placed underneath the wooden up lights of battery stand.

The tenderer shall indicate the safe size of the battery room for installation and connections of the above battery gang.

Necessary testing equipment i.e. hydrometer, cell testing voltmeter, thermometer, acid toppler and spencer etc. required quantity of electrolyte in non-refundable container including 5% spares shall be supplied.

The battery charging equipment housed in a floor mounting type sheet cabinet with single iron reinforcement and adequate ventilation for natural air cooling and comprising of the following shall have to be supplied and installed. The capacity should be suitable to close the vacuum breakers.

## **EARTHING OF EQUIPMENTS INSTALLED WITHIN THE PUM HOUSE AND SUB STATION INCLUDING MOTORS HT BOARD, TRANSFORMER ETC.**

### **EARTHING**

The total installation shall be effectively earthed by providing a ring earthing. Each earthing set shaft consist of twin G.I. pipes of not less than 2" dia of sufficient length the electrode shall be buried deep. the ground upto the depth of moist earth which shall be less than 12.0" from ground level and must be away from the pump house structure. The bottom portion of the electrodes shall be properly perforated and shall be filled up with black smith dust. One cast iron cap properly screwed of approved type and design and shall be fitted on the top of the electrode and the cap shall be properly provided with suitable lugs for fixing box electrically and mechanically of the connection leads to the earth bus inside the station. After fixing and drawing out of the earth leads, the top portion of the earth, electrode upto 1 ft. shall be properly brick pitched and shall be lifted with water proof bituminous compound. The connecting lead shall be copper bus 1" wide and 1/4" thick shall be laid at a depth of not less than 3 - 0" from ground level and shall be properly brick covered The leads shall be connected to copper each bus bar inside the pumping station by means of washers, nuts bolts etc. The nos. of individual earthing connected to the Earth bus should such that after installation the earth resistance of the system must be well below one station.

One connection copper bus bar 1" wide and 1/4" thick shall be provided so that the frames of a II electric motors, switch gears, transformers and other electrical connections and installation shall be connected to the above copper earth bus by two separate copper tape of adequate dimension. All metallic cover framer, equipments, installation etc, shall be earthed to the full satisfaction of Engineer in charge and the Govt. Electrical Inspector.

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The earthing and bonding shall be according to the I.E. Rules 1956. With amendment of 1990. All non current carrying metal parts associated with H. V. installation shall be effectively earthed to a grounding system as mat which will.

- a) Limit the touch and step potential to tolerable values.
- b) Limit the ground potential rise to tolerable values so as to prevent danger due to transfer of potential through ground earth wires, cable sheath fences, pipe lines etc.
- c) Maintain the resistance of the earth connection to such a value as to make operation of the protective device effective.

The same must be approved by the Govt. Electrical Inspector and shall pass the statutory tests. The successful tenderer shall have to submit the detailed and fully dimensioned drawing of the whole electrical system showing the proper earthing duly approved by the Govt. Electrical Inspector before commencement of the actual installation work.

The distance between each individual Earthing should not be more than 6 meters.

#### 14.0 ELECTRICAL ACTUATION

The suction and delivery side sluice valves shall be electrically operated and each shall be completed with suitable head stock, motor, starter with reversing control gear, limit switch, torque switch, shall be fitted on an indicator board showing the exact amount of valve operating. They will also automotive out off at the extreme and 0 valve gate travel. The valve shall also be provided with necessary management for operating the valve manually in case of emergency. The safety interlock switch will automatically out off the current in case the valve in operated manually Local and remote digital display of percentage opening of the valves are to be incorporated. The remote display would be in the control desk to be installed in Control Room. The Data Sheets would be as specified in Clause 13.00.

#### 15.0 LIGHTING SYSTEM

##### 15.1 Luminaries:

Industrial Medium bay luminaire type SDK 102 with SON 150W & HDK 102 with Son 250W lamps are to be provided in a row alternatively in the beams at the motor floor ceiling. Fluorescent lamps are also to be fixed on the wall of the motor floor. The positions are to be fixed as per requirement. The illumination level would be 150 Lux.

In the lower deck suitable number of SGK 27 with SON 70 watt lamps are to be provided for maintaining 100 Lux illuminations at pump floor level,

The control rooms lighting should be provided with TL D 36 watt cool day light type fluorescent. lamps with decorative type fixtures, illumination level would be 200-250 Lux.

In the corridors, toilets, Trimshine type luminaire with 40W fluorescent lamps are to be provided to generate adequate lighting at all units of water treatment plant, pump house and sub station.

At the entrance exists of all units of water treatment plant, pump house and sub-station should be provided with SGK - 27 with SOM 70 watt lamps and bulk head fittings with incandescent lamps of adequate water rage.

##### 15.2 WIRING

All wiring installation work must be as per relevant LS. with proper distribution network, M.C.B are to be used in distribution boxes, there must be colour segregation for power / Neutral/ground wires. Prior to taking up the work, necessary wiring diagram showing junction Boxes, distribution boxes, switches, earthing system is to be placed for approval of the E.LC.


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## 16.0 VENTILATION SYSTEM

Pump house will be single floor Bidder to design and supply and erect this arrangement

## 17.0 AIR CONDITIONING SYSTEM

In order to maintain temperature around 20° C and to control the relative humidity inside the control room cum office of dimension 6m x 10m x 4 m to 65% wall mounting window type AC units of suitable capacity are to be provided so as to offset the heat generated from the electrical panels as well as to maintain the temperature mentioned considering 5 nos. human occupancy in the room. The outdoor ambient condition for Guwahati summer has been considered as 38.0 dB and 40% PH as per standard design procedure for heat load determination. Necessary calculation is to be submitted for approval of capacity of the Air Conditioning machines.

## 18.0 VINYL FLOORING

Vinyl flooring of 1 mm thick of standard make is to be provided by the tenderer inside the control room cum office of area 6m x 10m.

## TECHNICAL SPECIFICATION

### 1. EIGHT PANEL 6.6 KV. 250 INDOOR TYPE H.T. SWITCH GEAR.

The H.T. Switch Gear shall be 6.6 KV, 250 MVA, 800 amp., 3 phase, 50Hz, AC earthed system totally enclosed indoor bulk oil circuit breaker, double break, vertical drop down, horizontal draw out, trip free & with electrical mechanical tripping arrangement having service, test, isolation & transfer position and complete with solenoid closing mechanism and having a symmetrical breaking capacity of 21.8 KV for fault level of 250 MVA at 6.6 KV. The short time rating of the breaker shall be 21.8 KV for one second at 6.6 KV.

The details of breakers as aforesaid are given below: (Each of the OCB's shall be supplied with initial filling of oil to full tank).

#### A. 800A Incomer HVVCB

- a) motorized operated closing mechanism with electrical and mechanized ON & OFF with indicators.
- b) electrical - mechanical close trip push button with red & green indicator.
- c) automatic safety shutter & two sets 6 way auxiliary contact NO and NC combined)
- d) 800 ampere single pole plugs & sockets.
- e) shunt trip coils for 110 volt D.C operation.
- f) resin east type CT of ratio 800 1 : 1 with 15 VA burden and accuracy class 5P 10 for protection & metering respectively.
- g) Ammeter with selector switch.
- h) Voltmeter with selector switch.
- ii) O/C & E/F relay i.e, IDMT relay type CDG-5, D/C 50% to 200 EIF 20% - 80%
- j) trip circuit supervision relay. type VAX.
- k) high speed tripping relay, type VAJH.
- l) 3 ph. 3 limbs 50 Hz resin cast and dual point 200 VA/ phase class -B potential transformer.
- m) Trivertor meter with recording arrangement.
- o) Power Factor meter.
- o) Frequency meter.
- p) ODC type Control Switch with local/remote selector switch

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- q) space heater with ON/OFF switch
- r) cable box suitable for 1X 400 sq mm. XLPE 11KV grade, 3 core, Al, armoured cable.

**B. 800 ampere Bus-Coupler Comprising of :**

Same as in corner (vide - A) excluding items appearing under f, g, h, i, j, k, l, m, n & o.

**C. 400 A outgoing H. V. feeder VCB for C. WP. Stn. and spare H. V. feeder**

Same as incomer (vide - A) excluding items appearing under 1. m, n & o with minor change in items d, f & as detailed below.

- a) 400 amp single pole plugs & sockets.
- b) resin cast type CT. of ratio 400 - 1-1 having IS VA burden with accuracy class SP10.
- c) cable box suitable for 1 x 300 sq. mm XLPE, 11KV grade 3 core, Al, armoured cable.

**D. 400 A outgoing H. V. feeder VCB for 1 MVA outdoor transformers**

Same as incomer (vide - A) excluding items appearing under l, m, n & o with minor change in d, f & s with additional feature vide (i) and (ii) as detailed below.

- a) 400 amp single pole plugs & sockets.
- b) resin cast type current transformer of ratio 100 I : I having 15 VA burden with accuracy Class SP10
- c) cable box suitable for 1 x 300 sq. mm. XLPE 11 K V grade 3 core Al armoured cable.
- d) VAA type relay for Bochholtz relay operation.
- e) IDMT type relay for Bochholtz relay operation.
- f) IDMT relay type CFG-31.

**2. REMOTE CONTROL DESK**

The remote control desk shall be of sheet steel enclosed and floor mounted type indoor type, dust, and vermin proof fabricated from 2 mm thick CRC sheet and suitable section of structural steel. It shall be suitable for tropicalised climate. The degree of protection shall be IP44, The switches & ON/OFF indicators of each panel with annunciation panel, accept, reset & Test push button shall be placed suitably so that the operator may handle it with ease, The mounting of the switch, indicators & annunciation, facia of each section should be in a row having symmetrical arrangement.

The annunciation system should have suitable number of annunciation facia with visual displays and audio visual alarm & trip. It shall be complete with all relays along with the pick up from different relays mounted on H. V. Panel. All indications should be engraved on transparent plastic windows those can be clearly visible when the indicating lamps are lighted. The following indicators shall be provided on the annunciation facia.

- i) Main power incomer trip indication for over current and earth fault.
- ii) Transformer feeders, CWPS feeders spare feeder trip indication for O/C & Elf relays.
- iii) Trip circuit open indication for all the eight panels.
- iv) Bochholtz relay alarm & trip indication for both the transformers.
- v) DC voltage low alarm.
- vi) Battery D. C. earth fault indication.

There shall be 4 spare windows in the annunciation facia. There shall be audible bell indications for the alarm signals and booster indications for trip signals with suitable relays in the following places.

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- a) Accept push button at a suitable place in clear water pumping station control room.
- b) Accept /Reset /Test push buttons on the control desk in medium voltage control panel room.
- c) Accept push button at a suitable place in Filter House control room.

### 3. TRANSFORMER

Two nos. identical outdoor type Transformers. ANON, step down core type 1 MYA, 6 KV/O 415, Delta/Star, percentage impedance within 5%, Dy-11 Vector Group with an additional brought out neutral, three phase 50, HZ shall be supplied and installed by the contractor. The transformers should be identical in all features, so that they can be operated in parallel, if necessary, detailed, specification of the transformers should be furnished on the following format

- 1) Name of the Manufacturer.
- 2) Service.
- 3) Rating.
  - a) Rated KVA
  - b) Rated Voltage in H.V.
  - c) Rated Voltage in L. V
  - d) Temperature rise in oil.
  - e) Temperature rise by resistance of winding
4. Connection
  - a) High Voltage
  - b) Low Voltage
  - c) Vector group reference
  - d) No load loss in K W at rated voltage & frequency.
5. Load loss at rated current at 75°C in K W
6. Reactance at rated current & frequency in percentage
7. Impedance at rated current & frequency 75°C in percentage
8. Maximum efficiency in percentage.
9. Efficiency at 75°C at unity power factor (in percentage)
  - a) At full load,
  - b) At V4 of full load
  - c) At 1/2 of full load.
10. Regulation at full load at 75°C (in percentage)
  - a) At unity PF.
  - b) At 0.8 PF lagging.
11. No load current at rated voltage & frequency (in amps)
12. Approximate quantity of oil in litre.
13. Overall dimension in mm.
  - a) Emgtj
  - b) Breadth
  - c) Height
14. Weight in Kg. of
  - (a) Core & windings
  - (b) Tank & fittings

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- (c) Oil
- (d) Total weight

4. **MEDIUM VOLTAGE CONTROL PANEL**

The MVCP shall be 400/440 volts, 3 phase and neutral, 50 HZ, AC distribution switch board sheet steel clad, compartmentalized, cubical pattern dust and vermin proof, floor mounted free standing type design having 1600 ampere TPN main with horizontal bus bar at top with facility for extension on both sides. The incoming & outgoing feeder compartments shall be arranged vertically one above the other in multimeter formation in standard sized panels. The height of the panel may be such that oil feeders can be operated from the working floor. Each compartment should be adequately spacious for cable termination and maintenance work and fitted with doors interlocked with the respective switches or circuit breakers so that they are not openable in switch circuit breaker in closed condition. The entire switch board shall be sectionalized in easily transportable section, each with suitable lifting books. The sections should be so designed that they can be easily coupled/joined together at site without any special tools or equipment.

The entire switch board shall be integrally mounted on a mild steel channel frame base of size ISMC-75 having grouting holes and anchoring bolts of suitable size and length. The cubicles should be of rigid folded type construction made of M.S. sheet. The frame work shall be made of sheet steel of minimum thickness of 3 mm and other shell of sheet steel of minimum thickness of 2mm. All sheet shall be dent free, smooth, straight, and properly annealed. Access of all cable entering the switch board shall be from the bottom through removable screwed gland plate of thickness 3mm. Feeders in a multi tier panel shall have common cable alley on either side for rise of cable. All openings of the control panel including doors, covers & plate shall be properly gasketed by soft rubber gasket to make it dust proof.

All bus bars, main and auxiliary riser and interconnections between bus bars and feeders and also between components of the feeder shall be of electrolytic grade copper conductors. For bus bars rectangular flat conductor shall be supported on non hygroscopic type insulating support of adequate mechanical and electrical strength. The bus bars shall be wrapped to insulating PVC tape or sleeves. The supports should be suitably spaced to give mechanical rigidity for withstanding stress due to system fault level of 50 KA for 1 sec. Normal current density in busbars shall not exceed 1.5 Amp per sq. mm. For interconnection between risers/ bushers and feeders, flat rectangular conductors may be used for feeders of rating 100 Amp and above. For feeders of rating below 100 Amp PVC insulated standard copper conductor cables of 11 00 volts grade may be used. All control circuit wiring shall be done by 2.5 sq. mm. PVC insulated standard flexible copper conductor cable of 11 00 volt grade. All power circuit and control circuit cable termination shall be by use of crimped type cable lugs only. All fasteners used shall be cadmium plated/passivated. Terminals for control circuit shall be of pressure clamp type of reputed make like ELMEX or equivalent. A continuous copper earth bar of size 50 x 6 sq mm all along the length of the switch board with termination arrangement at both ends shall be provided with oxidation inhibiting grease/compound shall be used at all joints.

The switch board shall be finished with two coats each of zinc rich primer paint and synthetic enamel finish paint. Paint drying shall be by stove baking prior to application of paint. The steel surface shall be degreased, de-rusted and phosphated, followed by application of nitro cellulose surfacer to achieve a smooth finish.

Type Test certificate for all electrical switch gears and components from respective manufacturer are to be submitted along with routine test certificate of the switch gear on completion of the inspection.

The medium voltage control panel shall be 1600 amp. 440V grade 3 phase, 4 wire neutral system for A.C. distribution with A. C. B.s. M.C.C.B & switch fuse units respectively of following ratings and components as stated below. ALL meters, relays and mimic shall be mounted on the front of the panel.

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**A) Incoming feeders**

- a) 1600 ampere manually operated draw out type air circuit breaker having thermal overload, magnetic short circuit trip, and shunt trip.
- b) triple pole TDMT type CDG-31 over current cum earth fault relay.
- c) 15VA C. T s with suitable ratio for metering and for protection to make the circuit & readings as sensitive as possible.
- d) square dial flush mounted ammeter and voltmeter with phase 'selection switches'.
- e) each ON & OFF indicating lamps Green and Red.
- f) Suitable cable entry arrangement to provide entry armoured PVC 11 KV grade Al cable.
- g) Both the breakers shall have mechanical & electrical inter locking arrangement.

**B) Bus coupler comprising of:**

1600 ampere air circuit breaker having over current short circuit release and shunt trip.

**C) Outgoing Feeders:**

**a) Feeders rated 1600 ampere each having :**

- i) 1600 ampere manually operated draw out type air circuit breaker having thermal overload, magnetic short circuit trip, under voltage release and shunt trip arrangement.
- ii) over current cum earth fault relay type CDG-31.
- iii) 15VA CTs with suitable ratio for metering and for protection to make the circuit and readings as sensitive as possible.
- iv) square dial flush mounted type ammeter with phase selector switch.
- v) each On & OFF indicating lamps, Green and Red.
- vi) breaker shall have cable entry arrangement to accordance 4 nos, 3 1/2 core, 1.1KV grade 500sq. mm. PVC armoured Al cable.

Both the breakers should be mechanically & Electrically inter locked.

**b) rated 800 ampere, each having :**

- i) 800 ampere manually operated draw-out type air circuit breaker having thermal over load, magnetic short circuit trip with shunt trip arrangement.
- ii) over current cum earth fault relay type CDG-31
- iii) 15VA CTs with suitable ratio for metering and for protection to make the circuit and readings as sensitive as possible
- iv) square dial type flush mounted type ammeter with phase selector switch.
- v) ON & OFF indicating lamps, Green & Red.
- vi) feeder shall have cable entry arrangement for 2 x 3 V2 core, 300 sq. mm PVC armoured Al cable

**D) Two feeders rated 200 ampere, each having :**

- i) 200 ampere MCCB having thermal overload, magnetic short circuit trip.
- ii) earth fault relay type CDG.

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- iii) auxiliary control switch.
- iv) 15VA suitable ratio CTs for metering and protections.
- v) square dial flush mounted type ammeter with phase selector switch.
- vi) ON & OFF indicating lamps Red/Green.
- vii) feeder breaker shall have cable entry arrangement for one number 3 1/2 core 240 sq. mm PVC armoured Al cable.

E) feeders rated 100 amperes, each having:

- i) 100 ampere TPN switch fuse unit with HRC fuses.
- ii) Shall have cable entry arrangement for two numbers 50 sq. mm. 3 1/2 core PVC armoured, Al cable.

5. 12 STAGE 300 KVAR AUTOMATIC POWER FACTOR IMPROVEMENT CAPACITOR BANK.

Tile APFC panel must be indoor type, totally enclosed metal clad dust free and vermin proof, free standing floor mounted type. The panel is to be made from 11 SWG MS sheet steel chemically treated with application of red oxide primer & 2 coats of synthetic enamel paint of approved colour shade.

The panel would be of 800 ampere capacity with 3 phase and neutral. The bus bar should be of adequate size made of electrolyte grade Aluminum & copper earth bus bar. The panel shall be complete in all respect with 8 (eight) stages of each 30 KVAR 4 (four) stages of each 15 KVAR capacitor banks to generate 300 KVAR at 400-440V as per requirement to improve the PF as near as 0.95 which contractors/relay/timers should be used Suitable current transformer should be used for the requirement of current & 200 VA 415V/110V power transformer is to be used for requirement of voltage for measuring the angle between voltage and current. There shall be also provision for manual push button operation in addition to the auto mode. Switches with HRC fuses should be provided for each circuit PF meters incoming & outgoing are to be placed along with one ammeter for displaying the improvement in PF achieved. The panel should be with all interconnection complete. The control wiring should be with 2.5 sq. mm. CD single core conductor of 11 KV grade. The capacitors shall be of APP type.

6. BATTERY & AUTOMATIC BATTERY CHARGING EQUIPMENT

110 volts M/s. Chloride India Ltd./ M/s EXIDE INDUSTRIES / AMCo / CALDYNE / HBL make "Plate" lead acid battery gang or equivalent as specified in BOQ consisting of 55 nos high performance closed top cells complete with positive plate pasted negative plate lids, vent lugs, buffers, separators, bolts, nuts and inter-cell connectors etc.

The capacity of the battery shall be 150Amp. hrs, at 10 hrs, rate of discharge to 1.85 volt per cell at 27°C.

Inter row connectors and inter tier connectors shall be provided when necessary sufficient quantity of sulphuric acid for first filling shall be included in the offer.

Suitable battery stand of first class teak wood finished with black anti-sulphuric point and complete with cell number plate and fixing nails shall be provided

Stand insulator shall be placed underneath the wooden uprights of battery stand.

The tenderer shall indicate the safe size of the battery room for installation and connections of the

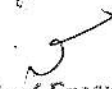
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above battery gang.

Necessary testing equipment i.e. hydrometer, cell treating volunter, thermometer, acid toppler and spanner etc. required quantity of electrolyte in non-refundable container including 5% spares.

The battery charging equipment housed in floor mounting type sheet steel cabinet with single iron reinforcement and adequate ventilation for natural air cooling and comprising of the following shall have to be supplied and installed. the capacity should be suitable to close the bulk oil circuit breakers. The initial charging of the YKP 13 cells should be done by separate DC source at site.

Float Charger:

- i) Triple pole ON/OFF switch for main incoming supply
- ii) HRC fuses for incoming line protection
- iii) Pilot lamp for indicating the main supply ON
- iv) AC contractor for adequate rating
- v) power transformer for 3 ph. D/VY neutral air cooled of adequate rating with taps on primary side + 10%
- vi) AVR unit for close loop control of float charger output with load limiting feature.
- vii) Secondary line surge suppression circuit.
- viii) High speed semi conductor fuses of OS type
- ix) Three phase full wave half controlled thyristor bridge with free wheeling diode
- x) Snubber network for semi conductor device protection
- xi) Auto/Manual selector switch rotary pattern
- xii) LC filter circuit for ripple reduction
- xiii) Bleeder resistance
- xiv) Indicating lamp for DC output
- xv) Silicon blocking diode with heat sink
- xvi) Double pole ON/Off rotary switch for DC output
- xvii) HRC fuses for DC output
- xviii) D C ammeter to measure the output current
- xix) DC ammeter to measure the trickle charge

### Boost Charger (Manual Variac Control)

- i) Triple pole ON/OFF rotary switch for main incoming supply
- ii) HRC fuses for incoming line protection
- iii) Pilot lamp for indicating the incoming supply ON
- iv) AC contactor for adequate rating
- v) power transformer for 3Ph. DIY, neutral air cooled of adequate rating with taps on primary side at + 10%
- vi) Auxilliary transformer 3 ph of adequate rating
- vii) Manual variac, 3 phase of adequate rating
- viii) Variac protection fuses HRC type
- ix) High speed semi conductor fuses GS type
- x) 3 Ph. full wave silicon diode bridge
- xi) Secondary line surge suppressor circuit
- xii) Snubber network for semi conductor device protection
- xiii) Indicating lamp for DC output
- xiv) Silicon blocking diode with heat sink
- xv) Double pole ON/OFF rotary switch for DC output
- xvi) HRC type fuses for DC output
- xvii) DC ammeter for measuring the boost output current

### Common items :

- i) DC contactor to cut off the float charge from the battery when boost charger is ON
- ii) Silicon blocking diode with heat sink for connection between tape cell and positive bass of float charger output
- iii) DC volt meter to measure the output voltage of float boost and battery
- iv) DC volt meter selector switch of rotary pattern
- v) Single phasing preventer circuit with trip
- vi) Battery earth leakage relay circuit
- vii) Sheet steel cubicle (14 SWG thick sheet) floor mounting type complete with louvers with fine wire mesh, hinged, doors on the front and back with rubber gasket and finally pointed with bight grey enamel colour conforming to shade No. 631 as per IS-5.
- viii) The panel shall be complete with removable type cable entry plate input/output terminals earthing terminals, name plates, internal wiring with tag mails etc.
- ix) The boost charger should be capable of supplying 80A rectified DC for which power rectifier of adequate capacity should be used. The power transformer shall also be of suitable capacity.

### 7. LAYING AND JOINTING OF MV CABLE

The MV cable should be of 1.1 KV, grade, PVC insulated and armoured aluminum conductor of 3 1/2 and single core of different cross sections as specified earlier. The core shall be standard and the installation shall be suitable for the working condition. The cable should be laid in under ground


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