Revamping with PLC based Automation system for existing 200/85/20 bars Air pressure Reducing Station

Tender specification

For

“Revamping with PLC based Automation system for existing 200/85/20 bars Air pressure Reducing Station”
Overview of existing 200/85/20 bar air pressure reducing station

I. Necessity of air Pressure Reducing Station

Compressed air at different pressure is required for operation of safety circuit breakers, making switches and resistive breakers of testing laboratory. The compressed air pressure is achieved by reducing the supply pressure (generation) of 200 bar to a switchgear operating pressure of 85 bar and 20 bar respectively.

The safety circuit breaker has a nominal pressure of 85 bar, for the resistive breaker and synchronized make switch as well as for the safety breaker control air, at nominal pressure of 20 bar is required.

Reduction takes place with pressure-dependent through replenishment of compressed air by means of electrically operated CLOSED-OPEN valves. According to the respective switchgear operating pressure range, the necessary pressure values for control and signalization are detected by means of pressure measurements at the 85/20 air receivers.

II. Operation & Control of existing 200/85/20 bar air pressure reducing station

Present system is interfaced between microprocessor controlled A-20 Logistat, AC/DC converter module, 24V DC distribution module, 20 bar air pressure detection electronic card module, 85 bars air pressure detection electronic card module, relay converter model along with 24V DC & 0-20 mA transducers fitted to manometers and electrically operated pressure controlling valves.

Operation A: 20 bar air pressure system

200 bar incoming air pressure is reduced to 20 bar by means of electrically operated Y11 pneumatic valve, and there by air will start filling up in 20 bar storage vessel and is closely monitored by pressure gauge F1 fitted to 20 bar vessel. Once the required pressure is reached to 20 bars in storage vessel, the pressure transducer (0-20mA) fitted to manometer gauge F1 will send equivalent analog input to the 20 bar pressure detection electronic card and A-20 logic stat control module. There by activating relay module which will operate immediately and sends signal to Y11 valve to shut-off and to maintain constant 20 bar air pressure in storage tank.
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Further this storage tank is connected with three output discharge pipe through control valves 4&5 indicated in diagram. Once the air pressure is discharged through the Valves there will be pressure drop in the storage tank and monitored in pressure gauge F1. Again signal will be communicated to controller and to relay module to Energize Y11 valve to refill the air to storage tank till pressure attains 20 bar. These operations will be repeated as and when pressure drops in storage tank.

Valve Y12 is electrically blocked when Y11 is energized, Y12 is required to drain the air out from switchgear and storage tank.

**Operation B: 80 bar air pressure system**

The similar procedure is followed for reduction of 200 bar incoming supply pressure to 85 bar and filling up air to 80 bar storage vessel with following control valve operation.

The 80 bar system includes following valves:

- Y21 for replenishment (input control valve), -Y22 for draining of output air pressure. When –Y22 is energized, -Y21 is electrically blocked.

- Y22 is open and de-energized. This means that the 85 bar system is discharged in the case of failure of the 220 V AC control voltage.

- Y23- 85 bar shut-off valve

This valve is arranged between the 85 bar pressure reduction and the compressed-air system of the safety circuit breaker. During normal operation, this valve is open, In the case of voltage failure, the valve closes and maintains the pressure within the tank while the compressed-air system of the safety circuit breaker is reduced to approx. 25 bar via the valve –Y22.
Annexure-II
Hardware component details of Existing system

Components Specification of existing pressure reducing station w.r.t diagram -1

<table>
<thead>
<tr>
<th>A.</th>
<th>Quantity</th>
<th>Designation</th>
<th>Type</th>
<th>Remarks</th>
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<td>1</td>
<td>Air-receiver</td>
<td>1000L 23bar</td>
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<tr>
<td>2</td>
<td>1</td>
<td>Air-receiver</td>
<td>1000L 120bar</td>
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<td>3</td>
<td>4</td>
<td>Ball-valve</td>
<td>DN10 PN500</td>
<td>KS 201 186</td>
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<td>4</td>
<td>6</td>
<td>Stop-valve</td>
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<td>V 521-8-200</td>
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<td>4</td>
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<td>Non-return valve</td>
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<td>Pressure-gauge</td>
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<td>Y23</td>
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<td>2/2-way-sluice valve</td>
<td>DN 6 PN250</td>
<td>450 737,220V AC</td>
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<td>F 2</td>
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<td>Pressure-transducer</td>
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Diagram of Existing Air pressure Reducing station

Diagram-1
Revamping with PLC based Automation system for existing 200/85/20 bars Air pressure Reducing Station

Annexure-III Scope of work:

1. Complete revamping of existing 200/85/20 bar air pressure reducing station with necessary Hardware and Software system
2. Design, supply, installation, testing and commissioning of new PLC based automation system for existing 200/85/20 air pressure reducing station
3. Supply of new programmable Logic controller (PLC) with suitable software and necessary interfacing modules
4. PLC based automation system should able to fill and maintain the regulated air pressure and volume in the 85 bar and 20 bar storage tank, by reducing 200 bar incoming supply pressure.
5. Automation system should work both in manual and remote mode operation by controlling the electrically operated pressure valves based on the transmitter set point.
6. Supply and installation of suitable WIKA make new pressure gauges along with necessary transducers.
7. Providing Continuous Monitoring of transmitter values, control valves status, trends and critical alarms
8. New PLC based control and operating system must match the present functions of the system
9. Additional manometers along with transducer to be provided in 20 bar output line if required
10. Suitable version desk top PC with wooden table to be provided for monitoring and controlling of parameters at generator control room
11. Overpressure/under pressure control, monitoring and protection to be provided for both 20 and 85 bar system
12. Interlocking control to be provided between 20 bar and 85 bar input line during initial filling up of air pressure to respective storage tank, such that always 20 bar must be filled first
13. Provision for Control and monitoring to be provided for 85 bar safety pressure relief valve
14. Separate Selector switches to be provided for 20 and 85 bar air pressure system with following mode of operation 20 bar selector switch: “TEST” — “MANUAL” — “REMOTE” and 85 bar selector switch: “TEST” — “MANUAL” — “REMOTE”
15. Two numbers of Emergency switches to be provided, one at pressure reducing station and another at short circuit bus bar control desk in generator control room
16. Controlling Valve Start, Stop Based On The Transmitter Set Point for Pressure Tank both local and remote mode operation
17. PLC and control modules to be provided with suitable rack at generator room
18. After Successful commissioning, the firm should arrange 4 days training to CPRI officials
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Annexure-IV

Additional requirements:

1. The entire system should be able to operate and control both in remote and manual mode.
2. HMI based control and monitoring system should be provided near reducing station and computer based control and monitoring system in generator control room.
3. System must be provided with necessary rack and platform.
4. Entire module Rack and platform must be insulated and able to withstand vibration as per standard.
5. Necessary hardware’s, transducers, manometers etc., to be arranged by supplier with standard make as specified in GTP.
6. Communication interfacing must be provided with Ethernet cable between generator control room and pressure reducing station.
7. All the equipment’s and modules should be properly earthed.
8. Proper protection should be provided against vibration, overvoltage, overcurrent and system malfunctioning.
9. All the modules, PLC system, measuring and indicating instrument must be calibrated by standard laboratory along with calibration report and certificates.
10. Selector switches to be provided separately for 20 and 85 bar air pressure operation system with following mode of operation:
   - 20 bar selector switch: “TEST”—“MANUAL”—“AUTOMATIC”
   - 85 bar selector switch: “TEST”—“MANUAL”—“AUTOMATIC”
11. PROGRAMMING Software should control the Valve Start and Stop Based on the Transmitter Set Point of Pressure Tank in Remote with pc.
12. Separate emergency switches to be provided one at PLC rack and other at SCBBS desk.
13. Provision should be provided to monitor the incoming supply air pressure by fitting additional manometer 0-400 bar with transducer.
14. Protection to be provided to de-energize the supply to the respective valve in case of malfunction of the pressure gauge and transducers.
15. PLC system should record and indicate the following faults in HMI, as well as in PC for 20 and 85 bar pressure separately:
   A) Automatic System operation Blocked:
   B) Over pressure / under pressure fault
   C) Main AC/DC power supply fault
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D) Emergency switch OFF
E) Pressure Fault
F) Valve Fault
G) 85 bar reducing Fault

16. **Automatic System blocked:** if any one of the above mentioned faults (A to G) appears except Fault (B), during automatic operation then entire automatic system of operation should be blocked till the fault has been eliminated and acknowledged by means of key pad or reset button. And to ensure further restoration of automatic operation.

17. **Test:** when the operation of the system changed to “TEST” mode, one or several valves and relay module status should be indicated at HMI display of PLC. After switching back to automatic, the system will be restored back to automatic operation.

18. **Over Pressure (20/85 bar):** if the pressure in the 20 or 85 bar storage tank is more than the set point value, the PLC controller should activate the electrically operated Valves Y12 and Y22 drain out excess pressure to maintain set value of pressure.

19. **Under Pressure (20/85 bar):** if the pressure in 20 or 85 bar storage tanks is less than the specified/set value, then PLC should activate for pressure replenishment through electrically operated control valve Y11 and Y21.

20. **Main power supply fault:** trip in MCB, failure of AC/DC power supply of the whole PLC cubicle should be displayed at HMI system.

21. **Emergency OFF:** this signal appears at PLC and relay Valve operating module when the main emergency OFF switch is disconnected and the valves are de-energized.

22. **Pressure fault (20/85 bar):** this signal will appears at I/O or relay modules for 20 bar system when the set pressure analog input signal in the 20 bar system is disturbed. And For 85 bar system signal appears when the set point of pressure is disturbed in I/O module of the PLC.
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23. Indication and protection to be provided in case signal failure of pressure transducers F1/F2/F3 due to wire breakage or failure of power supply.

24. Signal fault in measurement to be displayed in HMI

25. valve fault : When a valve is switched into operational mode “Automatic” a monitoring time is started. This time is pre-set to duration sufficient for the valve to reach a shutoff limit value. If this value is not reached, a fault exists within the valve control circuit and the aforementioned signal appears. time -60 seconds)

26. 85 bar Reducing blocked : In case of pressure-drop at the 20 bar system to a minimum value of 17.5 bar, the 85 bar replenishment valve –Y21 will be blocked immediately. After 30 seconds the 85 bar system beyond the replenishment devices will be ventilated down to approx...25 bar.

27. During manual mode operation, PLC system should activate the following function through the operational panel or HMI

   (a) Block: (i) Y11/Y21- close, (ii) Y12/Y22-close, (iii) Y13/Y23- close
   (b) Drain: (i) Y11/Y21- close, (ii) Y12/Y22-open, (iii) Y13/Y23-open
   (c) Replenish: (i) Y11/Y21- open,( check set points, (ii) Y12/Y22-close,(iii) Y13/Y23- open

28. Operational mode Details

   28.1 Manual operation : When switching over to manual operation (position 2 of the operational-mode selector switch), the operation of air filling should take place as per pressure set point in HMI key pad. As long as the tank pressure has not reached the predetermined valve shutoff pressure, “ON” and “OFF” control of the valves is possible by means manual entry of the required pressure values in HMI system. When the predetermined shutoff pressure value is reached, the valves shut off automatically and maintain set pressure in the tank. If the valves shall pass over to automatic operation, the selector switches must be switched to position 3 (“Automatic”) and the respective valve changed over to “Automatic” operation
28.2 Test operation: When the selector switch is in “TEST” mode position, (position-1) PLC should scan and display the healthiness and functional status of the entire system like A. Condition of all the Valves are ok, B. All manometer and Transducer status found ok, C. power supply status ok, D. internal status of PLC ok etc., E. all set point are ok.

28.3 Automatic operation: during automatic operation (selector switch position-2), the manual commands for the valve operating modules are ineffective. The valves are switches ON & OFF dependent on the pressure set point in PLC controller upon receiving their input signal 0-20 mA from pressure transducer F1 & F2.

Note: after Successful completion of work, the firm should provide test report along with operational manual for reference
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Annexure-V

Terms and conditions:

1.0 Bidder must provide one to one functional conditions of existing system without any deviation, however certain deviation may be allowed if satisfies existing functional Conditions.

2.0 Supplier/bidder shall request to visit the site/laboratory for study and understand the Existing air pressure reducing station before submission of their quotation.

3.0 For detail information supplier may contact JD, HPL generator control room

4.0 The supplier/ bidder must submit their offer along with necessary diagram indicating all the modules and their specifications in detail

5.0 Successful bidder/supplier requested to submit the necessary documents, diagram, circuit design etc. for approval by the competent authority before commencement of actual work.

6.0 Suppliers may submit the necessary technical specification, manual, circuit diagram etc., of each module separately

7.0 Any modification required during installation and commissioning, supplier may be requested do so with prior permission from competent authority without involvement of additional cost

8.0 Bidding will be awarded based on the technical comparative statement

9.0 Bidder will be requested to carry out successful installation, operation, testing, and commissioning of the entire system
10.0  Bidder /supplier are requested to furnish minimum of 2 years work experience in the similar field work.

11.0  Bidders are requested to study the various electrical and mechanical interlocking systems before commencement of work; the lab official may help in identifying in Interlocking system.

12.0  Successful bidder are requested to demonstrate the simulation work with suitable software before commencement of actual work for approval by competent authorities of CPRI

13.0  Bidder should carry out revamping and automation work without disturbing existing control system of the pressure reducing station

14.0  In the event of unsuccessful operation of new PLC based automation system, the supplier should restore back the old connections and ensure that old system must start to work as earlier

15.0  Bidders are requested to provide the provision for existing control system to operate in parallel with new automation system.

16.0  Operation and control of new Air pressure reducing station should be as per the AEG existing manual enclosed in annexure-VI
CENTRAL POWER RESEARCH INSTITUTE, HIGH POWER LABORATORY, BANGALORE

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