




TD-106-1 Rev No. 5	Form No.	<div style="text-align: center;">  <p><b>PRODUCT STANDARD</b> <b>SWITCHGEAR</b> <b>HYDERABAD</b></p> </div>	<b>Product</b> <b>STD NO.</b>	<b>SG 80050</b>
			Rev No    00	
			Page    1    of    17	
<div style="text-align: center;"> <p><b><u>PLC &amp; CONTROL PANEL FOR 1000LPM OXYGEN GENERATOR UNIT</u></b></p> <p><b><u>Material code: SG9780050019</u></b></p> </div> <p><b>1. Technical Specification for Control Panel:</b></p> <p>(i) Control Panel shall be to feed power for continuous operation to 2 no. air compressors &amp; 2 no. vacuum pumps, 1no of auto drain trap, 1 no. solenoid operated vacuum vent valve (VV) and PLC etc as per the scheme.</p> <p>(ii) The PLC circuit diagram shall be as attached in sheet nos. 7 to 16 of this document. In case of any query, party may ask BHEL directly.</p> <p>(iii) There shall be one cabinet for 'PDB- MO2 Conc.'. The Size of one Cabinet can be tentatively taken by party.</p> <p>(iv) Environmental condition: Panel shall be kept in covered shed (open from all sides). The surrounding temperature can reach up to 60°C and relative humidity up to 95%.</p> <p>(v) Degree of Protection shall be IP:65 or better.</p> <p>(vi) The Panel Board shall be Cubicle design, compartmentalized, wall mounted, free standing, Provision for incoming &amp; outgoing cables shall be through cable alley.</p> <p>(vii) Cable Entry shall be from bottom only.</p> <p>(viii) Features of Control Panel: Cabinets shall be manufactured with front &amp; rear doors/ covers of cold rolled (CR) sheet steel of minimum 2.0 mm thickness. Load bearing parts shall be of 2.5mm minimum thickness. Alternately, load bearing part mounted on 7 fold or more profile structure with minimum thickness of 1.5mm is acceptable. Base frame will be made of 3 mm. Anti-vibration rubber sheet mat of minimum thickness 15 mm to be supplied duly mounted between cabinets base frame. The chemical pre-treatment shall be done on ferrous components prior to manufacturing/ painting by 7 tank process. The cabinet shall be powder coated with minimum 75-micron thickness.</p> <p>(ix) Each drive shall give following feedback/ display at control panel for - Motor ON/ OFF/ overloaded/ Control Supply OK as per scheme with suitable lamps/ indicators.</p> <p>(x) Make of items shall be as under:</p> <p>(a) Contactors/ Aux relays AC/ Overload relay: L&amp;T/ Siemens/ Schneider</p> <p>(b) MPCB/ SDF unit/: L&amp;T/ Siemens/ Schneider/ GE.</p> <p>(c) Digital Indicators- Omron, Messibus, reputed.</p> <p>(d) Lamps/ PB: L&amp;T/ Siemens/ Schneider/ GE</p>				
<p><b>Revisions:</b></p> <p><b>Refer to record of revisions:</b></p>		<p><b>Prepared:</b> K. SANGEETHA</p>	<p><b>Approved:</b> RAVI J</p>	<p><b>Date:</b> 24.06.2021</p>

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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.		<p>(e) Ammeter/ CT: AE/ MECO/ standard          (f) MCB: Legrand/ Indo Asian/ GE/ standard/Siemens          (g) Control Transformer: Standard (if required)</p> <p>(xii) All control wiring shall be done by 1.5 mm<sup>2</sup> copper wire for AC module &amp; 2.5mm<sup>2</sup> for CT connection (where applicable). Door earthing shall be done by Green Cu wire 2.5mm<sup>2</sup>. Power wiring shall be done by suitable size Copper cable.</p> <p>All CT's connection for meters shall be through CT's shorting terminals.</p> <p><b>2. Brief Description of the system for which PLC is to be designed:</b></p> <p>The PLC is to be designed for continuous automatic operation of Solenoid operated Valves for Medical Oxygen Concentrator plant. The system comprises of 2 air compressors, 2 vacuum pump motors, starter and control system etc. The condensed water is drained out through a timer operated auto drain valve. Air is then passed through a twin tower. At a time one tower will be in operation &amp; other shall be under purging/ regeneration mode through vacuum pump.</p> <p><u>For the automatic changeover of tower from one to another a suitable sequence in PLC to be provided.</u></p> <p>Total cycle time for adsorption/regeneration is of 2 x 45 to 2 x 90 seconds depending upon type of operating pressure, output pressure and required purities. The unit is selected with a time cycle of 70+70 seconds initially.</p> <p><b>3. Specification for PLC to be designed:</b></p> <p>Technical requirement</p> <p>a) PLC-MO2 Concentrator shall comprise of CPU, PSU, Input- output modules Digital/ Analog), HMI etc for control / operate solenoid valves (11 nos. approx. of rating 230VAC) at schedules time intervals as per the bar chart provided as per Sheet No 6 below &amp; 4 nos. pressure switches meeting system requirement.</p> <p>b) Scope of supply shall include</p> <p>    b.1) Complete PLC for Medical Oxygen concentrator          b.2) Commissioning of PLC at BHEL Hyderabad          b.3) PLC Logics &amp; Pre- Loaded Software          b.4) 1-2 RED/GREEN lamps as on requirement basis.</p>				
		<b>Revisions:</b>  <b>Refer to record of revisions:</b>		<b>Prepared:</b> K. SANGEETHA	<b>Approved:</b> RAVI J	<b>Date:</b> 24.06.2021

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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.		<p>c) PLC shall also include provision of 220/230V AC as per the scheme attached along with this document.</p> <p>d) 415 V, 3-phase AC feeder shall be provided to the Party as per control panel scheme. Party to make suitable arrangement for 230V AC supply for PLC system. Other required voltages shall be derived internally in PLC cabinet by the vendor.</p> <p>e) Environmental condition: PLC shall be kept in covered shed (open from all sides). The surrounding temperature can reach upto 60°C and relative humidity upto 95%. Suitable protection class for PLC to be chosen.</p> <p>f) Vendor can give fresh appropriate size of PLC cabinet subject to BHEL approval.</p> <p>g) Make of PLC shall be Phoenix/ Wago/ Siemens/ ABB/ Fanuc/ Alan Bradley/ Schneider. Any other make shall be subjected to BHEL approval.</p> <p>h) Items like Cabinet, Power supply module, Timers, TB's, relays, bus bars, earthing requirement, indications which are part of PLC and required for completeness of the system to be included by the vendor in the offer.</p> <p>j) The PLC system shall be mounted in DIN Rail in a fabricated cabinet meeting general specifications.</p> <p>k) HMI 7-inch screen.</p> <p>m) Panel size shall be Min 900mmX1200mm.</p> <p><b>4. Datasheet for the PLC (for PVSA timing)</b></p> <table border="0"> <tr> <td>Cycle time</td> <td>- (45 + 45) to (90 + 90) Seconds (Editable).</td> </tr> <tr> <td>Selected initially</td> <td>70 +70 Seconds (As per Sheet No 6)</td> </tr> <tr> <td>Number of inputs/outputs</td> <td>- As required (12 Outputs)</td> </tr> <tr> <td>Input Voltage</td> <td>- 230 V., A.C.</td> </tr> <tr> <td>Operating Temp.</td> <td>- Up to 60Deg. C (Max.)</td> </tr> <tr> <td>Rel. Humidity</td> <td>- 5 to 95%</td> </tr> <tr> <td>Mounting</td> <td>- Wall mounted                      inside panel</td> </tr> <tr> <td>Make</td> <td>- With preface HMI</td> </tr> <tr> <td>Quantity</td> <td>- 1 Set</td> </tr> </table>					Cycle time	- (45 + 45) to (90 + 90) Seconds (Editable).	Selected initially	70 +70 Seconds (As per Sheet No 6)	Number of inputs/outputs	- As required (12 Outputs)	Input Voltage	- 230 V., A.C.	Operating Temp.	- Up to 60Deg. C (Max.)	Rel. Humidity	- 5 to 95%	Mounting	- Wall mounted                      inside panel	Make	- With preface HMI	Quantity	- 1 Set
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<p>Note: This PLC shall be used to operate solenoid valves as per Sequence Chart attached herewith (Sheet No 6).</p> <p><b>5. Control philosophy for PLC.</b></p> <p><b>Sequence of operations:</b></p> <ol style="list-style-type: none"><li>1. Make total power ON from the main Control Panel.</li><li>2. Confirmation of 3Phase incoming Power through lamp indication.</li><li>3. Make Compressor ON at the Compressor control panel which is on Compressor.</li><li>4. Now make the Valves sequence ON using HMI or using Push button provided on the main panel.</li><li>5. Make Vacuum pump ON using Push button on main panel.</li></ol> <p><b>Interlocks during the Valves sequence ON and Vacuum pump ON.</b></p> <ol style="list-style-type: none"><li>1. While starting after total power ON, Valves sequence and Vacuum pump should get ON only if Air receiver tank pressure is above 4.5 bar (may be chosen 6bar) after giving command using push buttons provided on main control panel. If pressure is LOW generate alarm.</li><li>2. Vacuum pump and valves sequence will be in ON condition until Oxygen pressure in oxygen storage tank reaches high pressure i.e 5.5 bar. When oxygen pressure reaches “High set point” both valves sequence and vacuum pump goes OFF. (vendor may chose NO for High set point).</li><li>3. When Oxygen pressure reaches “Low set point” i.e 4.5bar both Valves sequence and vacuum pump gets ON.(vendor may chose NC for Low set point).</li><li>4. Whenever Air receiver tank pressure drops below 4.5bar during running operation, Valves sequence and vacuum pump should get OFF and alarm to be generated.</li><li>5. If OLR of the Vacuum pump gets tripped, then all valves and pump should get OFF and alarm to be generated.</li><li>6. Vent Valve VV01 Should be ON whenever Vacuum pump goes OFF and Vent valve VV01 goes OFF whenever Vacuum pump goes ON. (230V AC, 50W).</li><li>7. Valves sequence should get ON as per the Time cycle diagram given. Alarms to be displayed on HMI and buzzer.</li><li>8. When Oxygen level (From Oxygen analyzer) drops below set value “Oxygen purity is LOW” alarm should be displayed with buzzer sound.</li></ol>							
<p><b>Revisions:</b></p> <p><b>Refer to record of revisions:</b></p>				<p><b>Prepared:</b> K. SANGEETHA</p>		<p><b>Approved:</b> RAVI J</p>	
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<p style="text-align: center;">COPYRIGHT AND CONFIDENTIAL</p> <p style="text-align: center;">The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.</p>		<p>9. All pressure status should be monitored and give corresponding described alarms</p> <ol style="list-style-type: none"> <li>Air receiver tank Pressure low.</li> <li>Vacuum Vessel Pressure Low</li> <li>Surge Vessel Pressure Low</li> <li>OLR of Vacuum pump tripped.</li> </ol> <p><b>Note:</b></p> <p>Any interruption in input electrical power, storage tank reached high point or any internal fault in this case bi directional valve sequence operation may stop in between of time cycle. in order to smooth operation of system PLC shall have the capability to capture the last stop time and restart the cycle from last stop time.</p> <p>All field elements like pressure switches, Oxygen analyser, solenoid valves, Vent valve, Auto drain valve and their filed wiring are in scope of BHEL. Vacuum Pump and compressor are in the scope of BHEL.</p> <p>PLC should be flexible and able to adjust the Time cycle of system.</p> <p><b>6. Quality assurance Inspection and Testing Requirement:</b></p> <ol style="list-style-type: none"> <li>QP to be furnished by manufacturer as per their standard practices.</li> <li>Test report / certificates to be furnished by the manufacturer.</li> <li>COC to be furnished by the manufacturer (for catalogue items)</li> </ol> <p><b>7. Painting, Conservation and Packing:</b></p> <p>Cleaning, painting conservation and packing shall be as per manufacturer standard practices.</p> <p><b>8. Warranty:</b></p> <p>The equipment is provided with warranty against faulty / defective material / workmanship / manufacturing defects for 18 months from the date of dispatch or 12 months from the date of commissioning whichever is earlier.</p> <p><b>9. Documents Required:</b></p> <p>Following documents and drawings shall be furnished by manufacturer:</p> <ul style="list-style-type: none"> <li>• Make and Model and Schematic Arrangement drawing</li> <li>• GA drawings including weight and dimensions.</li> <li>• Technical Datasheet</li> <li>• Bill of Materials</li> <li>• Installation, Operation &amp; Maintenance manual containing QAP, datasheet, test certificates, catalogue, List of spares, etc.</li> </ul> <p><b>10. Wiring diagram/ Line diagram for PLC is s per below sheet nos. 7 to 16.</b></p>				
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90010010952

DRG. NO.

OF

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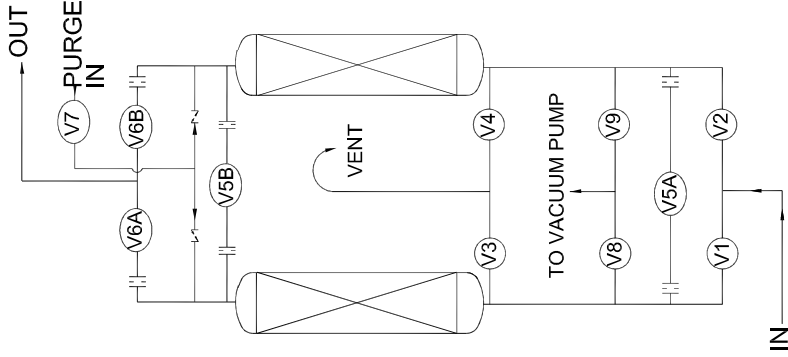
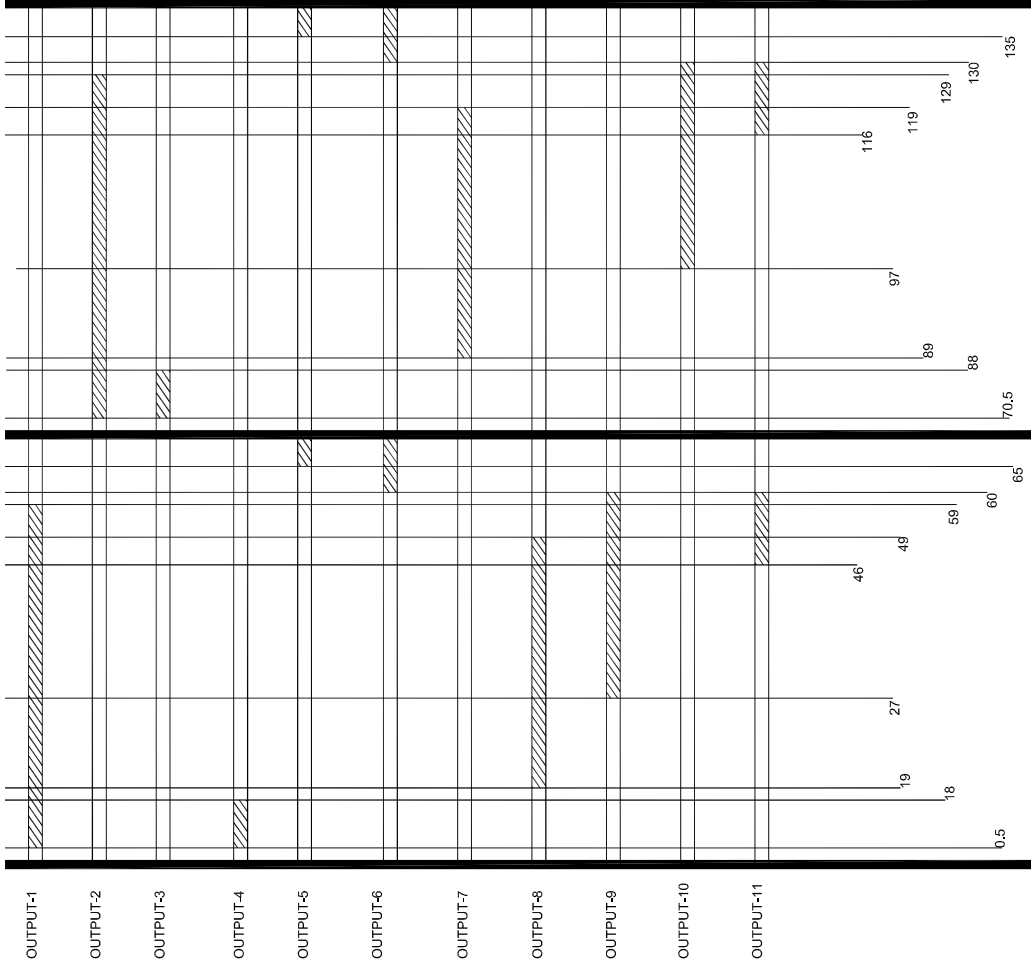
COMPUTER FILE NAME

REF. DRG. NO.

SIGN. AND DATE

INVENTORY NO

GENERAL DIMENSIONAL LIMITS, FITS & TOLERANCES AS PER HY0230261



NOTES :

1. DO NOT SCALE THE DRG. ASK IF IN DOUBT.
2. THE CYCLE SHALL BE REPEATED AFTER EVERY CYCLE TIME COMPLETION
3. IZZI SHOWS VALVES ENERGISED / OPEN
4. OPERATING VOLTAGE SHALL BE 230 VAC.
5. CONTACT RATING SHALL BE 230 VOLTS, 5 AMPS.
6. TOTAL NO. OF OUTPUTS : 11



BHARAT HEAVY ELECTRICALS LTD.  
HYDERABAD

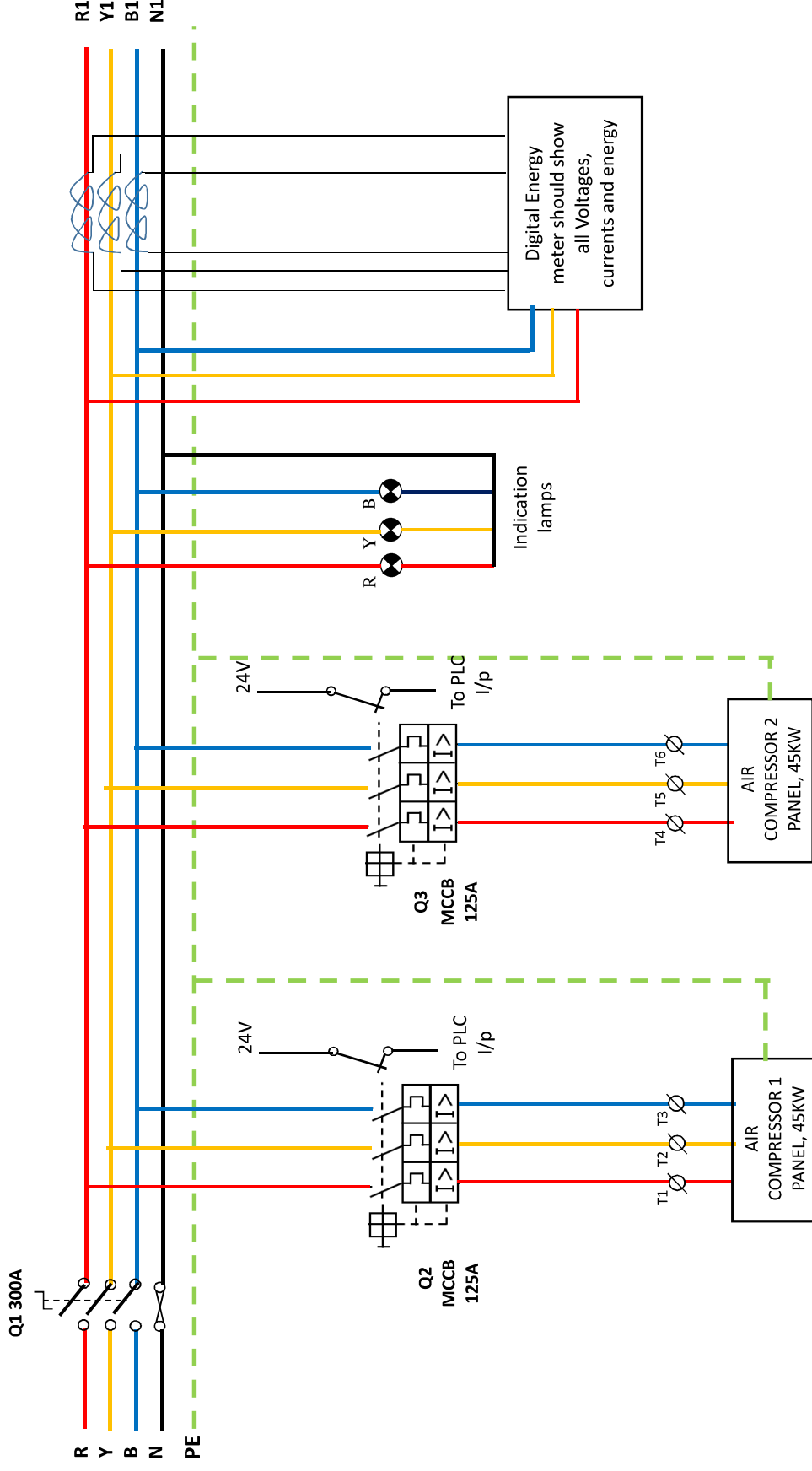
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UNTOOL. DIMS. GR. 450

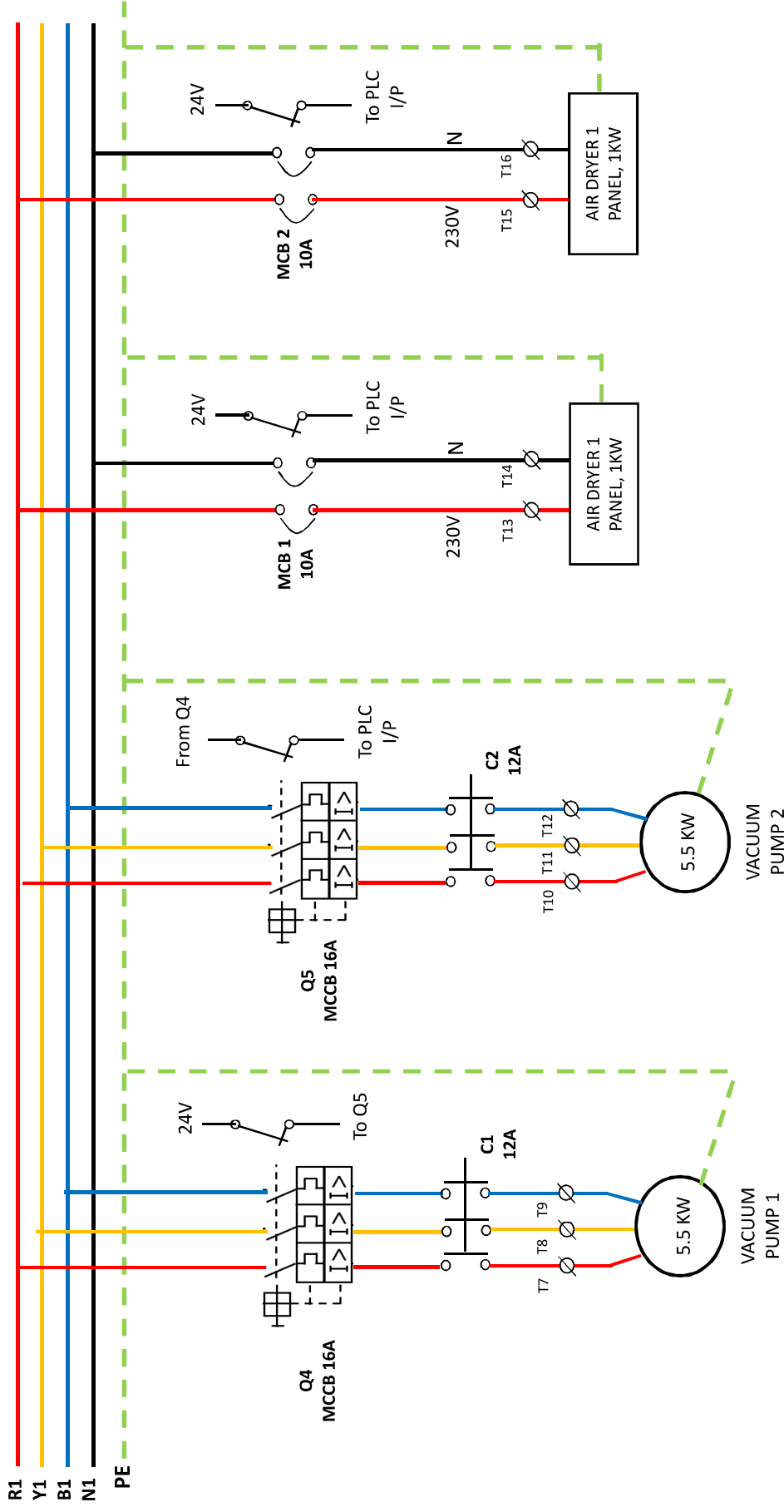


WEIGHT (KG) REF. TO ASSY. DRG. - N.A. -  
SCALE  
TITLE  
TIME SEQUENCING CHART 1000 LPM

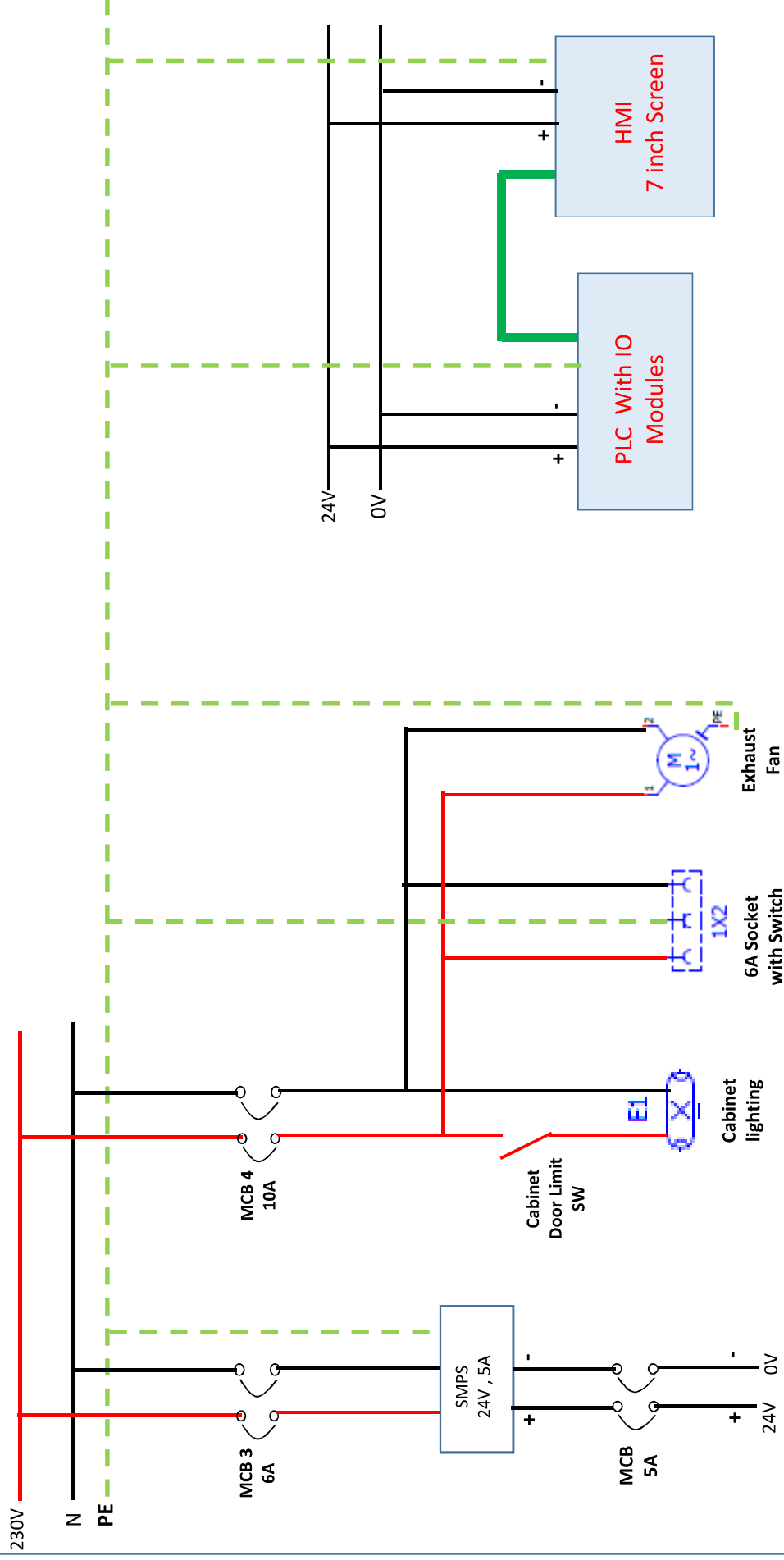
CARD CODE  
CUST DRG NO. 00  
BHEL DRG NO.

REV. 00  
SHT. No 6  
NO. OF SHT. 17





## CONTROL PANEL 1000 LPM MO2 CONCENTRATOR

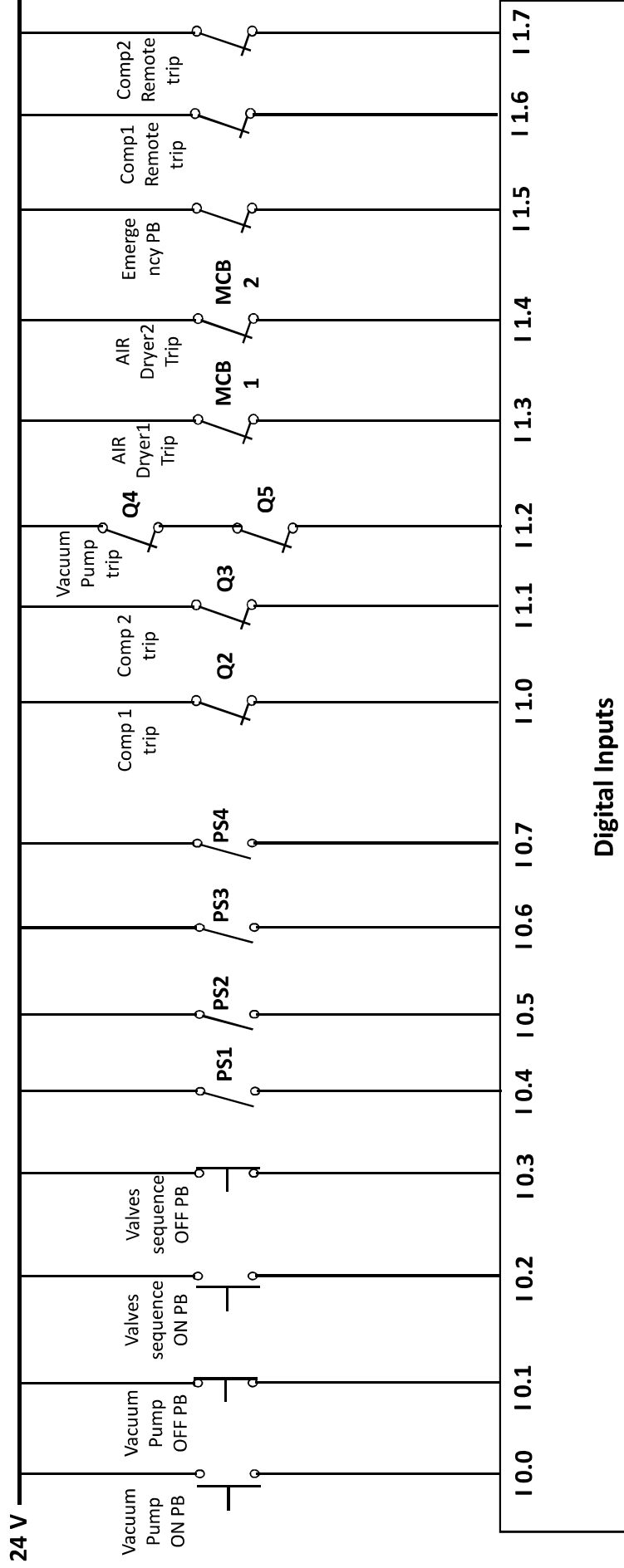


## PLC & HMI Connectivity

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CONTROL PANEL  
1000 LPM MO2 CONCENTRATOR



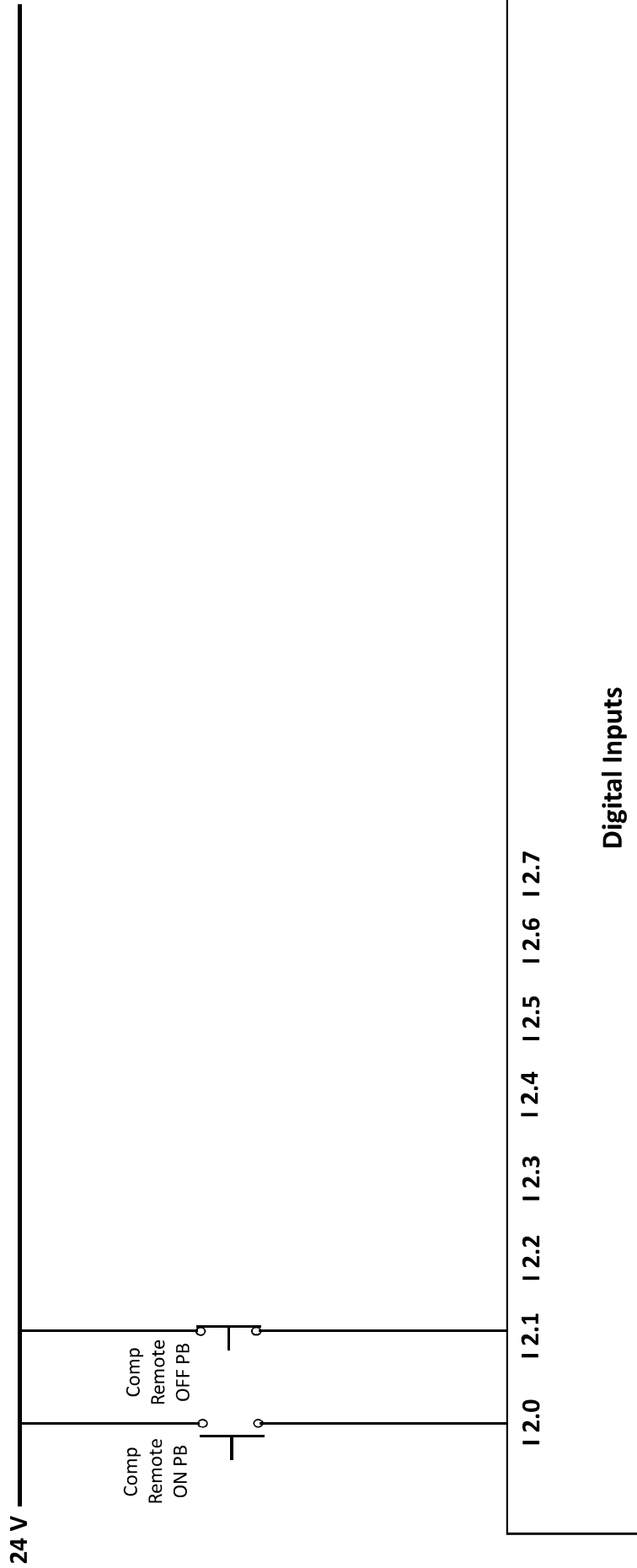
PS1 : Oxygen storage tank Pressure switch.  
 PS2: AIR Receiver tank pressure switch  
 PS3: Vacuum Surge Vessel pressure switch  
 PS4: Buffer vessel Pressure switch

## CONTROL PANEL 1000 LPM MO2 CONCENTRATOR

PLC Digital Inputs and Analog Inputs

BHEL, RC Puram, Hyderabad



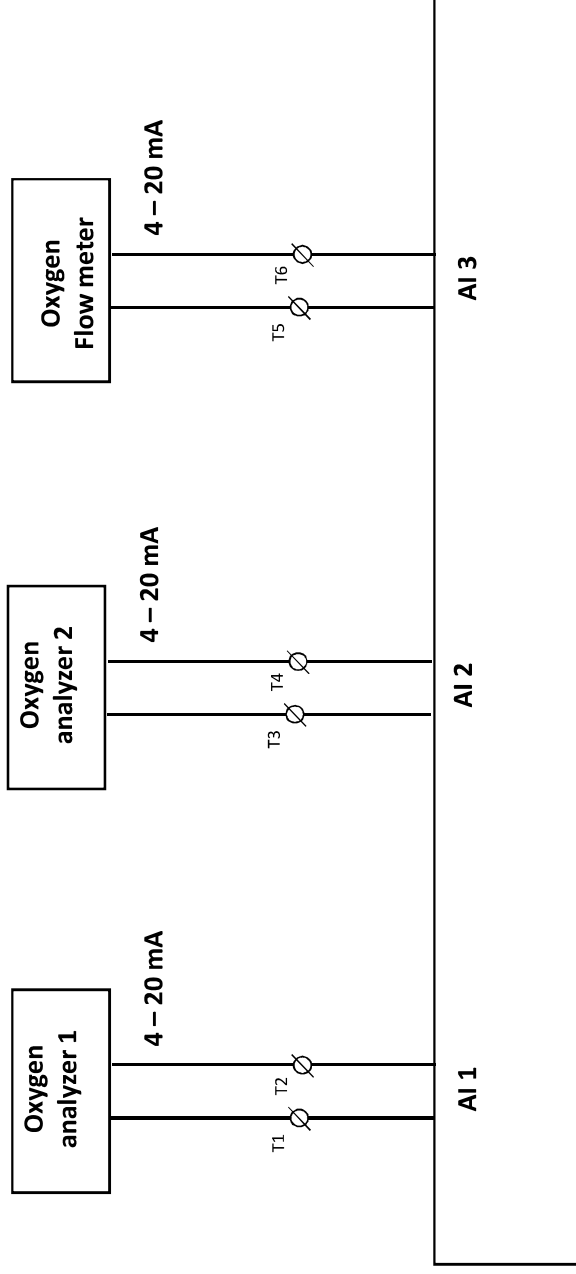


# CONTROL PANEL 1000 LPM MO2 CONCENTRATOR

PLC Digital Inputs and Analog Inputs

BHEL, RC Puram, Hyderabad





Analog Input module

CONTROL PANEL  
1000 LPM MO2 CONCENTRATOR

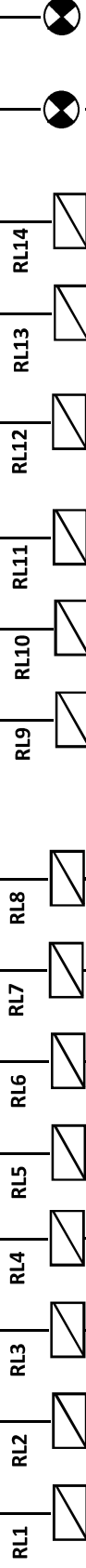
PLC Digital Inputs and Analog Inputs



BHEL, RC Puram, Hyderabad

# Digital Outputs

Q 0.0    Q 0.1    Q 0.2    Q 0.3    Q 0.4    Q 0.5    Q 0.6    Q 0.7    Q 1.0    Q 1.1    Q 1.2    Q 1.3    Q 1.4    Q 1.5    Q 1.6    Q 1.7



0 V

Valves

VAC pumps ON  
VW01 Vent Valve  
Hooter  
VAC Pump Trip  
Comp 1 Trip  
Indication Lamp

PLC Digital Outputs

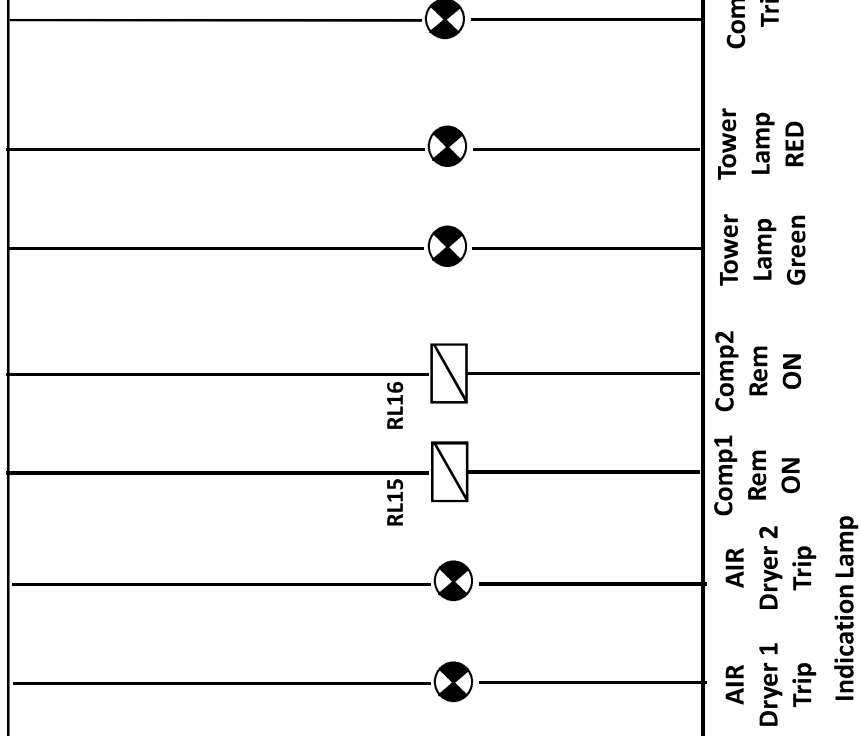
CONTROL PANEL  
1000 LPM MO2 CONCENTRATOR



BHEL, RC Puram, Hyderabad

## Digital Outputs

Q 1.0   Q 1.1   Q 1.2   Q 1.3   Q 1.4   Q 1.5   Q 1.6   Q 1.7



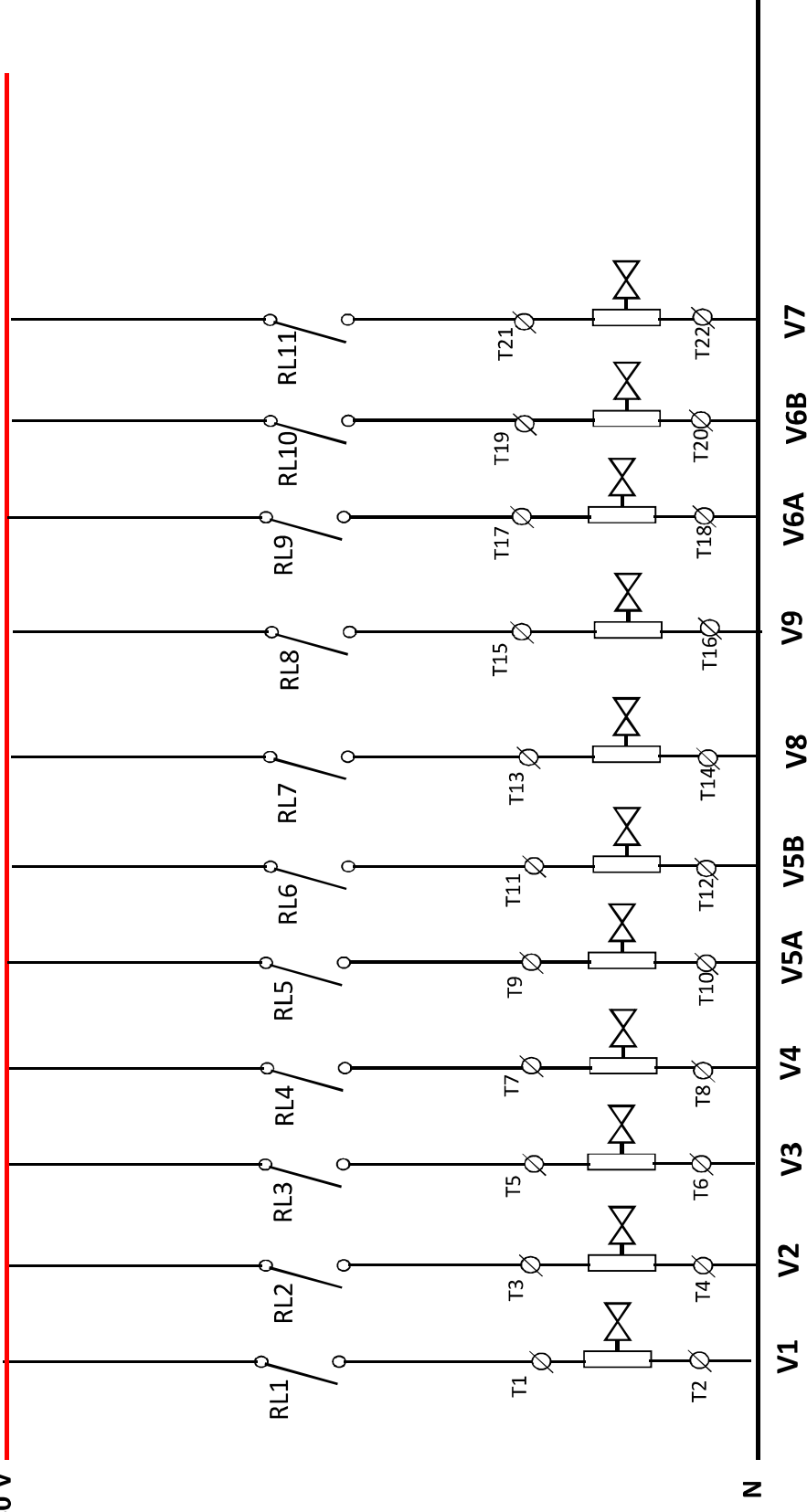
PLC Digital Outputs

CONTROL PANEL  
1000 LPM MO2 CONCENTRATOR



BHEL, RC Puram, Hyderabad

230 V

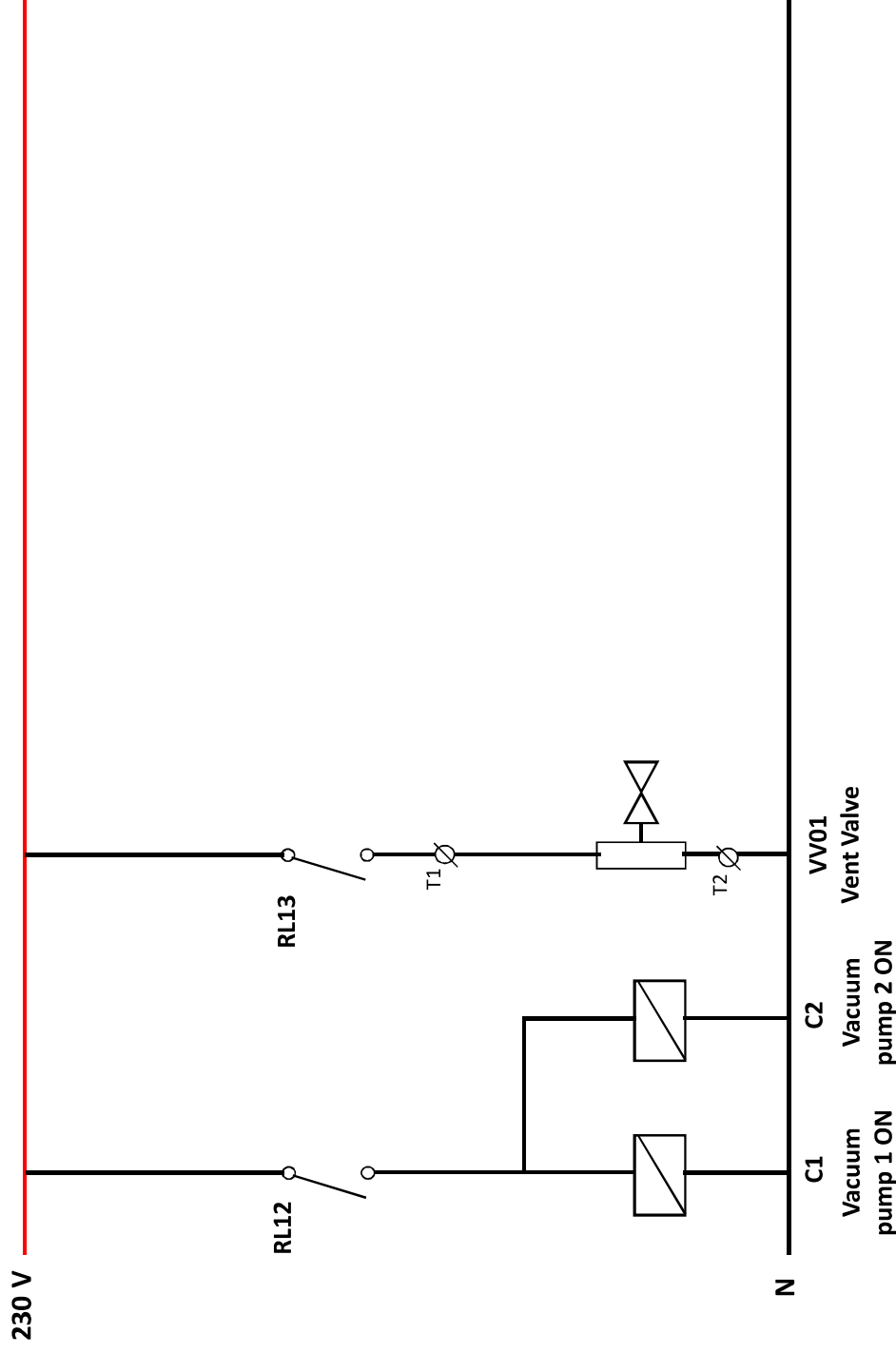


Valves Power circuit

## CONTROL PANEL 1000 LPM MO2 CONCENTRATOR



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# CONTROL PANEL 1000 LPM MO2 CONCENTRATOR

Control circuit

BHEL, RC Puram, Hyderabad





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## RECORD OF REVISIONS

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