DATA ACQUISITION & CONTROL SYSTEM

- **FEATURES:** Operated in Local / Remote and Auto / manual mode
- **PLC:** Siemens S7-300 series PLC based operation
- **PROGRAMMABLE:** Sequential and operational interlocks
- **INTERFACE:** Ethernet, PROFIBUS, OPC
- **SOFTWARE:** WINCC V7.0 SP3, RT 128
- **INTERLOCKS:** Hardwired, 10 -20 ms
- **CHANNELS:** AI (20)/ AO (14) & DI (48) /D0 (32)
- **DATA SERVER:** Storage, Analysis
- **TRENDS:** Online and Offline analysis of various signals

GUI of DACS

PRESENT STATUS

- The HPHT -WCS was successfully commissioned and integrated with HHFTF.
- The HPHT -WCS was validated performance wise as per design specifications.
- The control logic implemented was successfully tested at various operating parameters.
- Presently the system has been integrated with target handling facility of HHFTF and testing of plasma facing components is ongoing.

CONTACT

**Website:** www.ipr.res.in/httd/index.html
**Ph-No:** +91-79-2396 4420
**Fax.No:** +91-79-2396 2277
**E-mail id:** technology@ipr.res.in

HIGH PRESSURE HIGH TEMPERATURE WATER CIRCULATION SYSTEM

High Temperature Technologies Division

Institute for Plasma Research
Bhat, Gandhinagar, Gujarat, India-382428
www.ipr.res.in
**OBJECTIVE**
- To test water cooled test mock-ups / components at ITER parameters
- To operate at various process parameters
- To achieve and maintain the pressure and temperature anticipated during testing of divertor components at various heat fluxes
- To validate the various cooling configurations like smooth tube, swirl tube, hypervaportron used for the divertor components
- To investigate the consequences of Critical Heat Flux (CHF) at various operating conditions

**PROCESS & INSTRUMENTATION DIAGRAM**

**OPERATING PROCEDURE**

- **PRESSURIZING PROCESS**
  - Nitrogen gas pressurization
  - Pressure & Level achieved
  - Control: PRO-NI, PD pump

- **CIRCULATION PROCESS**
  - Booster pump (BP-1, 2)
  - Flow & Pressure achieved
  - Control: VFD, CV-1, PCV-1

- **HEATING PROCESS**
  - Heaters (HB-1, 2, 3)
  - Temperature achieved
  - Control: Contacto & Thyristor

- **MOCK-UP TEST PROCESS**
  - Control: Isolation valves

- **COOLING PROCESS**
  - Heat exchanger
  - Set temperature achieved

**TECHNICAL SPECIFICATIONS**

<table>
<thead>
<tr>
<th>S.No</th>
<th>COMPONENT</th>
<th>SPECIFICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Reservoir</td>
<td>Capacity: 2 m³, MOC: SS 316</td>
</tr>
<tr>
<td>2</td>
<td>PD pump</td>
<td>Type: Reciprocating piston pump, Flow: 55 LPM, Working pressure: 70 bar</td>
</tr>
<tr>
<td>3</td>
<td>Pressure vessel</td>
<td>Capacity: 2.3 m³, MOC: SS 316, Design pressure: 70 bar, Design temperature: 200°C</td>
</tr>
<tr>
<td>4</td>
<td>Nitrogen gas</td>
<td>No. of cylinders: 5 Nos., Flow: 25 Nm³/hr, cylinder max pressure of 140 bar, operating pressure: 60 bar</td>
</tr>
<tr>
<td>5</td>
<td>Booster pump</td>
<td>Type: End suction single stage centrifugal pump, suction pressure: 70 bar max., discharge pressure: 80 bar max., flow rate: 157 LPM (min) and 300 LPM (max), Temperature: 200°C, motor 18.5 kW, 2900 RPM, MOC: SS 316 &amp; Duplex steel, Make: Sulzer</td>
</tr>
<tr>
<td>7</td>
<td>Heat exchanger</td>
<td>Type: shell and tube, Heat load 210 kW, operating pressure at tube side 70 bar max., shell side of 5 bar max., operating temperature at tube side 160°C max, MOC: SS 316</td>
</tr>
<tr>
<td>8</td>
<td>Cooling tower</td>
<td>Induced draft round type, Capacity: 125 TR, Delta T-I/L &amp; O/L - 5°C, (38°C/33°C), motor: 2.2 kW with 1440 RPM</td>
</tr>
<tr>
<td>9</td>
<td>Cooling tower pump</td>
<td>End suction back pullout type, Flow rate: 1000 LPM, head: 52.9 meters</td>
</tr>
<tr>
<td>10</td>
<td>Valves</td>
<td>Type: Manual (Ball &amp; Globe), Control (electro pneumatic), Safety (Relief)</td>
</tr>
<tr>
<td>11</td>
<td>Pipe</td>
<td>MOC: SS 316 L, Line size: 2 inch, SCH:80S</td>
</tr>
<tr>
<td>12</td>
<td>Instrumentation</td>
<td>Level, pressure, temperature and flow transmitters, Make: Forbes Marshall</td>
</tr>
<tr>
<td>13</td>
<td>Insulation</td>
<td>Material: Perlite (Pipe sections and components), LRB Rockwell (Valves and Flanges), thickness: 50 mm</td>
</tr>
</tbody>
</table>

**PARAMETERS**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Operating</th>
<th>Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature at test mock-up, °C</td>
<td>30 to 160</td>
<td>200</td>
</tr>
<tr>
<td>Coolant pressure (Water), MPa</td>
<td>0.5 to 6</td>
<td>7</td>
</tr>
<tr>
<td>Coolant flow rate (Water), LPM</td>
<td>50 to 300</td>
<td>300</td>
</tr>
</tbody>
</table>

**HPHT-WCS ASSEMBLY**