Circulating Pumps for Radiant Syngas Cooling (RSC) System

IGCC Plant Operates HTI Pumps for Critical Cooling Application

Commissioned in 2013, the Integrated Gasification Combined Cycle (IGCC) facility at Edwardsport, Indiana is one of the cleanest and most efficient coal-based power plants in the world. At 618 MWe, it is also one of the largest plants of its kind in the world.

The IGCC process is an advanced technology that converts coal to a synthesis gas (syngas) and removes pollutants from the syngas before it is combusted in a gas turbine to produce electricity. The gas cleaning units that remove the pollutants operate at much lower temperatures, and therefore the syngas needs to be cooled. As a function of the Radiant Syngas Cooler (RSC) system, hot syngas exiting the gasifier at temperatures up to 2,900 F (1,600 C) is passed through a radiant syngas cooling vessel to lower the gas temperature. The heat is also recovered. Inside the vessel, high pressure (~1,650 psi) steam is generated from circulating cooling water as the hot syngas transfers heat across a ring of tubes connected together in a configuration called a waterwall. The steam generated is then sent to a heat recovery steam generator (HRSG) system and is used to power steam turbines for additional electricity production and improving the overall plant efficiency.

Featuring high operating temperatures and pressures, the RSC system is one of the most critical and highly-loaded components of the IGCC, and the RSC circulating pump is a crucial part of that system. Hayward Tyler’s high-performing circulating pumps were selected for this demanding application. Based on Hayward Tyler’s long-proven boiler circulating pump, the RSC vertical, wet stator circulating pumps supplied by Hayward Tyler, Inc. have operated reliably since the commissioning of the Edwardsport IGCC.

**Project Summary**

**SITE / LOCATION:**
Edwardsport, IN, USA
Integrated Gasification Combined Cycle (IGCC) Plant

**SOLUTION AND FEATURES:**
- Sealless, Vertical, Single Stage Centrifugal Pump with Wet Stator Unit (WSU)
- No seals, no oil-lubricated bearings
- “Hot neck” casing design limits the transfer of heat from the pump to the motor
- XLPE insulated and PVC protected motor stator windings for high protection
- Designed for serviceability with a stator assembly that is easily removed for maintenance

**BASIC DESIGN DETAILS**
- Rated Flow: 16,577 gpm
- Design Pressure: 3,303 psi
- Design Temp: 653° F
- Rated Power: 550 hp
- Power Supply: 4160 V / 60 Hz / 3 ph

**Designed in accordance with ASME B & PV VIII DIV 1**
**Designed and manufactured in Colchester, VT, USA**
**Project Data Sheet**

<table>
<thead>
<tr>
<th>Name</th>
<th>Edwardsport, IN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product</td>
<td>Radiant Syngas Cooler (RSC) Circulating Pumps</td>
</tr>
<tr>
<td>Quantity</td>
<td>Four (4)</td>
</tr>
</tbody>
</table>

**Codes and Standards**

- **Design**: ASME B & PV VIII DIV 1
- **Pump Test Standard**: Hydraulic Institute Standards
- **Flange Standard**: ANSI B16.5
- **Materials Standard**: ASME / ASTM
- **Welding Standard**: ASME B & PV IX
- **Electrical Standard**: IEEE 252 / NEMA MG1

**Pump Details**

- **Pump Type**: Centrifugal, Single Suction, Single Discharge
- **Pump Size**: 24 x 24 x 20
- **Fluid Pumped**: Demineralized Water

<table>
<thead>
<tr>
<th>Measure</th>
<th>Imperial</th>
<th>Metric</th>
</tr>
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<tbody>
<tr>
<td>Rated Flow</td>
<td>16,577 gpm</td>
<td>3,765 m³/hr</td>
</tr>
<tr>
<td>Rated Differential Head</td>
<td>40.83 ft</td>
<td>12.45 m</td>
</tr>
<tr>
<td>Specific Gravity (at Oper. Temp)</td>
<td>.6228</td>
<td>.6228</td>
</tr>
<tr>
<td>Design Pressure</td>
<td>2250 psig</td>
<td>155 bar(g)</td>
</tr>
<tr>
<td>Design Temperature</td>
<td>653° F</td>
<td>345° C</td>
</tr>
<tr>
<td>Hydrostatic Test Pressure</td>
<td>3303 psig</td>
<td>228 bar(g)</td>
</tr>
</tbody>
</table>

**Motor Details**

- **Motor Rating**: 550 Hp (410 kW)
- **Service Factor**: 1.15
- **RPM**: 1750
- **Power Supply**: 4160 V / 3 ph / 60 Hz
- **Motor Full Load Current**: 78.2 Amps

**Heat Exchanger Details**

- **Design Code**: ASME VIII, Division 1
- **Cooling Water Flow**: 22 gpm
- **Cooling Water Temperature (max)**: 100° F
- **Weights (Approximate Wet)**

<table>
<thead>
<tr>
<th>Component</th>
<th>Pounds (lbs.)</th>
<th>Kilograms (kg)</th>
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</thead>
<tbody>
<tr>
<td>Pump Casing</td>
<td>11,436</td>
<td>5,187</td>
</tr>
<tr>
<td>Motor Casing</td>
<td>16,808</td>
<td>7,624</td>
</tr>
<tr>
<td>Rotating Assembly</td>
<td>638</td>
<td>289</td>
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<tr>
<td>Bolting &amp; Residuals</td>
<td>1,527</td>
<td>693</td>
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<tr>
<td>Heat Exchanger Assembly</td>
<td>558</td>
<td>253</td>
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<tr>
<td>Total</td>
<td>30,967</td>
<td>14,046</td>
</tr>
</tbody>
</table>

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