

Solaris for Cellulosic Pretreatment

Direct Steam Injection Heater Handles Wide Variety of Biomass Feedstocks

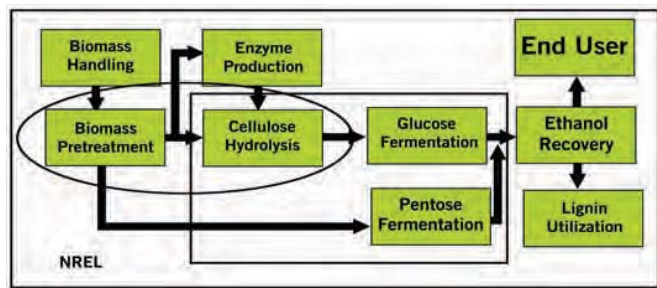
Solaris® Direct Steam Injection (DSI) Hydroheaters play a key role in biochemical pretreatment processes. Solaris sufficiently hydrolyzes and opens up the structure of lignin-based biomass feedstocks to allow efficient and effective enzyme hydrolysis of the hemicellulosic sugars.

These demanding pretreatment methods typically involve a wide range of difficult process conditions - medium consistency feedstocks, high temperature rises, rapid heat transfer, high pressures and low pH.



Solaris heats virtually any biomass

- » Plant and crop residue
- » Whole stillage
- » Pulp and paper mill residue
- » Fruit residue
- » Wastewater sludge
- » Food and beverage waste
- » Wood residues



Typical biochemical pretreatment process

Solaris is Ideal for Medium Consistency Feedstocks

The straight-through patented design of the Solaris is ideal for thick slurries and high fiber content common to a wide variety of biomass feedstocks. Solaris utilizes internally modulated high velocity steam which eliminates clogging and plugging.

Depending on the pretreatment process, Solaris can be designed and constructed around specific process conditions, such as high temperature, low pH and high pressures, while maintaining its key advantages:

- » No plugging or stock build-up
- » Large temperature rise
- » Near-instantaneous heat transfer
- » Precise temperature control
- » Process stability

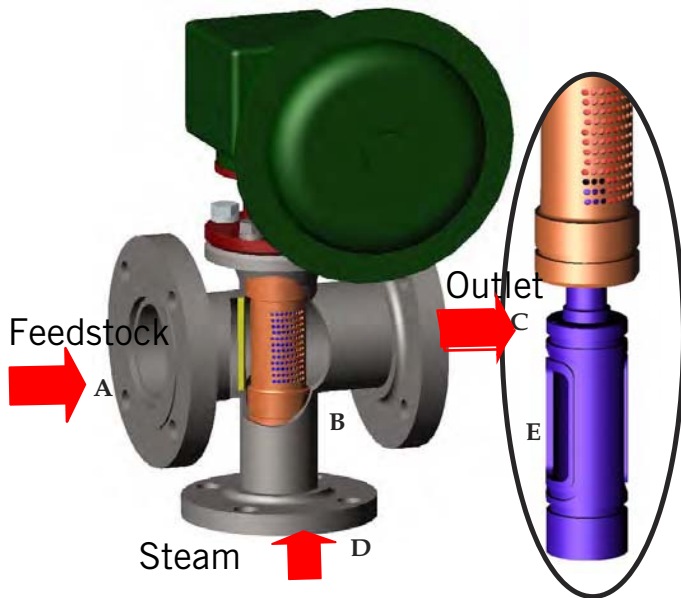
From pilot lab research projects to full-scale commercial plant operations, there is a full range of Solaris models for all cellulosic ethanol applications.



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Solaris Product Description and Specifications

How the Solaris Works



Biomass feedstock enters the heater (A), flows past the diverter and steam diffuser (B), and is discharged at the outlet (C). Full pressure steam enters at inlet (D) and travels up through the steam plug (E). Rotation of the stem plug controls steam flow.

To achieve precise temperature control, steam is metered into the stock at sonic or near-sonic velocity by exposing a multitude of small diffuser holes. Steam pressure and velocity remain constant throughout the rate of operation

The steam instantly mixes with the stock for uniform heating. The turbulent and high velocity steam discharge prevents fibers from clogging the diffuser holes.

About Hydro-Thermal Corporation

The leader in DSI for over 70 years, Hydro-Thermal has a strong legacy in first generation biofuels, with Jetcooker heaters in over 125 ethanol plants worldwide. This knowledge has been successfully leveraged to second generation biofuels. Let Hydro-Thermal apply this expertise to your cellulosic process.

Standard Product and Specifications

- » Body material: Stainless steel 316L
- » Internal wetted parts: Stainless steel 316L or similar
- » Connections: ANSI Class 150, ANSI Class 300, or PN 10/16
- » Standard Actuator: Fisher diaphragm actuator with integral positioner
- » Pressure rating: 150 and 300 psig at 450°F (10.3 and 20.7 bar at 232°C)
- » Size range: 3" to 18" diameter
- » Viscosity Range: 1 to 40,000 cP
- » Solids Concentration: .5% to 12% typical (higher depending on feedstock)

Compliances

- » Designed to ASME B31.1
- » CE/PED and CRN available upon request

100% Performance Warranty

If, at any time and for any reason, a Hydroheater should fail to perform as designed,* and Hydro-Thermal is given adequate opportunity to provide a remedy, Hydro-Thermal will, after receipt of the unsatisfactory unit, reimburse 100 percent of the original purchase price.

*Proper replacement of wear parts required



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