

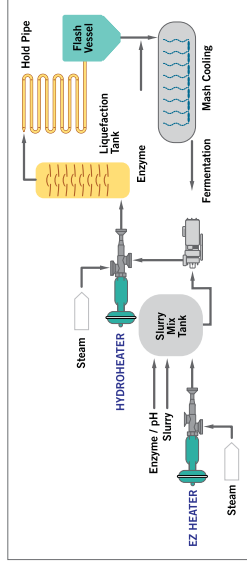
The Leader in Engineered Liquid Heating Solutions.

# Improve Starch Conversion and Biofuels Yield with Direct Steam Injection



**hydro**   
**THERMAL**®

WE BRING THE HEAT.



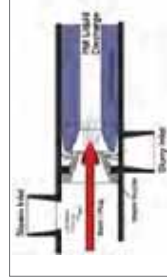
Improved Liquefaction with Hydroheater Direct Steam Injection



Improved shear and starch conversion with K500 Series Hydroheater with K5 Autopilot



Effective cookout of starch minimizes costly enzyme dosages



Realize maximum ethanol yield with optimal combining tube position

Effective starch conversion with the Hydroheater  
 The Hydroheater® is the industry standard with a proven track record in a variety of ethanol processing plant designs. Over six billion gallons of ethanol are produced each year, in over 100 plants worldwide, using Hydro-Thermal's proprietary Direct Steam Injection (DSI) Hydroheater.

The Hydroheater, also referred to as the Jetcooker™, is used in the enzymatic liquefaction of dry grind and wet milled grain to effectively and uniformly cook-out pre-gelatinized starch molecules via mechanical shear and precise temperature control. The resulting near-instantaneous hydrolyzation maximizes the amount of fermentable sugars during hydro-enzymatic liquefaction.

Maximized yield with K5 Autopilot  
 Installed on the Hydroheater, the K5 Autopilot® automatically adjusts the combining tube position for the ideal product flow path and maintains an ideal pressure drop to compensate for varying process conditions (raw material changes, grind size, flow rates and temperatures). The K5 Autopilot minimizes operator intervention, either on the shop floor or by manual inputs via the DCS.

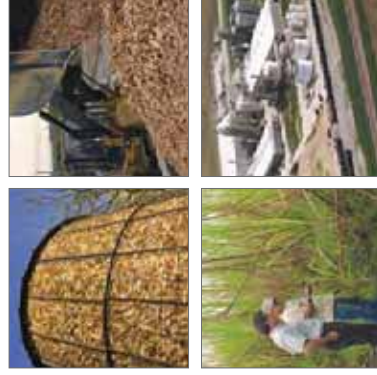
This automatic combining tube adjustment translates to:

- » Optimized sheer of the starch molecules resulting in higher sugar yields
- » Reduced enzyme dosages
- » Maximized ethanol output for a given amount of corn grind

This means significant increases in ethanol yield, which flow directly to significant bottom line profits, valued at hundreds of thousands of dollars, for plant ownership. The return on investment for the K5 Autopilot can be measured in months.

The Hydroheater is used to make biofuels from biomass sources such as:

- » Grains (wheat, rye, barley, sorghum, tapioca, millet, buckwheat)
- » Crops (corn, maize, sorghum, cassava, sweet potato, soybean)
- » Plant, crop, fruit residues (corn stover, small grains such as wheat and straw, perennial grasses such as switchgrass and miscanthus, citrus pulp and peels)
- » Whole stillage (either wet-cake/distillers grain or thin stillage)
- » Wastewater processing "sludge" and residues
- » Pulp and paper mill residues, trees, hardwood chips and forest resources
- » Animal manures, food and feed processing by-products and residues (including slaughtering and rendering waste)
- » Wood residues such as pallets, packaging materials, construction debris
- » Food and beverage waste such as brewer's waste and cheese whey permeate



Photos courtesy of DGE/ANIEL

Cellulosic ethanol processes use Solaris Direct Steam Injection Hydroheater Biofuels technology, which converts cellulosic feedstocks to fuel, requires processes that can handle heavy stock at high temperatures. Hydro-Thermal's Solaris® Hydroheater has the capability to heat crop and forest residues such as corn stover, switchgrass, citrus pulp and peels, and forest products.



Solaris is ideal for many cellulosic heating applications

The heavy stock is no problem for the Solaris and its straight-through design. The Solaris is available in high pressure ratings, with a variety of corrosion-resistant materials to meet demanding applications.



Heat water on demand with the EZ Heater

Heat water on demand  
 The EZ Heater® Direct Steam Injection exceeds industrial hot water needs with near 100 percent energy efficiency. It installs easily and quickly provides improved liquefaction with Hydroheater Direct Steam Injections. Which provides unlimited hot water to exacting temperatures (±½ F / 0.25°C) when and where it's needed. Use for:

- » Mash slurry tank pre-heating
- » Clean-in-Place (CIP)
- » Washdown stations
- » Anywhere hot water is needed



#### Hydro-Thermal Solutions Center and R&D

Hydro-Thermal is a leader in the biofuels industry, and is active in many research projects with partners on the edge of breakthroughs in biofuels technology. Our heaters are installed in pilot laboratories, including those at leading universities and governmental research facilities specializing in biofuels research and development.

In addition, we maintain a research and development lab in our plant to test how our product works in cutting-edge processes.



#### 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



The leader in Direct Steam Injection for over 70 years.



Founded in Milwaukee, WI, Hydro-Thermal Corporation entered the biofuels market with a line of innovative Direct Steam Injection

heaters designed specifically for the starch liquefaction process. Direct Steam Injection solutions from Hydro-Thermal have significantly improved the starch conversion process in ethanol plants.

Today, other Hydroheaters have been found to be very useful in biofuels plants. Using the capabilities of the Solaris Hydroheater to handle heavy stocks, DSI is being used for cellulosic ethanol production.

When hot water is in demand, the EZ Heater is called into use for mash tank pre-heating, processes CIP and hose stations.

To learn more contact  
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Hydro-Thermal Direct Steam Injection heaters are the industry standard for biofuels production.

*Unleashing the Energy of Biofuels™*