Drain Water Heat Recovery for Dishwashers

Cost Effective Energy Saving Opportunities for Commercial Kitchens in Retrofit and New Construction

BY: Gerald Van Decker, P.Eng., M.A.Sc.
Founded in 2000 by Gerald Van Decker
Gerald has worked in research, government, utilities and manufacturing
10 years of history and experience in developing Drain Water Heat Recovery Technologies & Markets
Manufacturer and developer of the Power-Pipe® technologies
Drain Water Heat Recovery (DWHR) is the process of using Outgoing warm to hot drain water to HEAT Incoming cold fresh water
All Mainstream DWHR Technologies are “Falling Film Heat Exchangers”

Rely on a simple principle caused by Surface Tension: as liquid falls down a vertical pipe, it clings to the inner surface rather than go down the middle.

It falls quickly in a thin film.

The heat energy in the drain water readily transfers to the wall of the pipe and then flows through the walls to heat the fresh water.

The Heat Exchangers MUST be vertical for this to happen.

Non-fouling and maintenance free in most applications.
Units must be “double wall, vented” to be allowed for use with drinking water.

Pressure loss imposed on water supply must be minimized (e.g. less than 2psi at 2.5gpm).

Efficient design:
- “True Counter-Flow” is required
- Excellent contact between tube & pipe

Long service life

No maintenance (the case for copper units)

Minimize copper content without sacrificing quality
Drain Water
Heat Recovery for Dishwashers
Why Falling Film Heat Exchangers for Dishwashers?

- Do not “foul up” easily or at all
- Continuous high heat recovery efficiency
- No maintenance in several applications, however maintenance required is a drain pump is needed
- Double-wall vented design is simple and cost effective
- Standard, industry accepted copper materials are used
## System Configurations for Falling Film

**Drain Water Heat Recovery for Dishwashers**

<table>
<thead>
<tr>
<th>Washer Type (and total flow)</th>
<th>Slab on Grade</th>
<th>Vertical Fall &gt;2ft., &lt;8ft</th>
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<th>DWHR Units</th>
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<tbody>
<tr>
<td>Batch</td>
<td>Drain water storage and pump to long single-pipe unit / Fresh water to primary water heater or direct to booster water heater</td>
<td>Falling drain water to unit / water in recirc loop prior to primary water heater</td>
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<td>Single- or Multi-Pipe</td>
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## Simplified Application Classifications and DWHR Configurations

### System Configurations for Falling Film Drain Water Heat Recovery for Dishwashers

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Save up to 70% on water heating
For both Batch and Continuous Dishwashers
Various ways to connect the fresh water
Shown Here: Recirculation loops prior to primary water heater with variable speed pumps
DWHR with falling drain flow (cont.)
Multi-pipe DWHR Unit recovering heat from a dishwasher
Save up to 70% on water heating

For Conveyor Dishwashers (continuous flow)

Various ways to connect the fresh water

Shown Here:
Fresh water preheat to primary water heater
Save up to 60% on water heating
For Batch Dishwashers
Various ways to connect the fresh water
Shown Here:
Fresh water preheat to primary water heater
Discussion and Conclusions

- DWHR can and is being used to recover heat from dishwasher drain water
- Falling film heat exchangers are the preferred type because of inherent maintenance- and fouling-free operation
- This is cost-effective in kitchens with moderate to heavy use
- There are a variety of ways to install falling film heat exchangers
- Field research and case studies of existing and new installations would assist in the development of this market
Other Applications
Single Residential Installation
• Hundreds of installations as early as 2003
• Preheat Cold Water to Washrooms only
• Serving thousands of apartments suites for many years now
• This is with a central water heater, there are other design options
• Very easy to incorporate into the design of a new building but can be retrofit if drains are exposed
• Used to reduce the overall primary water heater size
• Typically 25–35% Return on Investment
RECREATION FACILITIES

- Payback is typically 1-3 years
- Usually require manifolded systems to deal with higher flow rates
  - This is required for efficiency and lower pressure low
- Prefer to gravity-feed the units
- Photo from a college in Quebec
Certain applications require pumping
- Sometimes flow sensors and pump controllers are used to ensure a balance between drain water and freshwater

The higher energy savings justify the additional cost
EXAMPLE: BATCH LAUNDRY

- Design needs to create “counter-flow”
- Either the drain-water or the freshwater will need to be pumped
- Many ways to design the system
- Scalable for small to large laundry facilities
- Save as much as 65% on water heating
The Power-Pipe™ has great potential in the following industries:
- Pulp and Paper
- Food Processing
- Meat Packing
- Brewing
- Dairy production
- Baking
- Parts washing
- Textiles
- Automotive

Anywhere an energy efficiency study shows thermal energy can be saved

Energy can be recovered from:
- Waste water heat recovery
- Recovery wasted cooling energy
- Heating of oil, grease or other thick fluids
- Heating using steam
- Coated units can handle hostile environments
- Pressurized and non-pressurized systems
- Large or small flows

Paybacks of 4 months to 3 years
The Power-Pipe® Unilever system provides:

- 90% measured Return on Investment
- Zero Maintenance Operation for over 5 years
- Increased hot water capacity, eliminating need for additional water heaters when expansion. Peak thermal power performance is above 300 kW
- Increased life to primary water heater due to reduced “thermal shock” because inlet temperature is much warmer with large washing operations
- Savings of 130 Tonnes CO$_2$ per year
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We can provide technical consultation, design assistance and drawings

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