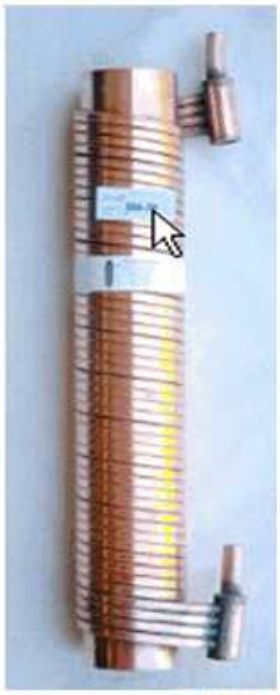
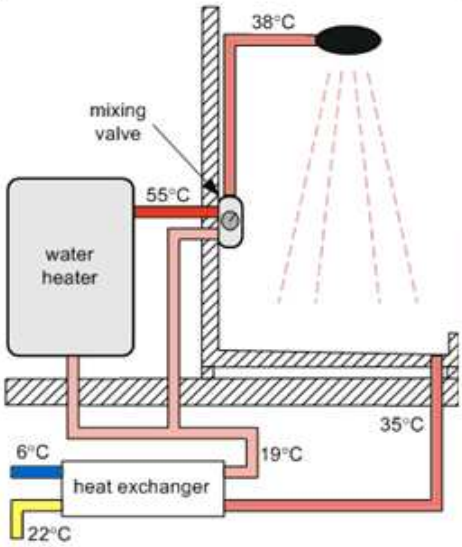
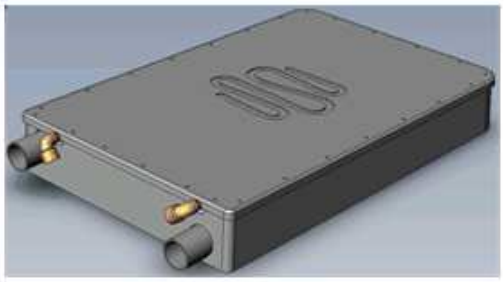
Shower Heat Recovery

Overview of Commercially Available DWHR Systems







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Meander Heat Recovery
April 2011
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www.meanderhr.com

MEANDER HEAT RECOVERY

Document revision history

Document revision	Date	Author	Comments
1.0	7-Apr 2011	Arthur Kimmels	Initial version for publication

Table of contents

1 Introduction to DWHR

Drain Water Heat Recovery or DWHR is the use of a heat exchanger to recover some of the heat from the drain water from activities such as dish-washing, clothes washing and especially showering. This is also referred to as water heat recycling, grey water heat recovery, or sometimes shower water heat recovery.

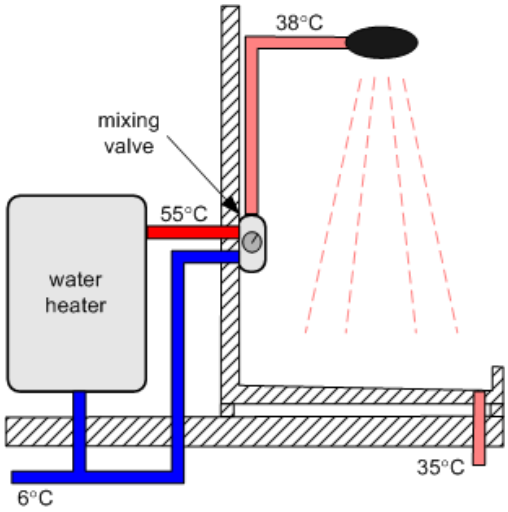


Figure 1-1: Shower setup, no DWHR installed, with example temperatures

It is important to note that it is not the drain water itself that is re-used, only the heat that it carries is partially recovered. All DWHR systems work by preheating the incoming cold water using the heat contained in the drain water.

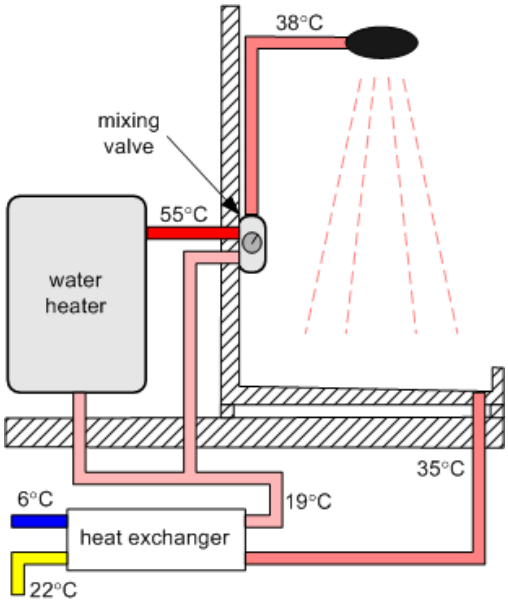


Figure 1-2: Shower setup, DWHR installed, with example temperatures

For the remainder of this discussion, we will focus on the application of DWHR in combination with a shower, since this is most common and also gives the best opportunity for energy savings in a domestic setting. Also, because of the simultaneous flow of drain water from the shower and cold water from the utility, a larger variety of DWHR systems can be implemented without the need of storing the drain water.
DWHR makes a lot of sense, considering that domestic drain water still carries a lot of energy: water that is used in the shower has a temperature of 38-40°C (100-104°F) and enters the drain at 35-37°C (95-99°F). This means that approximately 90% of the energy that has been used by the water heater to warm up this water is wasted.

In the following sections, we will present the types of domestic DWHR systems that are available and how they can be installed.
The temperatures given in the accompanying figures for cold, hot and preheated water are meant as typical examples only. Cold water temperature varies with local conditions and time of year, hot water temperature depends on the settings and performance of the water heater. The preheated water temperature depends the effectiveness of the DWHR system itself, the shower flow, cold water temperature and installation details.

2 DWHR Categories

The DWHR systems commercially available for domestic use can be divided into the following four groups:

2.1 Vertical systems

The vertical system typically consists of a large diameter copper pipe through which the drain water flows. The water clings to the copper surface as a thin film, which allows good heat transfer into the copper. The cold water to be preheated flows in a smaller diameter copper pipe which is wrapped around the drain pipe. Alternatively, the cold water flows in a thin area between the drain pipe and a pipe with a slightly larger diameter fixed around it. This is also called pipe in pipe heat exchanger.

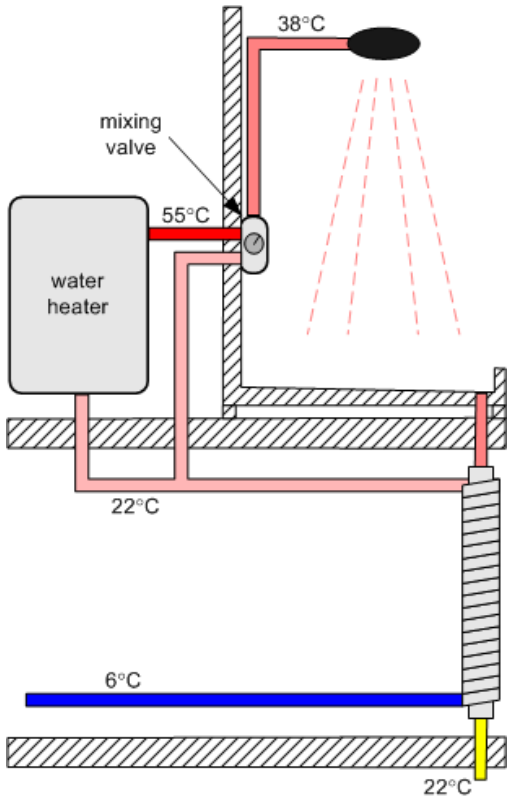


Figure 2-1: Vertical (tubular) DWHR system

Vertical systems are available in various lengths up to ca 2 meters (6 ft). They need to be installed below the shower, although some horizontal displacement is allowed. Due to the height they are often installed in the basement. Of all types of DWHR, the vertical units are the most effective and the most common. This type is produced by a number of manufacturers, both in USA, Canada as well as in Europe.

2.2 Shower platform with integrated heat exchanger

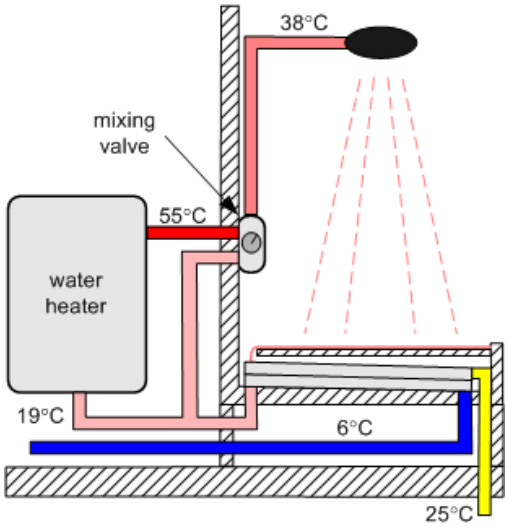


Figure 2-2: Shower platform with integrated DWHR

The second type of DWHR system, shower platform with integrated heat exchanger, is not as common. They can be used whenever the vertical DWHR is not possible to install. They are typically more expensive and not as effective as the vertical systems.

2.3 Horizontal systems for installation under the shower

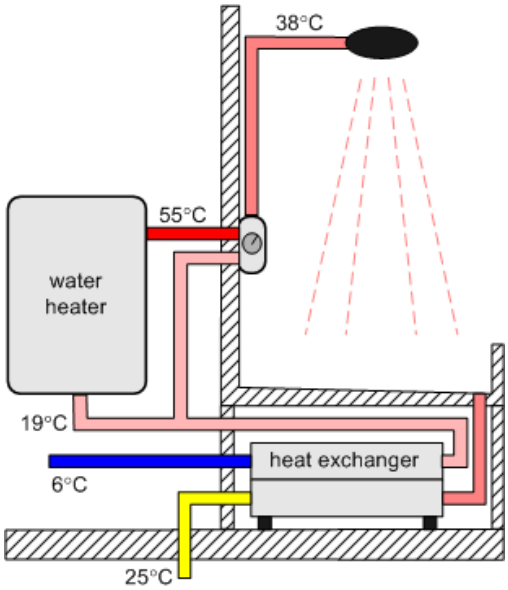


Figure 2-3: Horizontal DWHR system

Horizontal units that can be placed close by or under a shower rely on easy access to drain and cold water, but then provide very easy installation. They are most suited as add-ons for shower cabinets and are presently not so common.

2.4 Tank based systems

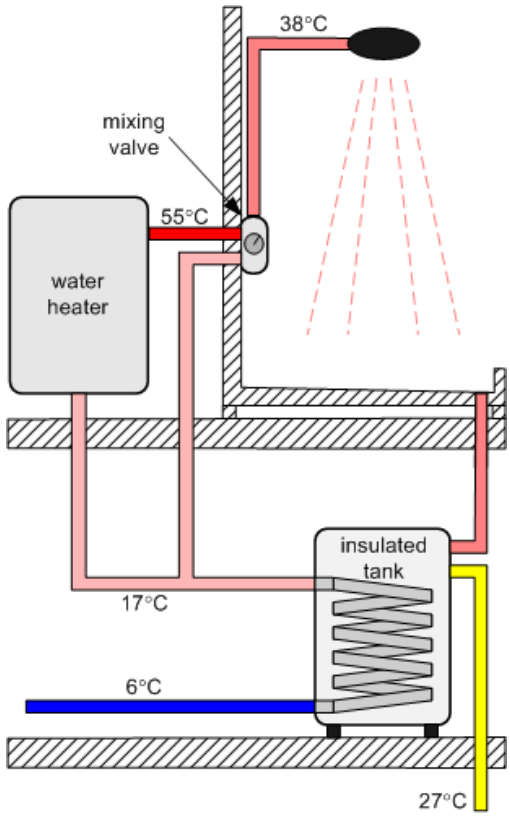


Figure 2-4: Tank based DWHR system

The fourth type of DWHR uses an insulated tank where the drain water is stored temporarily, and through which the cold water is guided in a heat exchanger. This allows heat recovery also from other household appliances as clothes washer, and dish washer because it doesn't depend on water draining at the same time as cold water being used.

3 Installation Standards

There are three ways of installing a DWHR system, depending on how the preheated cold water is used.

3.1 Balanced Flow

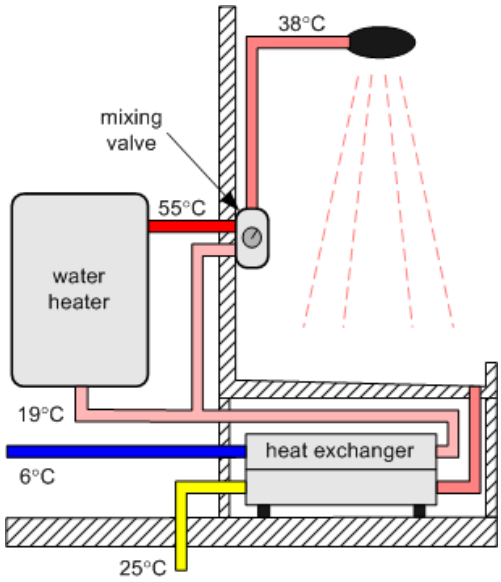


Figure 3-1: Balanced flow DWHR installation

The preheated water can be plumbed into both the mixing valve of the shower and into the cold water supply of the water heater. In this case the flow of the drain water is equal to the flow of the cold water through the DWHR system. This is called a balanced-flow setup and gives the best performance in terms of energy savings. It also requires most plumbing and installation effort and cost.

3.2 Water heater only

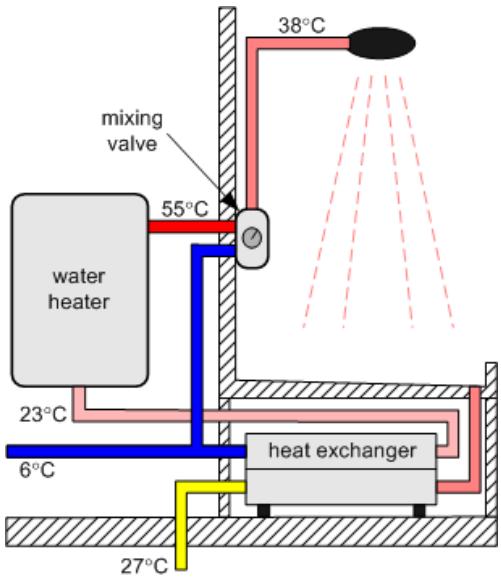


Figure 3-2: Water heater only DWHR installation

In the second installation option, the preheated water is fed into the cold water supply of the water heater only. The energy savings are due to the preheated water requiring less energy to get up to the temperature setting of the water heater. The flow is unbalanced, because the cold water flow is smaller than the drain water flow, and this reduces the performance of the DWHR to some extent as compared to a balanced flow setup. (The temperature of the preheated cold water could actually be higher but due to its lower flow the total power transferred is less as compared to the balanced flow setup.)

3.3 Shower only

Feeding the preheated water into the mixing valve of the shower only allows the simplest installation: only shower drain and cold water input to the shower mixing valve need to be diverted locally. For this case, the flow is also unbalanced (cold water flow is 30-60% of drain flow, depending cold and hot water temperatures), which again reduces DWHR performance somewhat (15% is reported for a particular DWHR unit)

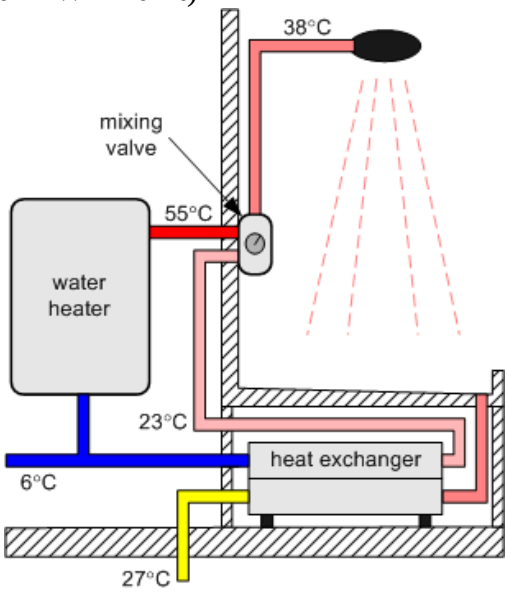


Figure 3-3: Shower mixing valve only DWHR installation

For a retro-fit into an existing building, the preferred installation option depends on the relative position of the water heater as compared to the shower, any available space under the shower, ease of access to existing plumbing etc., and should be considered for each case. A new-built house obviously gives much greater freedom in designing in an optimal DWHR system layout.
In principle, all four types of DWHR systems could be used in the install options given above, but typically the shower floor with integrated heat exchanger and the ‘under shower’ horizontal unit are most suited for a local install in the shower and a feed only into the mixing valve. On the other hand, the vertical and tank based systems are typically placed in a separate room (basement, floor under the shower, technical room) where a more extensive install into both water heater and shower mixing valve is a viable option.

4 Test standards

4.1 Definitions

4.1.1 Efficiency

The efficiency ε of a DWHR is the ratio of the actual heat transferred to the maximum heat that could possibly be transferred from one stream to the other, as calculated from the temperature differences (see e.g. reference [1]). For a balanced flow this amounts to the following expression:

$$\varepsilon = (T_{COLD\_OUT} - T_{COLD\_IN}) / (T_{DRAIN\_IN} - T_{COLD\_IN})$$

T_{COLD_OUT}: temperature of the preheated cold water coming out of the DWHR unit
T_{COLD_IN}: temperature of the cold water entering the DWHR unit
T_{DRAIN_IN}: temperature of the drain water entering the DWHR unit

Typical values are:

$T_{COLD\_OUT} = 20°C$
$T_{COLD\_IN} = 6°C$
$T_{DRAIN\_IN} = 36°C$

$$\Rightarrow \varepsilon = (20 - 6) / (36 - 6) = 47\%.$$

4.1.2 Power

In some cases, the DWHR power is given in the product datasheet. Power can also be calculated given the flow rate and temperature increase of the cold water:

$$P = (FR/60) \cdot c_p \cdot (T_{COLD\_OUT} - T_{COLD\_IN})$$

P: Power transfer in heat exchanger (Watt)
FR: Flow rate of cold water through heat exchanger (litres per minute)
c_p: Specific heat capacity of water (4.2kJ/kg·.K)

For the balanced flow setup, the temperature increase of the cold water should equal the temperature decrease of the drain water (energy balance), assuming negligible heat is lost to the surroundings of the heat exchanger.

4.2 Europe

For Europe, the NEN5128 A1:2009 norm published 1-May 2009 (correction letter 26-Jun 2009 from TNO) prescribes performance testing for DWHR systems for shower. The test is based on a shower cabinet with no occupant, 40°C shower water temperature, 10°C cold water temperature and two flow settings, respectively 9.2l/min and 12.5l/min. The flow is balanced meaning that the cold water flow equals the drain water flow (equivalent to an installation scheme feeding both shower valve and water heater).
In the test certificate, the efficiency of the unit is reported as well as the pressure loss across the cold water connections at the given flows.

4.3 Canada and USA

A standard proposed at the Natural Resources Canada institute (NRCan) for vertical, 3” and 4” DWHR units prescribes the following test conditions (reference [2]):

- Equal flow, 9.5 l/min (2.5 GPM) for reporting
- Additional testing at ca. 4, 8, 11 and 14 l/min
- Inlet water temperature difference (drain inlet – cold inlet) of 28°C (typical cold water inlet at 8°C and drain water inlet at 36°C)
- Measurement at steady state
- Energy balance checking at 5% limit for measurement to be valid.
- Pressure drop measurement

This standard seems to have been used for the Canadian units that are eligible for government subsidy (3rd party testing required), other units have been tested under different conditions (e.g. 8.6 l/min for the GFX units, temperature difference of 30°C for the EcoInnovation unit, non- equal flow for the Watercycles HX 3030 model). Any change of the test conditions will impact DWHR effectiveness and makes comparisons between units hard.

5 Overview of Available Systems

5.1 Disclaimer

The overview in the following sections is based on information available on the websites of the manufacturers and/or suppliers and was gathered in March and April 2011. Technical specifications, prices and availability can change in time. The overview can be used to obtain an impression of the available systems, but the suppliers should always be contacted for most up to date information on a particular system.
The information in the tables is compiled with great care but may contain errors. No guarantee is given for completeness of the overview. In fact, if the reader knows of any more manufacturers of shower DWHR systems, we would very much appreciate to obtain this information.
No rights can be derived from this overview.

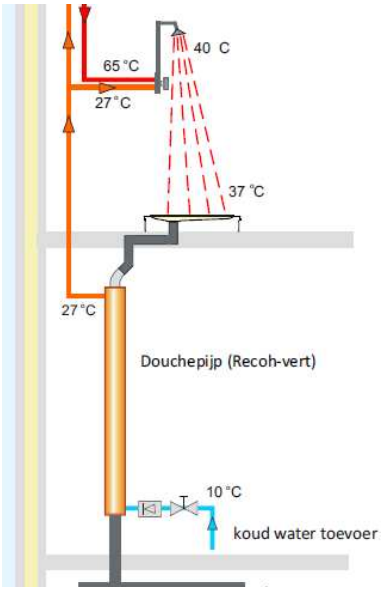
5.2 Hei-tech B.V., The Netherlands

5.2.1 Recoh-vert V3

Product name:
Recoh-vert V3

DWHR category:
Vertical (pipe-in-pipe)

Manufacturer:
Hei-tech B.V.
Phileas Foggstraat 145
7825 AW Emmen
The Netherlands
Tel. +31 (0) 591-553562
info@hei-tech.nl
www.hei-tech.nl



Performance:

Efficiency:	65.4% at 9.2l/min 62.2% at 12.5l/min
Pressure loss:	0.37 bar at 9.2l/min 0.62 bar at 12.5l/min
Performance test norm:	NEN 5128 A1:2009
Third party testing:	Yes, KIWA, the Netherlands, April 2010
Dimensions:	length: 210 cm (83”) diameter: ca. 7 cm (2.8”)
Double wall HE:	Yes
Price:	€600 - €800 UK: £575 (ref. 1worldsolar.co.uk)
Produced since:	Unknown
Number of units produced:	6000 units / year (2010
Availability:	Netherlands, Denmark, UK, Sweden, Ireland, Germany, Belgium, France, Greece

Connections:

Drain	∅50mm (ca. 2”)
Fresh water	**½”**

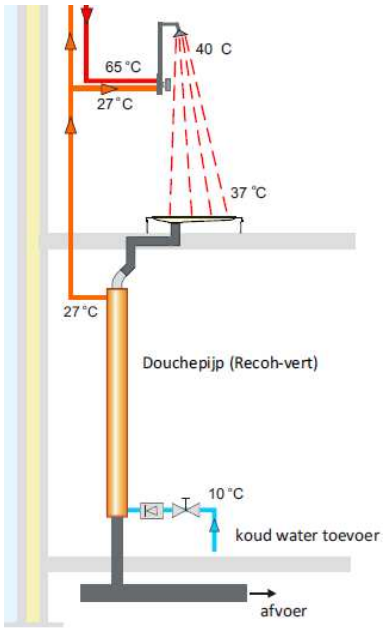
Comments:
Installation instruction prescribes min. 248.5cm (98”) height necessary. Shorter units also available (RV16-V3 and RV12-V3, see following pages). Drain water from shower routed through so-called ‘rotator’ to swing drain water against side of drain tube. Excellent documentation and installation instructions, very professional. Pipe-in-pipe design, both pipes in copper.

5.2.2 Recoh-vert RV16-V3

Product name:
Recoh-vert RV16-V3

DWHR category:
Vertical (pipe-in-pipe)

Manufacturer:
Hei-tech B.V.
Phileas Foggstraat 145
7825 AW Emmen
The Netherlands
Tel. +31 (0) 591-553562
info@hei-tech.nl
www.hei-tech.nl



Performance:

Efficiency:	55.8% at 9.2l/min 52.8% at 12.5l/min
Pressure loss:	0.40 bar at 9.2l/min 0.65 bar at 12.5l/min
Performance test norm:	NEN 5128 A1:2009
Third party testing:	Yes, KIWA, the Netherlands, Jan 2011
Dimensions:	length: 168 cm (66”) diameter: ca. 7 cm (2.8”)
Double wall HE:	Yes
Price:	Unknown
Produced since:	Jan 2011
Number of units produced:	Unknown
Availability:	Netherlands, Denmark, UK, Sweden, Ireland, Germany, Belgium, France, Greece

Connections:

Drain	∅50mm (ca. 2”)
Fresh water	**½”**

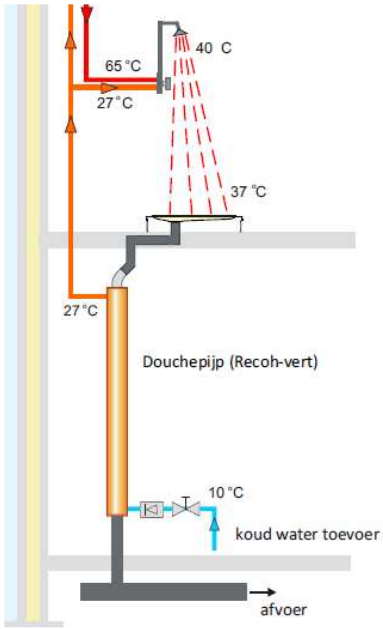
Comments:
Installation instruction prescribes min. 206.5cm (81”) height necessary. Drain water from shower routed through so-called ‘rotator’ to swing drain water against side of drain tube. Excellent documentation and installation instructions, very professional. Pipe-in-pipe design, both pipes in copper.

5.2.3 Recoh-vert RV12-V3

Product name:
Recoh-vert RV12-V3

DWHR category:
Vertical (pipe-in-pipe)

Manufacturer:
Hei-tech B.V.
Phileas Foggstraat 145
7825 AW Emmen
The Netherlands
Tel. +31 (0) 591-553562
info@hei-tech.nl
www.hei-tech.nl



Performance:

Efficiency:	46.9% at 9.2l/min 43.6% at 12.5l/min
Pressure loss:	0.24 bar at 9.2l/min 0.40 bar at 12.5l/min
Performance test norm:	NEN 5128 A1:2009
Third party testing:	Yes, KIWA, the Netherlands, Jan 2011
Dimensions:	length: 127 cm (50”) diameter: ca. 7 cm (2.8”)
Double wall HE:	Yes
Price:	Unknown
Produced since:	Jan 2011
Number of units produced:	Unknown
Availability:	Netherlands, Denmark, UK, Sweden, Ireland, Germany, Belgium, France, Greece

Connections:

Drain	∅50mm (ca. 2”)
Fresh water	**½”**

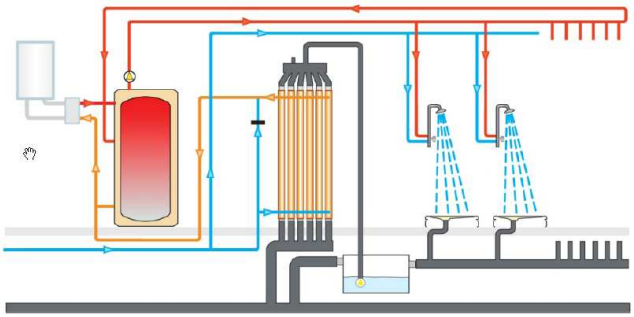
Comments:
Installation instruction prescribes min. 165.5cm (65”) height necessary. Drain water from shower routed through so-called ‘rotator’ to swing drain water against side of drain tube. Excellent documentation and installation instructions, very professional. Pipe-in-pipe design, both pipes in copper.

5.2.4 Recoh-multivert

Product name:
Recoh-multivert

DWHR category:
Vertical (pipe-in-pipe, 4,6 or 8 in parallel)

Manufacturer:
Hei-tech B.V.
Phileas Foggstraat 145
7825 AW Emmen
The Netherlands
Tel. +31 (0) 591-553562
info@hei-tech.nl
www.hei-tech.nl



Performance:

Efficiency:	30-60% savings on shower water heating claimed
Pressure loss:	
Performance test norm:	Unknown
Third party testing:	Unknown
Dimensions:	Depending configuration
Double wall HE:	Yes
Price:	Unknown
Produced since:	Unknown
Number of units produced:	Unknown
Availability:	Netherlands, Denmark, UK, Sweden, Ireland, Germany, Belgium, France, Greece

Connections:

Drain	Unknown
Fresh water	Unknown

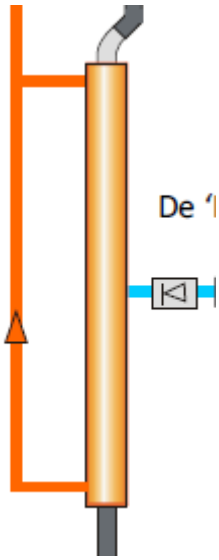
Comments:
For swimming pools, hotels, sporting halls etc. with many showers. Option to pump the drain water if showers and DWHR unit are on the same floor. Units available with 4 6 or 8 parallel pipes.

5.2.5 Recoh-vert, centre

Product name:
Recoh-vert (centre connection)

DWHR category:
Vertical (pipe-in-pipe)

Manufacturer:
Hei-tech B.V.
Phileas Foggstraat 145
7825 AW Emmen
The Netherlands
Tel. +31 (0) 591-553562
info@hei-tech.nl
www.hei-tech.nl



Performance:

Efficiency:	Unknown
Pressure loss:	0.1bar at 12.5l/min 0.25 bar at 30l/min
Performance test norm:	Unknown
Third party testing:	Unknown
Dimensions:	length: 210 cm (83”) diameter: ca. 7 cm (2.8”)
Double wall HE:	Yes
Price:	Unknown
Produced since:	Unknown
Number of units produced:	Unknown
Availability:	Netherlands, Denmark, UK, Sweden, Ireland, Germany, Belgium, France, Greece

Connections:

Drain	75mm
Fresh water	¾”

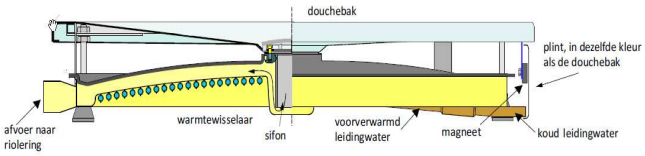
Comments:
For shower with high flow (up til 24l/min). Cold water connection at centre of heat exchanger, cold water flowing both up and down (parallel connection for lower pressure loss). Lower efficiency than standard recoh_vert, but no data found. For flow >24l/min, 2 of these can be coupled in parallel, ev. with a bypass in the drain.

5.2.6 Recoh-tray RT2

Product name:
Recoh-tray RT2

DWHR category:
Shower tray with integrated heat exchanger

Manufacturer:
Hei-tech B.V.
Phileas Foggstraat 145
7825 AW Emmen
The Netherlands
Tel. +31 (0) 591-553562
info@hei-tech.nl
www.hei-tech.nl



Performance:

Efficiency:	39.6% at 9.2l/min 34.2% at 12.5l/min
Pressure loss:	0.38 bar at 9.2l/min 0.60 bar at 12.5l/min
Performance test norm:	NEN 5128 A1:2009
Third party testing:	Yes, KIWA, the Netherlands, Jun 2010
Dimensions:	length: 90cm (35.4”) width: 90cm (35.4”) height: 3.5cm (1.4”)
Double wall HE:	Yes
Price:	UK: £725 (ref. 1worldsolar.co.uk)
Produced since:	Unknown
Number of units produced:	Unknown
Availability:	Netherlands, Denmark, UK, Sweden, Ireland, Germany, Belgium, France, Greece

Connections:

Drain	50mm (ca. 2”)
Fresh water	15mm (1/2”)

Comments:
Patented system where the drain water flows over a dish, the cold water tubing is fixed under the dish in a spiral. Dish surface can be cleaned using a special brush. Can be integrated in a shower cabinet, but also built into the floor (see pictures)

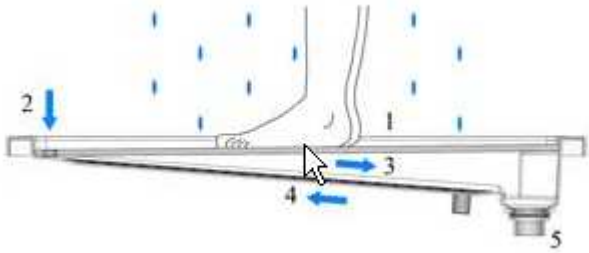
5.3 Bries Energietechniek / Dutch Solar Systems (DSS), The Netherlands

5.3.1 Douchebak WTW ver. 2

Product name:
Douchebak WTW ver. 2

DWHR category:
Shower tray with integrated heat exchanger

Manufacturer:
BRIES Energietechniek
Grasbroek 7
9301 WC Roden
The Netherlands
Tel.: 050-5012373
info@bries.nl
www.bries.nl



Performance:

Efficiency:	44% at 9.2l/min 40.7% at 12.5l/min
Pressure loss:	Unknown
Performance test norm:	NEN 5128 A1:2009
Third party testing:	Yes, KIWA, the Netherlands, Apr 2010
Dimensions:	length: 90cm width: 90cm height: 12cm (21cm with sifon)
Double wall HE:	No
Price:	ca. €990 (ref. www.dutchsolarsystems.com) (with installation set)
Produced since:	2010
Number of units produced:	Unknown
Availability:	NL, through Dutch Solar Systems (www.dutchsolarsystems.com)

Connections:

Drain	50mm
Fresh water	15mm

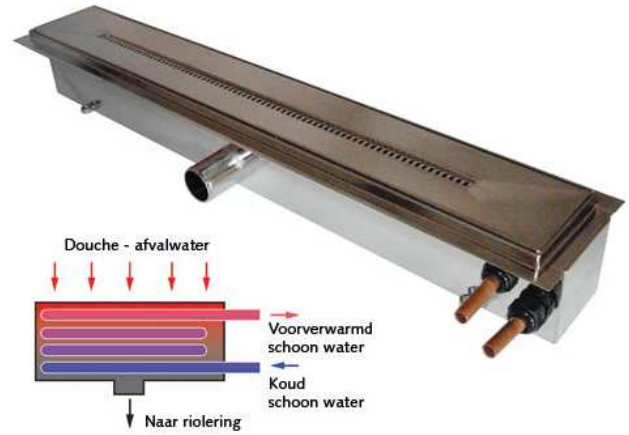
Comments:
This is the second generation of douchebak wtw. The first version used a RVS pipe as heat exchanger instead of a plate. The heat exchanger plate is RVS (316L quality).
Easy to clean. Higher efficiency than the recoh-tray, simpler construction.

5.3.2 Douchegoot WTW

Product name:
Douchegoot WTW

DWHR category:
Horizontal Unit

Manufacturer:
Dutch Solar Systems B.V.
Tinsteden 18
7547 TG ENSCHEDE
The Netherlands
T: +31-(0)53-4822010
F: +31-(0)53-4822015
I : www.zonneboiler.nl
E: info@dutchsolarsystems.co



Performance:

Efficiency:	49.1% at 9.2l/min (9.4kW) 47.7% at 12.5l/min (12.5kW)
Pressure loss:	0.24 bar at 9.2l/min 0.40 bar at 12.5l/min
Performance test norm:	NEN 5128 A1:2009
Third party testing:	Yes, KIWA, the Netherlands, Jan 2011
Dimensions:	lenght: 94cm width: 16.8cm height: 12.8cm / 19.3cm
Double wall HE:	Yes
Price:	Unknown
Produced since:	Jan. 2011
Number of units produced:	Unknown
Availability:	NL, ?
Connections:	
Drain	50mm
Fresh water	15mm

Comments:
Dutch Solar Systems (DSS) is the distributor for Bries. This product was developed as a co-operation between DSS/Bries and a manufacturer of shower drains (www.aco.nl).
Unclear how the double wall is implemented in this product.
Two versions are available, differing in height. The standard product is ca. 12cm high, the version with larger heat exchanger and higher efficiency is ca. 19cm high.

5.3.3 Douchepijp WTW

Product name:
Douchepijp WTW

DWHR category:
Vertical (pipe-in-pipe)

Manufacturer:
BRIES Energietechniek
Grasbroek 7
9301 WC Roden
The Netherlands
Tel.: 050-5012373
info@bries.nl
www.bries.nl

Performance:

Efficiency:	57.6% at 9.2l/min (11.1kW) 56.0% at 12.5l/min (14.6kW)
Pressure loss:	0.55 bar at 9.2l/min 1.00 bar at 12.5l/min
Performance test norm:	NEN 5128 A1:2009
Third party testing:	Yes, KIWA, the Netherlands, Jun 2009
Dimensions:	lenght: 200cm diameter: 6.3cm (7.7cm max.)
Double wall HE:	Yes
Price:	ca. €390(ref. www.dutchsolarsystems.com) (with installation set)
Produced since:	2009
Number of units produced:	Unknown
Availability:	NL, through Dutch Solar Systems (www.dutchsolarsystems.com)

Connections:

Drain	50mm
Fresh water	15mm

Comments:
Second generation with PVC outer tube and copper inner tube and reduced length. Good efficiency, high pressure loss. Also version available for high flow shower (centre tap?), pressure loss at resp. 0.25 and 0.5 bar, ¾" cold water connection, somewhat lower efficiency. No details provided.

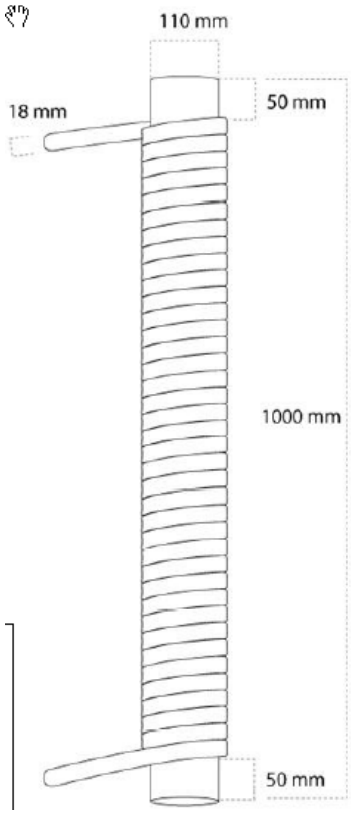
5.4 Ecoteb AS, Norway

5.4.1 Ecoteb110-100-01011

Product name:
Ecoteb110-100-01011

DWHR category:
Vertical

Manufacturer:
ECOTEB AS
Bjerkelundsveien 8
1621 Gressvik
Norway
Tel.: +47 451 10 101
post@ecoteb.no
www.ecoteb.no



Performance:

Efficiency:	39% claimed on datasheet,
Pressure loss:	Unknown
Performance test norm:	Unknown
Third party testing:	No
Dimensions:	length: 100cm diameter: ca. 150mm
Double wall HE:	Yes
Price:	NOK 6990,- (webshop)
Produced since:	2011
Number of units produced:	Unknown
Availability:	Norway (webshop and through contractors/plumbers)

Connections:

Drain	110mm
Fresh water	18mm

Comments:
New product on Norwegian market. Relatively short with relatively large drain diameter. Currently limited documentation regarding performance and installation. Efficiency claimed 50-60%, but 39% mentioned in datasheet. Claims 25-40% savings in water heating.

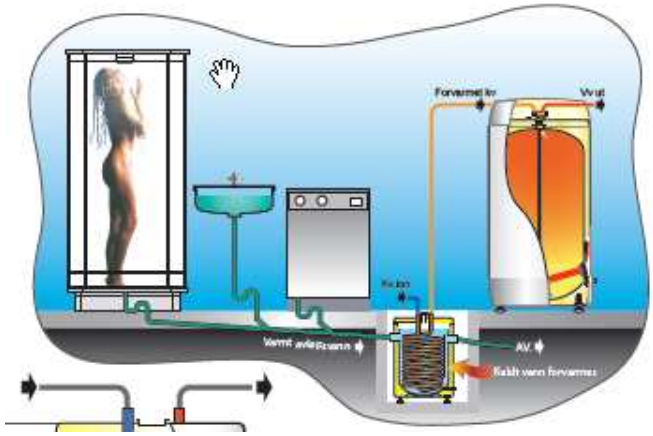
5.5 OSO Hotwater AS, Norway

5.5.1 OSO ES120

Product name:
OSO ES 120

DWHR category:
Tank based

Manufacturer:
OSO Hotwater AS
Industriveien 1, 3300 Hokksund
Tel: +47 32250000
Fax: +47 32250090
info@osohotwater.com
www.osohotwater.no



Performance:

Efficiency:	Claims >40% efficiency
Pressure loss:	Unknown
Performance test norm:	Unknown
Third party testing:	Not for performance
Dimensions:	Height: 85cm Diameter: 58cm
Double wall HE:	No
Price:	NOK 11.500
Produced since:	Unknown
Number of units produced:	Unknown
Availability:	Norway. Suppliers in various countries, see contact page on OSO website.

Connections:

Drain	75mm
Fresh water	15mm

Comments:
Tank and heat exchanger coil from stainless steel. Heat exchanger area of 1.3m^2, tank volume of 110l. Standby losses claimed at 1kWh/day. Yearly maintenance prescribed: opening of the top lid and cleaning/rinsing the coil.

5.6 SUP Technology – Sakal, Czech Republic

5.6.1 The small bathroom heat exchanger

Product name:
The small bathroom heat exchanger

DWHR category:
Horizontal

Manufacturer:
SUP technology - SAKAL
Lipova 127
Tyn nad Vltavou
375 01 Czech Republic
Tel.:. 00 420 602 437 596
Tel.:. 00 420 385 731 147
Fax: 00 420 385 731 148
i.sakal@sakal-ovt.cz

i@sakal-ovt.cz

Performance:

Efficiency:	Delta T of 10-15°C on cold water claimed, depending flow. No test conditions given.
Pressure loss:	Unknown
Performance test norm:	Unknown
Third party testing:	No performance testing. Pressure testing at SINTEF (Norway)
Dimensions:	lenght: 56cm width: 40.5cm height: 9.2cm (info miljodusj.no) height: 10cm (info SUP)
Double wall HE:	No
Price:	NOK 3450 (webshop miljodusj.no)
Produced since:	Unknown (on Norwegian market since 2008)
Number of units produced:	Unknown
Availability:	Norway (webshop), Austria, Germany, Czech Republic, Slovenia

Connections:

Drain	32mm (info miljodusj.no) DN40 (info SUP)
Fresh water	½'' + ¾'' (info miljodusj.no) 2x ½'' (info SUP)

Comments:
Relatively small unit for installation under shower cabinet. Limited information on performance. Some information on installation at miljodusj.no. Mismatch in dimensional info and connections from producer SAKAL and Norwegian supplier. Different version?

5.7 RenewABILITY Energy Inc, Canada

5.7.1 Power-Pipe R2-series

Product name:
Power-Pipe
R2-36, R2-42, R2-48, R2-54, R2-60,
R2-66, R2-72, R2-78, R2-84

DWHR category:
vertical

Manufacturer:
RenewABILITY Energy Inc.
60 Baffin Place, Unit 2
Waterloo, ON
N2V 1Z7
Canada
Tel: 519-885-0283
Toll free: 1-877-606-5559
Fax: 519-885-4475
customerservice@renewability.com
http://www.renewability.com/


R2-36

Performance:

Efficiency:	R2-36: 31.6% R2-84: 55.8%
Pressure loss:	Unknown
Performance test norm:	Equal flow, 9.5l/min (2.5G/min)
Third party testing:	Natural Resources Canada University of Waterloo
Dimensions:	Diameter: ca. 3” (7.5cm) Height: as indicated by model number (‘’)
Double wall HE:	Yes
Price:	36” version: CAD $495, US$495 84” version: CAD $750, US$750 (ref. webshop Renewability.com, Mar-2011)
Produced since:	Unknown
Number of units produced:	Unknown
Availability:	USA, Canada, webshop Renewability www.homedepot.ca
Connections:	
Drain	2” (ca. 5cm)
Fresh water	¾” (18mm) ?

Comments:
This is the version with 2’’ drain, coming in the lengths as indicated by the model number. 60” is recommended if it can be fitted. For cold water, 4 parallel tubes with manifolds at ends in order to reduce pressure drop as compared to single tube. Tubes flatted to increase heat transfer. Available vertical drain should be 5-1/4” higher then Power-Pipe (e.g. 41-1/4” for the R2-36) for proper installation. 3” and 4” drain version readily available, 6” mentioned as well

5.7.2 Power-Pipe R3-series

Product name:
Power-Pipe
R3-30, R3-36, R3-42, R3-48, R3-54,
R3-60, R3-66, R3-72, R3-78, R3-84

DWHR category:
vertical

Manufacturer:
RenewABILITY Energy Inc.
60 Baffin Place, Unit 2
Waterloo, ON
N2V 1Z7
Canada
Tel: 519-885-0283
Toll free: 1-877-606-5559
Fax: 519-885-4475
customerservice@renewability.com
http://www.renewability.com/


R3-30

Performance:

Efficiency:	R3-30: 32.9% R3-84: 62.4%
Pressure loss:	Unknown
Performance test norm:	Equal flow, 9.5l/min (2.5G/min)
Third party testing:	Natural Resources Canada University of Waterloo
Dimensions:	Diameter: ca. 3.7” (9.5cm) Height: as indicated by model number (‘’)
Double wall HE:	Yes
Price:	30” version: CAD$555 US$555 84” version: CAD$982 US$982 (ref. webshop Renewability.com, Mar-2011)
Produced since:	Unknown
Number of units produced:	Unknown
Availability:	USA, Canada, webshop Renewability www.homedepot.ca

Connections:

Drain	3” (75mm)
Fresh water	¾” (18mm)?

Comments:
This is the version with 3’’ drain, coming in the lengths as indicated by the model number. 60” is recommended if it can be fitted. For cold water, 4 parallel tubes with manifolds at ends in order to reduce pressure drop as compared to single tube. Tubes flattened to increase heat transfer. Available vertical drain should be 5-1/4” higher then Power-Pipe (e.g. 35-1/4” for the R3-30) for proper installation. 2” and 4” drain version readily available, 6” mentioned as well

5.7.3 Power-Pipe R4 series

Product name:
Power-Pipe
R4-30, R4-36. R4-42, R4-48, R4-54,
R4-60, R4-66, R4-72, R4-78, R4-84

DWHR category:
vertical

Manufacturer:
RenewABILITY Energy Inc.
60 Baffin Place, Unit 2
Waterloo, ON
N2V 1Z7
Canada
Tel: 519-885-0283
Toll free: 1-877-606-5559
Fax: 519-885-4475
customerservice@renewability.com
http://www.renewability.com/


R4-30

Performance:

Efficiency:	R4-30: 40.4% R4-84: 66.7%
Pressure loss:	Unknown
Performance test norm:	Equal flow, 9.5l/min (2.5G/min)
Third party testing:	Natural Resources Canada University of Waterloo
Dimensions:	Diameter: ca. 4.8” (12.2cm) Height: as indicated by model number (‘’)
Double wall HE:	Yes
Price:	30” version: CAD$663 US$663 84” version: CAD$1277 US$1277 (ref. webshop Renewability.com, Mar-2011)
Produced since:	Unknown
Number of units produced:	Unknown
Availability:	USA, Canada, webshop Renewability www.homedepot.ca

Connections:

Drain	4” (100mm)
Fresh water	¾” (18mm)?

Comments:
This is the version with 4’’ drain, coming in the lengths as indicated by the model number. 60” is recommended if it can be fitted. For cold water, 4 parallel tubes with manifolds at ends in order to reduce pressure drop as compared to single tube. Tubes flattened to increase heat transfer. Available vertical drain should be 5-1/4” higher then Power-Pipe (e.g. 35-1/4” for the R3-30) for proper installation. 2” and 3” drain version readily available, 6” mentioned as well

5.8 Watercycles Energy Recovery Inc., Canada

5.8.1 DX-3058

Product name:
DX-3058

DWHR category:
vertical

Manufacturer:
Watercycles Energy Recovery Inc.
110 Brewer St
Edenwold, SK S0G 0E0
Canada
780/628-7421
306/531-9478
Fax: 519/913-0808
info@watercycles.ca
www.watercycles.ca

Performance:

Efficiency:	42% (7.54kW)
Pressure loss:	0.17bar at 7.6l/min (2.4PSI at 2GPM)
Performance test norm:	Unknown
Third party testing:	Saskatchewan Research Council
Dimensions:	Diameter: 9.7cm (3.8”) Length: 145cm (57.25”)
Double wall HE:	Yes
Price:	ca. CAD$ 700 (ref. www.circasolarenergy.com)
Produced since:	Unknown
Number of units produced:	Unknown
Availability:	USA, Canada,Lithuania
Connections:	
Drain	3” (76mm)
Fresh water	¾” (18mm)

Comments:
Wrapped with 59 feet (ca. 20m) 0.5” (12mm) tubing, two parallel tubes stacked on top of each other (see product photo).

5.8.2 DX-4048

Product name:
DX-4048

DWHR category:
vertical

Manufacturer:
Watercycles Energy Recovery Inc.
110 Brewer St
Edenwold, SK S0G 0E0
Canada
780/628-7421
306/531-9478
Fax: 519/913-0808
info@watercycles.ca
www.watercycles.ca

Performance:

Efficiency:	43.5% (8.1kW)
Pressure loss:	0.12bar at 9.5l/min (1.8PSI at 2.5GPM)
Performance test norm:	Unknown
Third party testing:	Saskatchewan Research Council
Dimensions:	Diameter: 12.2cm (4.8”) Length: 122cm (48”)
Double wall HE:	Yes
Price:	ca. CAD$ 700 (ref. www.circasolarenergy.com)
Produced since:	Unknown
Number of units produced:	Unknown
Availability:	USA, Canada,Lithuania
Connections:	
Drain	4” (102mm)
Fresh water	¾” (18mm)

Comments:
Two parallel tubes stacked on top of each other (see product photo).

5.8.3 DX-3036

Product name:
DX-3036

DWHR category:
vertical

Manufacturer:
Watercycles Energy Recovery Inc.
110 Brewer St
Edenwold, SK S0G 0E0
Canada
780/628-7421
306/531-9478
Fax: 519/913-0808
info@watercycles.ca
www.watercycles.ca

Performance:

Efficiency:	37%
Pressure loss:	Unknown
Performance test norm:	Unknown
Third party testing:	Unknown
Dimensions:	Diameter: 9.7cm (3.8”) Length: 91cm (36”)
Double wall HE:	Yes
Price:	ca. CAD$ 500 (ref. www.circasolarenergy.com)
Produced since:	Unknown
Number of units produced:	Unknown
Availability:	USA, Canada,Lithuania
Connections:	
Drain	3” (76mm)
Fresh water	¾” (18mm)

Comments:
Two parallel tubes stacked on top of each other (see product photo).

5.8.4 HX-3030

Product name:
HX-3030

DWHR category:
vertical

Manufacturer:
Watercycles Energy Recovery Inc.
110 Brewer St
Edenwold, SK S0G 0E0
Canada
780/628-7421
306/531-9478
Fax: 519/913-0808
info@watercycles.ca
www.watercycles.ca

Performance:

Efficiency:	38%
Pressure loss:	Unknown
Performance test norm:	Unknown
Third party testing:	Unknown
Dimensions:	Diameter: 9.7cm (3.8”) Length: 76cm (30”)
Double wall HE:	Yes
Price:	ca. CAD$ 440 (ref. www.circasolarenergy.com)
Produced since:	Unknown
Number of units produced:	Unknown
Availability:	USA, Canada,Lithuania
Connections:	
Drain	3” (76mm)
Fresh water	1/2” (15mm)

Comments:
3” drain version with no parallel tubing for cold water. 29 feet (ca. 10m) of tubing wrapped around the drain pipe. Test report gives delta T for cold water of 18 - 6.3=11.7°C, for the drain water: 37 – 29.6 = 7.4°C stating 38% effectiveness, which is consistent with these numbers (11.7 / (37 – 6.3)=0.38). However, the difference in the delta T for cold and drain water indicates a non-balanced flow test. No installation documentation can be found, graphics on the web suggest an installation where the output of the DWHR feeds only into the water heater.

5.9 EcoInnovation Technologies Inc., Canada

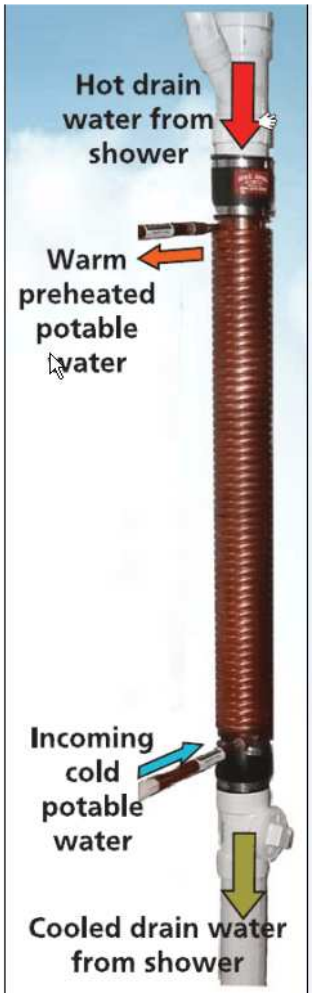
5.9.1 Thermodrain TD340

Product name:
Thermodrain TD340

DWHR category:
vertical

Manufacturer:
EcoInnovation technologies inc.
231 Ste-Marie Street
Saint-Louis-de-Gonzague,
Quebec, Canada, J0S 1T0

T. 1 888 881-7693 Toll Free
T. 1 450 377-5900 International
Fax. 1 888 899-1135 Toll Free
E. info@ecoinnovation.ca
www.ecoinnovation.ca



Performance:

Efficiency:	50.9% (10kW)
Pressure loss:	0.45bar
Performance test norm:	Equal flow, 9.5l/min, dT=30 (37 – 7)
Third party testing:	Unknown
Dimensions:	Diameter: ca. 10cm (4”) Length: 101.6cm (40”)
Double wall HE:	Yes
Price:	ca. CAD$ 490
Produced since:	Unknown
Number of units produced:	Unknown
Availability:	Canada, USA
Connections:	
Drain	3” (76mm)
Fresh water	1/2” (15mm)

Comments:
This is the model for residential use. Ecoinnovation offers a much larger selection of models for commercial applications, ranging in diameter from 3” to 4” and length from 30” to 100”, with parallel tubing (stacked) for the higher flow versions. Four series depending on required flow rate (resp. max. 15, 19, 23 and 26 l/min).

5.10 EcoDrain, Canada

5.10.1 EcoDrain Shower Heat Exchanger

Product name:
EcoDrain shower heat exchanger

DWHR category:
Horizontal unit

Manufacturer:
699 St. Maurice, Suite 501
Montreal, QC, Canada
H3C 1L4
Phone: 514.448.4798
Fax: 514.312.4913
info@ecodrain.com
www.ecodrain.com

Performance:

Efficiency:	cold water delta T from 50F (10°C) to 85F (29.4℃) according manufacturer
Pressure loss:	0.35 bar at 10l/min
Performance test norm:	Unknown
Third party testing:	No
Dimensions:	Unknown
Double wall HE:	Yes
Price:	CAD $499 (webshop)
Produced since:	Unknown, firm started 2005
Number of units produced:	Unknown
Availability:	USA/world: directly through mft Canada: http://www.scodesign.com/ Webshop

Connections:

Drain	Unknown
Fresh water	Unknown

Comments:
Non-stick coating to prevent soap, hair or debris to collect inside.
Mention is made of multiple sizes, as well as a vertical system but no technical details are provided of these. Webshop and technical downloads not operational as per 3-Mar 2011

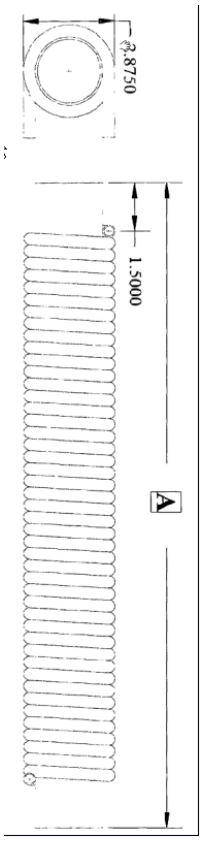
5.11 WaterFilm Energy Inc., USA

5.11.1 GFX G2 series

Product name:
GFX
G2-20, G2-24, G2-30

DWHR category:
vertical

Manufacturer:
WaterFilm Energy Inc.
P.O. Box 128
Medford, NY 11763
USA
Tel. 631-758-6271
Fax. 631-730-3918
gfx-ch@msn.com
www.gfxtechnology.com



Performance:

Efficiency:	G2-20: 24% G2-24: 28% G2-30: 33%
Pressure loss:	G2-20: <0.41 bar (6 psi) G2-24: <0.48 bar (7 psi) G2-30: <0.62 bar (9 psi)
Performance test norm:	Equal flow, 8.6l/min (2.25 GPM), temperatures unknown
Third party testing:	Unknown
Dimensions:	Diameter: ca. 7.3 cm (2.875”) Length: G2-20: 50.8 cm (20”) G2-24: 61.0 cm (24”) G2-30: 76.2 cm (30”)
Double wall HE:	Yes
Price:	Unknown
Produced since:	Firm established 1994
Number of units produced:	Unknown
Availability:	USA
Connections:	
Drain	2” (76 mm)
Fresh water	1/4” (8 mm)

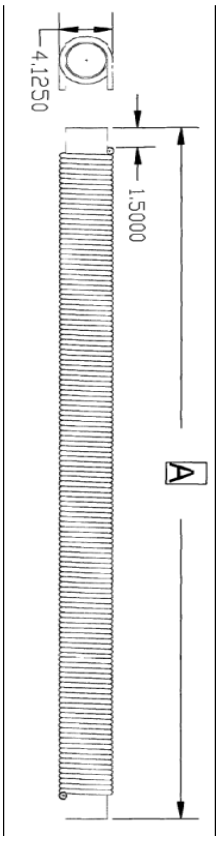
Comments:
The G-series has a single coil for the cold water for relatively low flow installation (single bathroom homes). G2 series for single shower installation. Also comes in 3” (G3 series) and 4” (G4 series) drain version. Special versions for (e.g. parallel coupled) also mentioned on website of manufacturer. P-series for commercial applications, see website manufacturer.

5.11.2 GFX G3 series

Product name:
GFX
G3-30, G3-40, G3-60

DWHR category:
vertical

Manufacturer:
WaterFilm Energy Inc.
P.O. Box 128
Medford, NY 11763
USA
Tel. 631-758-6271
Fax. 631-730-3918
gfx-ch@msn.com
www.gfxtechnology.com



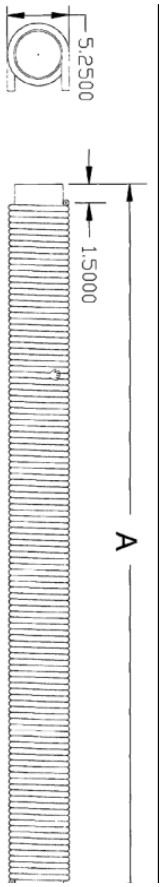
Performance:

Efficiency:	G3-30: 41% G3-40: 49% G3-60: 60%
Pressure loss:	G3-30: 0.28 bar (4 psi) G3-40: 0.34 bar (5 psi) G3-60: 0.55 bar (8 psi)
Performance test norm:	Equal flow, 8.6l/min (2.25 GPM), temperatures unknown
Third party testing:	Unknown
Dimensions:	Diameter: ca. 10.5cm (4.125”) Length: G3-30: 76.2cm (30”) G3-40: 101.6 cm (40”) G3-60: 152.4 cm (60”)
Double wall HE:	Yes
Price:	G3-30: US$485 G3-40: US$550 G3-60: US$680 (ref. website manufacturer)
Produced since:	Firm established 1994
Number of units produced:	Unknown
Availability:	USA
Connections:	
Drain	3” (76mm)
Fresh water	1/2” (15mm)

Comments:
The G-series has a single coil for the cold water for relatively low flow installation (single bathroom homes). Also comes in 2” (G2 series) and 4” (G4 series) drain version. Special versions for (e.g. parallel coupled) also mentioned on website of manufacturer. P-series for commercial applications, see website manufacturer.

5.11.3 GFX G4 series

Product name:
GFX
G4-30, G4-40, G4-60



DWHR category:
vertical

Manufacturer:
WaterFilm Energy Inc.
P.O. Box 128
Medford, NY 11763
USA
Tel. 631-758-6271
Fax. 631-730-3918
gfx-ch@msn.com
www.gfxtechnology.com

Performance:

Efficiency:	G4-30: 48% G4-40: 56% G4-60: 67%
Pressure loss:	G4-30: 0.34 bar (5 psi) G4-40: 0.48 bar (7 psi) G4-60: 0.75 bar (11 psi)
Performance test norm:	Equal flow, 8.6l/min (2.25 GPM), temperatures unknown
Third party testing:	Unknown
Dimensions:	Diameter: ca. 13.3cm (5.25”) Length: G4-30: 76.2cm (30”) G4-40: 101.6 cm (40”) G4-60: 152.4 cm (60”)
Double wall HE:	Yes
Price:	G4-30: US$580 G4-40: US$655 G4-60: US$810 (ref. website manufacturer)
Produced since:	Firm established 1994
Number of units produced:	Unknown
Availability:	USA
Connections:	
Drain	4” (76mm)
Fresh water	1/2” (15mm)

Comments:
The G-series has a single coil for the cold water for relatively low flow installation (single bathroom homes). Also comes in 2” (G2 series) and 3” (G3 series) drain version. Special versions for (e.g. parallel coupled) also mentioned on website of manufacturer. P-series for commercial applications, see website manufacturer.

6 References:

[1]: “A Heat Transfer Textbook”, Third Edition, John H. Lienhard IV and John H. Lienhard V, January 16, 2008.
[2]: “Testing method for Measuring Efficiency of Drain Water Heat Recovery Units”, December 2008, Natural Resources Canada (NRCan)
http://www.dwhrma.com/Evaluating%20the%20Performance%20of%20DWHR.pdf