THE ULTIMATE GUIDE TO
PLATE HEAT EXCHANGERS

STOKVIS
ENERGY SYSTEMS

Introduction

This PDF presentation is designed to highlight the features and benefits of Plate Heat Exchangers, both “bare” and “packaged” as opposed to other methods of heat transfer.

This guide covers…

- *When & why to use Plate Heat Exchangers (PHE’s)*
- *Benefits that many heating engineers often overlook*
- *How PHE's work*
- *How to improve performance*
- *How to reduce specification with pre designed packages*
- *What mediums can be used*
- *How to reduce on site assembly time for installers*
- *Design/installation Diagrams*
- *Building selection guide*

and much more

Ultimately this guide serves to make the overall design process easier for consultants, and the installation a lot quicker and easier for contractors.

If you need any help or further assistance with anything in this guide the Stokvis team would love to hear from you. You can call us on **020 8783 3050** or visit **stokvisboilers.com**

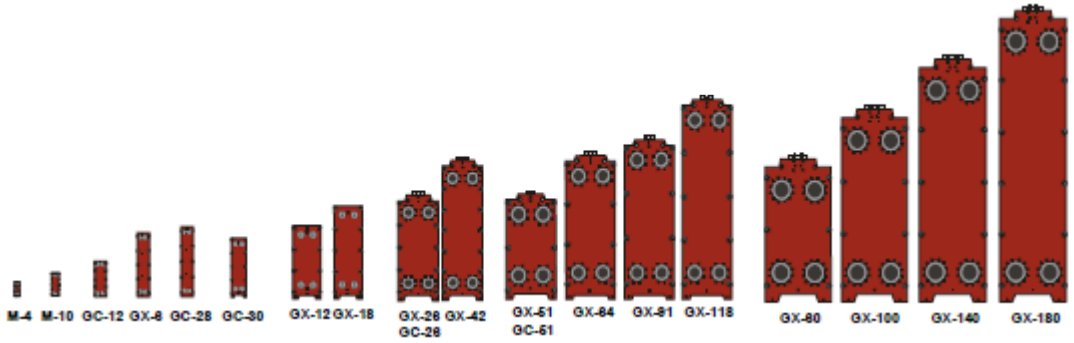
Plate Heat Exchanger Applications

Industrial

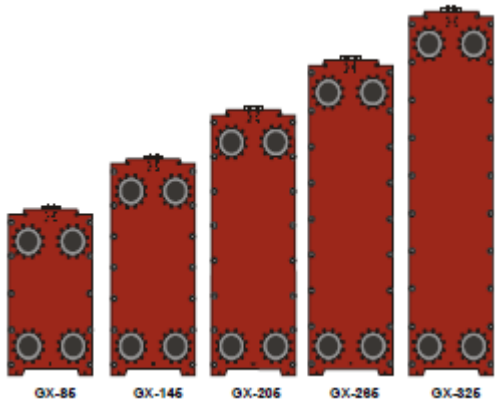
Heating & Hot water

Marine

Plate Heat Exchangers (PHE)



Type	Connection Size	Max Flow Rate (m3/h)	Max Heat Transfer Area (m^2)
GC-12	25	10	3
GX-6	25	10	7
GC-28	25	10	10
GC-30	40	27	17
GX-12	50	40	18
GX-18	50	40	27
GX-26	100	170	110
GX-42	100	170	180
GX-51	150	380	220
GX-64	150	380	260
GX-91	150	380	360
GX-118	150	380	220
GX-60	200	680	220
GX-100	200	680	400
GX-140	200	680	280
GX-180	200	680	760
GX-85	300	1500	340
GX-145	300	1500	580
GX-205	300	1500	820
GX-265	300	1500	1060
GX-325	300	1500	1300



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Typical Applications

- Acting as a system break between Old and New heating systems
- As a separation between systems due to pressure limitations
- To convert MTHW to LTHW
- Act as an integration with Renewables (Biomass, Ground Source)
- Different mediums - Steam to LTHW or DHWS

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General Mechanical Features

- **Heat exchangers can accommodate a wide range of temperatures and pressures for example:**

- **Working Pressures up to 25 bar**
- **System Operating Temperatures up to 150^{o}C**
- **Port or Connection sizes available up to 300mm**
- **Plates Pack materials available in high grade SS or Titanium.**
- **Gasket materials are available in NBR, EPDM, VITON**
- **Fluids:- Can be used for Liquids and Steam**

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Why Use Plate Heat Exchangers?

- **Small physical size:-** Due to extremely large surface area for heat exchange giving easy plant room access and location
- **Less fouling and scaling:-** Due to high turbulence and smooth surfaces creates a self cleaning action.
- **Easy to maintain:-** By removing the front chassis the plate pack is accessible**.**
- **No Cross Contamination** - Double gaskets around the ports with an opening to atmosphere to prevent cross contamination, with a visible leak.
- **Improved heat transfer** –Thinner plate material with the high turbulent flow 0.4 to 0.6mm typically
- **Easy to adjust or increase output:-** By addition of stainless steel plates.

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Additional Plate Heat Exchanger Benefits

- No stored water to harbour bacteria
- Fast heat up – almost instant – from cold
- Low water content, less water to treat
- Low water content, smaller expansion vessels
- High pressure rating for sealed systems
- Can be expanded to increase performance
- High temperature drop on primary, small flow rates, smaller pipes, lower power pumps
- They are a certified product with almost universal acceptance across the world, complying with the pressure equipment directive

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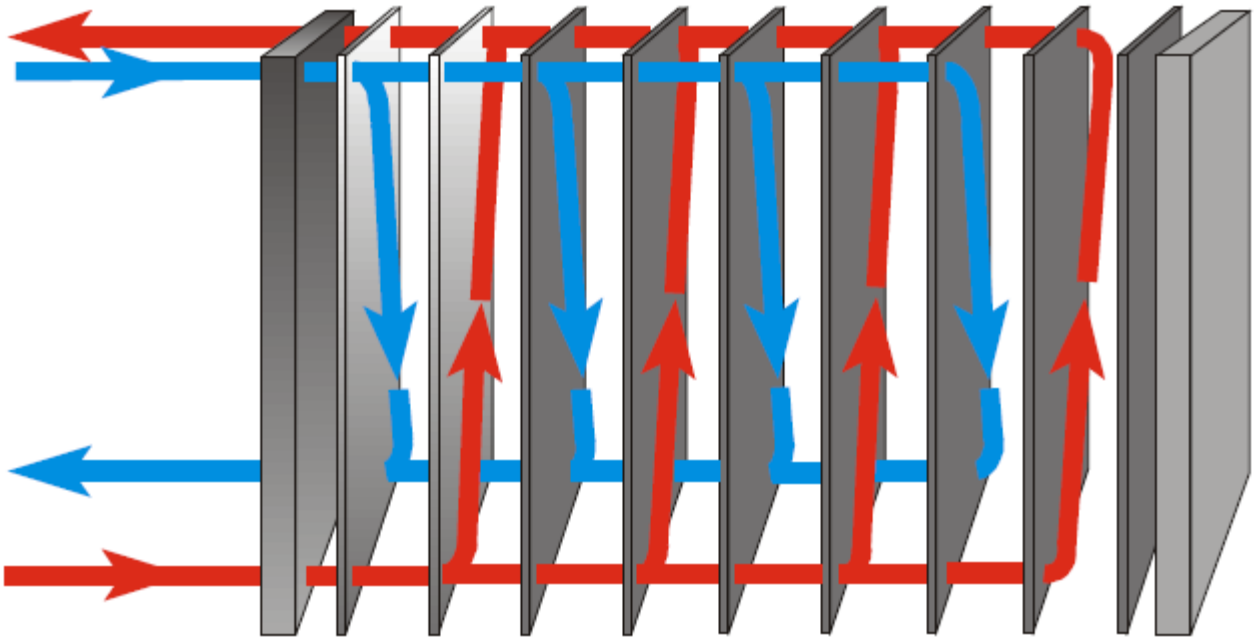
How do they work? – Single Pass



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How do they work?

- **Double Gasket Around Ports:-** This ensures NO cross contamination is possible. A small opening to atmosphere provides an early warning of any gasket issues in this area.

- **Chevron Design:-** Alternate plate arrangement creates the turbulent flow and high heat transfer.

- **Double Gasket Arrangement:-** Alternates left to right ensuring primary & secondary fluids alternate across the pack.

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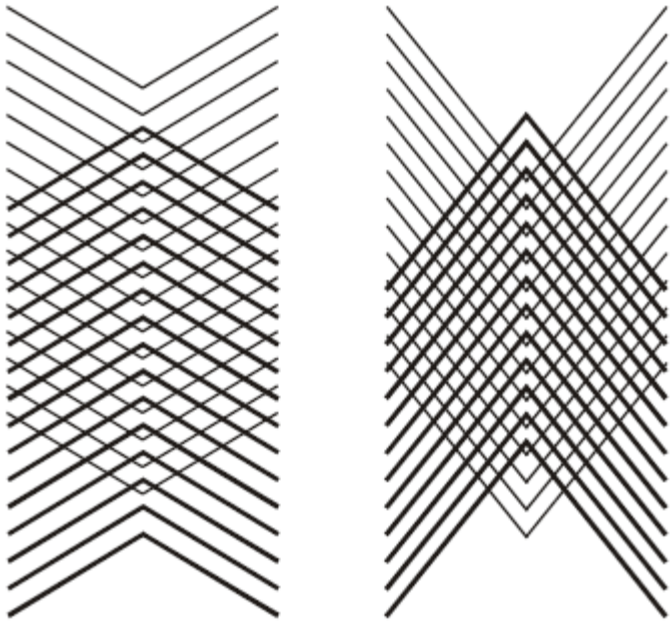
How can we change the performance?

➢**Increasing the Performance:-**
By increasing the flow rate through the PHE or by the simple addition of stainless steel plates to the plate pack will provide an increase in duty very quickly and at relatively low cost. This is not possible with a Calorifier or Water heater.

➢**High Theta Plates:-** Provide a higher heat transfer and turbulent "self cleaning" effect, but have a higher pressure drop

➢**Low Theta Plates:-** Provide a lower heat transfer BUT do have a lower pressure drop.



High theta channel

Low theta channel

What else is required to design a complete heat exchanger system?

- **For simple "system separation"/or "pressure break" you may only need a PHE with pumps on both the primary & secondary circuits.**
This would be the case if the secondary temperature does not need to be controlled at a different temperature to the primary circuit. ie:- similar temperatures required on both sides of the PHE subject to the "Laws of Heat Transfer".

If different temperatures are required between side 1 and side 2 then you will need some form of temperature controls and sensors which would probably act on a 2, 3 or 4-Port control valve.
Also safety devices to suit the system which could be an F&E Tank (open system) or Sealed system. (pressurisation set).

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For DHWS from LTHW we put together a package which includes...

- A Packaged Plate Heat Exchanger with the following:-
  - 10 bar primary, 6 bar secondary heat exchanger
  - Max primary temperature 110^{o}C
  - Plate material 316, WRAS Approved EPDM gasketS
  - Bespoke electronic PID temperature controller to control modulating valve, pumps and provide fault indication
  - Primary and Secondary Pump(s)
  - Motorised control valve 2,3 or 4 port c/w fast acting actuator
  - Fast reading temperature sensor
  - Non return valve for HWS return
  - Primary and secondary drain valve

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The package design process involves the selection of the pump

- **We select the correctly sized state of the art Grundfos Magna3 pump in accordance with EuP Legislation introduced in January 2013.**
- **This transports primary water from the heat source around the heat exchanger and provides the correct required flow rate through the PHE and over comes the PHE pressure drop.**

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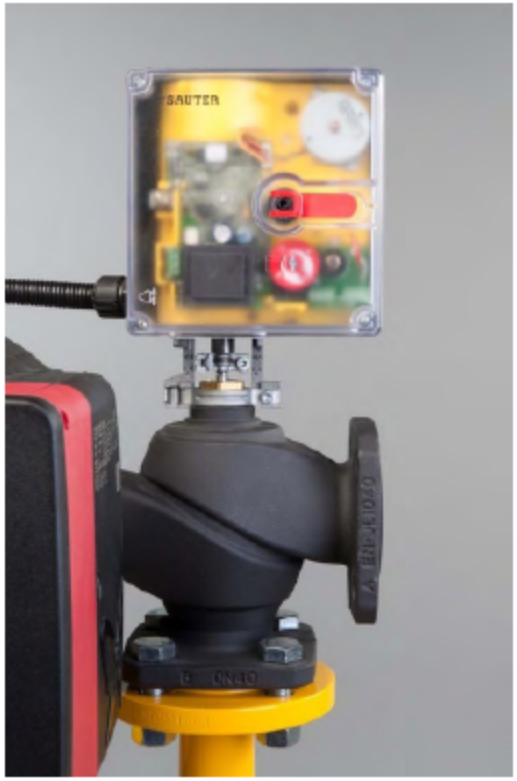
Then the motorised valve

- **We also size and select the correct size of valve and speed of actuation to regulate the volume of primary water which is allowed into the unit and thus control the secondary temperature. The selected valve provides 0-100% full modulation.**



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For the secondary side of a DHWS installation there are two possible configurations

- **DHWS secondary recirculation:-** An optional secondary DHWS recirculation pump can be included to provide circulation around the building/system.

- **Buffer Vessel:-** An option to include a suitably sized “transfer pump” is available when the PHE is being installed in conjunction with a buffer vessel.

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The finished item

- **The result would look like our “E3Ci Series” Plate heat exchanger unit pictured here complete with ECONOTROL 2100 PID temperature controller, primary pump and 3 port control valve**

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Other things to consider

- **You may also need spring closing 2-Port valve and mechanical reset high limit thermostats to comply with G3 Building Regulations.**

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G3 Regulation

Requirement	*Limits on application*
G3. (1) There must be a suitable installation for the provision of heated wholesome water or heated softened wholesome water to: (a) any washbasin or bidet provided in or adjacent to a room containing a sanitary convenience; (b) any washbasin, bidet, fixed bath and shower in a bathroom; and (c) any sink provided in any area where food is prepared.	
(2) A hot water system, including any cistern or other vessel that supplies water to or receives expansion water from a hot water system, shall be designed, constructed and installed so as to resist the effects of temperature and pressure that may occur either in normal use or in the event of such malfunctions as may reasonably be anticipated, and must be adequately supported.	
(3) A hot water system that has a hot water storage vessel shall incorporate precautions to: (a) prevent the temperature of the water stored in the vessel at any time exceeding 100°C; and (b) ensure that any discharge from safety devices is safely conveyed to where it is visible but will not cause a danger to persons in or about the building.	Requirement G3(3) does not apply to a system which heats or stores water for the purposes only of an industrial process.
(4) The hot water supply to any fixed bath must be so designed and installed as to incorporate measures to ensure that the temperature of the water that can be delivered to that bath does not exceed 48°C.	Requirement G3(4) applies only when a dwelling is— (a) erected; (b) formed by a material change of use within the meaning of regulation 5(a) or (b).

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Why have another valve (G3)

- **On unvented systems, where the heat source is capable of raising the temperature over 95°C, a manual reset high limit thermostat set to 90°C can be provided to interrupt the supply of energy to the primary side of the heat exchanger.**

- **Where a flow can persist, even when the high limit thermostat has switched off the primary pump, an additional spring return primary shut off valve, operated by the same manual reset high limit thermostat set to 90°C, could be provided. This valve will also interrupt the supply of energy if the electrical power supply is interrupted.**

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Insulation jackets

- **We supply easily removable insulation jackets to reduce heat loss but still allow easy servicing of the heat exchanger**

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Advantages of Packaged PHE'S

- **Reduced design requirements, matched set of components: pump, valve, actuator and controls are included as standard.**
- **Reduced on site assembly time for the M&E installer**
- **Guarantees fast response to changes in the DHWS demand**
- **Accurate and close temperature control**
- **Easy to use purpose built integrated controls**
- **Mixing valve giving low temperature heat exchange at part load – reducing scale build up**
- **Full turbulent flow has a self cleaning affect on the plates reducing fouling and scaling**
- **Low water content less than 15 litres. No T&P required by G3 regulations.**
- **Proven design.**

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Advantages for hot water production

- **Units should be WRAS approved**
- **No stored water, no static water, no stratification**
- **Virtually eliminating risk of legionellosis**
- **Reduced total system volume:**
- **Reduced size expansion vessel required**
- **Less chemicals needed to periodically treat the system**
- **Reduced heat losses due to small size and small hold up volume.**

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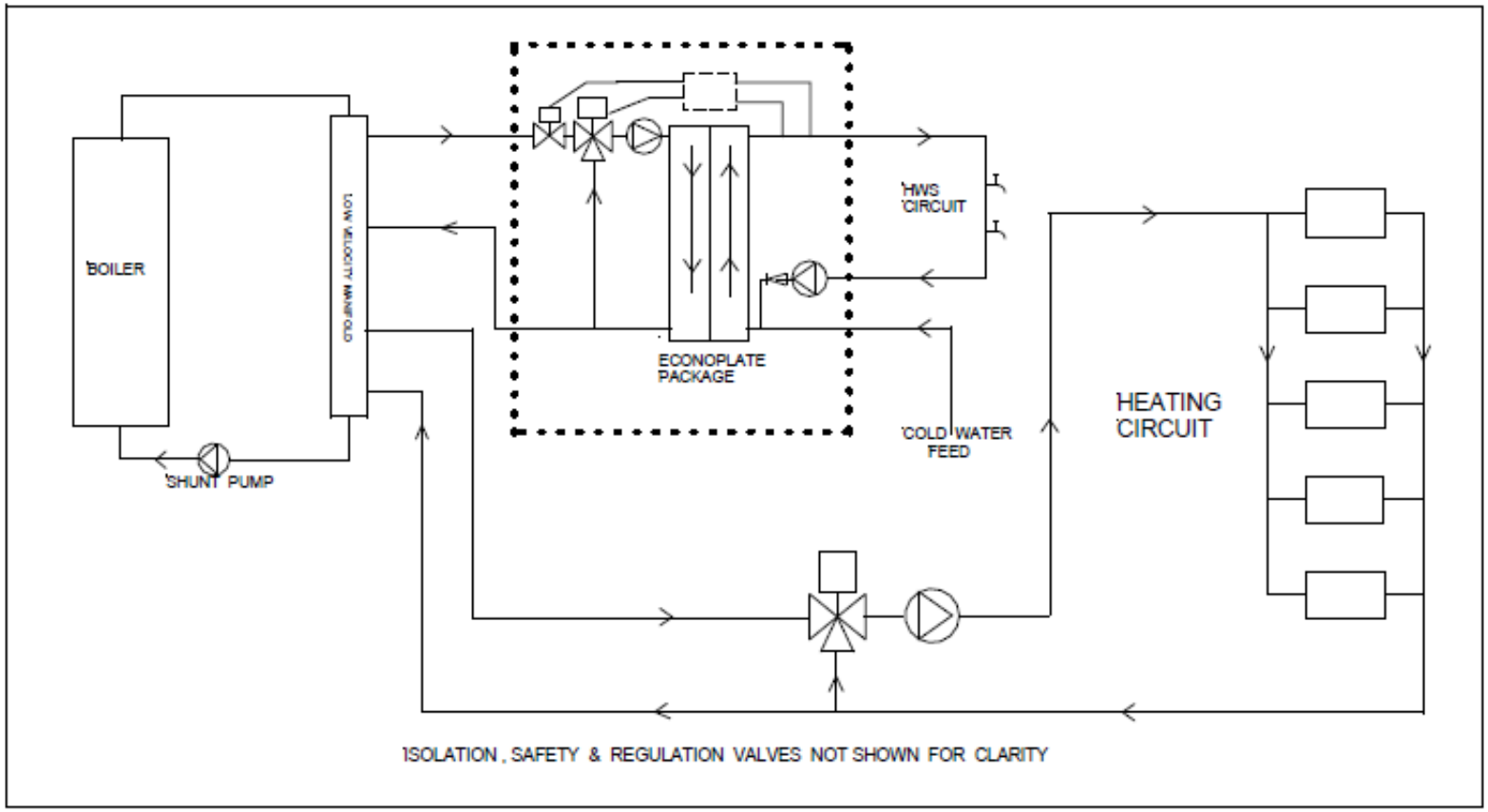
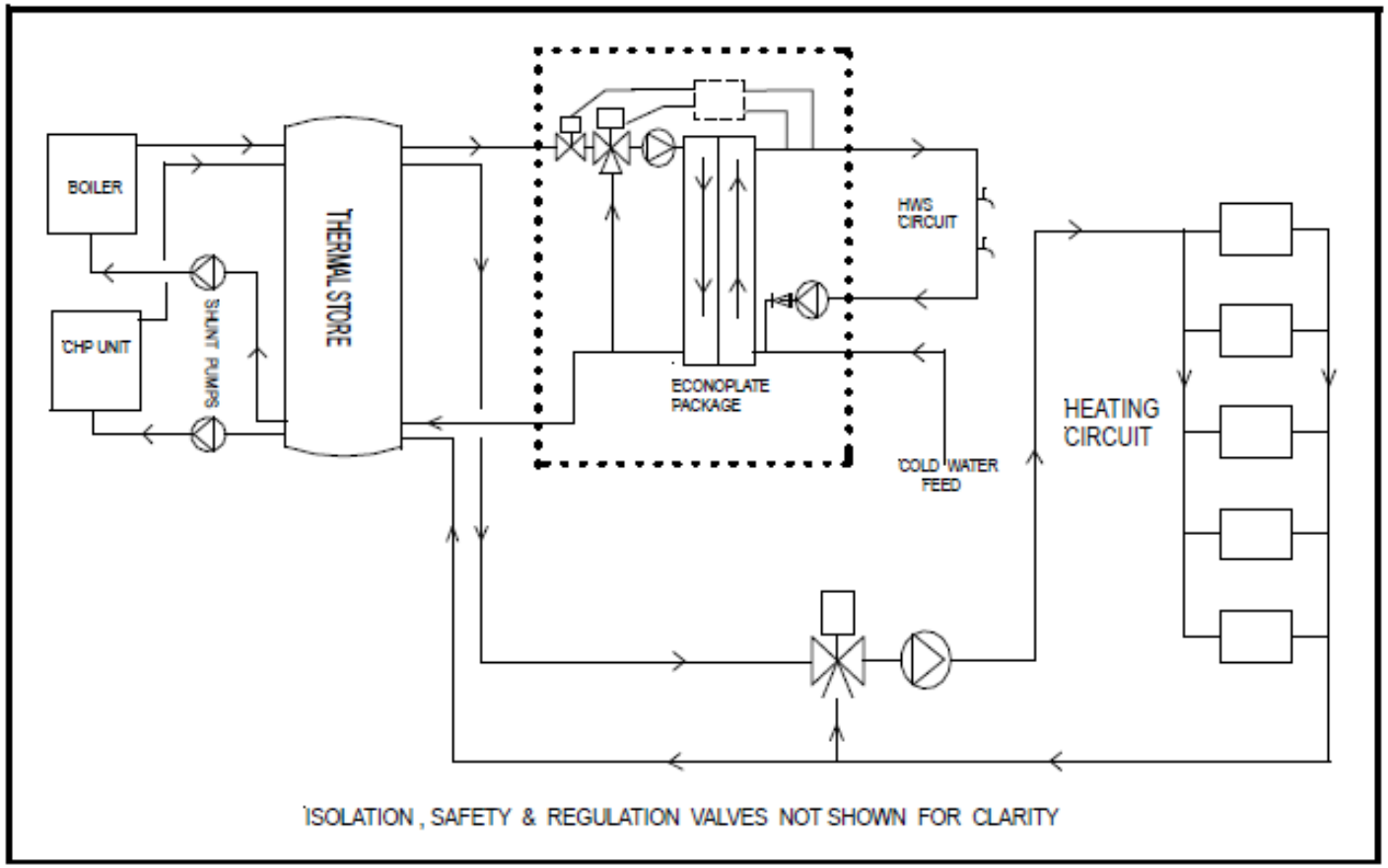
Typical installation with a boiler



Typical installation with a thermal store



What about steam

- **The principle is similar without the primary pump**
- **Single or twin steam valves dependent upon level of safety**
- **Safety shut off valve complete with high limit thermostat available.**

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Why have another valve?

- **Other additional equipment required is for high limit protection of the secondary circuit to prevent the temperature exceeding 95°C**

- **This should be a manual reset mechanical type of system, which will cut off the steam supply in the event of a high temperature scenario, caused by a failure of the control system or a loss of power**

- **This can be included by selection of one of the control valve options, or a completely independent system could be used**

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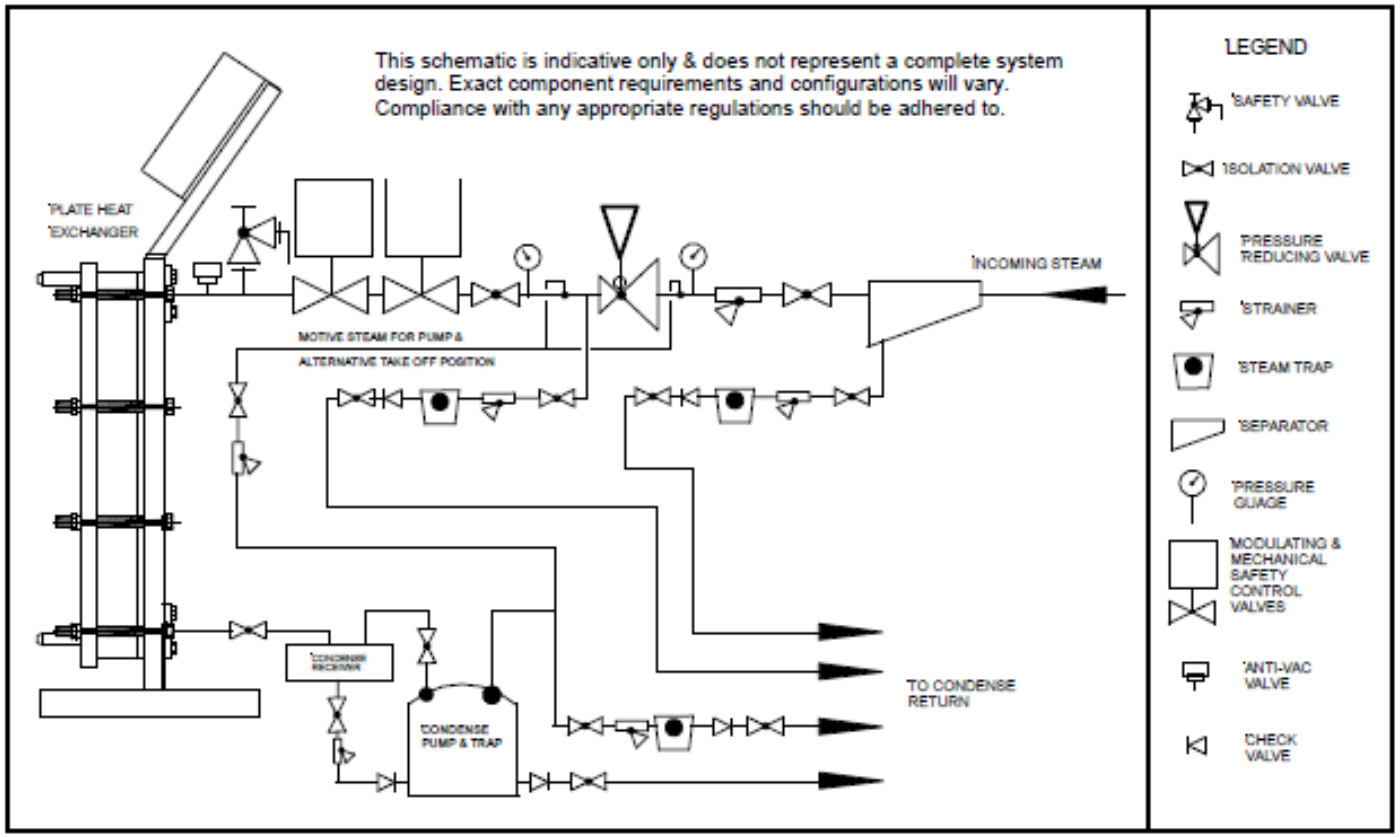
Steam processing and condense removal needs to be allowed for



A complete system with all steam And condense equipment shown

Considerations for PHE'S for DHWS service

- **High secondary pressure drop – not normally an issue with boosted or mains pressure cold water supplies.**

- **Larger kW input required in comparison with storage calorifiers – not normally an issue with hot water priority pipe-work arrangement.**

- **Secondary pumped circulation must be maintained around the building as an HWS return, locally if trace heated or around a buffer vessel**

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Semi-Instantaneous DHWS Production with the introduction of a Buffer Vessel

- **If storage is added it does not introduce the same problems as associated with calorifiers: slow heat up, stratification and cold spots**

- **The volume of water can be heated up very quickly**

- **The system does not rely on stratification, it uses a continuous high flow pump to draw cold water from the tank through the heat exchanger and back to the tank, heating the water from cold to hot in a single pass**

- **The secondary pressure drop is reduced to that of the vessel only**

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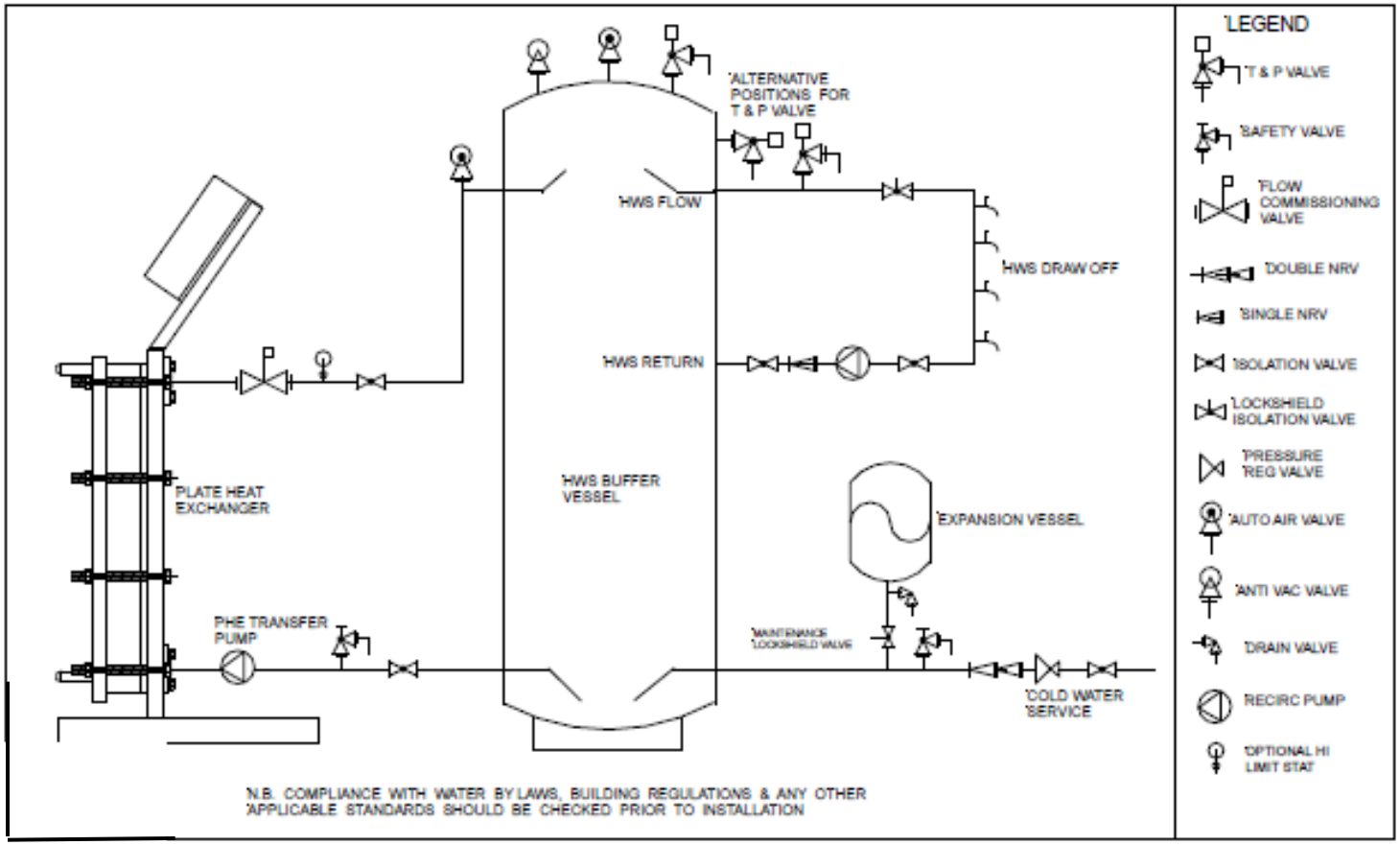
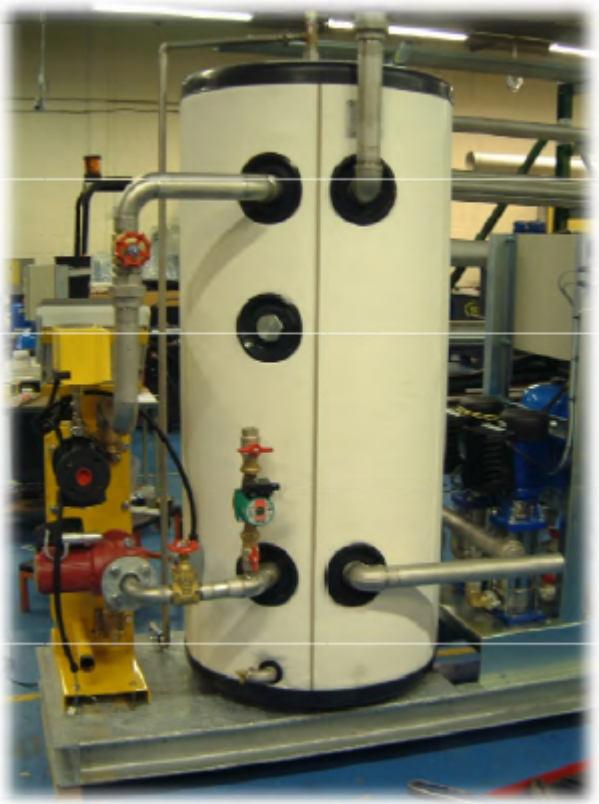
Installation with a vessel

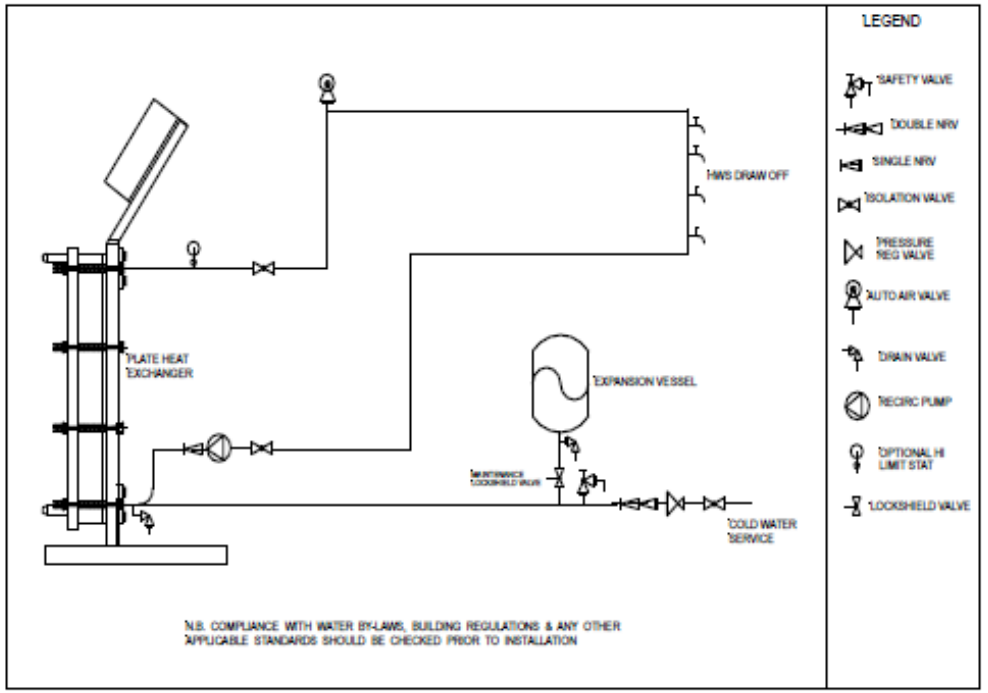


Examples of ECONOPLATES with Buffer Vessels



Mains Connection

- Pressure reducing valve.
- Double check valve
- Safety valve
- Expansion vessel



Selection guide

	E3Ai 321	E3Ai 323	E3Ai 325	E3Ai 327	E3Ai 329	E3Ai 331	E3Ai 333	E3Ai 335	E3Ai 337	E3Ai 339	E3Ai 341	E3Ai 343	E3Ai 345
"Tourist Hotel" by No. of Rooms	55	62	71	77	82	90	97	103	108	113	120	126	130
"Luxury Hotel" by No. of Rooms	36	42	48	53	57	61	65	69	73	76	80	85	88
Number of "Standard Flats"	85	98	114	125	135	149	161	171	182	190	201	212	220
Number of "Luxury Flats"	56	65	77	88	95	107	116	123	133	139	146	155	160
Hospital or Nursing Home by No. of Rooms	100	115	136	155	168	185	198	210	226	239	251	264	272
Leisure Centre or Sports Stadium by No. of Showers	27	32	37	41	45	50	55	58	62	65	70	75	77

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Heat Interface Units

- **On a smaller scale we have H.I.U's for individual dwellings**
- **3 basic formats are available:-**

DIRECT HEATING & INDIRECT HOT WATER WITH 1 HEAT EXCHANGER – temperature controlled production of DHWS from LTHW

INDIRECT HEATING & INDIRECT HOT WATER WITH 2 HEAT EXCHANGERS – system separation with temperature control and LTHW to DHWS

INDIRECT HEAT ONLY WITH 1 HEAT EXCHANGER FOR PROPERTIES WITH A DHW CYLINDER – system separation with temperature control

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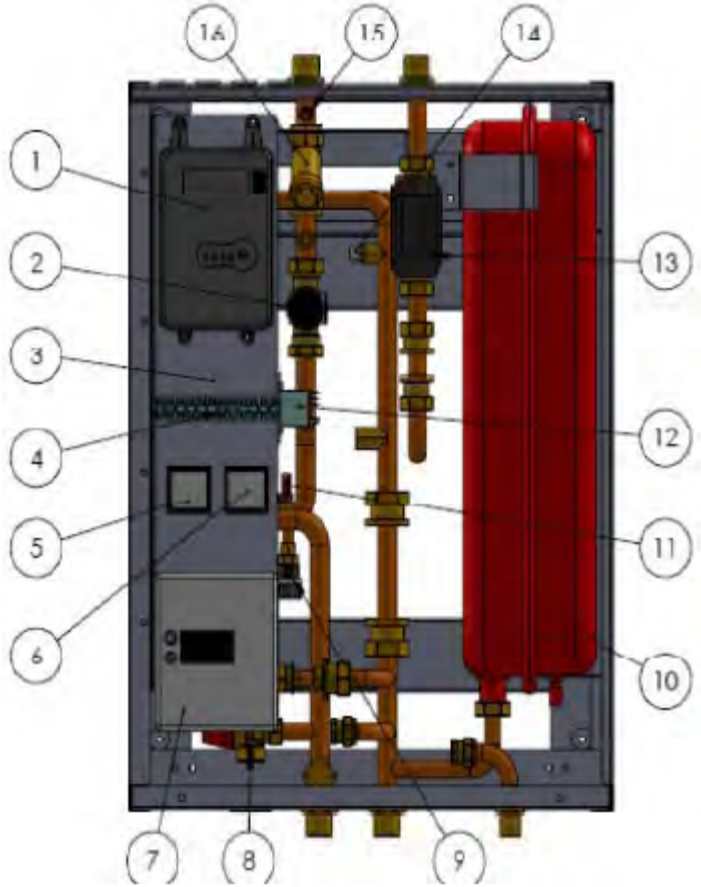
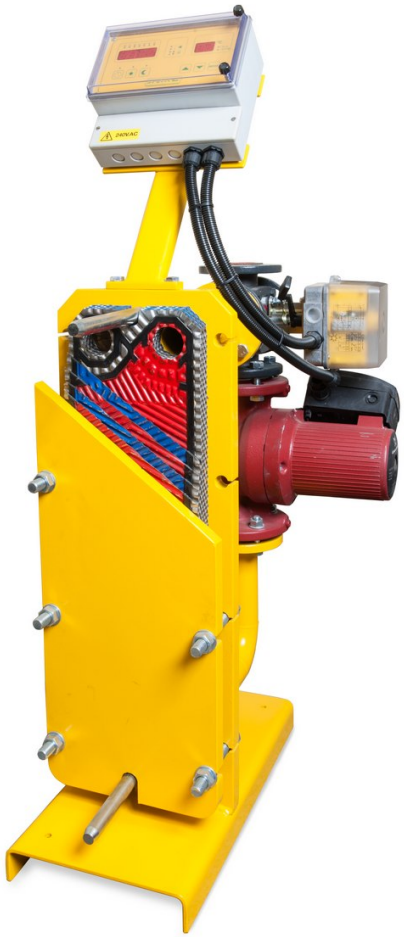
Direct heating and Indirect hot water – ECONOPLATE H1

Indirect heating and Indirect hot water
ECONOPLATE H2

Indirect Heat only – H1





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