Hamworthy

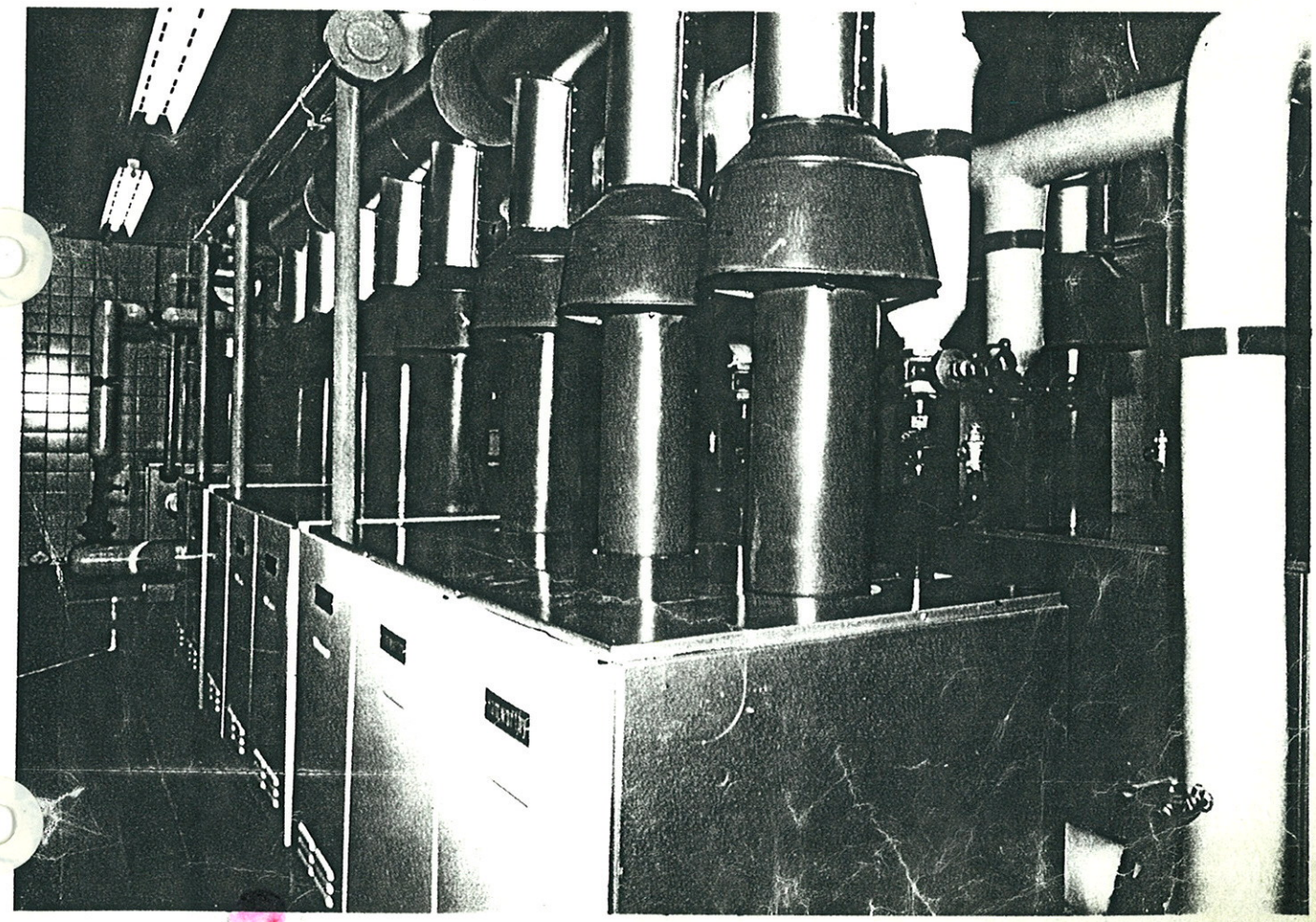
gas fired modular boiler systems

180 - 3 + WB. + 3 BB. - 7" FLUE. FLOW REAR.
210 - 3 + WB. + 4 BB. - 8" FLUE. FLOW REAR.
250 - 4 + W.B. + 4 BB - 8 FLUE. FLOW FRONT.
280/300* - 5 + W.B. + 4 BB - 8" FLUE FLOW REAR RETURN 12" UP
320. - 5 + W.B. + 4 BB - 8" FLUE FLOW REAR. RETURN 15" UP

*LPG
EARLY (PRE'74) N.G.

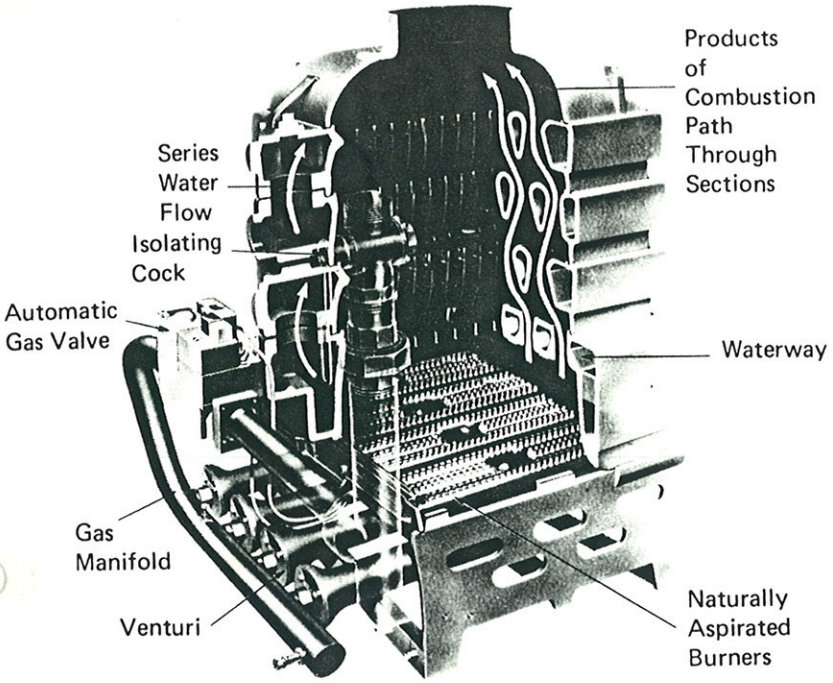
NORMAL CO_2 = 6·5-8·0% (STICOC 11·8%)

with outputs from 42kW to 900kW and above



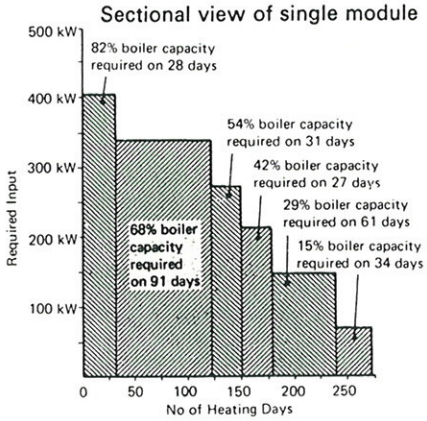
Introduction

Hamworthy – the U.K. pioneers of modular boiler systems with over 10 years experience – provide the system with all the advantages for user and installer.



Sectional view of single module

The basic module utilises cast iron water sections which are pressed together with nipples at alternate ends. This forms the heat exchanger which employs the unique horizontal series flow water system. Each bank is pressure tested to 13.8 bar (200 p.s.i.g.) which allows a maximum working pressure of 6.9 bar (100 p.s.i.g.). The burner system employs effective but simple controls coupled with a naturally aspirated burner which is designed to give trouble free and near silent operation. By piping up any number of the basic modules to a "reverse return" layout a modular system is achieved which eliminates the conventional necessity to provide standby plant to cover for varying heat loads and breakdown, thereby reducing the overall size of the plant and the initial capital cost involved.



Typical heat load distribution in 3600 degree day area.

Experience has shown that during 90% of the heating season, 60% or less of the heating capacity is required. Single unit large output boilers must cycle to meet these conditions whereas the Hamworthy modular system is designed to cope with those needs thereby increasing overall seasonal efficiency.

Hamworthy modular boiler systems can therefore offer you *all* these advantages

- Infinitely variable outputs from 42 kW upwards
- Cast iron construction—max 100 psi working pressure.
- Compact minimum dimensions.
- Can be installed anywhere, roof-top, cellar or any convenient space.
- Will go through any normal doorway.
- No independent standby.
- Are cheaper to run and install because the system can be varied to give you just the amount of heat you want—when you need it.
- Exceptionally low noise level.
- Low water content—rapid response time.
- Fully packaged and factory tested.

The basic boiler design has received approval from many organisations throughout the world including :-

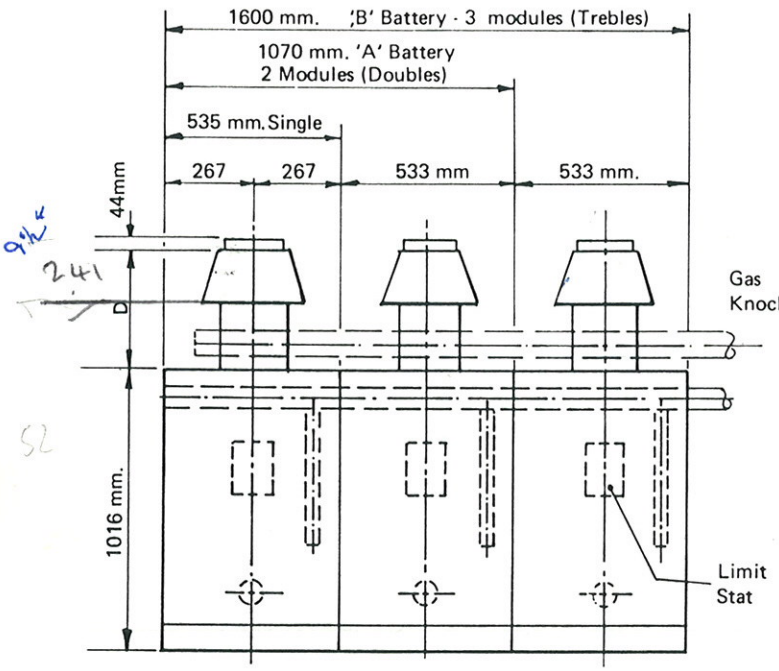
ENGLAND AGA BELGIUM CSA HOLLAND GERMANY

The backing of Hamworthy's comprehensive 10 year guarantee plan on the cast iron sections.

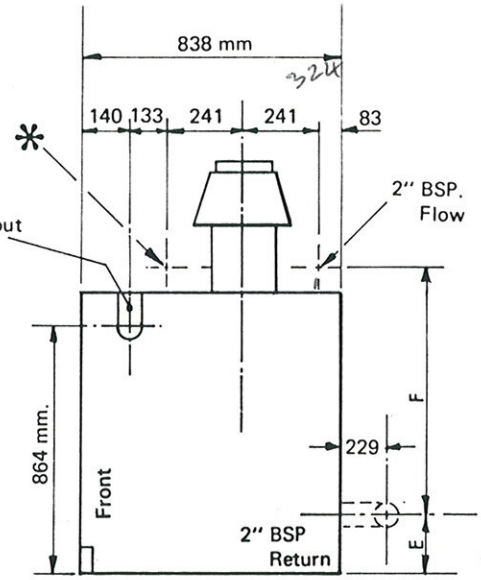
Technical Data

Casing Details

Dimensions in millimetres



* Note:
For flow outlets on models R.250, MR.750 and MR.1000 2" B'S'P' Flow Tapping positioned on front as indicated.



Water Flow Data

Hamworthy modular boilers are designed as quick response low water content units, and to run continuously with minimum or no operating problems care should be taken in the initial design and layout having due regard to water flow and control aspects of the installation. General considerations are set out in the I.H.V.E. Guide and this should be consulted in conjunction with the tables shown below.

Boilers should always be installed on closed systems whether they are of the header tank or pressed type and as such, checks should frequently be carried out and water leaks repaired to avoid the ingress of raw make-up water.

The tables given indicate the design and minimum conditions applicable to Hamworthy modular boilers. Naturally the total system should be designed on a flow rate consistent with the design temperature rise across the modules of 11 °C (20°F) shown in Column A. Where combined heating and H.W.S. systems are employed the action of mixing valves or other devices can reduce the water flow through modules at certain times and in these cases steps must be taken to ensure that this flow never drops below the figure given in Column B. In hard water areas, higher minimum flow rates must be applied and these are shown in Column C.

Compliance with minimum flow rates can be achieved by oversizing of the primary H.W.S. pumps could to a diverter valve, limits on the mixing valve operation, or the use of a shunt pump and flow switch. Where summer use of a bank of modules for H.W.S. load only occurs, it is advisable to isolate banks of modules not required.

	System design flow rate for 11°C rise across boilers		Minimum flow rates at any time			
			General		Hard water areas (where total hardness exceeds 100 ppm)	
	Column A		Column B		Column C	
	l/min	g/min	l/min	g/min	l/min	g/min
R180	54·6	12·0	13·65	3·0	27·3	6·0
R210	63·7	14·0	15·9	3·5	31·85	7·0
R250	75·5	16·6	18·9	4·2	37·75	8·3
R280	84·6	18·6	21·2	4·7	42·3	9·3
R300	91·0	20·0	22·75	5·0	45·5	10·0
R320	100·0	21·3	25·0	5·3	50·0	10·6

For multiples of these boilers in parallel arrangement the minimum flow is multiplied by the number of boiler modules

76% EFFICIENT.

Specifications

Natural Gas

Single Units

Model	No. Boiler Modules	Single Boilers	Output Kw	Output Btu/h x 1,000	Input Gas (Natural) m³/h	Input Gas (Natural) ft³/h	Flue Dia. mm	Flue Dia. in	Flue Height "D" mm	Flue Height "D" in	Water Connections E mm	Water Connections E in	Water Connections F mm	Water Connections F in	Approx. Shipping Wt. kg	Approx. Shipping Wt. lb
NGR.180	**1**	**–**	**42**	**144**	**5,09**	**180**	**178**	**7**	**457**	**18**	**305**	**12**	**940**	**37**	**222**	**490**
NGR.210	1	–	50	168	5,94	210	203	8	508	20	305	12	940	37	227	500
NGR.250	**1**	**–**	**60**	**200**	**7,07**	**250**	**203**	**8**	**610**	**24**	**305**	**12**	**940**	**37**	**255**	**560**
NGR.280	1	–	65	224	7,92	280	203	8	686	27	305	12	940	37	282	620
NGR.320	**1**	**–**	**75**	**256**	**9,05**	**320**	**203**	**8**	**686**	**27**	**381**	**15**	**863**	**34**	**286**	**630**

Multi Units

Model	No. Boiler Modules	Number of Batteries A	Number of Batteries B	Output Kw	Output Btu/h x1,000	Input Gas m³/h	Input Gas ft³/h	Flue Dia. mm	Flue Dia. in	Flue Height "D" mm	Flue Height "D" in	Water Connections E mm	Water Connections E in	Water Connections F mm	Water Connections F in	Approx. Shipping Wt. kg	Approx. Shipping Wt. lb
NGMR.360	**2**	**1**	**–**	**84**	**288**	**10,18**	**360**	**178**	**7**	**457**	**18**	**305**	**12**	**940**	**37**	**435**	**960**
NGMR.420	2	1	–	100	336	11,88	420	203	8	508	20	305	12	940	37	450	990
NGMR.500	**2**	**1**	**–**	**120**	**400**	**14,15**	**500**	**203**	**8**	**610**	**24**	**305**	**12**	**940**	**37**	**504**	**1,110**
NGMR.560	2	1	–	130	448	15,83	560	203	8	686	27	305	12	940	37	555	1,220
NGMR.640	**2**	**1**	**–**	**150**	**512**	**18,12**	**640**	**203**	**8**	**686**	**27**	**381**	**15**	**863**	**34**	**562**	**1,236**
NGMR.750	3	–	1	180	600	21,23	750	203	8	610	24	305	12	940	37	753	1,660
[illegible]R.840	**3**	**–**	**1**	**195**	**672**	**23,78**	**840**	**203**	**8**	**686**	**27**	**305**	**12**	**940**	**37**	**830**	**1,830**
[illegible]R.960	3	–	1	225	768	27,18	960	203	8	686	27	381	15	863	34	840	1,852
[illegible]R.1000	**4**	**2**	**–**	**240**	**800**	**28,31**	**1000**	**203**	**8**	**610**	**24**	**305**	**12**	**940**	**37**	**1,006**	**2,220**
NGMR.1120	4	2	–	260	896	31,71	1120	203	8	686	27	305	12	940	37	1,108	2,440
NGMR.1280	**4**	**2**	**–**	**300**	**1 024**	**36,24**	**1280**	**203**	**8**	**686**	**27**	**381**	**15**	**863**	**34**	**1,124**	**2,472**
NGMR.1400	5	1	1	325	1,120	39,64	1400	203	8	686	27	305	12	940	37	1,384	3,050
NGMR.1600	**5**	**1**	**1**	**375**	**1,280**	**45,30**	**1600**	**203**	**8**	**686**	**27**	**381**	**15**	**863**	**34**	**1,402**	**3,088**
NGMR.1920	6	–	2	450	1,536	54,36	1920	203	8	686	27	381	15	863	34	1,680	3,704
NGMR.2240	**7**	**2**	**1**	**525**	**1,792**	**63,43**	**2240**	**203**	**8**	**686**	**27**	**381**	**15**	**863**	**34**	**1,964**	**4,324**
NGMR.2560	8	1	2	600	2,048	72,49	2560	203	8	686	27	381	15	863	34	2,242	4,940
NGMR.2880	**9**	**–**	**3**	**675**	**2,304**	**81,55**	**2880**	**203**	**8**	**686**	**27**	**381**	**15**	**863**	**34**	**2,520**	**5,556**
NGMR.3200	10	2	2	750	2,560	90,61	3200	203	8	686	27	381	15	863	34	2,764	6,176
NGMR.3520	**11**	**1**	**3**	**825**	**2,816**	**99,67**	**3520**	**203**	**8**	**686**	**27**	**381**	**15**	**863**	**34**	**3,082**	**6,792**
NGMR.3840	12	–	4	900	3,072	108,73	3840	203	8	686	27	381	15	863	34	3,360	7,408

Town gas and LPG

Single Units (Multi-units available on request)

Model	No. Boiler Modules	Single Boilers	Output Kw	Output Btu/h x1,000	Input Gas (Towns) m³/h	Input Gas (Towns) ft³/h	Flue Dia. mm	Flue Dia. in	Flue Height "D" mm	Flue Height "D" in	Water Connections E mm	Water Connections E in	Water Connections F mm	Water Connections F in	Approx. Shipping Wt. kg	Approx. Shipping Wt. lb
R.180	**1**	**–**	**42**	**144**	**10,18**	**360**	**178**	**7**	**457**	**18**	**305**	**12**	**940**	**37**	**222**	**490**
R.210	1	–	50	168	11,88	420	203	8	508	20	305	12	940	37	227	500
[illegible]50	**1**	**–**	**60**	**200**	**14,15**	**500**	**203**	**8**	**610**	**24**	**305**	**12**	**940**	**37**	**255**	**560**
[illegible]00	1	–	70	240	16,99	600	203	8	686	27	305	12	940	37	282	620

Summary of technical data

Information tabulated per module

Module Size	Water Content G	Water Content L	Waterway Pressure Drop 20°F. Diff. ft	Waterway Pressure Drop 20°F. Diff. m	No. of Section including Bottom Waterway	Dia. of Gas Conn. BSP. N.G L.P.G.	Dia. of Gas Conn. BSP. T.G.	Gas Pressure at Burners N.G. in	Gas Pressure at Burners N.G. mm	Gas Pressure at Burners T.G. in	Gas Pressure at Burners T.G. mm	Gas Pressure at Burners L.P.G. in	Gas Pressure at Burners L.P.G. mm	Waste Gas Vol. NTP. approx. (boiler exit) ft³	Waste Gas Vol. NTP. approx. (boiler exit) m³	Current Rating 240 V. 50 Ω 1–PH. e
R.180	**4.38**	**19**	**0.4**	**0.12**	**4**	**1"**	**1"**	**4.6**	**115**	**1.8**	**45**	**11**	**275**	**2500**	**70**	**1**
R.210	4.38	19	0.5	0.15	4	1"	1"	4.6	115	2.2	55	11	275	2800	80	1
R.250	**5.2**	**23**	**0.9**	**0.27**	**5**	**1"**	**1¼"**	**4.6**	**115**	**1.8**	**45**	**11**	**275**	**3300**	**94**	**1**
R.280	6.04	27	1.4	0.43	6	1"		6.0	150					3700	104	1
R.300	**6.04**	**27**	**1.6**	**0.5**	**6**		**1¼"**			**1.8**	**45**	**11**	**275**	**4000**	**114**	**1**
R.320	6.04	27	1.8	0.55	6	1"		6.0	150					4100	118	1

Boiler efficiency

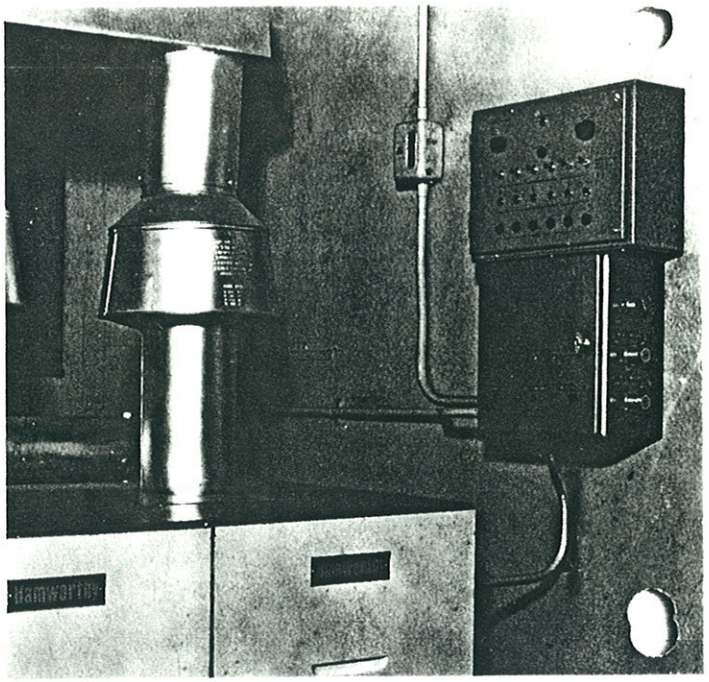
This can be calculated by the British or Continental method using gross or nett calorific value respectively. For the Hamworthy range of boilers above the following figures are applicable (NGR.320 shown as example).

[illegible]SH METHOD. } efficiency = $\frac{\text{Output} \times 100}{\text{Gross input}} = \frac{256{,}000 \times 100}{320 \times 1035} =$ **77·3%**

CONTINENTAL METHOD } efficiency = $\frac{\text{Output} \times 100}{\text{Nett input}} = \frac{256{,}000 \times 100}{320 \times 920} =$ **86·95%**

Installation Guide

Hamworthy boilers offer the designer and installer a really tremendous scope on layouts all of which cannot be shown in this brochure, however, some basic schemes are outlined. All systems however designed should be in accordance with I.H.V.E. practice.



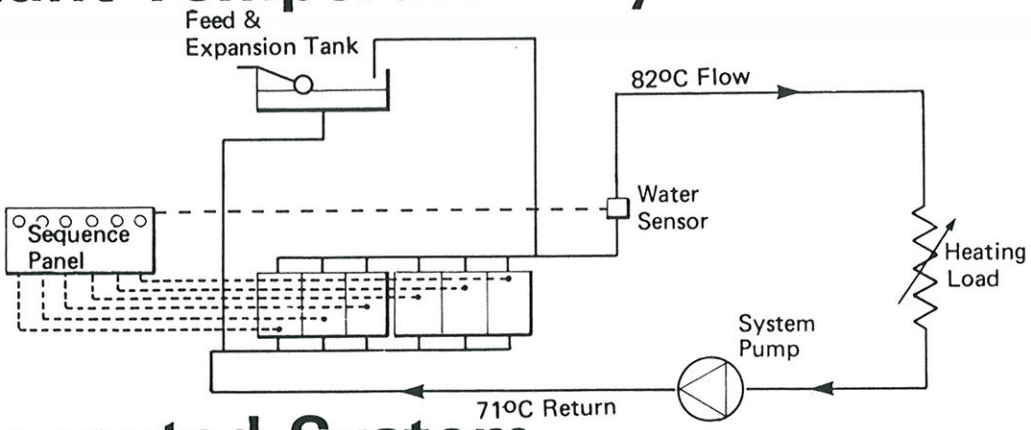
In order to gain the maximum advantage from a modular system it is recommended that a sequence panel be used where four or more boiler modules are installed. Hamworthy can provide this panel in an electronic solid state form in sizes of 4, 6, 8, 10 and 12 steps.

The panel can be utilised for constant flow temperature systems or alternatively for compensated systems with the addition of an outside air detector.

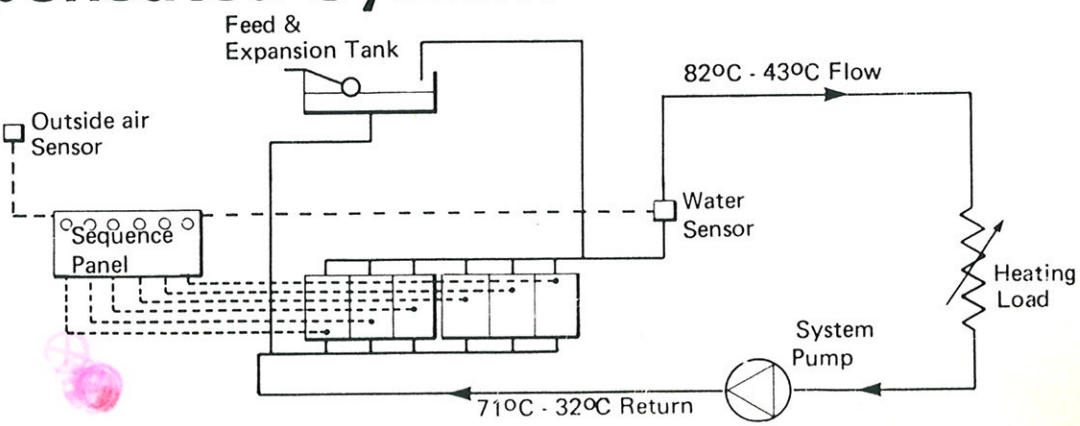
Other features can be employed to advantage with the sequence panel such as optimisation and night set back.

The layouts shown below are for general guidance and include a sequence control panel where necessary.

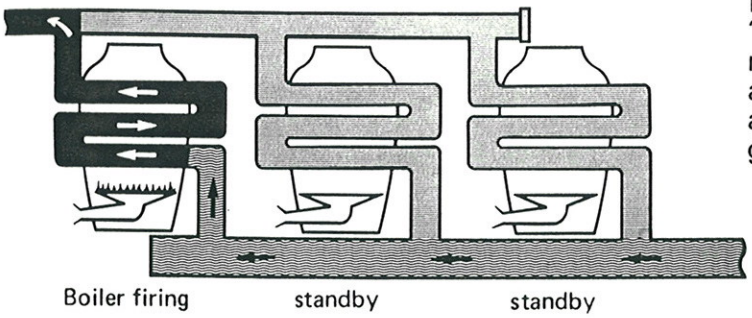
Constant Temperature System



Compensated System

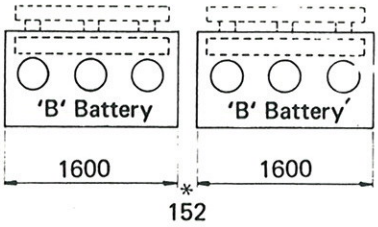


Horizontal series flow water system

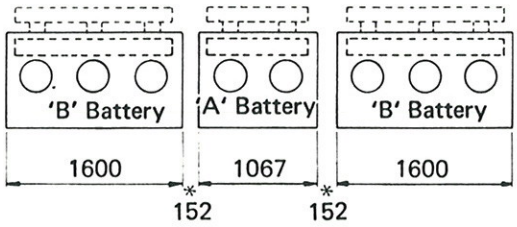


It will be seen that the system layouts employ the "reverse return" method of water connection which must always be used to ensure even water flow across the modules. In this way the pressure loss across any size bank of boiler modules is never greater than 1.9 ft head plus local pipework losses.

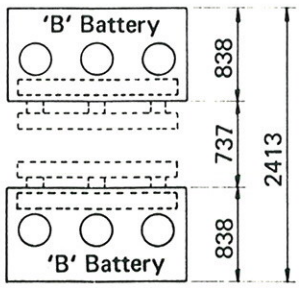
Typical battery groupings



2 'B' Batteries Side by Side

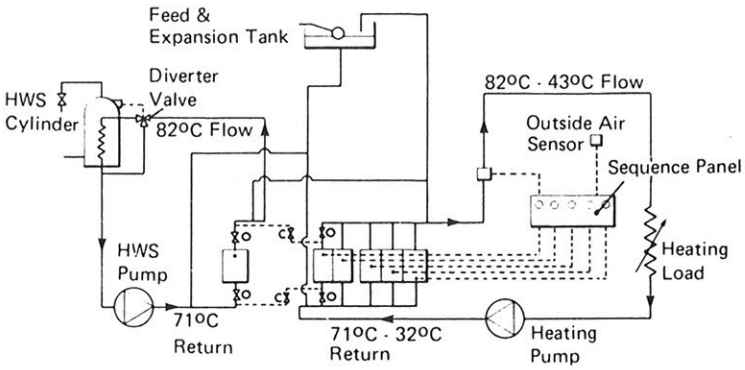


2 'B' Batteries & 1 'A' Battery Side by Side

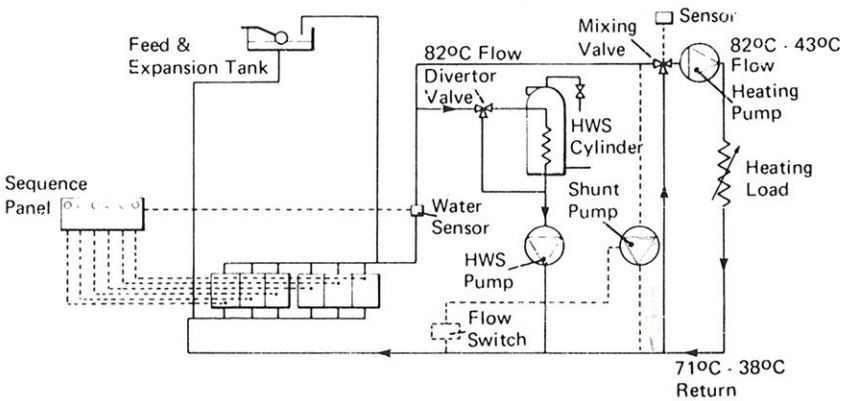


2 'B' Batteries Back to Back

Heating and HWS Split System

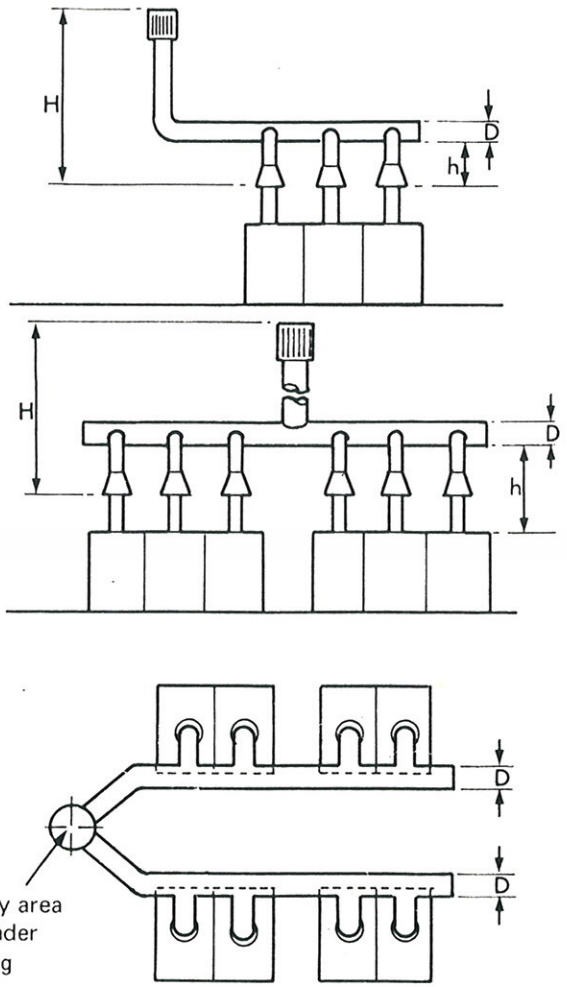


Heating and HWS Joint System



'ue Header Sizing Data

- For any atmospheric fired modular boiler system certain factors must be taken into account to ensure the correct removal of flue gases and the notes below are designed to compliment the table which gives header sizes applicable to the Hamworthy range.
- The tabulated diameters are standard for the typical arrangements shown.
- Any flue layout should be designed to achieve a suction of 0.125 mbar at all times at the draught diverter outlets on all modules in the bank.
- Where more than 8 modules are employed it is recommended that two headers be used.
- The chimney off-take can be taken from the centre or end of the header but centre connec- 'on is preferred where possible.



Min Chimney area = sum of header areas entering

- The header should be positioned as high as possible in the boilerhouse but dimension h, should not be less than 500 mm.
- In design of flue systems due reference must always be made to Local Authorities byelaws and regulations governing chimney heights and termination points.
- Where boilers are sequentially controlled in a line arrangement it is preferable for optimum draught conditions to step boilers commencing with the boiler nearest to the chimney.
- Where the layouts shown, or header sizes indicated cannot be accommodated due to site conditions, alternative arrangements and methods of flue gas removal can be utilised and reference should be made to Hamworthy Technical Department.

Recommended Header Diameters (D) mm					
Model Size	Height of chimney above draught diverter(H)m				
	2m	3m	6m	10m	20m
180	178	178	178	178	178
210	203	203	203	203	203
250	203	203	203	203	203
280	203	203	203	203	203
320	203	203	203	203	203
360	279	254	203	203	203
420	305	279	229	213	203
500	330	305	254	229	203
560	356	315	279	254	229
640	381	330	289	264	254
750	406	356	305	279	264
840	432	381	330	305	279
960	457	406	346	320	295
1000	467	416	356	330	305
1120	483	432	366	340	315
1280	508	457	381	356	330
1400	533	483	406	381	340
1600	584	508	432	406	381
1920	610	559	457	432	406
2240	660	584	508	457	432
2560	711	610	533	508	457

Fan Dilution Systems

An alternative method of flue gas removal which can be employed where conditions permit is fan dilution. Basically the flue gas from the boilers is ...ted with fresh air to reduce the CO_2 concen- ...on to less than 1%.

This mixture can then be discharged at low level. Further details are available from our Sales or Technical Departments.