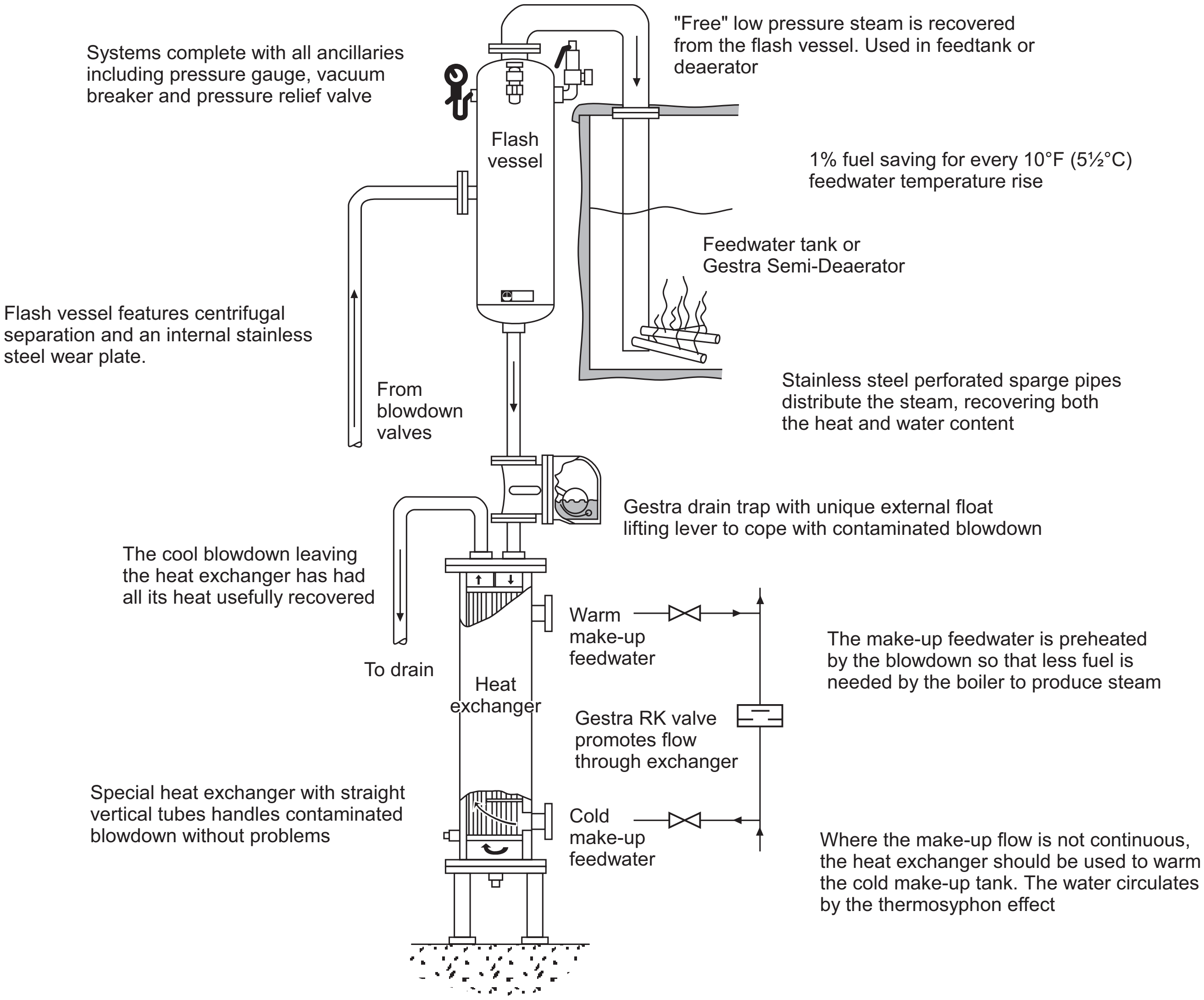
Boiler blowdown contains useful heat.
Recover the heat content and a proportion of the water content of blowdown with a Gestra boiler blowdown heat recovery system.
Recovers up to 80% of the blowdown heat.

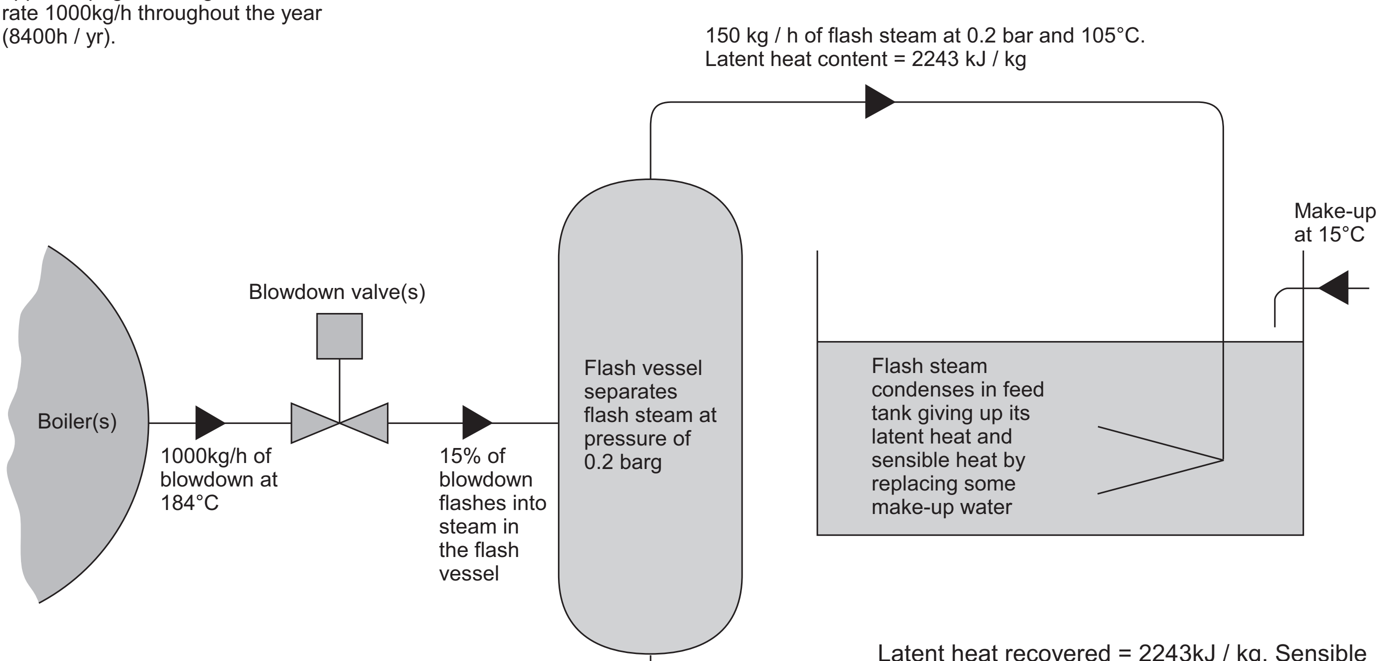


Ask us for a **free** survey to assess the potential for Boiler Blowdown Heat Recovery

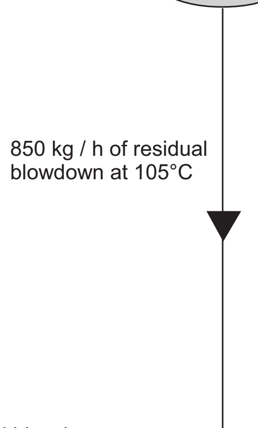
Calculating the heat recovery cost savings

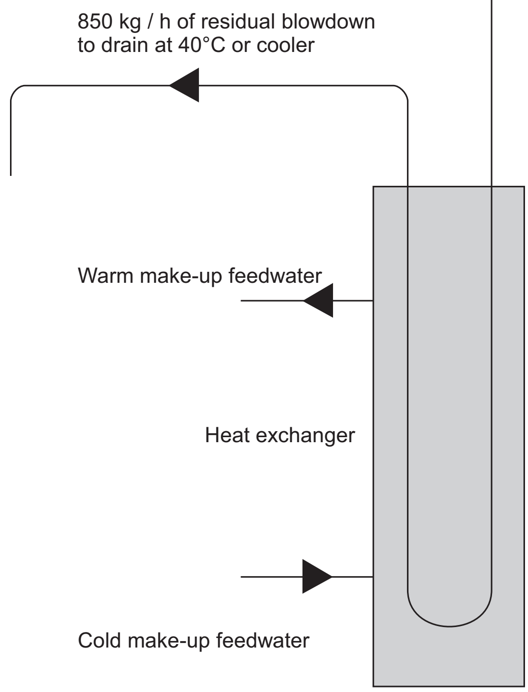
SI Units

Example
10 bar boilers, oil fired producing steam at £21.00 per 1000kg (cost of heat = 0.8p / MJ) see opposite page. Average blowdown rate 1000kg/h throughout the year (8400h / yr).



Boiler pressure barg	Percentage flash steam
5	10.3
6	11.4
7	12.4
8	13.4
9	14.3
10	15.0
12	16.6
14	17.9
16	19.2
20	21.4
30	25.6





Latent heat recovered = 2243kJ / kg. Sensible heat recovered by cooling condensed flash steam from105°C to 15°C

$= (105 - 15)°C \times 4.19 \frac{kJ}{kg°C} = 377\ kJ / kg$

Total heat recovered in flash steam

$= 150\frac{kg}{h} \times (2243 + 377) \frac{kJ}{kg} = 393\ MJ / h$

For a cost of heat of 0.8p / MJ

Annual cost savings from flash steam recovery

$= 393\frac{MJ}{h} \times 0.8\frac{p}{MJ} \times 8400\frac{h}{yr}$

= £26410 every year

Heat recovered to the feedwater

= heat lost by the residual blowdown

$= 850\frac{kg}{h} \times (105\text{-}40)°C \times 4.19\frac{kJ}{kg°C}$

= 231 MJ/h

Annual cost savings by recovering heat in the heat exchanger

$= 231 \frac{MJ}{h} \times 0.8\frac{p}{MJ} \times 8400\frac{h}{yr}$

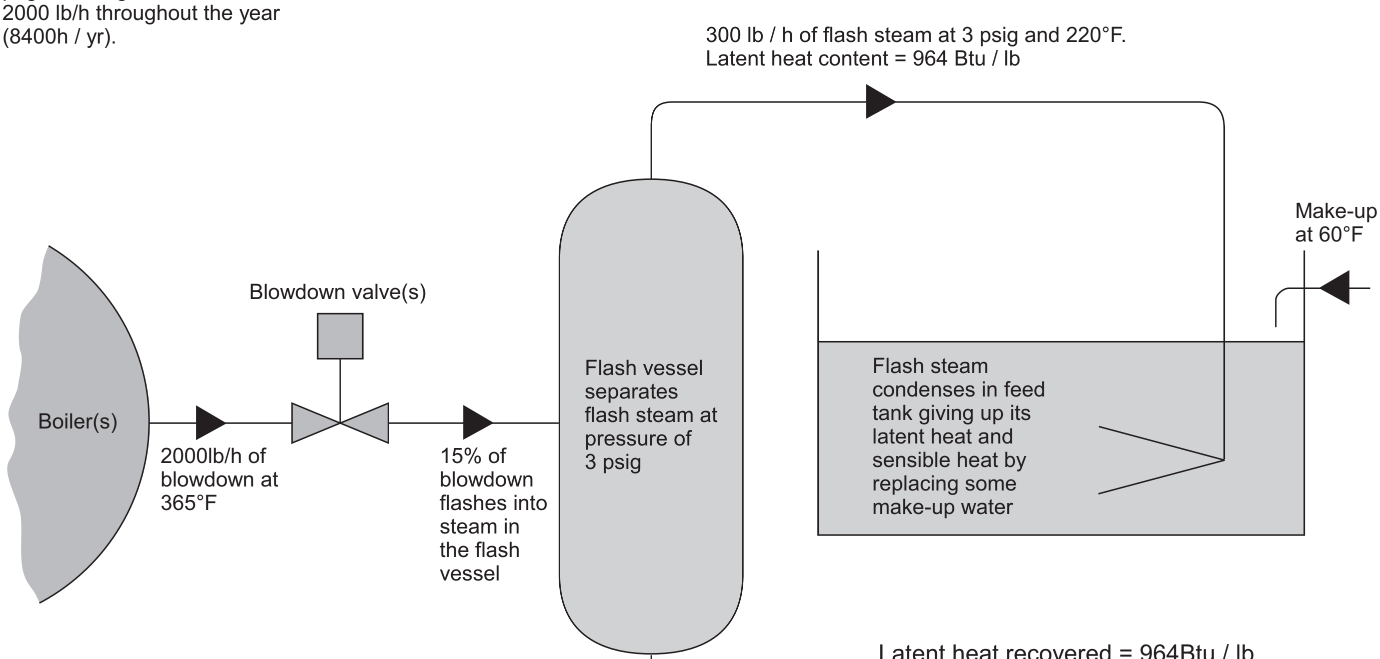
= £15524 every year

Total heat recovery cost savings = £26410 + £15524 = £41934 every year

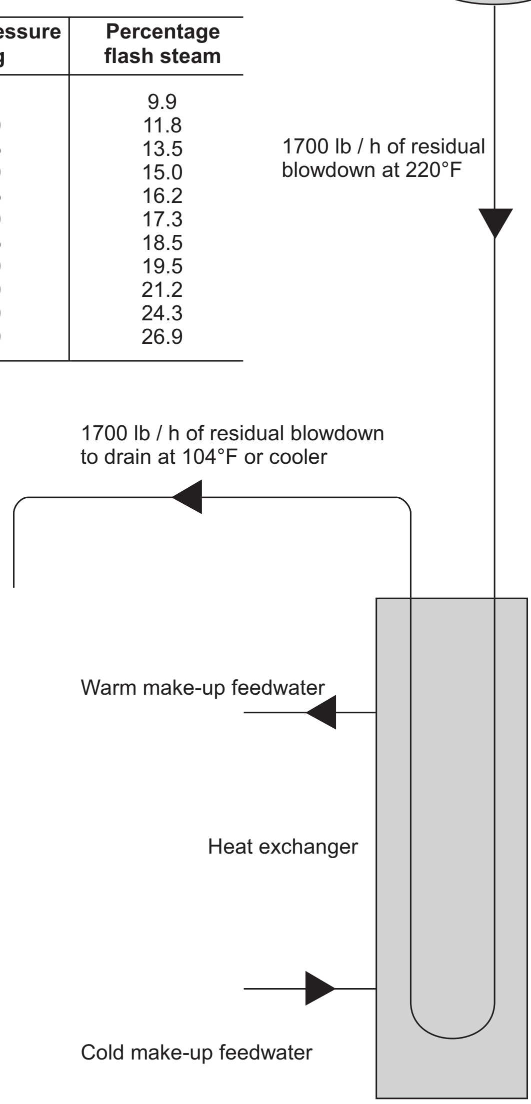
Calculating the heat recovery cost savings

Imperial Units

Example
150 psi boilers, oil fired producing steam at £5.38 per 1000lb (cost of heat = 49.7p / therm) see next page. Average blowdown rate 2000 lb/h throughout the year (8400h / yr).



Boiler pressure psig	Percentage flash steam
75	9.9
100	11.8
125	13.5
150	15.0
175	16.2
200	17.3
225	18.5
250	19.5
300	21.2
400	24.3
500	26.9



Latent heat recovered = 964Btu / lb.

Sensible heat recovered by cooling condensed flash steam from 220°F to 60°F

$= (220 - 60)°F \times 1 \frac{Btu}{lb°F} = 160$ Btu / lb

Total heat recovered in flash steam

$= 300\frac{lb}{h} \times (964 + 160) \frac{Btu}{lb} = 3.37$ therm / h

(10^5 Btu = 1 therm)

For a cost of heat of 49.7p / therm

Annual cost savings from flash steam recovery

$= 3.37 \frac{therm}{h} \times 49.7\frac{p}{therm} \times 8400\frac{h}{yr}$

= £14069 every year

Heat recovered to the feedwater

= heat lost by the residual blowdown

$= 1700\frac{lb}{h} \times (220-104)°F \times 1 \frac{Btu}{lb°F}$

= 1.97 therm/h

Annual cost savings by recovering heat in the heat exchanger

$= 1.97 \frac{therm}{h} \times 49.7\frac{p}{therm} \times 8400\frac{h}{yr}$

= £8224 every year

Total heat recovery cost savings = £14069 + £8224 = £22293 every year

The cost of fuel, cost of heat and cost of steam

Typical fuel costs

Fuel	Price	Gross calorific value	Cost per MJ	Cost per therm
Natural gas	34.2p / therm		0.342p	34.2p
Oil- 35s - 200s - 950s - 3500s	19.3p / litre 16.5p / litre 14.4p / litre 13.4p / litre	3.81 MJ / l 40.4 MJ / l 40.6 MJ / l 41.1 MJ / l	0.507p 0.407p 0.354p 0.326p	53.4p 42.9p 37.3p 34.4p
Coal - singles - small	£66.60 / tonne £61.60 / tonne	5000 MJ / tonne 49300 MJ / tonne	0.235p 0.219p	24.8p 23.1p

Prices based on July 1995 figures. Oil prices are very variable and may be considerably lower than these 'official' figures.

Cost of heat

The table above gives some typical costs of heat based on the fuel gross calorific value. Not all this heat can be transferred to the steam, mainly due to the heat lost in the flue gases and other heat losses from the boiler. The boiler efficiency is the usual way of representing these heat losses.

The cost of heat usefully transferred to the steam may be obtained by dividing the cost of fuel above (p / MJ or p / therm) by the boiler efficiency. Typical figures are tabulated below.

Cost of steam

The amount of heat required to convert 1kg of feedwater to steam is the latent heat of evaporation plus the sensible heat needed to bring the feedwater up to the boiler saturation temperature.

In the case of a 10 bar boiler where the feedwater is at 60°C the heat required =

$$2000 \text{ kj / kg} + [(184-60)\text{°C} \times 4.19 \frac{\text{kJ}]}{\text{kg°C}} = 2520 \text{ kJ / kg}$$

The imperial equivalent works out at 860 + 223 = 1083 Btu / lb

The table below is based on a 10 bar (145 psi) boiler with feedwater at 60°C (140°F) operating with an overall efficiency of 75%

Fuel	Cost of heat as steam		Cost of steam (£)	
	p / MJ	p / therm	per 1000 kg	per 1000 lb
Natural gas	0.432	45.6	10.89	4.94
Oil - 35s - 200s - 950s - 3500s	0.676 0.543 0.472 0.435	71.2 57.2 49.7 45.9	17.04 13.68 11.89 10.96	7.71 6.19 5.38 4.97
Coal - singles - smalls	0.313 0.292	33.1 30.8	7.89 7.36	3.58 3.34

Estimating the heat recovery cost savings

The graph below can be used for a quick estimate of the cost savings which may be obtained by recovering the waste heat in the blowdown. For a more exact figure follow the calculation example.

The fuel savings by recovering the waste heat in continuous boiler blowdown can often be very worthwhile. Many systems have paid for themselves well within 12 months, and continue to save fuel year after year.

A typical Gestra heat recovery system will recover about 80% of the waste heat in the blowdown, slightly more than half the savings being made in the flash vessel, the remainder in the heat exchanger.

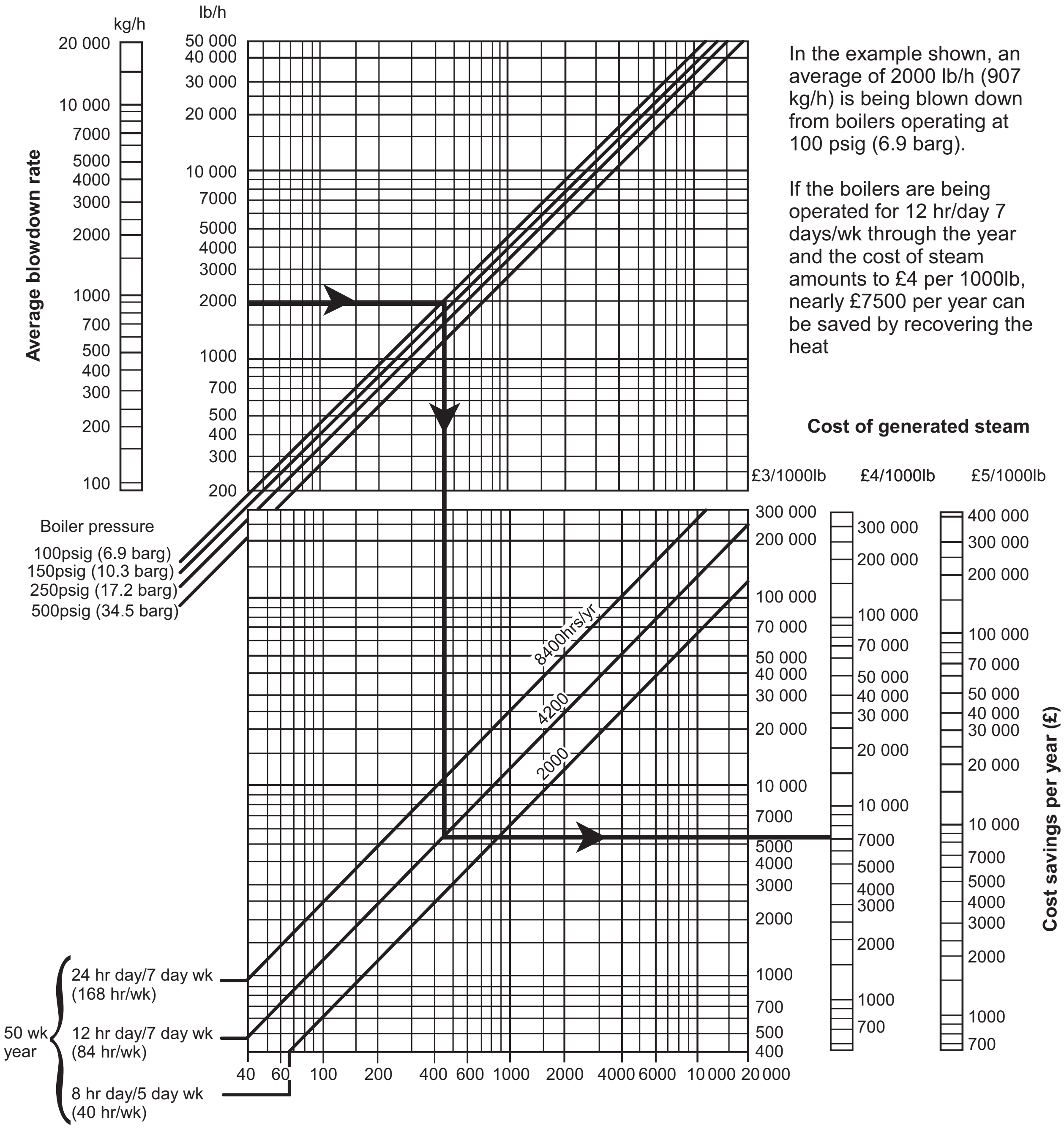
Choosing a heat recovery system.

The blowdown rate

Before any equipment can be selected it is necessary to estimate the **maximum** amount of blowdown that will be required. Measurement of the feedwater TDS will allow a percentage blowdown rate to be calculated and therefore a maximum blowdown rate based on the maximum steam to be generated by the plant. When selecting heat recovery equipment it pays to be generous and base the sizing on maximum possible flowrates.

If in doubt, we can survey your boiler plant and advise on the equipment selection.

Heat recovery cost savings



In the example shown, an average of 2000 lb/h (907 kg/h) is being blown down from boilers operating at 100 psig (6.9 barg).

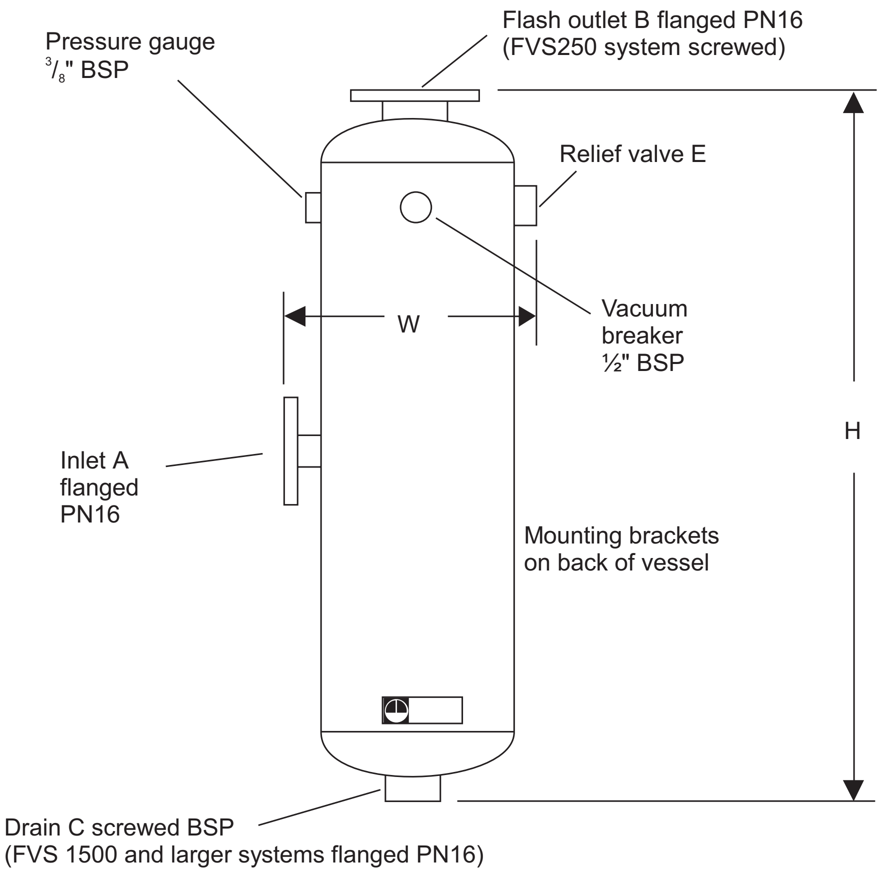
If the boilers are being operated for 12 hr/day 7 days/wk through the year and the cost of steam amounts to £4 per 1000lb, nearly £7500 per year can be saved by recovering the heat

Equipment specifications and dimensions

Flash Vessel

Carbon steel pressure vessel designed and manufactured to BS5500 Category 3 with dished ends and internal stainless steel wear plate.

System type FVS	250	500	750	1000	1500	2000
Inlet A	25mm	32mm	40mm	50mm	50mm	65mm
Outlet B	2" BSP	80mm	100mm	100mm	150mm	150mm
Drain C	1¼" BSP	1½" BSP	1½" BSP	1½" BSP	65mm	65mm
Relief valve E	¾" BSP	1" BSP	1½" BSP	1½" BSP	1½" BSP	2" BSP
Dimension H mm	975	1250	1450	1460	1480	1505
Dimension W mm	290	340	395	445	475	600



Pressure gauge set

Direct mounting gauge 0 - 2.5 bar, complete with syphon tube and gauge cock. $^3/_8$" BSP.

Vacuum breaker

Prevents a vacuum in the flash vessel and avoids possible syphoning of water from the feedtank when the system is shut down. ½" BSP.

Pressure relief valve

'Pop' type valve set to open at 2 bar. Screwed bronze valve for systems up to FVS2500. Flanged cast iron valve for larger systems.

Drain trap

Cast iron float trap with stainless steel working parts. A float lifting lever is fitted so that any solids can easily be purged out of the system.

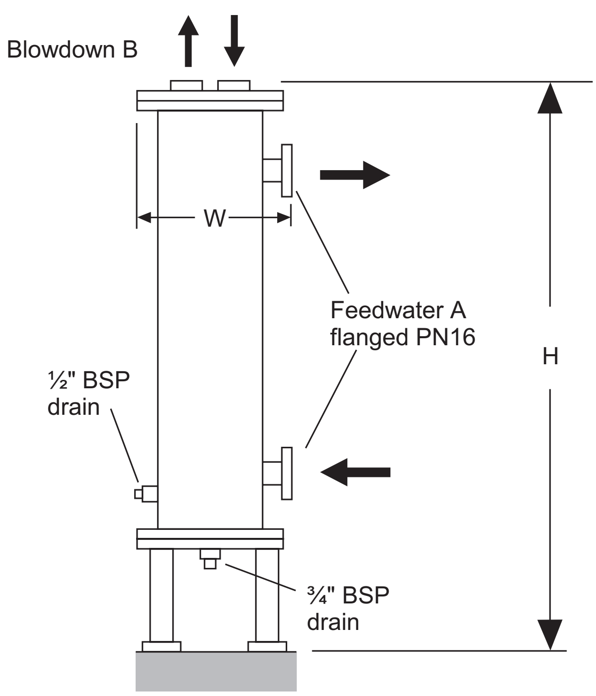
Sparge pipes

The complete assembly is in stainless steel. The FVS250 system uses a single sparge pipe with elbow which screws onto the flash steam downpipe. Larger systems have multiple sparge pipes which screw into a distribution manifold prepared for welding to the downpipe.

Heat exchanger

Carbon steel shell with copper tubes (stainless steel tubes also available at extra price)

Type HE	Connections A	Connections B	Dimensions in mm	
			H	W
43 44 45	40mm	1" BSP	1230 1530 1830	270
63 64 65	50mm	1½" BSP	1250 1550 1850	325
83 84 85 86	80mm	1½" BSP	1285 1585 1885 2185	380
104 105 106	80mm	2" BSP	1590 1890 2190	440
124 125 126	80mm	80mm PN16	1675 1975 2275	495



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