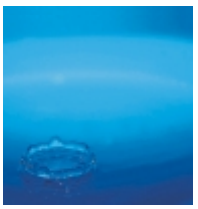
ARMATUREN
ARI ARMATUREN STEAMLINE LLP

Flash Separators

Celebrating
15 years of service
to the
Indian Process
Industry



Rescue energy that's draining away...

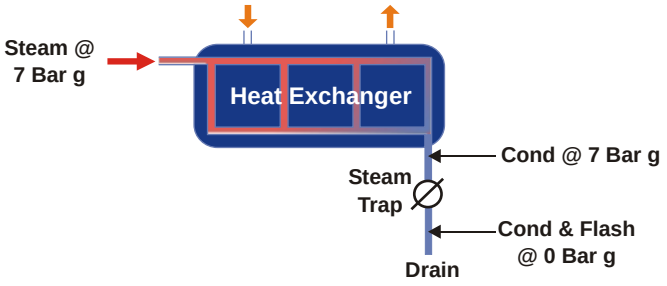
We sell Savings©

WHAT IS FLASH STEAM?

In most steam installations, it is common to see a plume of steam rising above the boiler house or a condensate tank. This “flash steam” is just like live steam and contains as much heat as live steam at the same pressure.

When pressure is reduced, water boils at a lower temperature. As steam is discharged from the steam space of equipment, its pressure reduces from that of the steam supply (or, steam space) to that of the outlet.

Flash steam is generated at the point at which pressure drops. For e.g. At trap outlets. The pipe downstream of the trap will contain a mixture of condensate and flash steam (at the lower pressure) .



For example, if the heat exchanger shown here is supplied with steam at 7 bar g, and this is discharged via the trap to the atmosphere, the pressure after the trap is close to 0 bar g (atmospheric pressure).

The boiling point (and therefore, temperature) drops sharply.

This means that the sensible heat of the condensate is suddenly reduced from 171.3 kcal/kg to 100 kcal/kg.

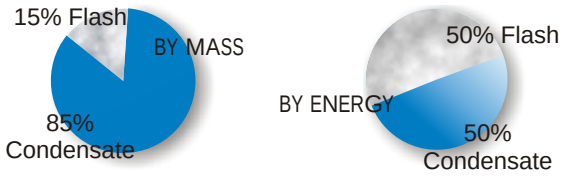
So, where does the surplus sensible heat of 171.3 - 100 = 71.3 kcal/kg go?

Pressure kg/cm2 (absolute)	Temp. Deg C	Enthalpy of water kcal/kg	Enthalpy of steam kcal/kg	Latent heat of vapourisation kcal/kg
P	T	hf	hg	hfg=hg-hf
1	99.1	**100**	638.5	539.4
2	119.6	119.9	645.8	525.9
4	142.9	143.6	653.4	509.8
6	158.1	159.3	657.8	498.5
8	169.6	**171.3**	660.8	489.5
10	179.0	181.2	663.0	481.8
11	183.2	185.6	663.9	478.3

Flashes into steam!!

DOES IT MATTER ?

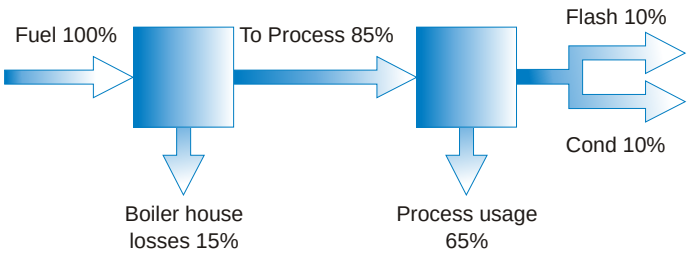
A condensate pipe contains only 15% flash steam as compared to 85% of condensate by mass. The flash steam may therefore, seem trivial. However, the heat energy present in steam at 1kg/cm^2 is more than **6 times** that of water !!



**IN OTHER WORDS,
HALF THE ENERGY IN CONDENSATE CAN BE LOST
IF FLASH STEAM IS VENTED !**

TYPICAL STEAM SYSTEM ENERGY BALANCE

Even if condensate is returned, but flash is vented, the energy lost is still almost 10%.



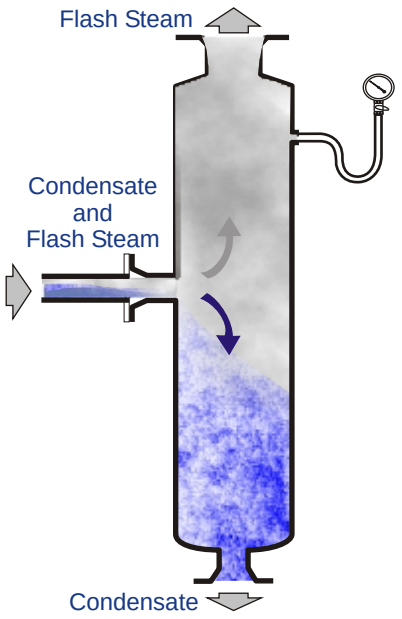
SAVING ENERGY FROM FLASH

As seen here, any condensate pipe carries approximately 99% (by volume) of flash steam, and 1% of condensate. This bi-phase condition occurs immediate downstream of the trap or discharge orifice.

WORKING PRINCIPLE

The ARI Steamline Flash Separator is designed with efficiency and economics in mind. It effectively separates this bi-phase fluid into flash steam & condensate as seen in the diagram. The vessel diameter is sized so as to reduce the velocity of the fluid in the pipe. The heavier condensate falls to the bottom of the flash separator and is drained by a suitable steam trap. The height of the vessel is chosen such that flash steam rises without entraining water droplets, resulting in drier steam.

This flash steam can be recovered from condensate. It can then be used for low pressure steam applications, for removing dissolved oxygen in deaerator tanks and heating boiler feedwater. Even blowdown or contaminated condensate can be flashed and put to good use. Remember, flash is as good as live steam hence, flash recovery is the best form of energy conservation.



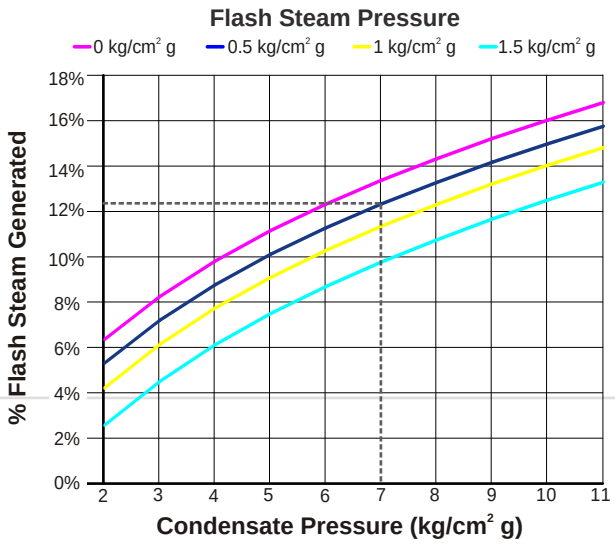
WHAT BENEFIT CAN I EXPECT ?

Flash steam is just as good as live steam therefore, the cost of flash steam is exactly the same as live steam. To estimate flash quantities quickly, we use the formula below to develop a set of graphs. (Note: Normally we flash at 0.5 or 1kg/cm^{2}g)

$$\% \text{ Flash Steam Generated} = \frac{(h_{f1} - h_{f2}) \times 100\%}{h_{fg2}}$$

Where,

h_{f1} = Enthalpy of water at higher press in kcal/kg
h_{f2} = Enthalpy of water at the flashing press in kcal/kg
h_{fg2} = Latent heat of vaporisation at the flash steam pressure in kcal/kg



Calculating Flash Steam separated

For example, if a heat exchanger is supplied with 500 kg/hr of steam @ 7 kg/cm^{2}g, this steam condenses to the same quantity of condensate after giving off heat to process. This condensate at 7 kg/cm^{2}g is discharged to a flash separator at 0.5 kg/cm^{2}g. Let us see how much flash steam can be separated.

In the graph above, travel vertically up from the condensate pressure at 7 to the 0.5 flash line. At that point go horizontally across to the Y-axis to see the % flash separated.

Quantity of flash steam = 12.5% of 500 kg/hr = 62.5 kg/hr

$$\text{Fuel savings/hr} = \frac{\text{Qty of flash X heat content X Cost of fuel}}{\text{GCV of fuel X boiler efficiency X Sp. gravity}}$$

Assuming boiler is oil fired, furnace oil cost Rs. 30 per litre, and that the heat exchanger runs for 8000 hrs/year.

$$\text{Fuel savings} = \frac{62.5 \times 532 \times 30}{10200 \times 0.84 \times 0.88} = \text{Rs } 132.29 \text{ /hr}$$

= Rs. 132.29 p/hr X 8000 hrs = Rs. 10,58,320 /yr

Water savings = Qty of flash X water cost/litre X hrs/yr

= 62.5 kg/hr X 0.1 paise/litre X 8000 hrs/yr

= Rs. 50,000 /yr

The total savings are Rs. 11,08,320 /yr. A Flash Separator costs a fraction of this amount.

HOW CAN FLASH STEAM BE USED ?

Utilising flash steam can improve boiler efficiency substantially, and decrease the steam consumption from the boiler.
In continuous blowdown systems where blowdown rates are higher due to the poor feed water quality, heat from the blowdown water can be recovered in the form of flash steam.

✓Nearly 50% of energy available in the hot pressurized water (either blowdown or condensate) can be recovered in the form of flash steam.

✓Low pressure steam can be useful in LP steam processes. This is well illustrated in Fig 1 below.

✓Low pressure flash steam is often used in the deaerator to reduce dissolved oxygen content and save fuel by increasing feedwater temperature.

✓Specific steam consumption is reduced by using flash

✓It can even be condensed so at least the water can be saved.

✓Even if no use at all can be found for low pressure flash steam it can always be used to heat feedwater thus reducing fuel consumption. See Fig 2 below.

Figure 1

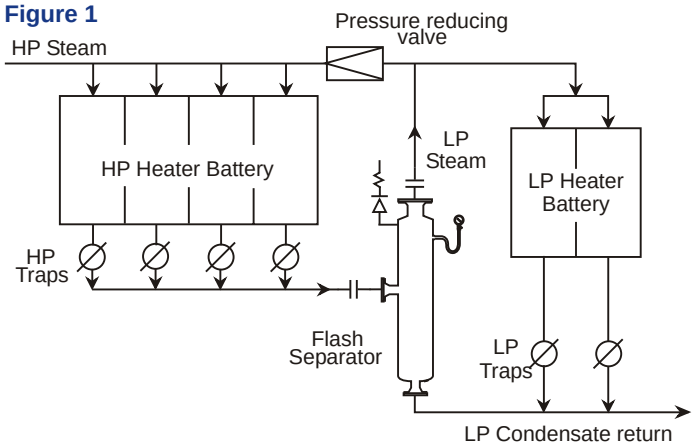
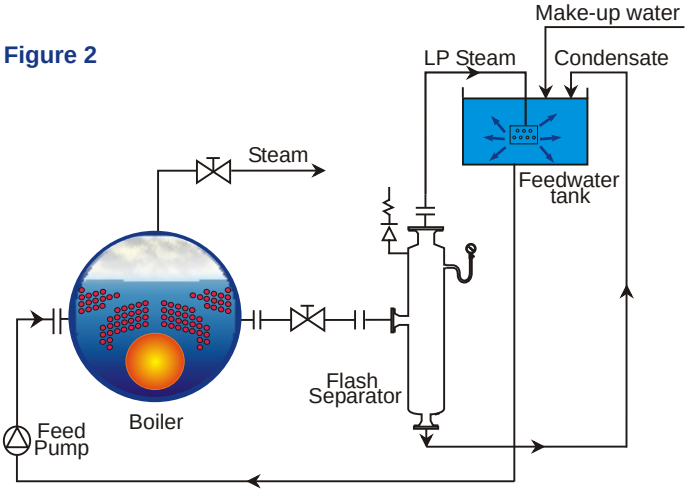


Figure 2



A common thumb rule states that every 6°C rise in feedwater temperature results in a 1% fuel saving.
(Source: PCRA handbook for energy conservation)

SIZING AND SELECTING THE CORRECT SEPARATOR

The FS is sized depending on the following factors :

- Condensate inlet flow to the flash vessel
- Pressure of the flash steam inside the flash vessel.
- Qty of flash steam (calculated)

Our heat exchanger example has an inlet condensate flow of 500 kg/hr. The quantity of flash steam as seen from the %Flash steam graph is =12.5% of 500 kg/hr = 62.5 kg/hr

From the selection table below, we can see that FS150 is the separator suited for our needs.

Condensate kg/hr	Flash Steam, kg/hr				
	50	100	200	500	1000
15000	FS400	FS400	FS400	FS400	FS400
10000	FS350	FS350	FS350	FS350	FS350
5000	FS300	FS300	FS350	FS350	FS350
2500	FS250	FS250	FS300	FS300	
2000	FS250	FS250	FS250	FS300	
1500	FS200	FS250	FS250	FS300	
1000	FS200	FS200	FS250		
500	FS150	FS150			
250	FS150				

Selection Table

ORDERING INFORMATION

☐ FS150
☐ FS200
☐ FS250
☐ FS350
☐ FS400

☐ I =IBR
☐ N=NIBR

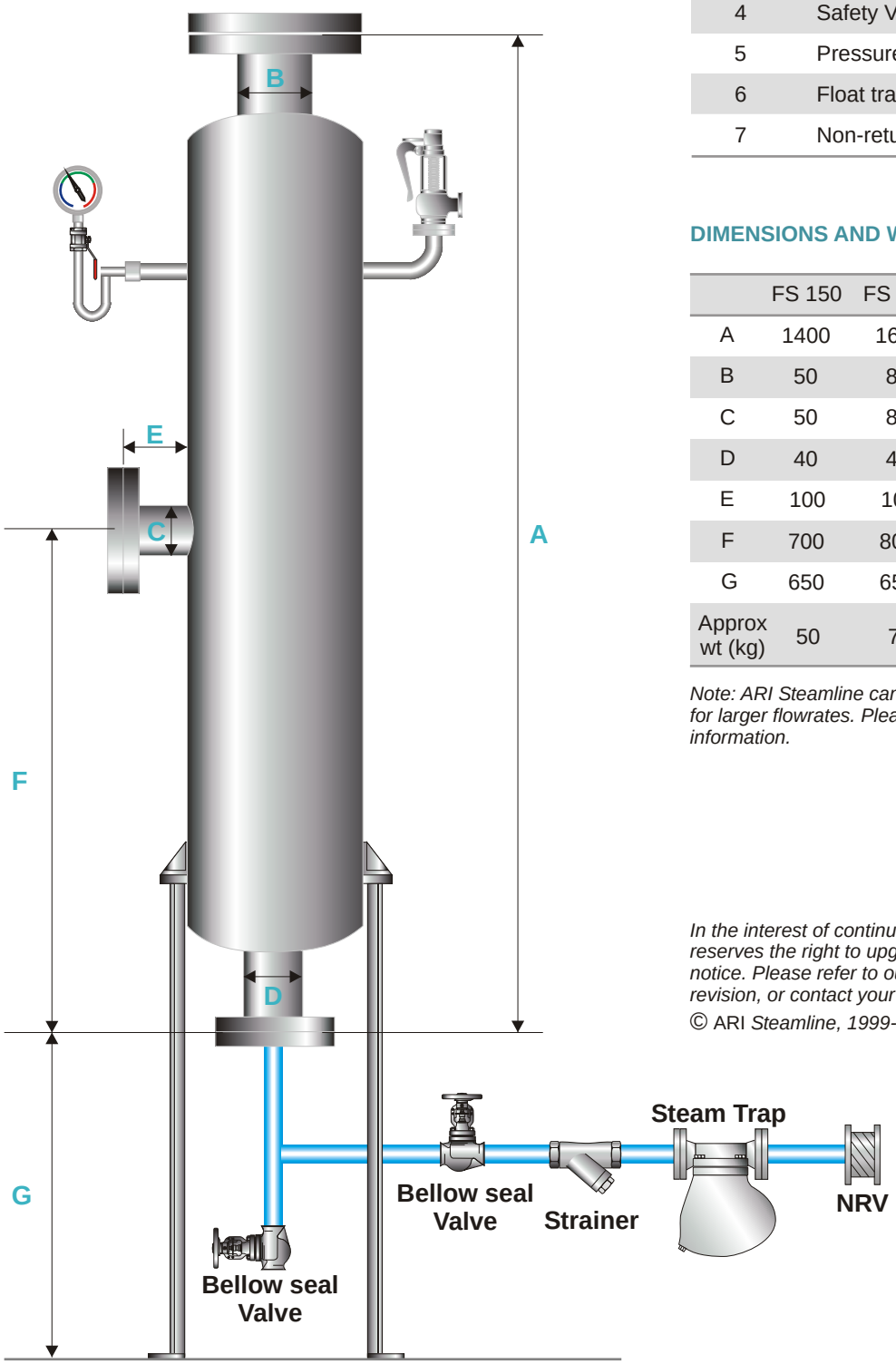
☐ S= Std. Flanges (ASA150)
☐ X= Non-std. Flanges

FEATURES OF ARI STEAMLINE **FLASH SEPARATORS**

- Low separation velocity ensures dryness
- Supplied complete with all required accessories
- Designed in accordance with IBR code
- IBR certified versions available
- Superior build quality and parts
- Optional customized level based discharge for larger flow-rates

STANDARD SUPPLIES

- ✓ Pressure gauge with syphon and cock
- ✓ Safety valve
- ✓ Strainer and steam trap
- ✓ Mounting kit
- ✓ Lifting eye (FS 250 and above)



MECHANICAL SPECIFICATIONS

Operating Parameters

Design Pressure	10 kg/cm^{2}g
Pressure Class	#150 (Higher on request)
Design Temperature	200°C
Flange Standard	ASA150

Materials

S.No.	Part	Material
1	Shell & Nozzles	CS to ASTM A 106 Gr. B
2	Dished ends	CS to ASTM A 234 Gr. WPB
3	Flanges	CS to ASTM A 105
4	Safety Valve	CS to ASTM A 216 Gr. WCB
5	Pressure gauge	SS 304
6	Float trap module	CS / NI
7	Non-return Valve	Disc Type SS 316

DIMENSIONS AND WEIGHTS

	FS 150	FS 200	FS 250	FS 300	FS 350	FS 400
A	1400	1600	1600	1600	1800	1800
B	50	80	100	100	150	150
C	50	80	100	100	150	150
D	40	40	50	50	50	50
E	100	100	100	100	100	100
F	700	800	800	800	900	900
G	650	650	700	700	700	700
Approx wt (kg)	50	75	110	150	190	250

Note: ARI Steamline can also make custom-designed Flash Separators for larger flowrates. Please contact sales@ari-steamline.com for more information.

In the interest of continuous product development, ARI Steamline reserves the right to upgrade or modify any specifications without prior notice. Please refer to our website www.ari-steamline.com for the latest revision, or contact your local ARI Steamline Sales Engineer.

Flash Separator

Partial Reference List

Sr.	Client & Location	Qty
1	Weikfield Agro, Pune	1
2	Cadbury India, Pune	1
3	Cadbury India, Pune	1
4	Wimco, Mumbai	1
5	Hindustan Polyamides, Pune	1
6	Coca-cola, Wada	1
7	Fresenius Kabi, Pune	1
8	Dynamix Dairy, Pune	5
9	Coca-cola, Wada	3
10	Coca-cola, Wada	3
11	Shriram Trading, Kolhapur	1
12	Nestler Limited,Mumbai	2
13	Fresenius Kabi,Pune	2
14	Privi Aromatic, Mahad	1
15	ACSI, Pune	1
16	Global Oils and Fats Ltd, Gujrat	5
17	Thermax Chemicals, Khopoli	3
18	Thermax Microlabs, Chinchwad	4
19	Aggarwal Rice Mill, Moga	1
20	Godfrey Phillips, Mumbai	1
21	Godfrey Phillips, Mumbai	1
22	Baxter India,Waluj	3
23	ACSI, Pirangut	1
24	Cee Dee Vaccum, Pune	1
25	Privi Organics, Mahad	1
26	Pratima Enterprises, Pune	1
27	ACSI, Uttaranchal	1
28	ACSI, Pirangut	1
29	Shalina Laboratories P. Ltd., Mumbai	2
30	Praj Industries Ltd., Pune	1
31	Godfrey Phillips, Mumbai	1
32	Orchid Chemicals, A'bad	1
33	Precision Controls, Pune	1
34	Orchid Chemicals, A'bad	1
35	Precision Controls, Pune	1
36	Alok Industries, Vapi	5
37	Cargill Foods India Ltd,.Kurkumbh	1
38	Multi Organics, Chandrapur	1
39	Precision Controls. Pune	2
40	Alok Industries, Vapi	1

Sr.	Client & Location	Qty
41	Precision Controls, Pune	2
42	Suvarna Fibrotech,Pune	1
43	Serum Institute, Pune	3
44	Serum Institute, Pune	1
45	Serum Institute, Pune	3
46	Alok Industries, Vapi	5
47	ATC Tires, Tirunelveli	4
48	Precision Controls, Pune	1
49	Zytex Biotech Pvt. Ltd., Mumbai	1
50	Bodal Chemicals Ltd-VII, Gujarat	1
51	Sudarshan Chemicals, Roha	3
52	Meghmani Organics, Ahmedabad	1
53	Meghmani Organics, Ahmedabad	1
54	Cipla Limited,Patalganga	1
55	Alok Industries, Vapi	2
56	Mayur Dye Chem, Baroda	1
57	Precision Controls, Pune	1
58	Sudarshan Chemicals, Mahad	1
59	Precision Controls, Pune	1
60	Sudarshan Chemicals, Mahad	2
61	Orchid Chemicals, Aurangabad	1
62	ATC Tyres, Tirunelvelli	4
63	Mayur Dyechem, Baroda	1
64	Orchid Chemicals, Aurangabad	1
65	Orchid Chemicals, Aurangabad	1
66	Chhaya Packers, UP	1
67	NOCIL Ltd, Dahej	5
68	UPL, Ankleshwar	1
69	Satyam Petro, Pune	1
70	UPL, Ankleshwar	1
71	UPL, Vapi	1
72	Heritage Beverages, Gurgaon	1
73	Triumph Boilers, Delhi	1
74	UPL, Vapi	2
75	UPL, Jagadia	1
76	UPL, Jagadia	1
77	UPL, Ankleshwar	1
78	Archean Chemicals, Gujrat	1

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