

HVAC

How to save energy (part 2)



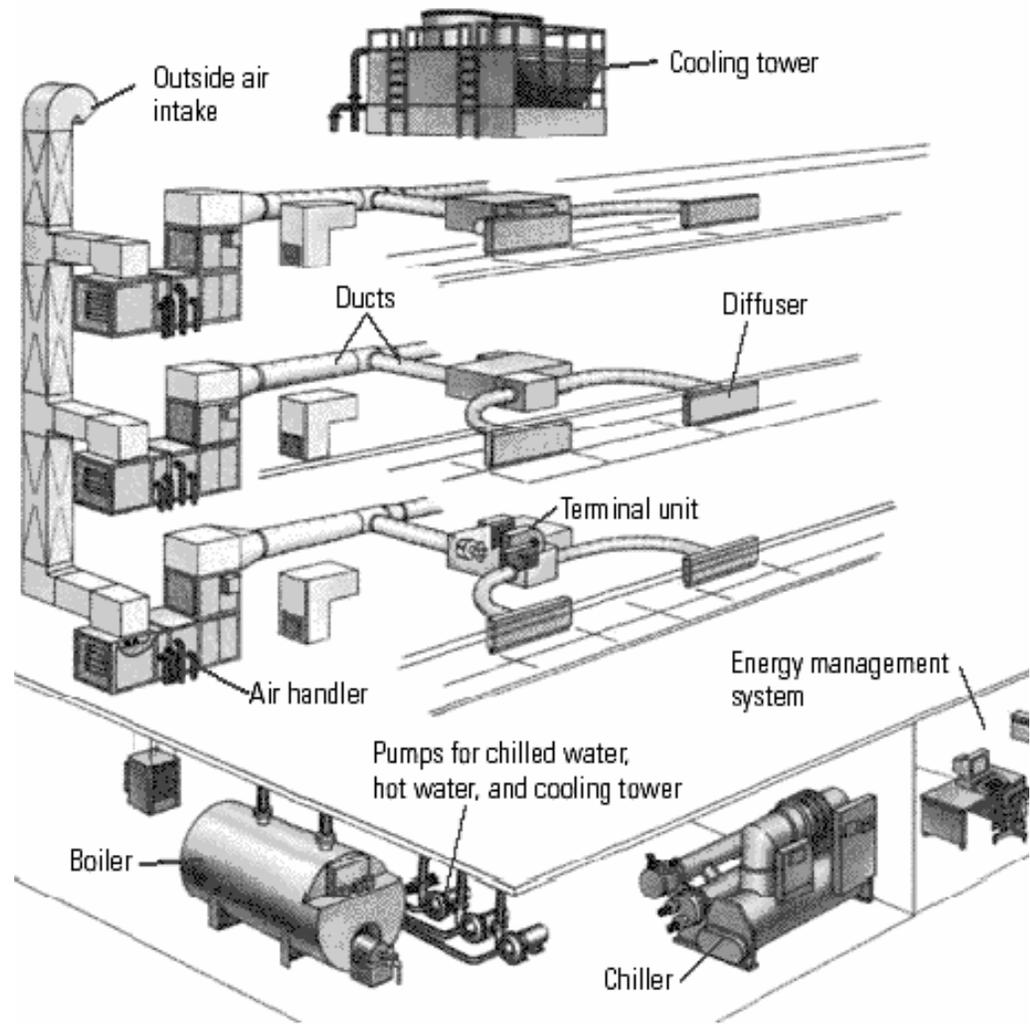
State Energy Assessment Workshop

By:

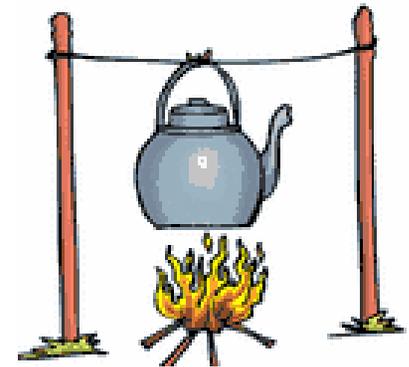
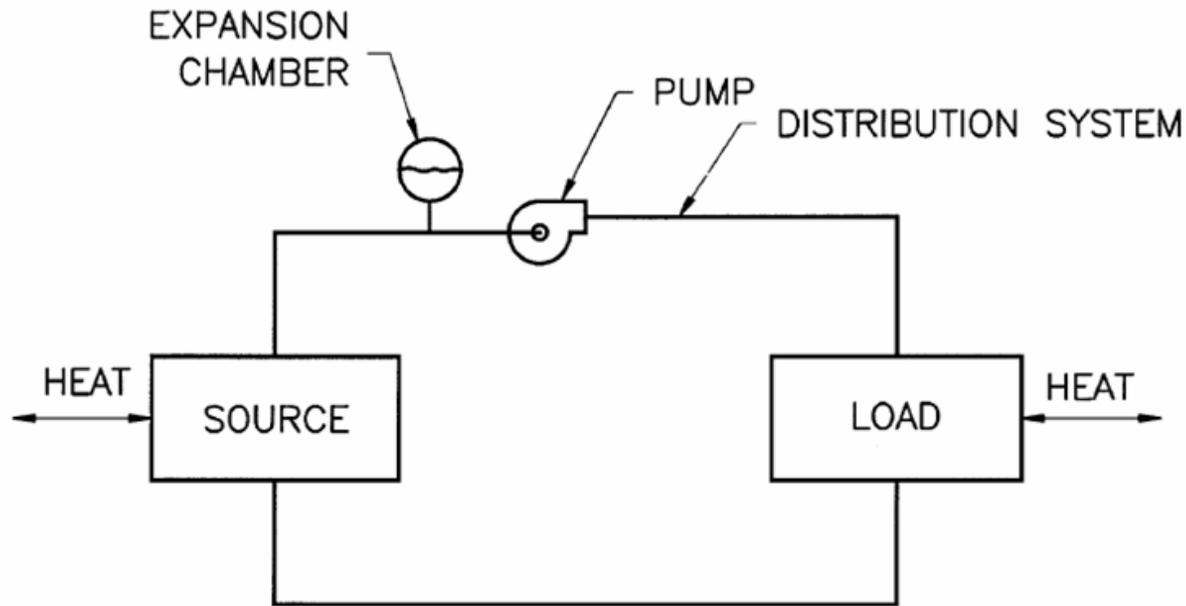
DTE Energy Partnership & Services

HVAC components

1. Building
2. Airduct system
3. Heating Hot water system
4. Steam/condensate system
5. Cooling tower water system
6. Chilled water system
7. Refrigeration system



Heating Hot Water System



- ❑ *Hot Water Piping*
- ❑ *Hot Water Boilers*
- ❑ *Hot water pump*

Piping

What to afraid?

- ❑ Corrosion
- ❑ Air
- ❑ Heat losses



Corrosion



How to save energy ☺

Use chemical treatment

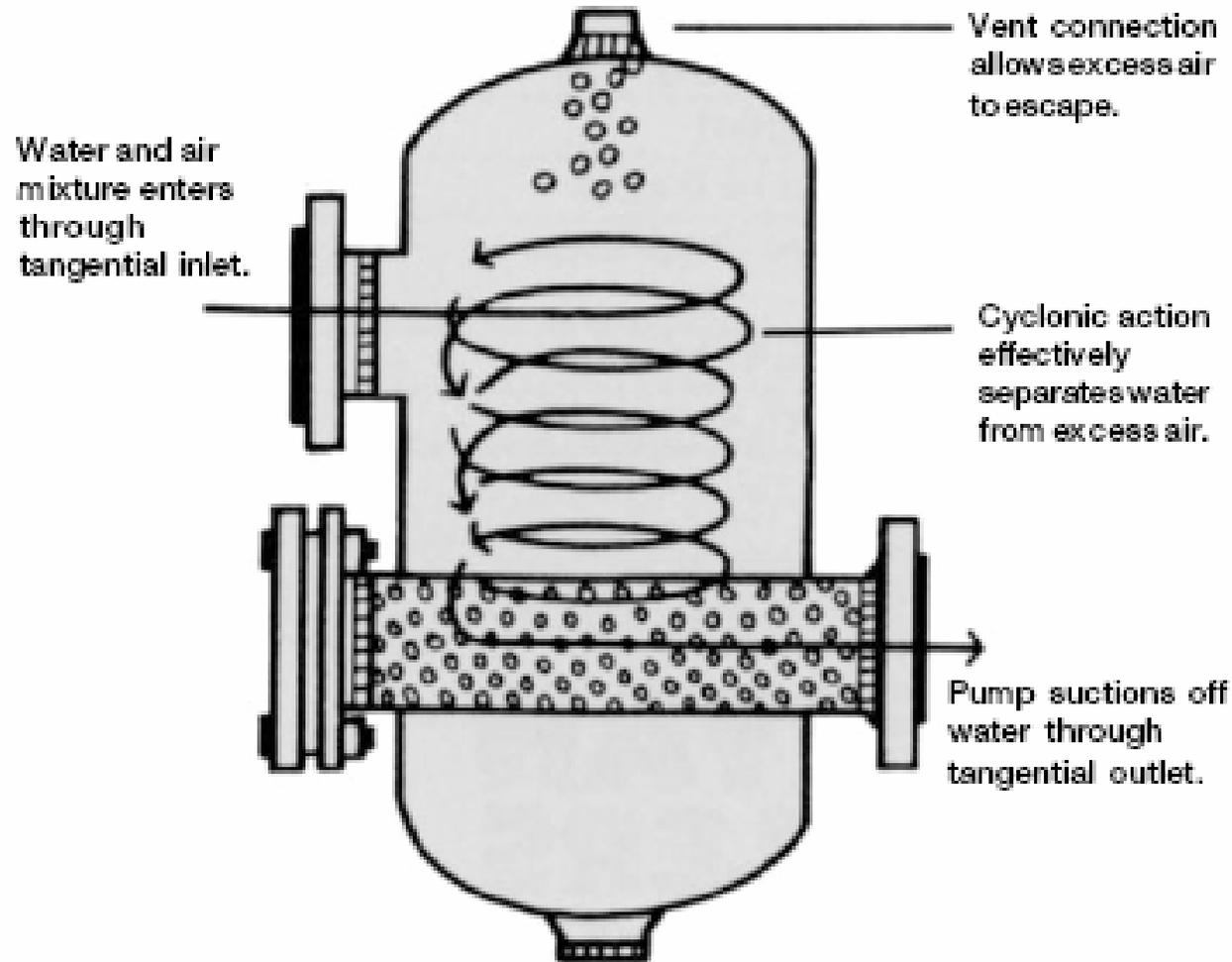


Air in piping

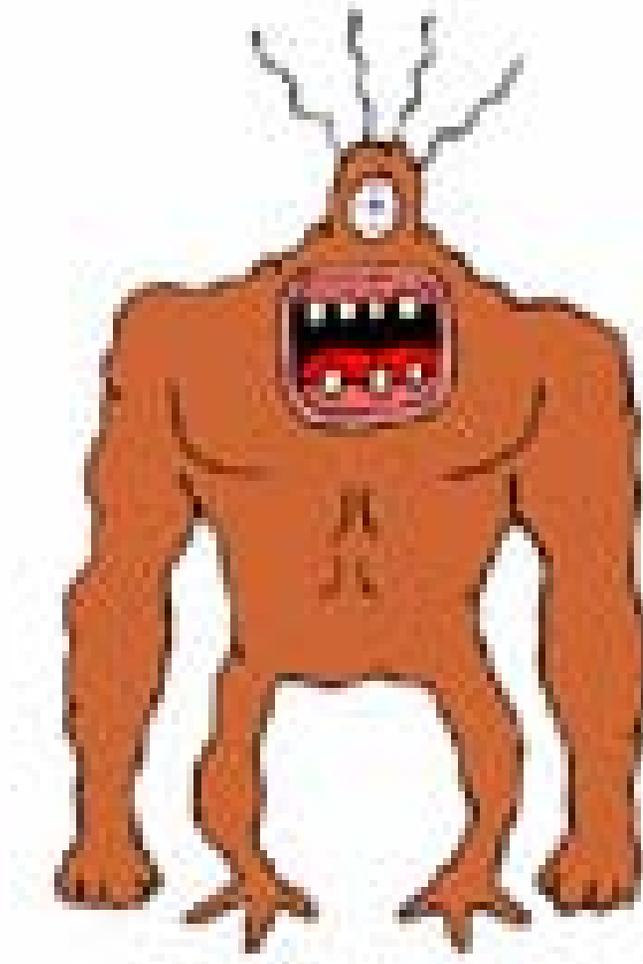
- Increase corrosion
- Create noise
- Decrease system heating capacity

How to save energy ☺

Install air separator



Heat losses through piping





How to save energy

Insulate piping



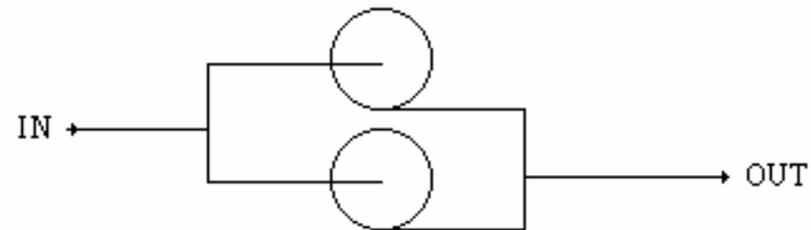
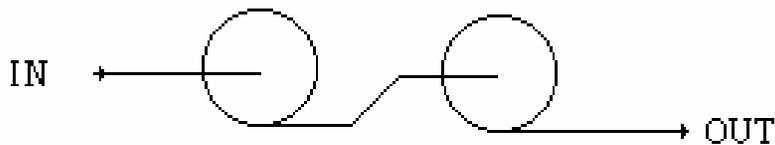
Hot water pump

What to avoid



Two pumps in series must be of the same flow rate

Two parallel pumps must be of the same head



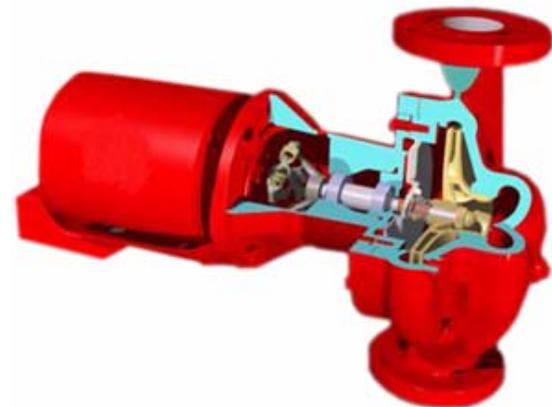
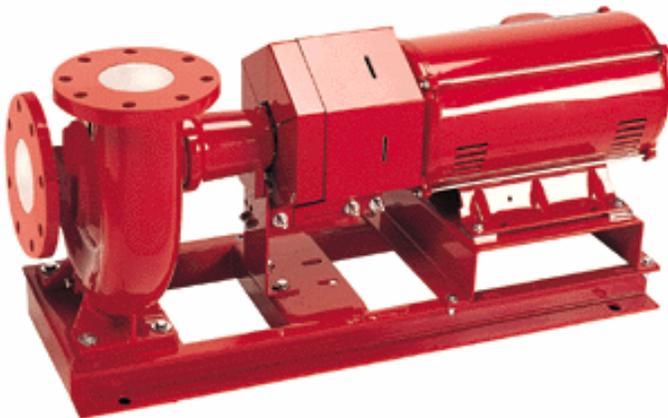
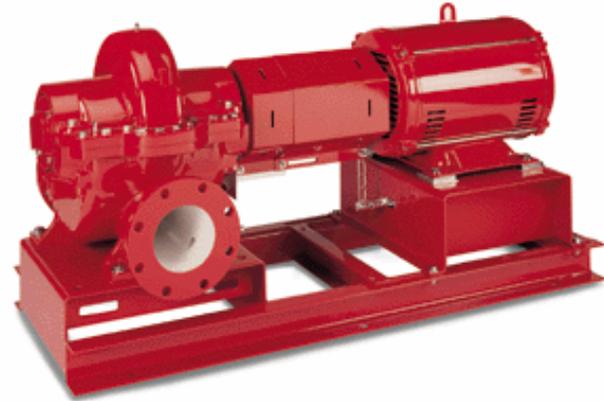


Parallel pumps of different head fight each other



How to save energy 😊

Pump must be efficient

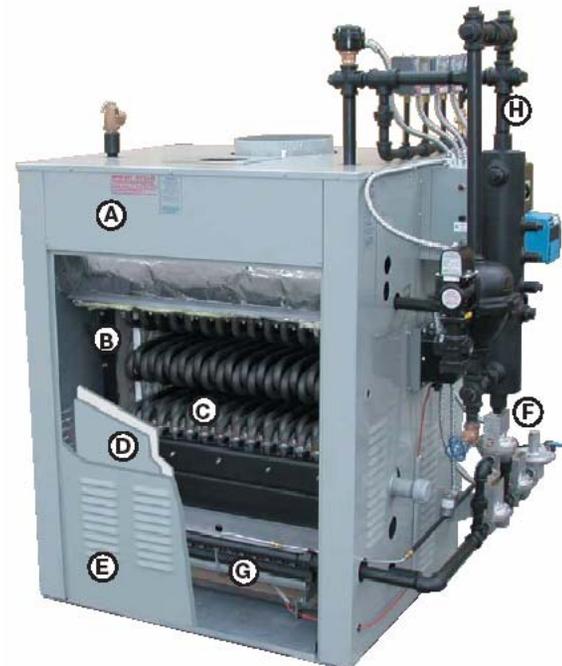


Hot Water Boilers

□ Electrical Boilers

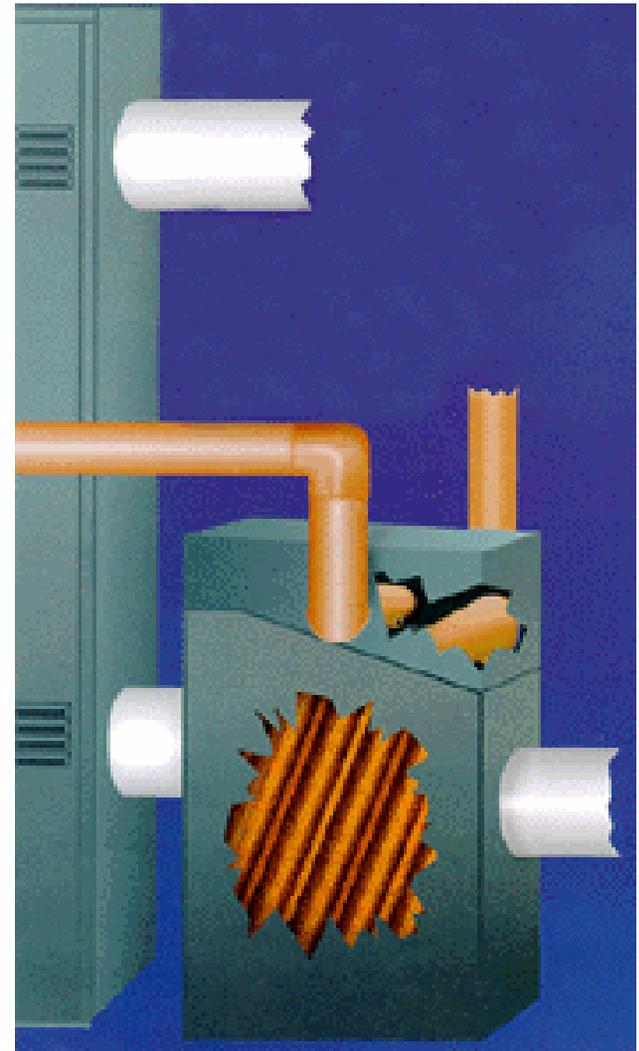


□ Gas fired boilers



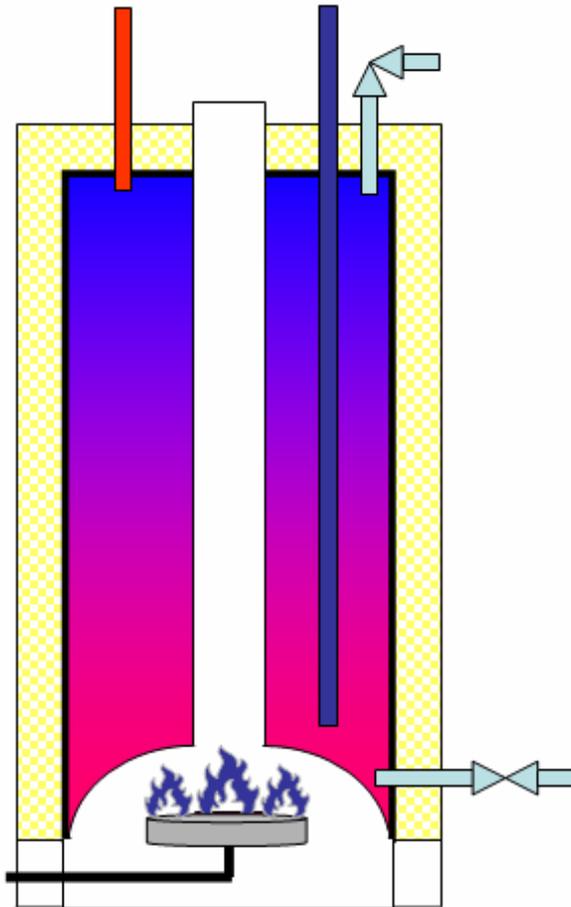
How to increase boiler efficiency? Heat Exchanger

- ❑ The heat exchanger has been specifically designed to capture the maximum amount of energy from exhaust gases.
- ❑ Squeeze out an amazing 97% of all heat of combustion energy contained in the flue gases.



How to increase boiler efficiency?

Do not oversize boiler



□ D1

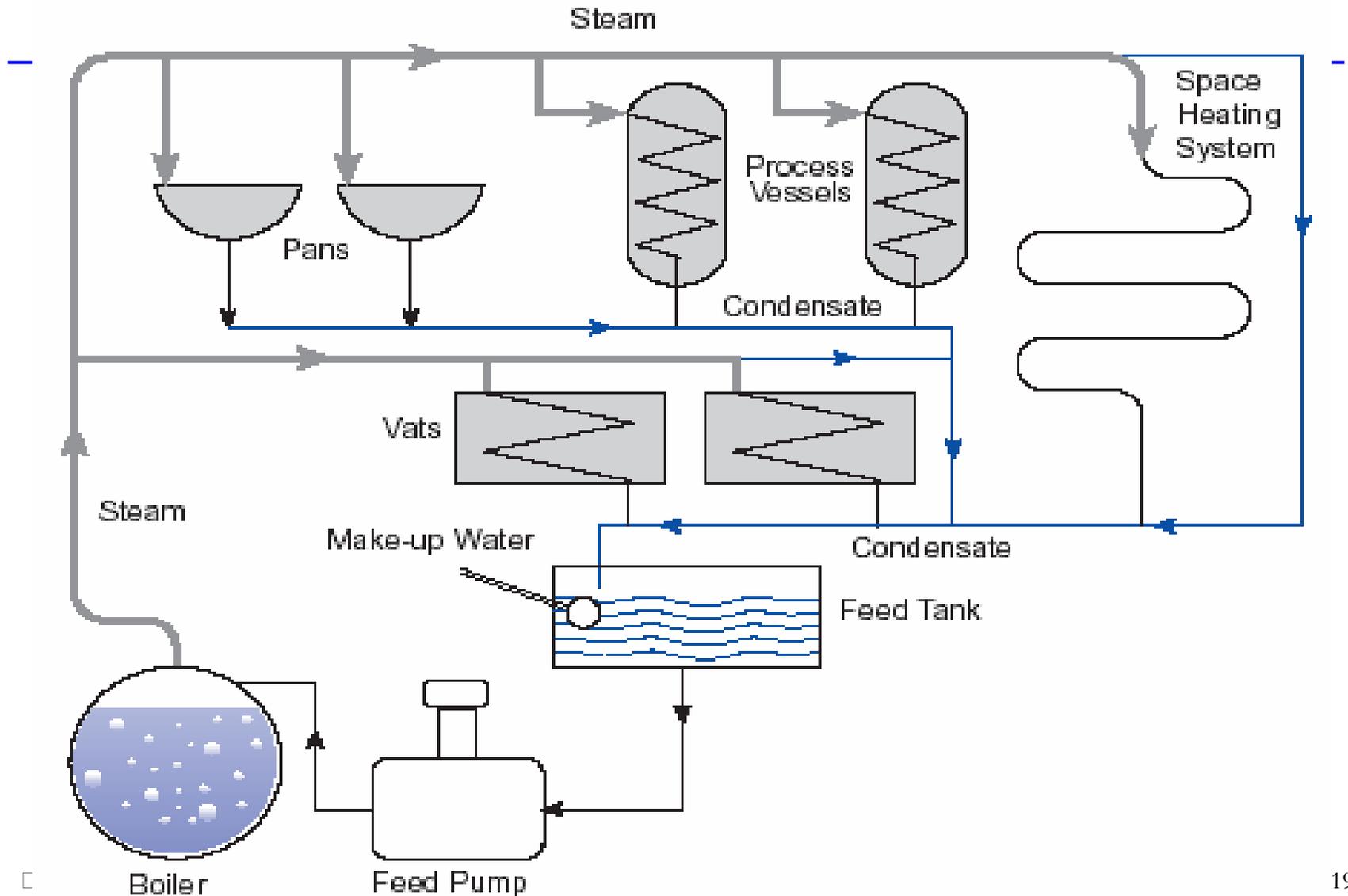
Use boiler modules



Steam boilers

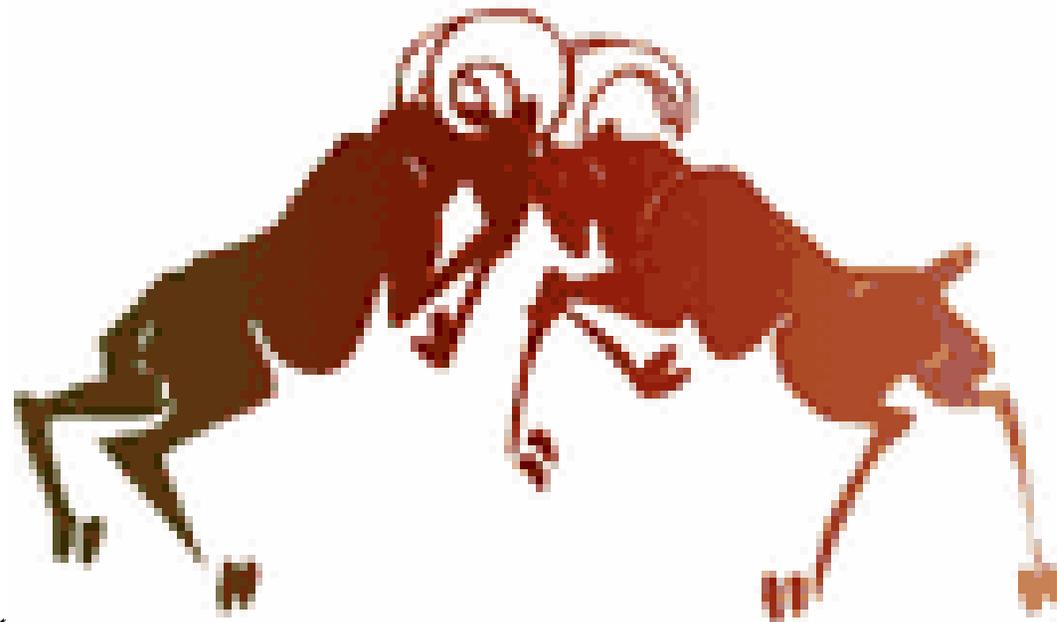


Steam system/condensate system



Steam does all its best to turn into
~~condensate~~

We do all our best to pick up
condensate



Steam Boiler

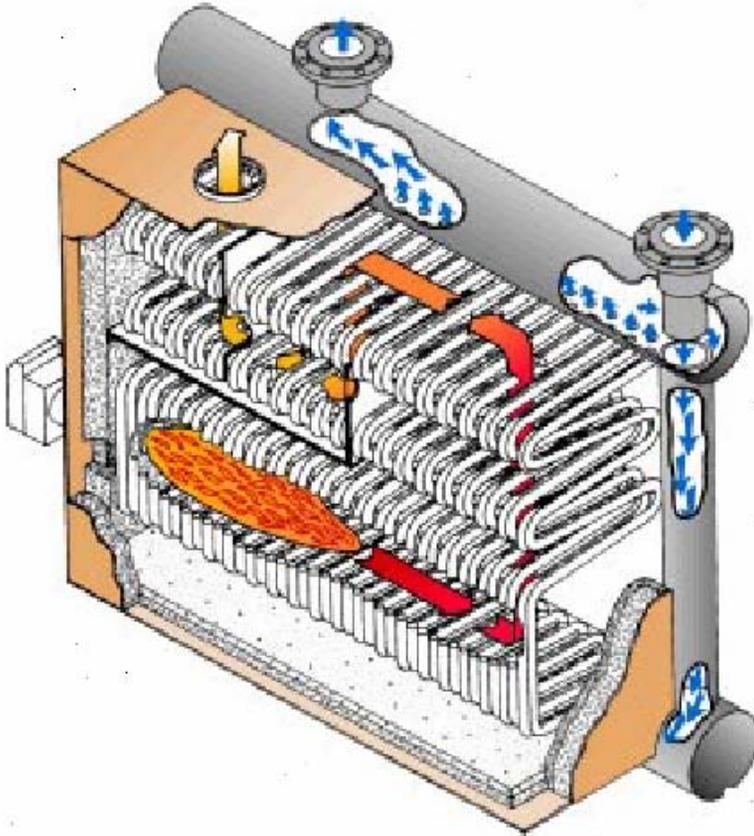
□ Electrical



□ Gas fired



What steam boiler wants?



- ❑ Proper size
- ❑ Heat exchanger
- ❑ Air removal
- ❑ Blow down
- ❑ Water treatment

Proper sized Steam boiler are the most efficient

- ❑ A boiler operating at low load conditions can cycle as frequently as 12 times per hr, or 288 times per day.
- ❑ With each cycle air flow removes heat from the boiler and send it out the stack.



Heat Exchanger

Recover waste heat from the boiler flue gas and transfer heat to desired heat sink (boiler feed water, domestic water, etc.)



DEAERATORS

Remove corrosive gases from boiler feed water to protect against boiler and steam line corrosion; substantially reduce chemical usage and boiler blowdown requirements.



FEEDWATER SYSTEMS

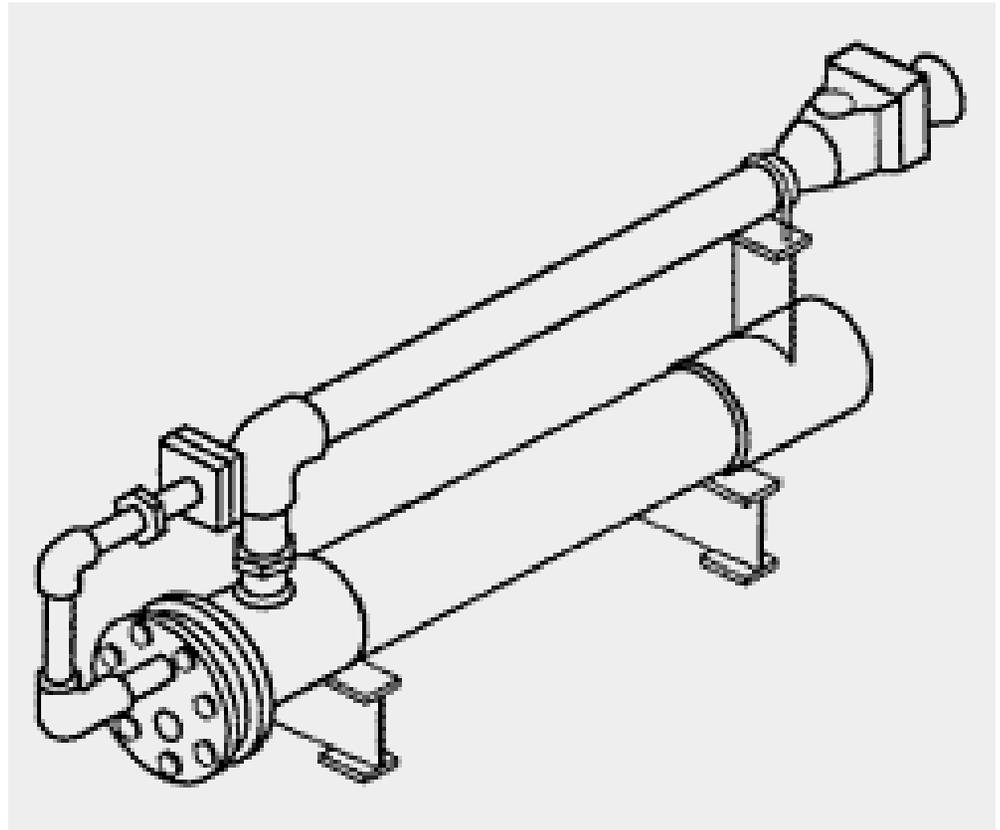
Receive and store condensate return; provide fresh water makeup as required



Boiler blow down

It automatically controls the surface blowdown to maintain the desired level of total dissolved solids (TDS) in the boiler, reducing the amount of blowdown to a minimum.

It recovers the heat from the high temperature blowdown, and transfers it to the incoming cold make-up water, maximizing boiler efficiency.



Water treatment

Chemical treatment



Provides means of injecting necessary chemicals into the feed water tank and/or boiler to control corrosive gases and prevent scale formation in the boiler

□ DTE Energy Partnership & Services

Water softener

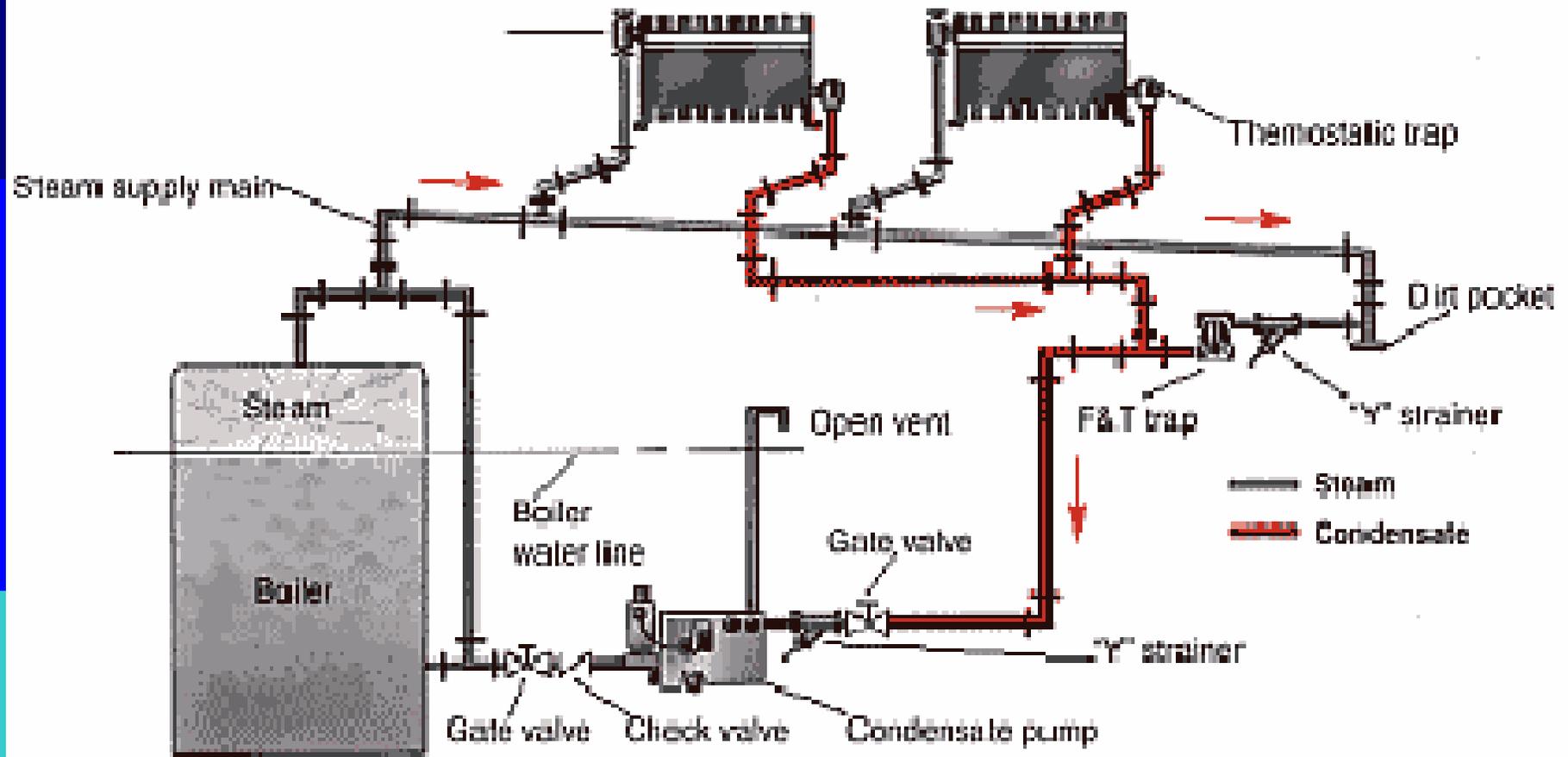


Softens boiler feed water by exchanging hardness minerals (calcium and magnesium ions) with sodium ions forming a soluble non-scaling mineral that will not build up on hot surfaces.

Steam boiler equipment is complicated and expensive



Steam/condensate system



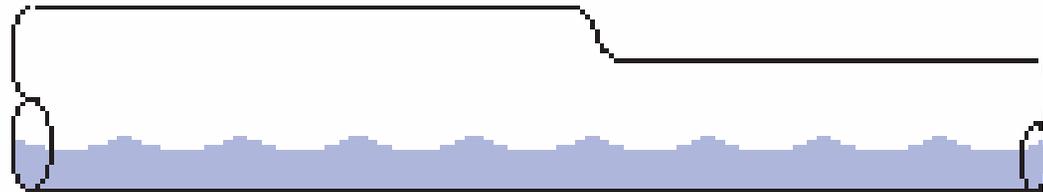
Steam distribution needs

- ❑ Right layout
- ❑ Condensate removal
- ❑ Air removal

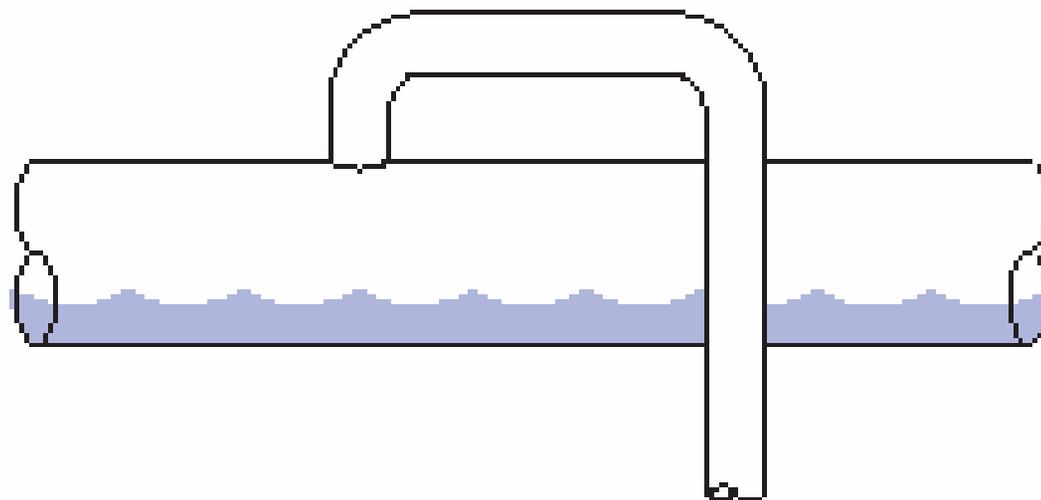


Right layout – slope 1% min

Steam Line Reducer



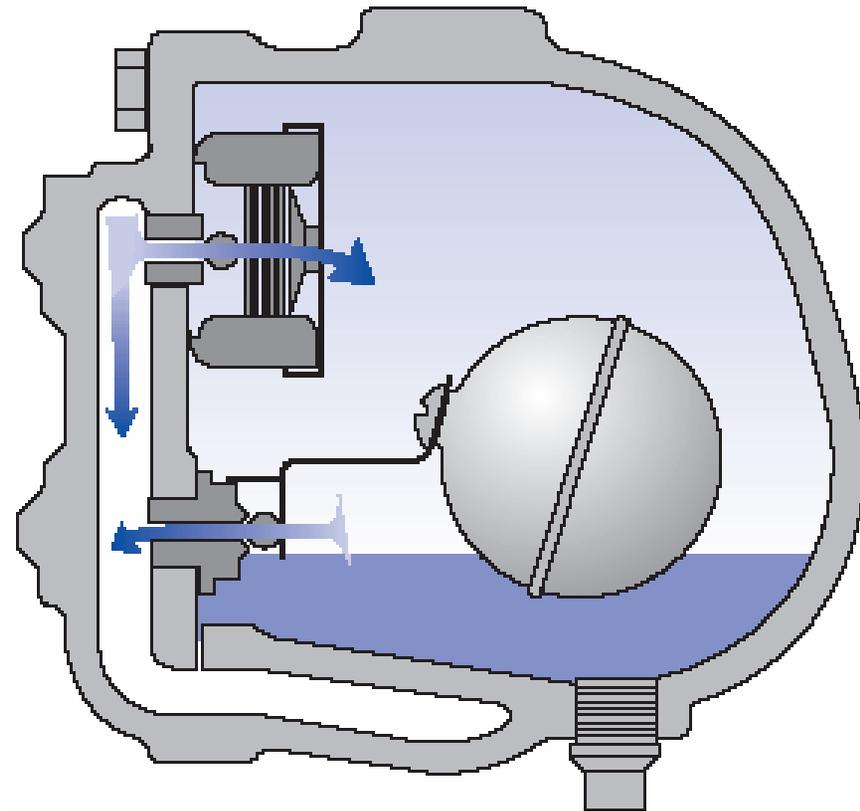
Steam Branch Line





Condensate removal

Many plants do not have a steam trap repair and maintenance program, and the great majority of plants, do not know how many traps they have, or where they are located. Steam traps are probably the major contributor to waste steam loads, and result in considerable financial losses. Just how considerable these losses are can be determined by using the table below:





Failed Steam Trap \$\$ Loss per month

Pressure at Trap	2 psig	5 psig	10 psig	15 psig	25 psig
Pipe Size of Trap	Dollars lost <u>per month</u> when steam cost is \$6.00 per 1,000 pounds				
1/2" radiator trap	\$22	\$32	\$40	\$48	\$65
3/4" radiator trap	\$34	\$50	\$63	\$76	\$101
1" radiator trap	\$48	\$72	\$91	\$109	\$145



Pressure at Trap	2 psig	5 psig	10 psig	15 psig	25 psig
Pipe Size of Trap	Dollars lost <u>per month</u> when steam cost is \$6.00 per 1,000 pounds				
1/2" bucket trap	\$22	\$32	\$40	\$48	\$65
3/4" bucket trap	\$34	\$50	\$63	\$76	\$65
1" bucket trap	\$86	\$129	\$162	\$194	\$145



Pressure at Trap	2 psig	5 psig	10 psig	15 psig	25 psig
Pipe Size of Trap	Dollars lost <u>per month</u> when steam cost is \$6.00 per 1,000 pounds				
Thermostat	\$22	\$32	\$40	\$48	\$65
3/4" F&T trap	\$22	\$32	\$40	\$48	\$65
1" F&T trap	\$22	\$32	\$40	\$48	\$65
1-1/4" F&T trap	\$34	\$50	\$63	\$76	\$65
1-1/2" F&T trap	\$57	\$85	\$105	\$129	\$101
2" F&T trap	\$86	\$129	\$162	\$194	\$228

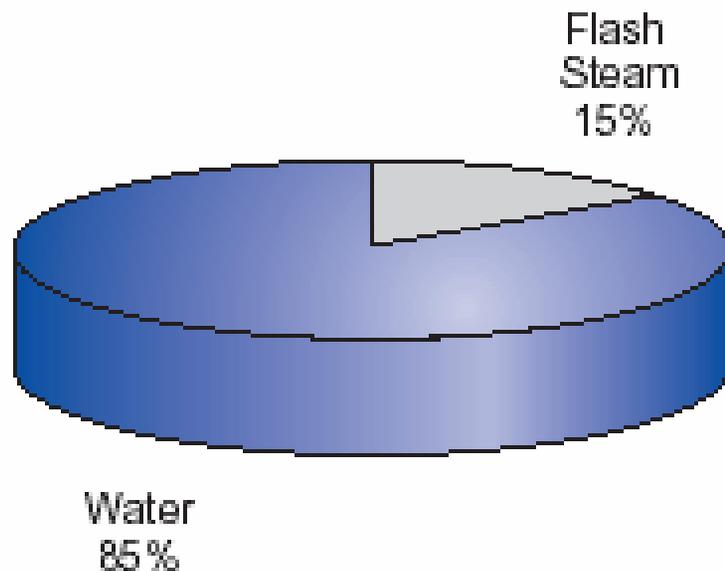
Steam system maintenance



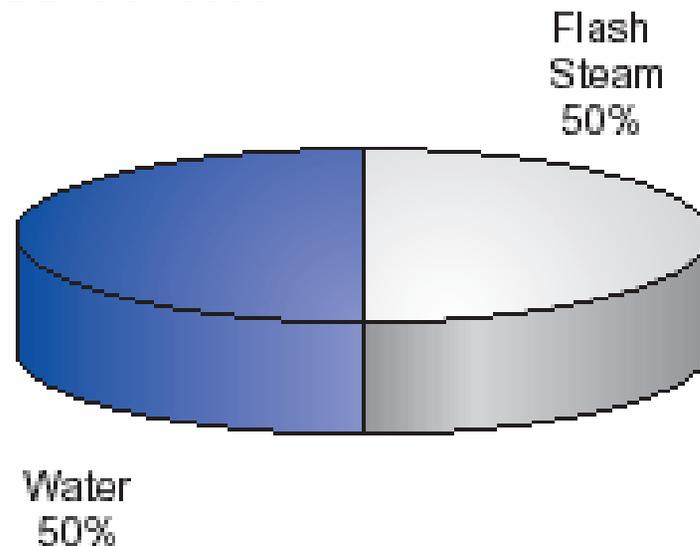
Steam energy recovery



Approximate amount of flash steam in Condensate



Approximate amount of energy in Condensate



Hot water versus steam

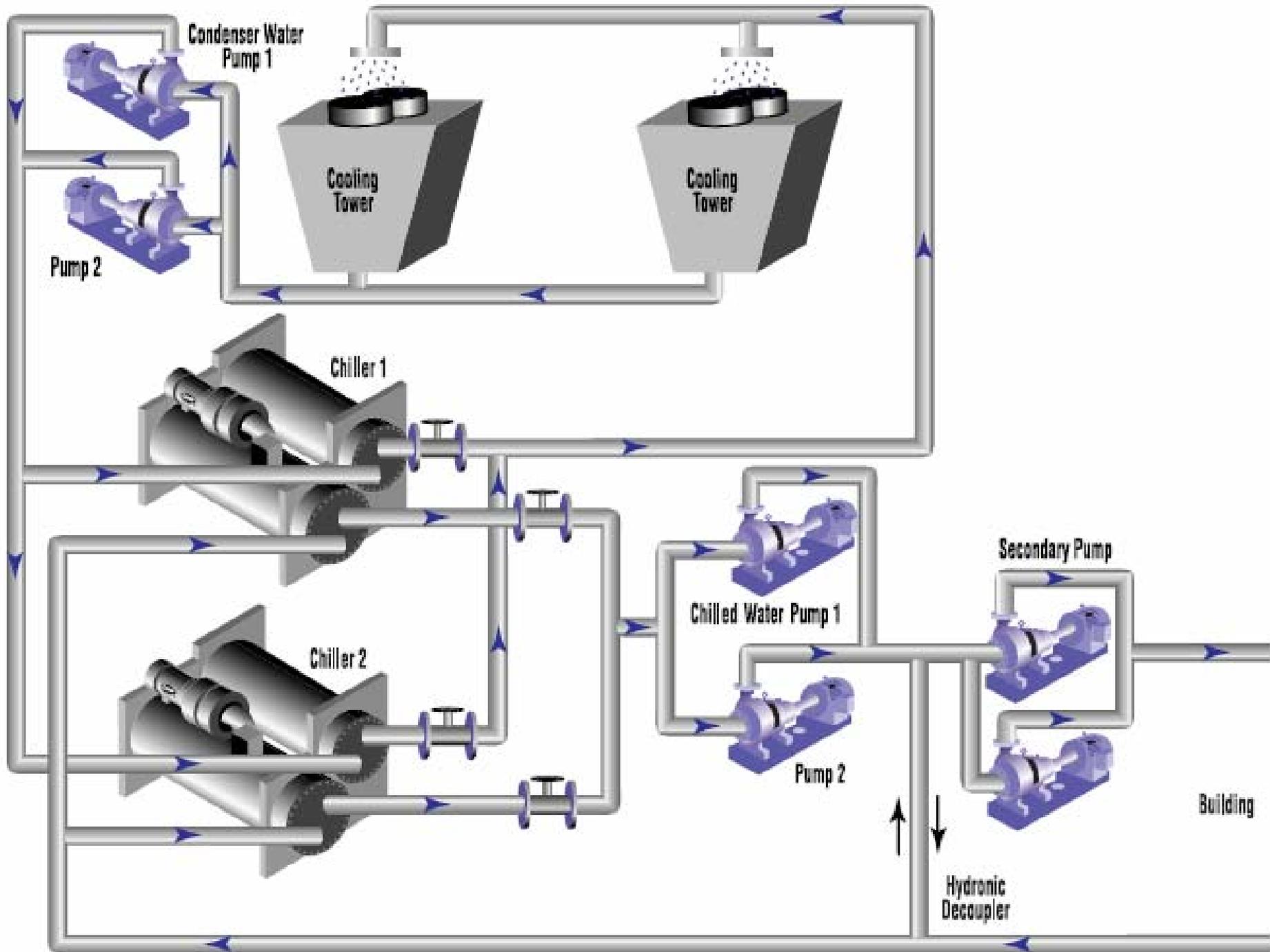
- When to use steam:
 - In Hospitals
 - 100% Outside Air

- Steam disadvantages over Hot Water
 - Water treatment
 - Condensate trap maintenance
 - Lack of control
 - No VAV system



Cooling system



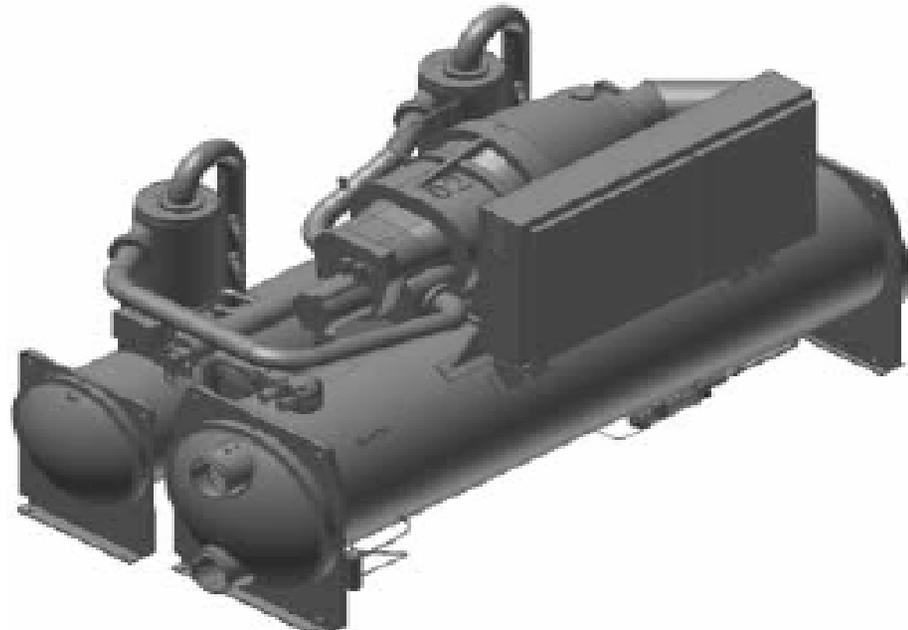


Chiller

Air cooled chiller



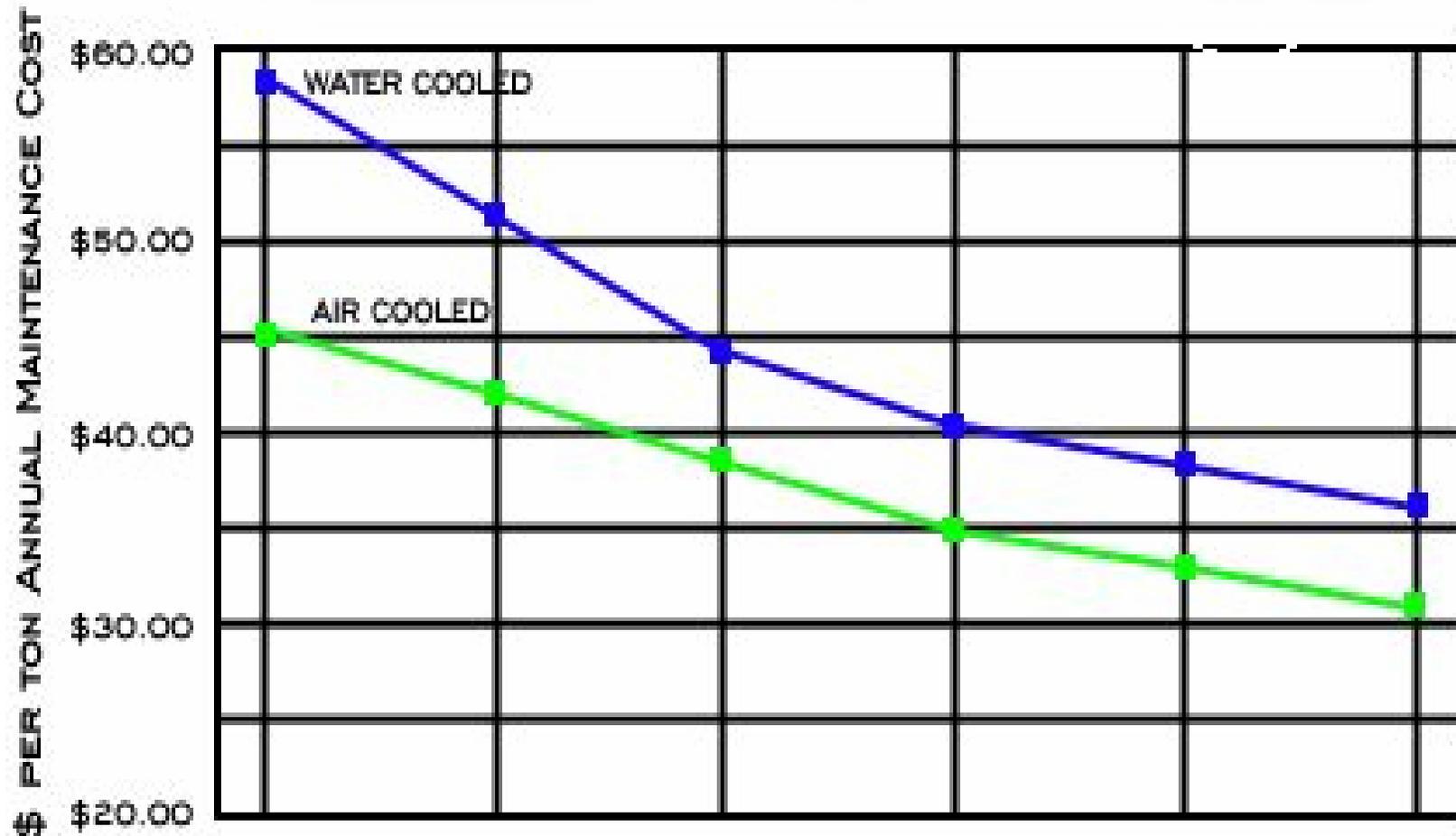
Water cooled chiller



Chillers energy efficiency

Air-cooled (including condenser power)	kW/ton
ASHRAE Standard 90.1 1999	1.26
Good	1.21
Best	1.13
Water -cooled	kW/ton
ASHRAE Standard 90.1 1999	0.72
Good	0.65
Best	0.45

Annual maintenance cost



To keep your chiller efficient

- ❑ Chilled water piping must be insulated



To keep your chiller efficient

- ❑ Condenser surface must be cleaned



To keep your chiller efficient

- ❑ Do not oversize chillers



To keep your chiller efficient

- Use module chillers



Chillers/Boilers

- ❑ Perfect control
- ❑ Use variable flow system

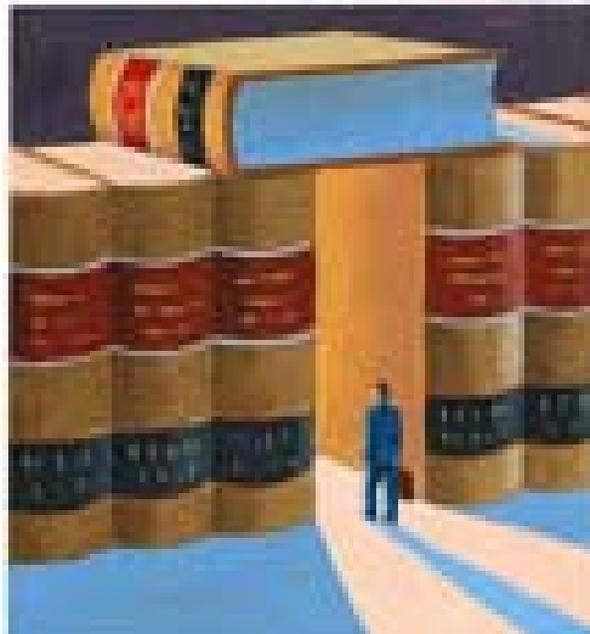
Roof top units

- ❑ Cheaper price
- ❑ Less maintenance



Control System

- ❑ Electric Control System
- ❑ Pneumatic Control System
- ❑ Digital Controls



Control is a manager of your saving



The end

Wake up now!

