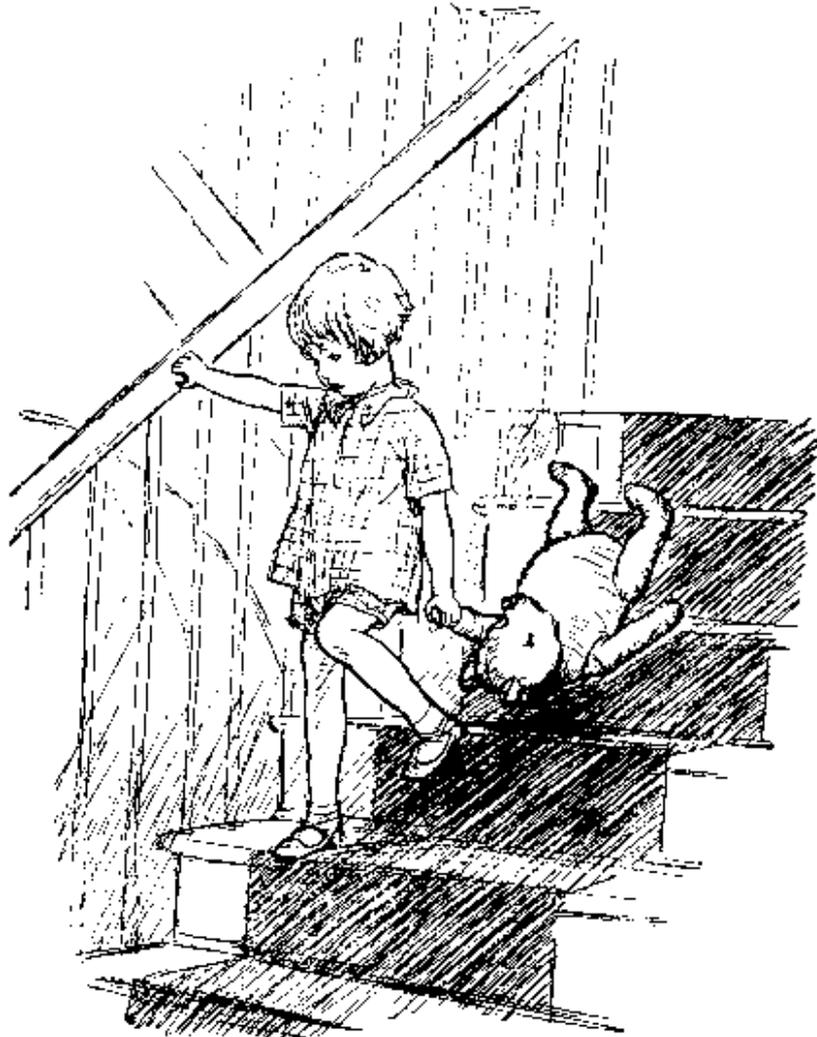


The Route to a Safe reliable Steam Plant

Paul Mayoh

Technical Manager

Avoiding the bumps



Chapter One

In which we are introduced to Winnie-the-pooh and some bees, and the story begins

Here is Edward bear, coming down stairs, bump, bump, bump on the back of his head, behind Christopher Robin. It is, as far as he knows, the only way of coming downstairs, but sometimes he feels that there really is another way, if only he could stop bumping for a moment and think of it.

Effective steam installation- identify the bumps!

- Objective

- To deliver:

- Good quality steam for.

- Maximum heat transfer

- Maximum plant utilisation

- Safely in compliance with PSSR

- Duty of care on designers, installers and users to ensure that steam systems are safe.

Pressure Systems Safety Regulations 2000

Firmly places responsibility for the safe operation of gas, steam and air systems (incl. pressurised hot water systems which could flash) on the user.

It is mandatory that no pressurised system be operated unless a written scheme exists for its periodic examination, a ruling which includes all protective devices.

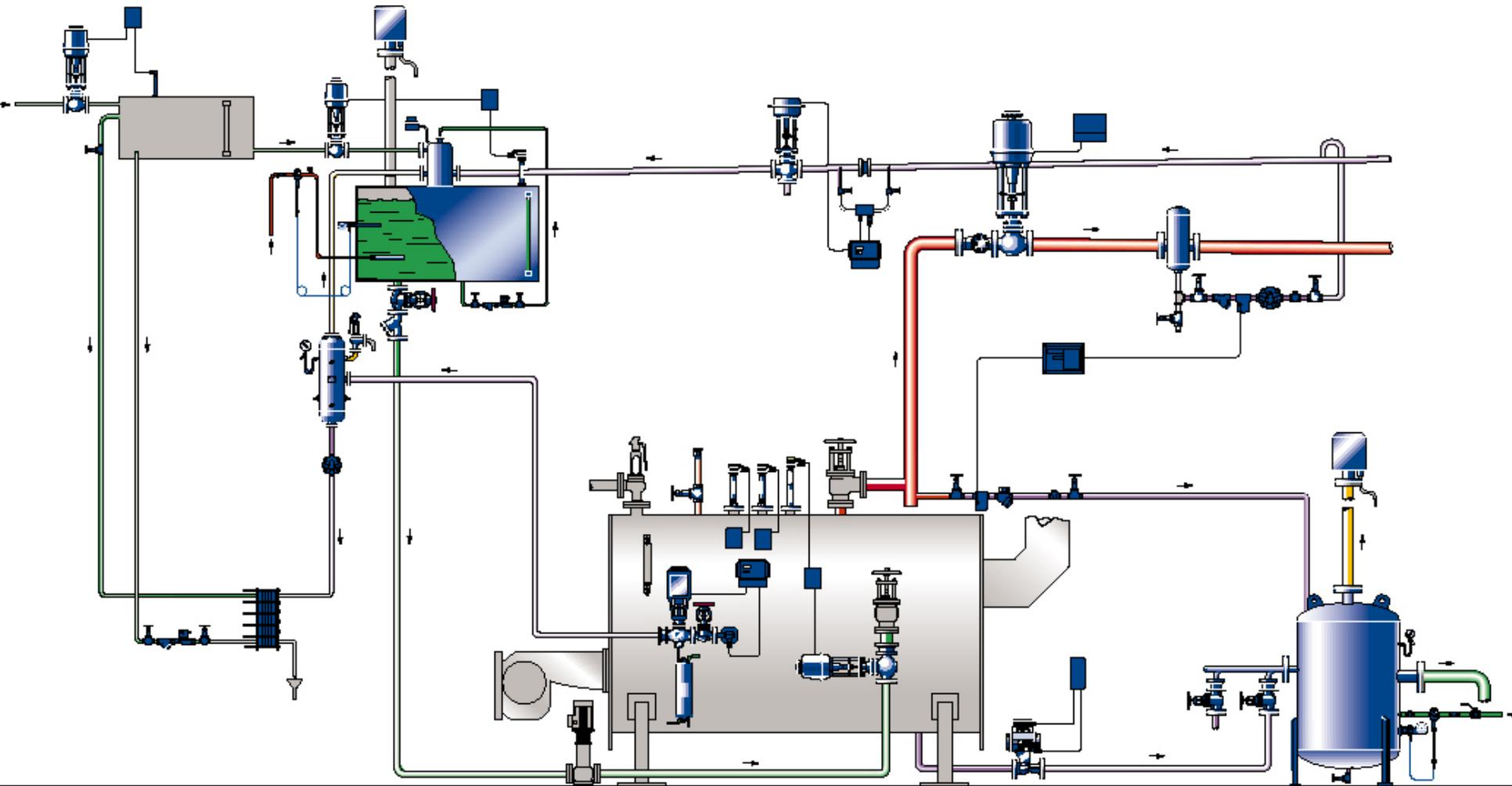
Pressure Equipment Regulations

- **Pressure Equipment Directives became mandatory in May 2002 , since then all safety valves sold in the EU must be CE marked**
- **Safety valves are category 4 products and will have to be certified by an approved “notified body” to BS EN ISO 4126**

Pressure Systems Safety Regulations 2000

1. Design and construction
2. Marking and information
3. Installation
4. Safe operating limits
5. Written scheme of examination
6. Examination
7. Operation
8. Maintenance and repair
9. Keeping records

The journey from the boiler



Distribute at High Pressure

Safe operation of boiler plant:

- The boiler should be operated at its design operating pressure for maximum thermal efficiency.
 - Minimise water carryover on peak loads
 - Benefit from smaller mains and fittings etc

Reduce pressure at point of use

Control the warm-up time

Longer warm-up times give less trouble due to:

- Waterhammer
- Thermal shock
- Priming

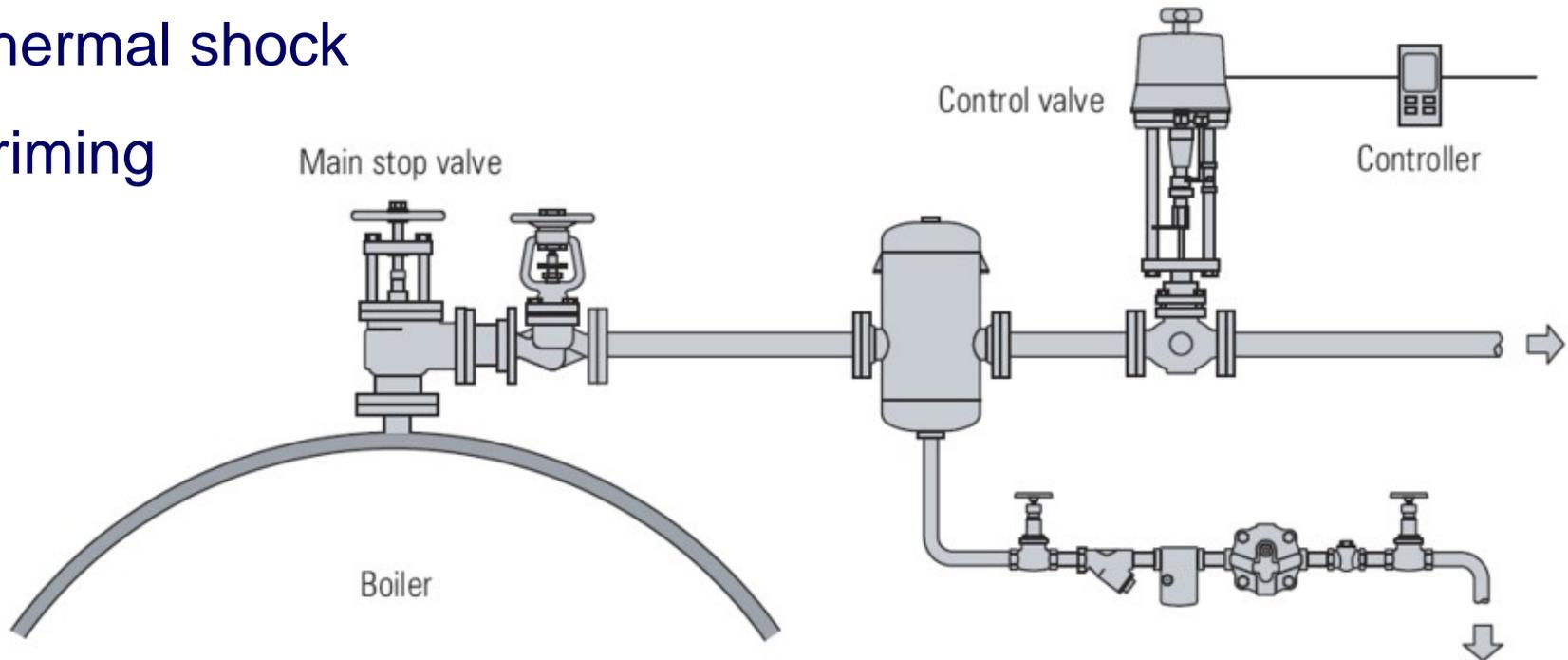


Fig. 3.8.4 Control valve after main stop valve

Possible solutions

- Pressure maintaining valve on the boiler
... will help to maintain boiler pressure.

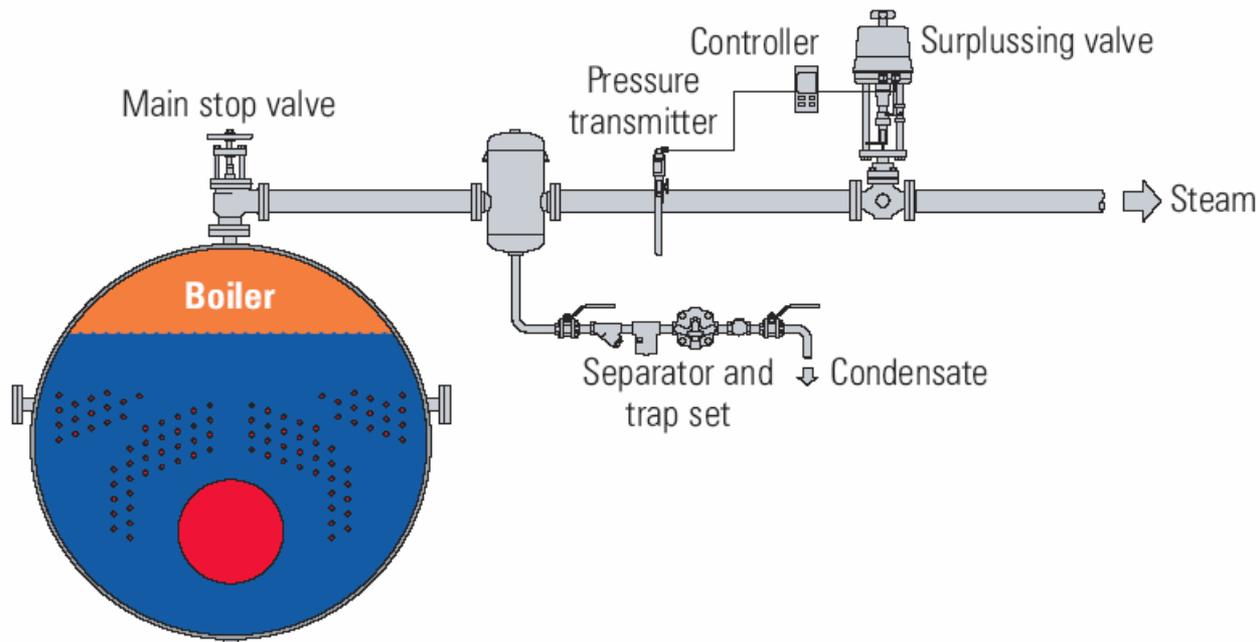


Fig. 3.22.3 Surplussing valve on a boiler main

Typical arrangements

Directly coupling the boiler to the accumulator

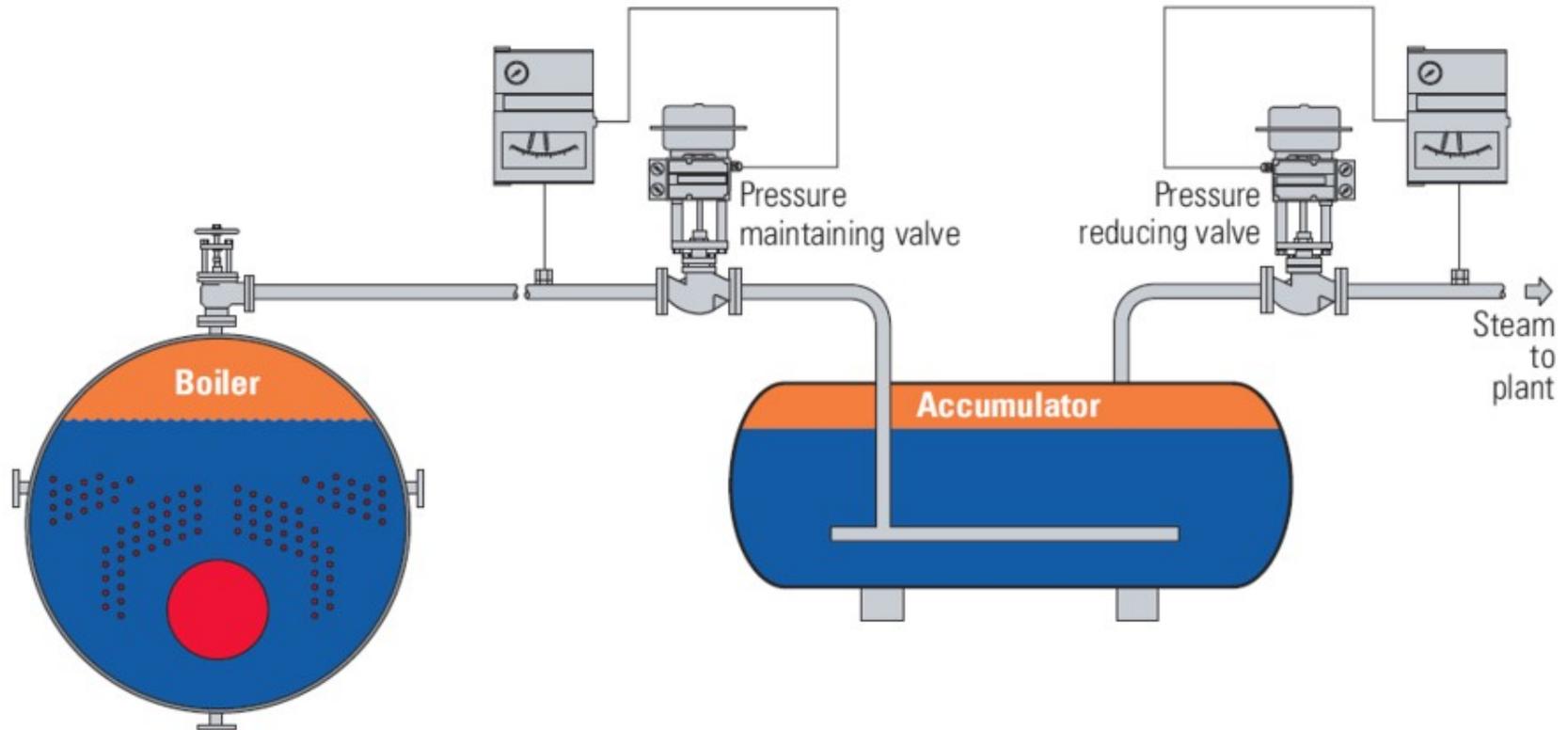


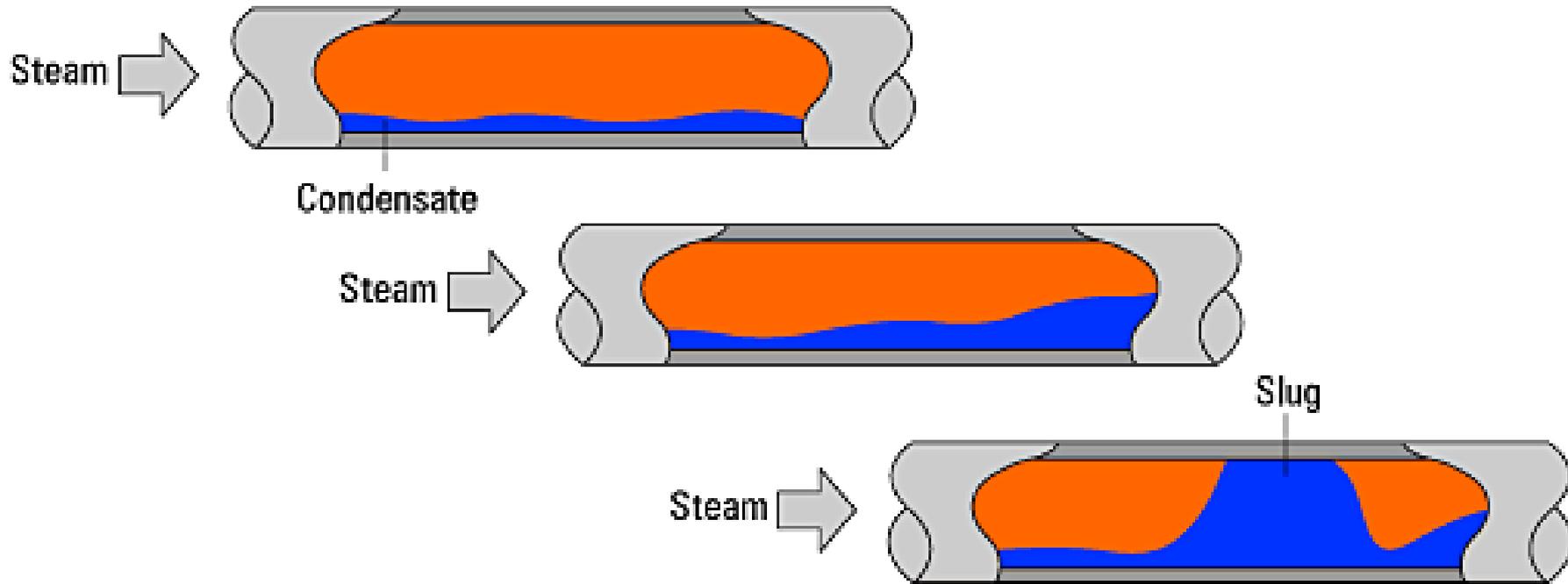
Fig. 3.22.11 Steam accumulator adjacent to the boiler

Preventing water hammer- SAFed fact sheet

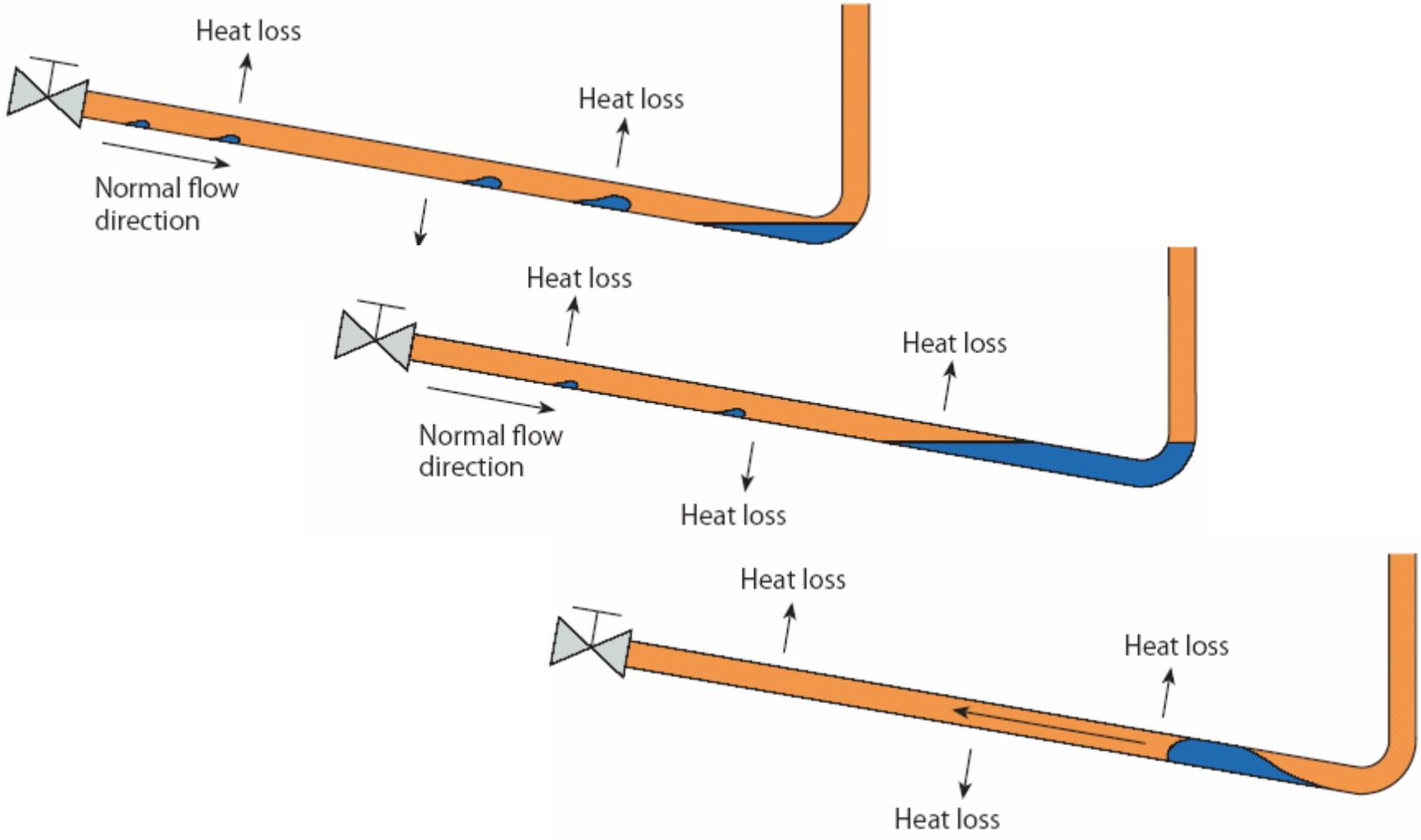
- **Causes**

- Condensate driven by steam
- Condensate moving into a vacuum
- Incorrect operation of isolation valves
- Cycling of boilers from continuously to regular shutdowns

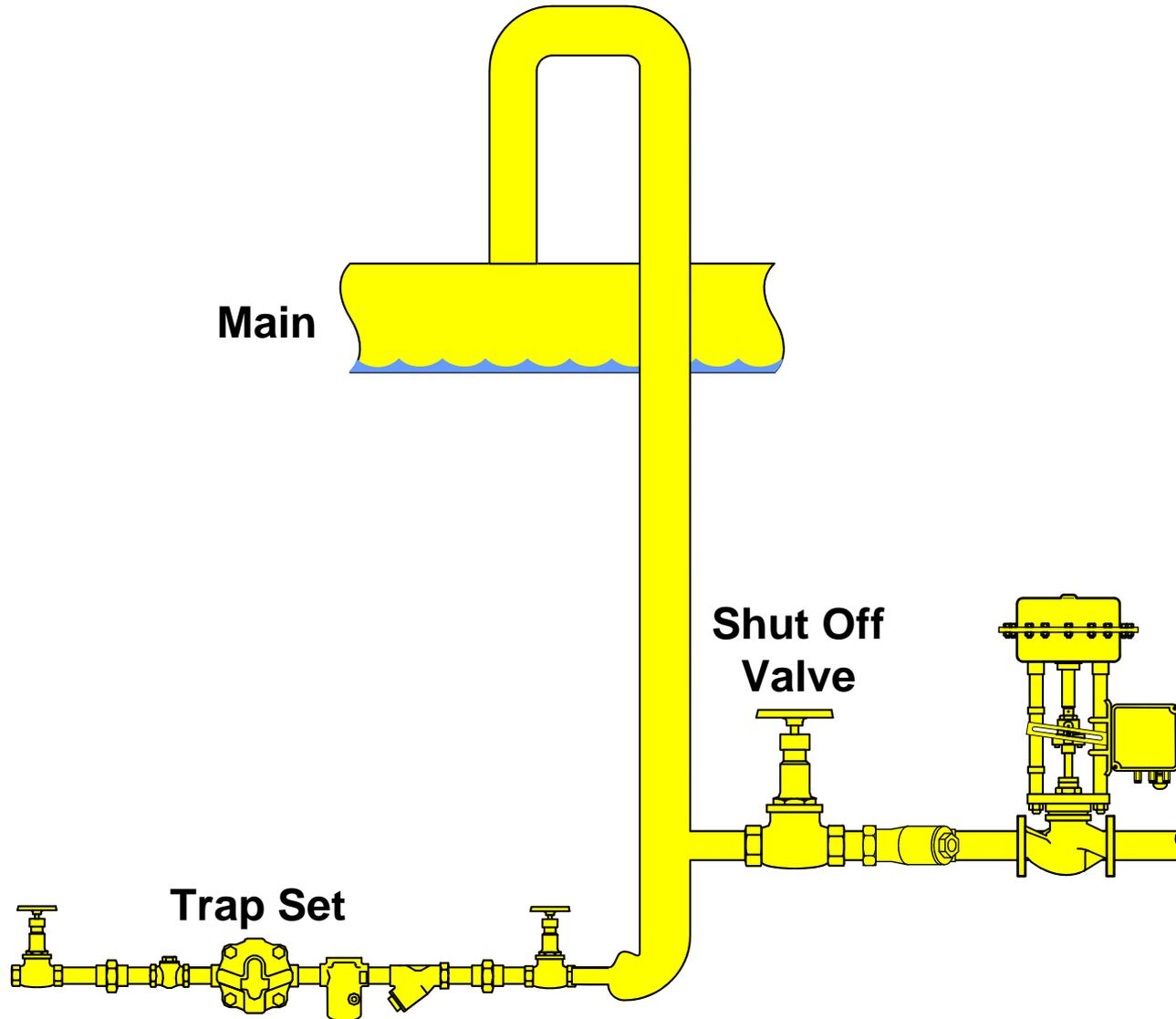
Waterhammer



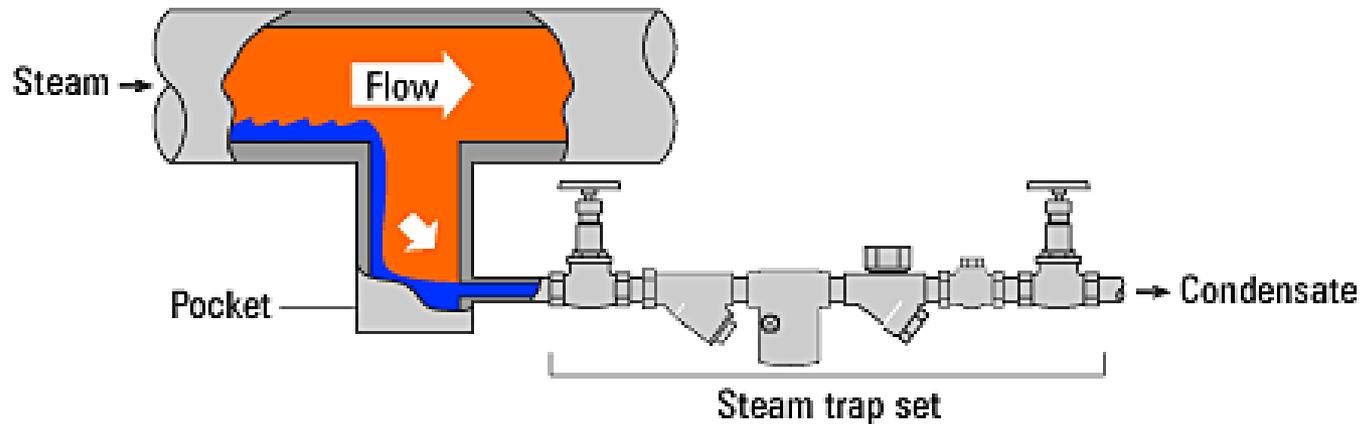
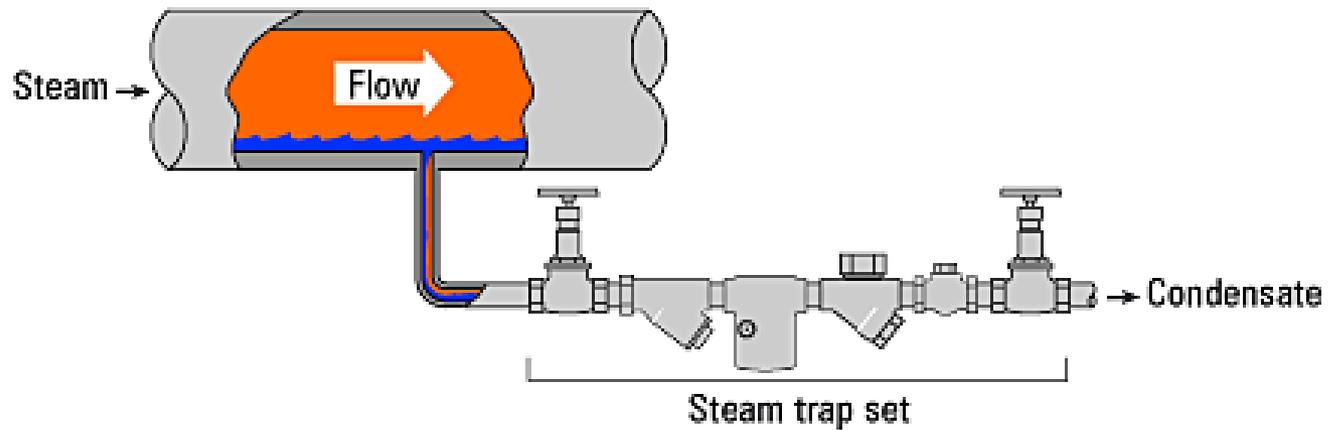
Pipe Alignment and Drainage



Drop Leg



Correct Drainage Points



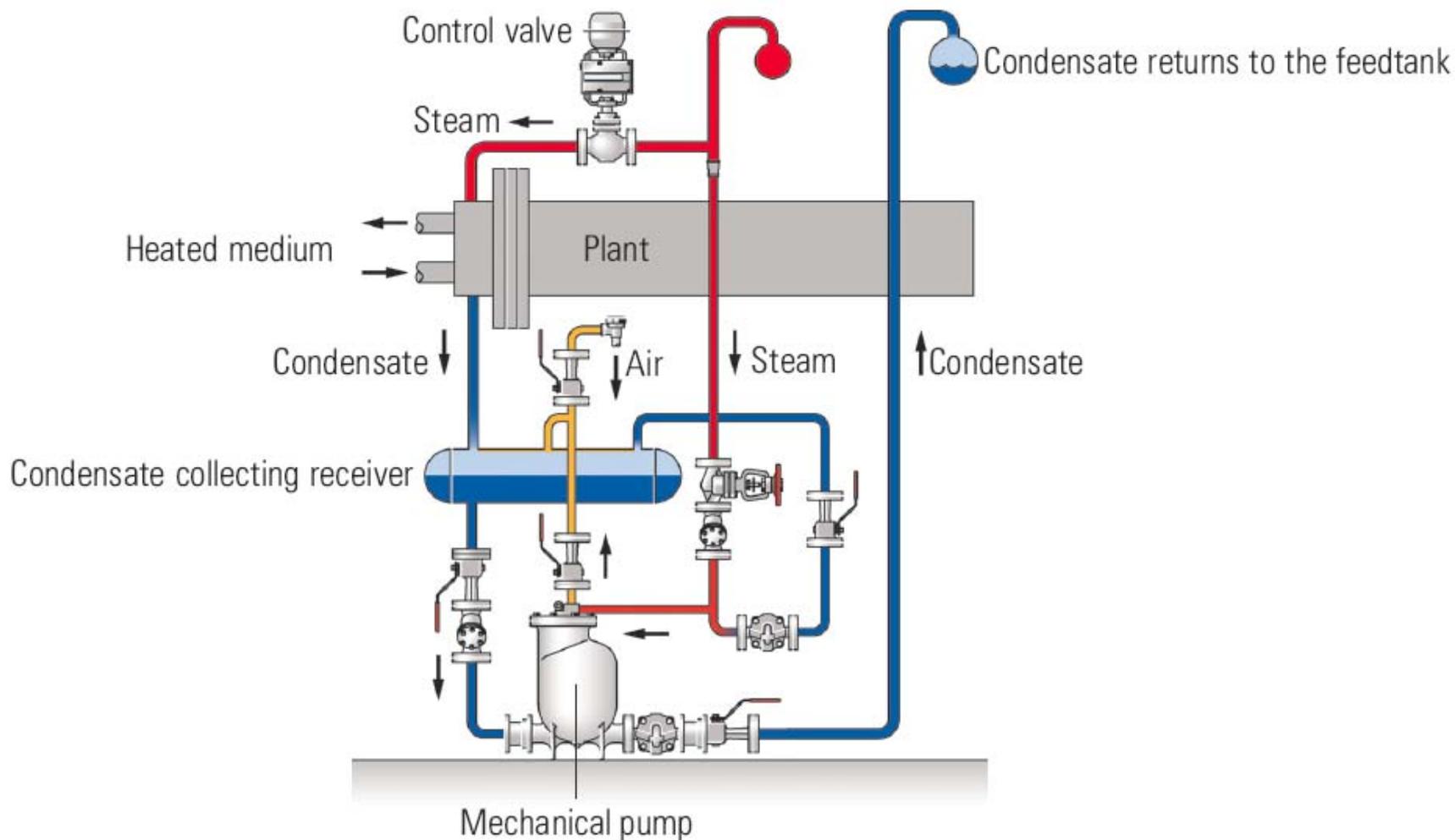
Correct Drainage Points



Preventing water hammer- SAFed fact sheet

- 5 point Action plan to minimise the hazard
 1. Enhance training of boiler operators
 2. Pipework and drainage
 3. Condensate collection points
 4. Operation of steam traps
 5. Isolation valves

Condensate systems: Trapping, collection and removal



How to drain steam mains

Steam traps are the most effective and efficient method of draining condensate from a steam distribution system.

How to drain steam mains

Steam traps are the most effective and efficient method of draining condensate from a steam distribution system.

The steam traps selected must suit the system in terms of:

- **Pressure rating**
- **Capacity**
- **Suitability**

Pressure rating

Pressure rating is easily dealt with; the maximum possible working pressure at the steam trap will either be known or should be established.

Capacity

Capacity, that is, the quantity of condensate to be discharged, which needs to be divided into two categories; warm-up load and running load.

System Leaks



Steam system services

Simple site appraisal



Ultrasonic steam trap testing



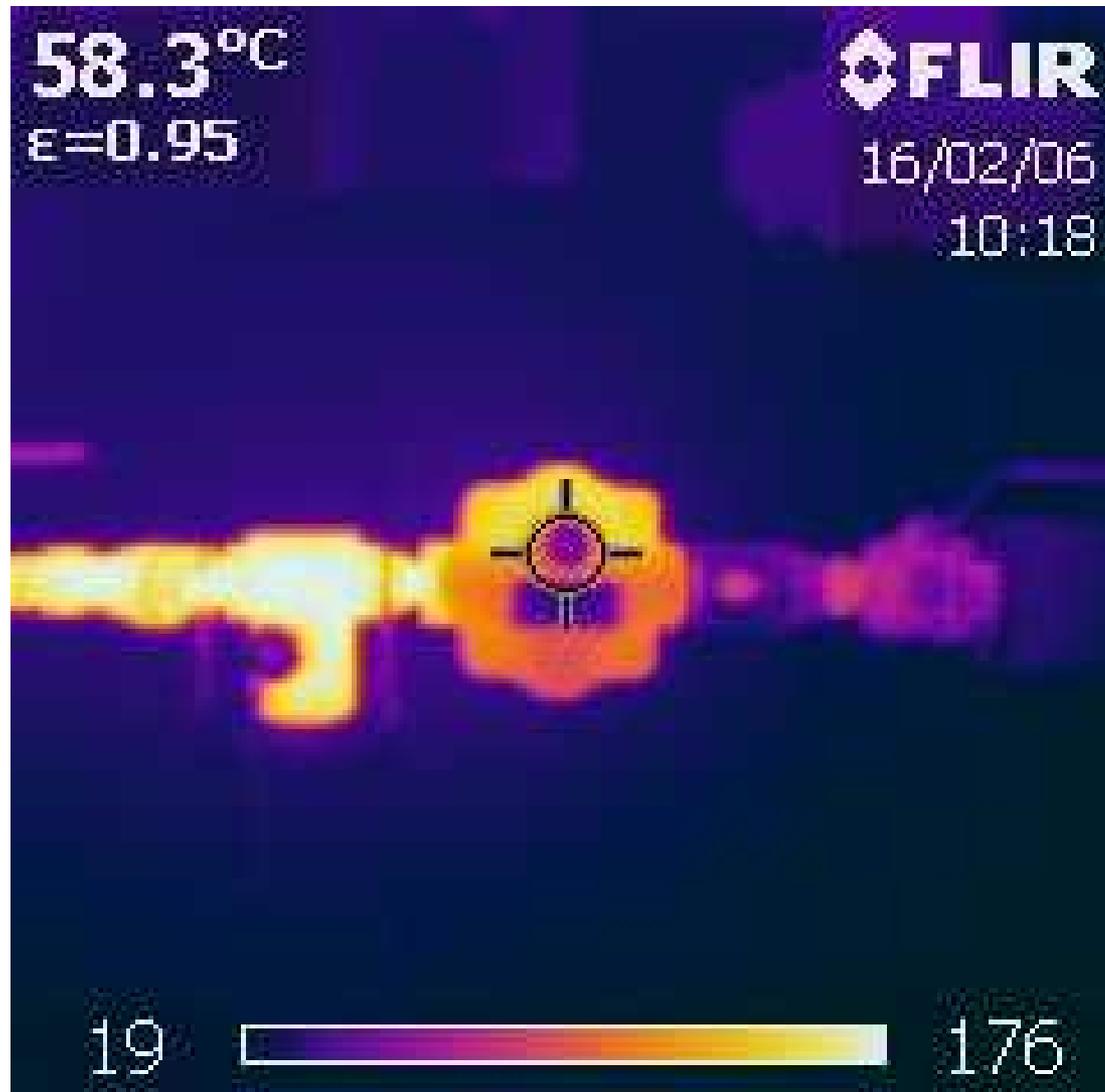
Spot temperature indication



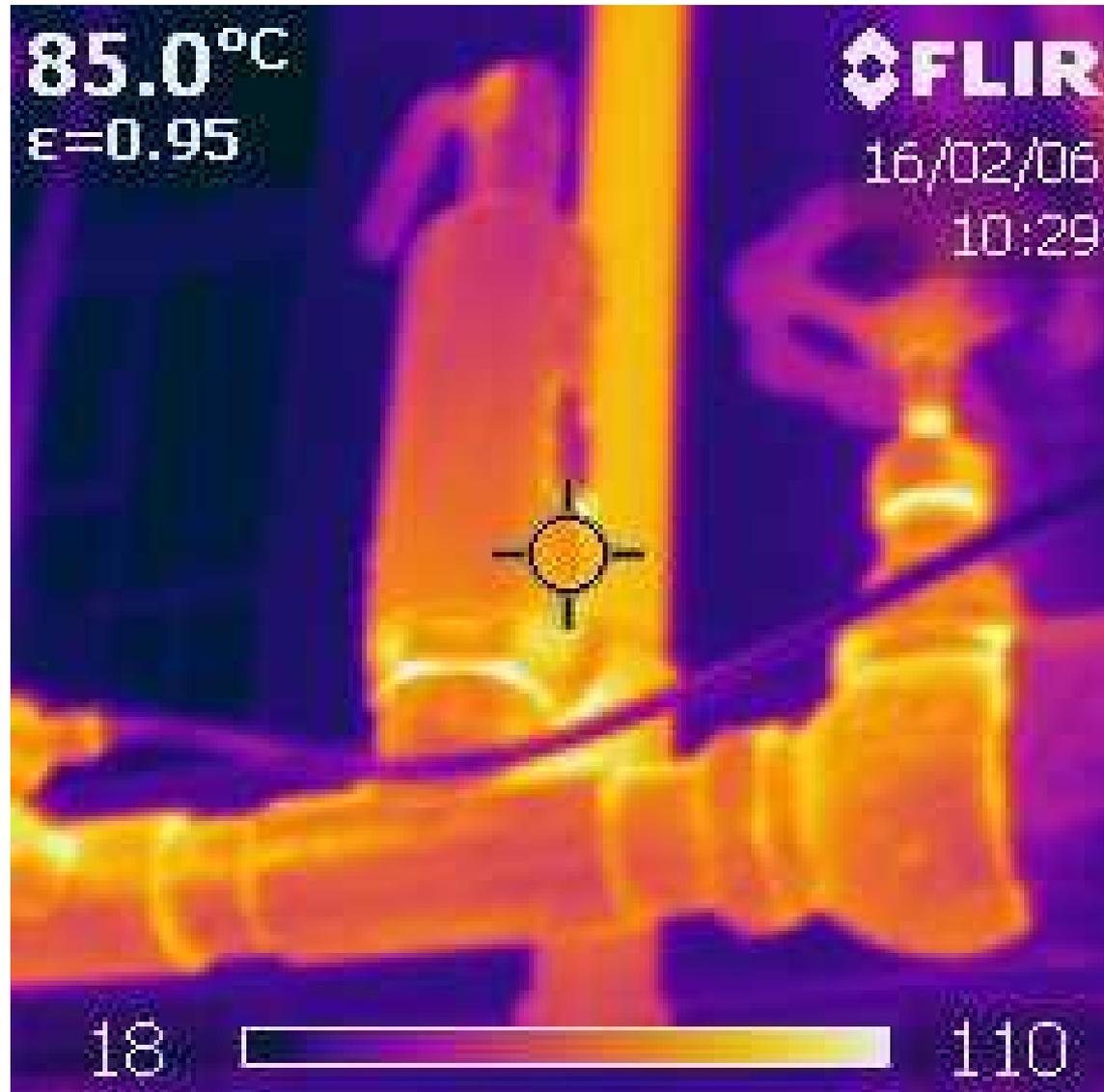
Thermal imaging



Thermal imaging



Thermal imaging



Protective devices

- Devices designed to protect the system against against failure and give warning that system failure may occur, such as:
 - Excess pressure
 - Excess temperature

Safety valves



Protective devices – Safety valves

- Protecting people

A company's most valued asset is secure in the knowledge that their safety has been put first

- Protecting plant

Safeguard plant against major damage from excess pressure and ensure continued efficient operation

- Protecting Profit

Major shutdowns interfere with production and result in loss of customers.

A continuous supply of products protects a company's image and profits

What is a safety valve ?

Definition from BS EN ISO 4126 – 1: 2004 (supercedes BS 6759);-

A valve which automatically, without the assistance of any energy other than that of the fluid concerned, discharges a quantity of the fluid so as to prevent a predetermined safe pressure being exceeded, and which is designed to re - close and prevent the further flow of fluid after normal pressure conditions of service have been restored.

(BS6759 stated “certified” quantity)

Standards

- **BS EN ISO 4126 -1:2004 (replaced BS 6759 part 1 steam, part 2 gas and air, part 3 process fluids)**
- **A.D.Merkblatt A2 Pressure vessel equipment, TRD 421 steam boilers, TRD 721 heating installations**
- **USA ASME I - boiler applications, ASME VIII - pressure vessel applications (Approval authority - National Board)**

Definition of pressure terminology

In order to establish the set pressure correctly, the following terms require careful consideration:

Normal working pressure (NWP) - The operating pressure of the system under full-load conditions.

Maximum allowable working pressure (MAWP) - Sometimes called the safe working pressure (SWP) or design pressure of the system. This is the maximum pressure existing at normal operating conditions (relative to the maximum operating temperature) of the system.

Maximum allowable accumulation pressure (MAAP) - The maximum pressure the system is allowed to reach in accordance with the specification of the design standards of the system. The MAAP is often expressed as a percentage of the MAWP.

BS 6759 (superseded by EN ISO 4126. May 2004)

“ All safety valves shall be sealed by the manufacturer , his representative or a responsible authority. Unauthorised interference with the load on the spring, after the safety valve has been adjusted, shall be prevented by :

- a. the fitting of a ferrule under the adjusting collar
or
- b. the fitting of a compression ring under the adjusting screw collar
or
- c. the locking of the adjusting screw

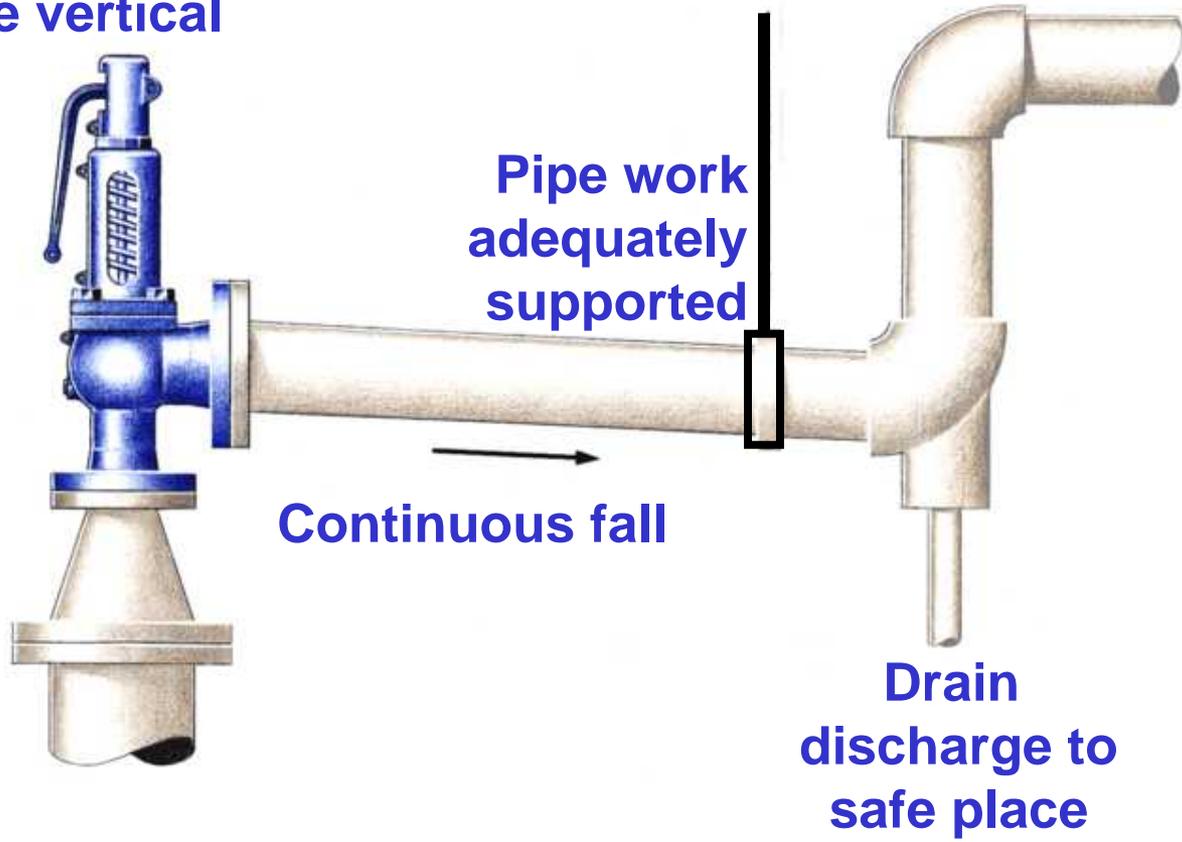
Note : Alterations should only be made with the authority of the manufacturer and / or the inspecting authority ”

Safety valve setting rig



Installation pointers

**Safety valve
mounted with
spindle vertical**



**Pipe work
adequately
supported**

Continuous fall

**Discharge
to safe
place**

**Drain
discharge to
safe place**

Waterlogged safety valve - prior to fitting drain



**Note, safety
valve not
locked**

Poor installation – inlet pipe to the valve



Poor installation - outlet pipe



Safety valve installation issues



Safety valve installation issues

Discharge
pipework still
in place

Removed/
blanked off
Safety Valve



Hi-limit fail-safe temperature control

Description

There are many applications where a totally independent high limit cut-out device is either desirable, or even a legal requirement.

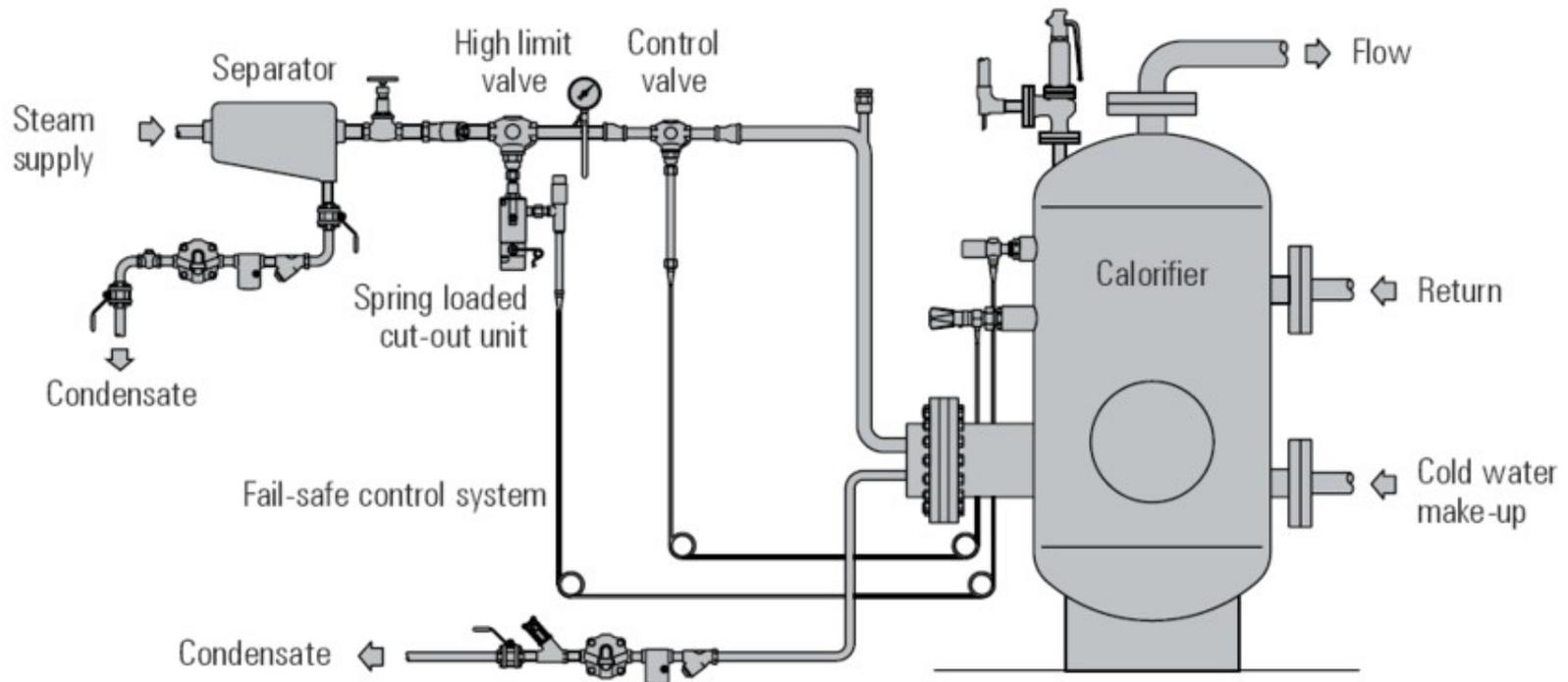


Fig. 8.2.7 General arrangement of a high temperature cut-out on a DHWS storage calorifier

A long journey and a lot of potential bumps but
a risk assessment will ensure all is easily
resolved.

Any Questions?