CODE OF PRACTICE FOR THE SAFE OPERATION OF STEAM RECEIVERS

Issued under Section 18A of the Boilers and Pressure Vessels Ordinance

Occupational Safety and Health Branch
Labour Department

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Occupational Safety and Health Branch
Labour Department

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INTRODUCTION

The Boilers and Pressure Vessels Ordinance, Chapter 56, sets out the provisions relating to the control in the use and operation of boilers and pressure vessels in Hong Kong. Pressure vessels include steam receivers that contain steam under pressure for various uses.

This Code of Practice is issued by the Boilers and Pressure Vessels Authority under section 18A of the Ordinance for the purpose of providing guidance in order to ensure safe operation of steam receivers.

Under section 18A(2) of the Ordinance, any person who fails to observe the provisions of this Code shall not render himself liable to criminal proceedings of any kind, but any such failure may, in any proceedings whether civil or criminal and including proceedings for an offence under the Boilers and Pressure Vessels Ordinance, be relied upon by any party to the proceedings as tending to establish or to negative any liability which is in question in those proceedings.

Steam receivers are extensively used in various industries, like power plants, laundries, food processing factories, hospitals and clinics for heating, cooking and sterilizing. Using the equipment by personnel without sufficient knowledge about its operation and maintenance may cause serious accidents. All personnel engaged in the use of such equipment are strongly advised to familiarize themselves with the safe operation of steam receivers.

The Commissioner for Labour has been appointed as the Boilers and Pressure Vessels Authority.

This Code advises users on the acceptable standards in the design, manufacture, installation, maintenance, examination, testing and operation of steam receivers. Where there is any conflict or inconsistency between this Code and any legislative provision, that legislative provision prevails.

Enquiries

If you wish to enquire about this Code of Practice or require advice on the regulation of boilers and pressure vessels, please contact the Boilers and Pressure Vessels Division of the Labour Department through:

Telephone : 3107 3458
Fax : 2517 6853
E-mail : enquiry@labour.gov.hk

Information on the services offered by the Labour Department and on major labour legislation is also available on our website at www.labour.gov.hk.

For details on the services offered by the Occupational Safety and Health Council, please call 2739 9000.

Complaints

If you have any complaint about unsafe operations and environments at workplaces, please call the LD's OSH complaint hotline at 2542 2172 or fill out and submit an online OSH complaint form on our website. All complaints will be treated in the strictest confidence.

Online OSH Complaint Form

LIST OF APPLICABLE ORDINANCE AND REGULATIONS

(a) Boilers and Pressure Vessels Ordinance, Cap. 56

(b) Boilers and Pressure Vessels Regulations, Cap. 56A

(c) Boilers and Pressure Vessels (Forms) Order, Cap. 56B

(d) Boilers and Pressure Vessels (Exemption) (Consolidation) Order, Cap. 56C

CHAPTER ONE

1. GENERAL

1.1 Purpose and Scope

The purpose of this Code of Practice is to promote the safe operation of steam receivers.

This Code may also offer practical guidance for those responsible for the safety and direct supervision of steam receivers.

The scope of the Code is limited to such basic information as is necessary for the safe operation of steam receivers.

1.2 Interpretation

For the purpose of this Code:

"Authority" means the Boilers and Pressure Vessels Authority that is, the Commissioner for Labour;

"Boiler Inspector" means a person who has been appointed by the Authority to be a Boiler Inspector and whose appointment to be a Boiler Inspector has not been suspended;

"Certificate of Competency" means a Certificate of Competency issued by the Authority;

"Certificate of Fitness" means a Certificate of Fitness of a steam receiver issued by a Boiler Inspector under section 33 of the Boilers and Pressure Vessels Ordinance;

"competent person" means a person whose name is for the time being entered in the register of competent persons kept pursuant to section 7(1)(e) of the Boilers and Pressures Vessels Ordinance;

"Ordinance" means Boilers and Pressure Vessels Ordinance;

"owner", in relation to a steam receiver, includes any person who is in possession of the steam receiver under an agreement of hire purchase or under a contract between a supplier of the steam receiver, or the agent of any such supplier, and such person for the sale of the steam receiver, notwithstanding that the property in the steam receiver has not passed to such person, and, where the owner of a steam receiver cannot be found or ascertained or is absent from Hong Kong or is under disability, also includes the agent of the owner;

"steam receiver" means any vessel or apparatus (other than a boiler, a steam container, a steam pipe or coil, or a part of a prime mover) used for containing steam under pressure greater than atmospheric pressure.

CHAPTER TWO

2. ESSENTIALS OF STEAM RECEIVER

2.1 General

Every steam receiver must be constructed and maintained to withstand the maximum pressure of steam which is supplied by other sources.

There are various types of steam receivers in the industry, such as i) steam rolls for calendering; ii) dryers for heating and drying materials; iii) kiers for dyeing purposes; iv) sterilizers and autoclaves used in the preparation of food and disinfection of medical materials.

Steam receivers may have vent valves, working door/cover with thermostatic sensor locking device for additional safety in operation. Nevertheless all steam receivers have certain safety fittings, for example:

(a) a reducing valve or other automatic appliance to prevent the maximum permissible working pressure of the steam receiver being exceeded;

(b) a spring-loaded safety valve that is capable of being sealed and shall be adjusted to permit the steam to escape as soon as the maximum permissible working pressure of the steam receiver is exceeded or an appliance for cutting off automatically the supply of steam as soon as that pressure is exceeded;

(c) a correct steam pressure gauge, which shall indicate the pressure of steam in the steam receiver in pascals or multiples of pascals and shall have marked upon it by a red line the maximum permissible working pressure (MPWP) of the steam receiver;

(d) the safety valve [item (b)] and the steam pressure gauge [item (c)] of every steam receiver shall be fitted on the steam receiver or on

the supply pipe between the steam receiver and the reducing valve or other appliance provided to prevent the maximum permissible working pressure of the steam receiver being exceeded;

(e) means for attaching a test pressure gauge shall be available on every steam receiver;

(f) a suitable stop valve to regulate inflow or outflow of steam; and

(g) if more than one steam receiver are fitted, a plate bearing distinguishing number that is fixed on each steam receiver shall be easily visible for identification.

2.2 Fittings for Steam Receivers

2.2.1 Pressure Reducing Valve

Figure 2.1 shows a pressure reducing valve which is used to reduce the steam pressure supplied from a boiler. Usually boiler generates steam at a pressure higher than normally required for steam receiver operation.

Pressure reducing valve can control and maintain the pressure in the steam receiver. This valve also has a throttling effect which minimizes the water droplets in the steam. The bellow in the reducing valve should be checked periodically to ensure the safe operation of the equipment at the receiving end. No by-pass valve connected in parallel with the reducing valve is allowed.

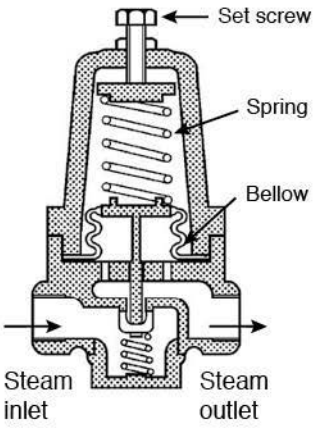


Figure 2.1

2.2.2 Safety Valve

Figure 2.2 shows a safety valve which is fitted on a steam receiver to prevent the pressure in the vessel from going above a safe working pressure by its automatic opening to release the excess pressure when the set point is reached. It guards against possible explosion from excessive pressure.

When an easing gear is fitted for lifting the valve from its seat, it should be actuated periodically to avoid seizure.

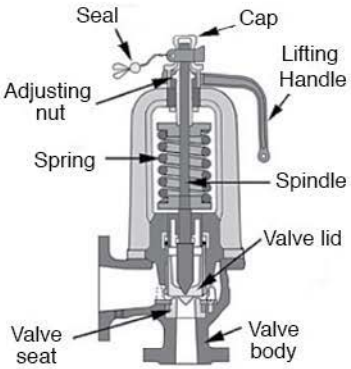


Figure 2.2

2.2.3 Steam Pressure Gauge

Pressure gauge (see Figure 2.3) connected to steam receiver should be easily visible, and should be marked on it by a red line indicating the maximum permissible working pressure (MPWP) of the steam receiver. The gauge should be calibrated and marked with suitable range to indicate the pressure of steam in the steam receiver in pascals or multiples of pascals.

Means for attaching a test pressure gauge shall be provided for each steam receiver.

Figure 2.3

2.2.4 Stop Valve

Figure 2.4 shows a stop valve which is normally found in a steam system and is used to allow the flow of steam into a steam receiver. It may also be used to control steam outflow when fitted on the outlet of the steam receiver.

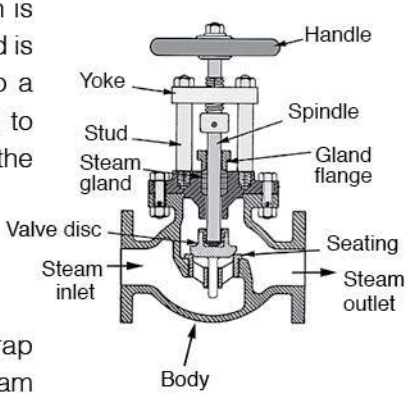


Figure 2.4

2.2.5 Steam Trap

Figure 2.5 shows a typical steam trap which is used to drain out steam condensate as well as non-condensable gases from a steam receiver. As the condensate level rises, the float in the trap will move up and in turn, connects the leverage to open the valve lid and drains the condensate away. When the level falls, the float will go down and close the valve. In case non-condensable gas exists in steam, it cools down the thermostatic bellow valve and escapes together with the steam condensate. If excessive condensate fills up the trap, it will also escape from the bellow valve by the temperature drop of the thermostatic bellow.

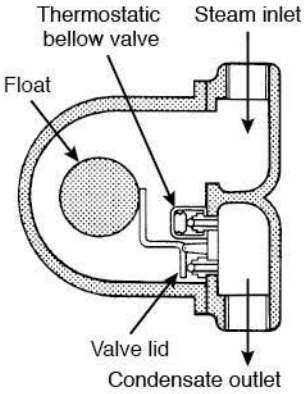


Figure 2.5

2.2.6 Door Interlock

Door interlock is used to prevent accidental opening of the door of a steam receiver when pressurized as the hot steam water mixture in the steam receiver will expand vigorously and lower the boiling point of the water further causing it to evaporate rapidly causing a dangerous situation.

Figure 2.6 shows a popular steam receiver door interlock device which comprising a clamp plate and a cam disc with a ventilation valve handle pinioned to it. The door is blocked to open from turning counterclockwise by the circular profile of the cam disc when the ventilation valve handle settles inside the socket at its close position. When the ventilation valve is at open position, steam pressure inside the steam receiver is released and the flat line profile of the cam disc will allow the clamp plate to pass when the door is turned to open in counterclockwise direction.

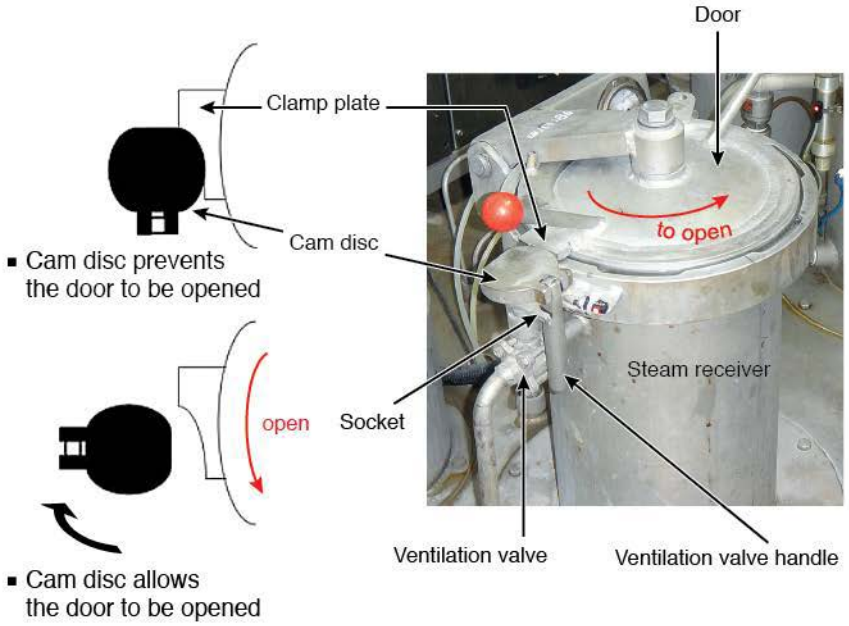


Figure 2.6

It is important that operating procedures in a language suitable to the operators and a safety caution sign of appropriate wordings shall be displayed conspicuously on or next to the steam receiver, and that the operators should be trained in the proper use of the interlock and closure mechanisms.

CHAPTER THREE

3. ARRANGEMENT OF SAFETY FITTINGS

3.1 General

An operator of a steam receiver should be familiar with the working principle of the steam receiver. There are many different types of steam receivers in the industry. Operator should possess adequate knowledge on safety fittings, general arrangement and the common defects that can be found on the steam receiver.

Followings are common types of steam receivers:

(a) Sterilizer;
(b) Multi-Cylinder Dryer;
(c) Autoclave;
(d) Fabric Dyeing Kier;
(e) Cone Dyeing Kier; and
(f) Steam Bowl.

3.2 Proper Arrangement of Steam Receivers

The proper arrangement of safety fittings on two steam receivers "A" and "B" respectively is shown in Figure 3.1 as follows:

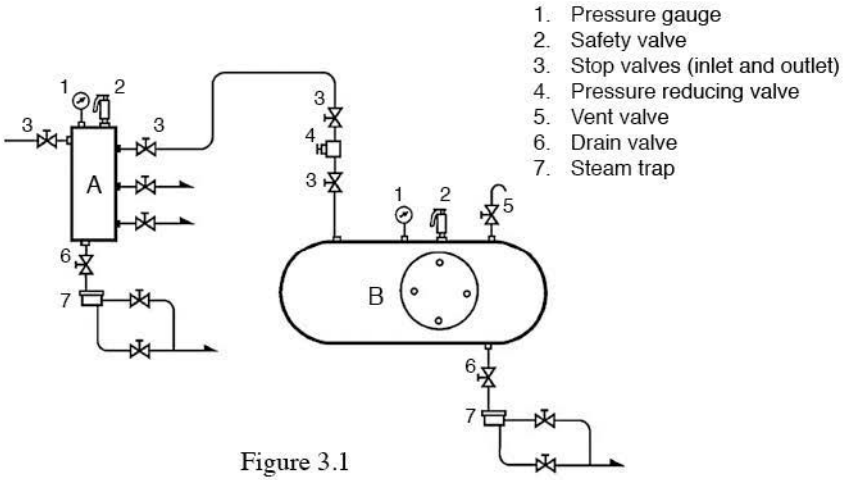


Figure 3.1

In Figure 3.1, dry steam from boiler is admitted to steam receiver "A" that acts as a steam distribution manifold where steam is then distributed to three locations for various purposes. Steam receiver "B" is connected at downstream of steam receiver "A".

Any products in steam receiver "B" may be raised to the required temperature for drying, breaching, sterilizing and etc.

Both receivers are equipped with drains where steam traps"7"were fitted to automatically drain out any steam condensate generated during the processes.

3.3 Types of Steam Receivers

3.3.1 Sterilizer

3.3.1.1 Proper Arrangement of Sterilizer

The proper arrangement of the safety fittings of a sterilizer is shown in Figure 3.2 as follows:

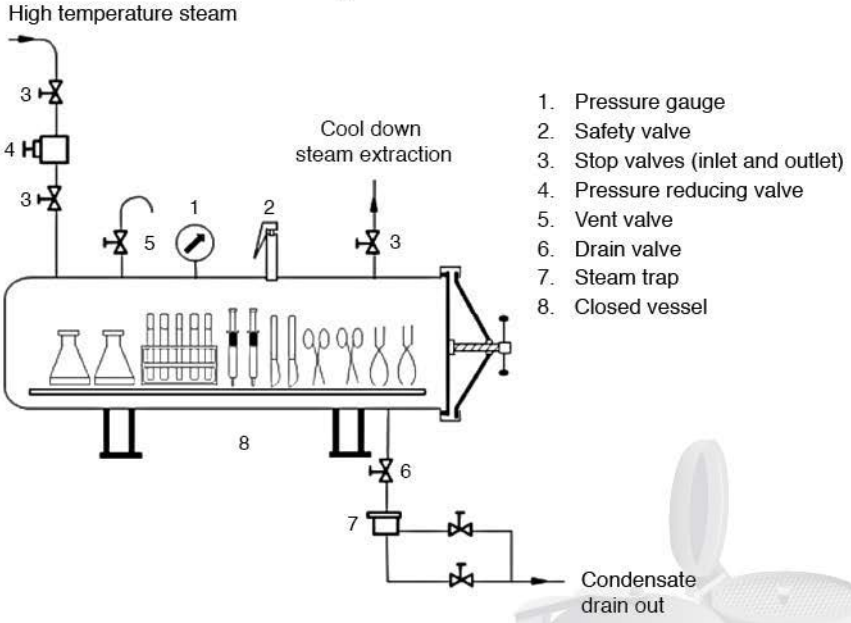


Figure 3.2

3.3.1.2 Principle of Operation of Sterilizer

High temperature steam is admitted to the closed vessel and removes the air content inside to raise the temperature for a period of time for sterilization. The exposure time for steam sterilization is depended on the steam temperature. A typical sterilization process includes an exposure time of 20 minutes at 121 °C. Increase steam temperature will reduce the time needed for sterilization.

3.3.2 Multi-Cylinder Dryer

3.3.2.1 Proper Arrangement of Multi-Cylinder Dryer

The proper arrangement of the safety fittings of a multi-cylinder dryer is shown in Figure 3.3 as follows:

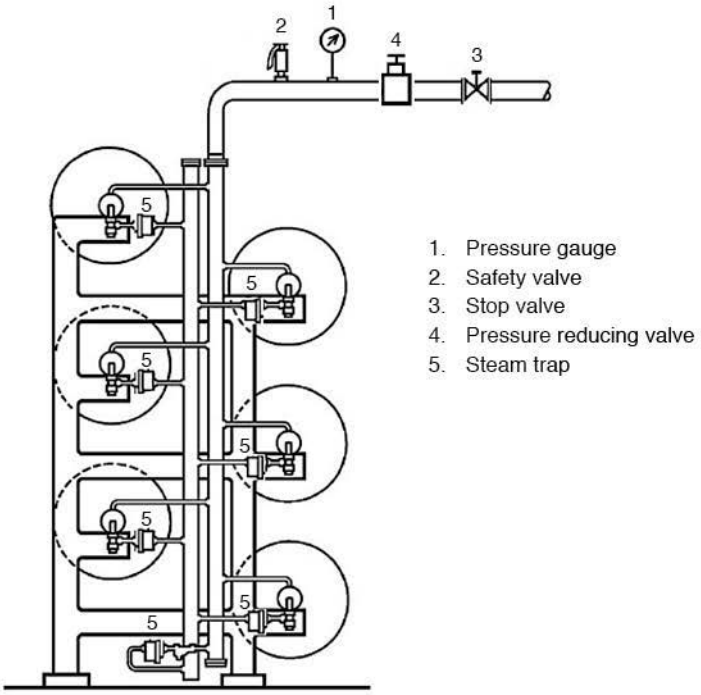


Figure 3.3

3.3.2.2 Principle of Operation of Multi-Cylinder Dryer

High temperature steam is admitted to steam receivers in the form of steam rolls. Cloth or paper passes through the heated rolls in turn and comes out dry and flat. They are commonly used for calendering.

3.3.3 Autoclave

3.3.3.1 Proper Arrangement of Autoclave

The proper arrangement of the safety fittings of an autoclave is shown in Figure 3.4 as follows:

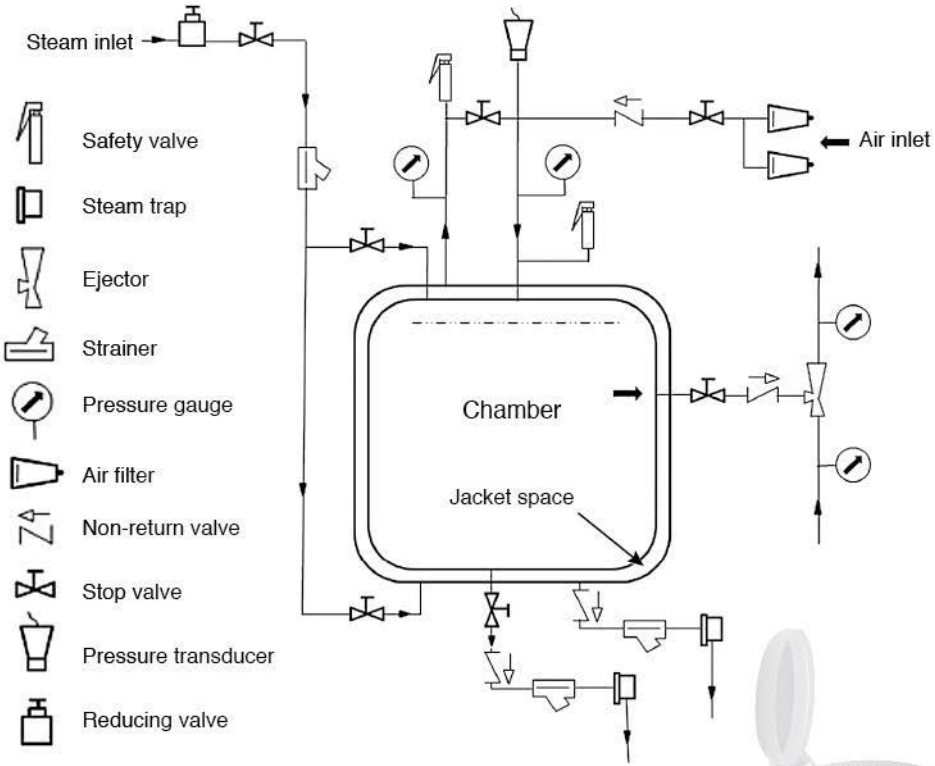


Figure 3.4

3.3.3.2 Principle of Operation of Autoclave

An autoclave is a steam receiver when steam is supplied to the jacket space and the chamber to heat up the products inside to perform sterilization. The fine water mist within the products is evaporated. After several cycles of air extraction and steam injection, the products are dried and sterilized. This type of steam receiver is commonly found in hospitals and laboratories for sterilizing purpose.

The first stage is air evacuation cycle, in which the air content inside the chamber of the autoclave is extracted out before steam is injected. This extraction and steam injection actions are repeated for several times and to repel the air from the chamber.

The second stage is sterilization cycle of not less than 6 minutes that depends on different makers, when steam is injected into the chamber to maintain high temperature (134°C – 138°C) for sterilizing of not less than 3 minutes.

In the third stage of exhaust cycle, the chamber content is extracted leaving the products inside to be dried up under negative pressure.

Finally, the chamber pressure is risen up to atmospheric pressure by filling up with air passing through a bacteriological air filter.

Sometimes, the autoclave is double casing chamber and steam could surround the inner casing properly to make it possible to sterilize large loads of instruments or textiles in a relative short period of time as well as improving the drying result, as the temperature of the chamber is maintained at the same level permanently.

The key parameters in successful sterilization are to maintain pressure and temperature. On the other hand, the duration of sterilization will greatly depend on the products' properties, e.g. quantity, size & characteristic etc.

3.3.4 Fabric Dyeing Kier

3.3.4.1 Proper Arrangement of Fabric Dyeing Kier

The proper arrangement of the safety fittings of a fabric dyeing kier is shown in Figure 3.5 as follows:

1. Service door
2. Lifter reel
3. Nozzle
4. Service tank
5. Dyestuff feed pump
6. Filter & heat exchanger
7. Circulation pump
8. Drain valve
9. Water inlet valve
10. Compressed air inlet valve
11. Depressure valve
12. Mixing valve
13. Cooling water inlet valve
14. Steam inlet valve
15. Cooling water outlet valve
16. Safety valve
17. Pressure reducing valve
18. Non-return valve
19. Steam trap
20. Drain

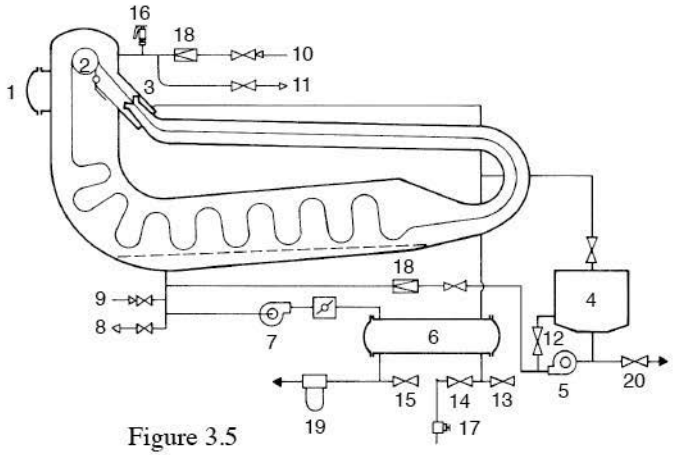


Figure 3.5

3.3.4.2 Principle of Operation of Fabric Dyeing Kier

The fabric to be dyed forms a loop in the vessel and is circulated inside with the help of liquor circulation and lifter reel.

The dye stuff and chemicals are added at the appropriate temperature after the cover is closed.

The vessel is pressurized by compressed air or by the vapour pressure of steam.

The temperature and pressure inside the vessel vary for different dyestuff and chemicals used.

3.3.5 Cone Dyeing Kier

3.3.5.1 Proper Arrangement of Cone Dyeing Kier

The proper arrangement of the safety fittings of a cone dyeing kier is shown in Figure 3.6 as follows:

1. Kier cover
2. Dye tank
3. Circulation pump (main pump)
4. Heating coil
5. Overflow valve
6. Drain valve
7. Steam inlet valve
8. Cooling water inlet valve
9. Condensate outlet valve
10. Cooling water outlet valve
11. Lid valve
12. Drain valve
13. Injection pump
14. Service tank
15. Safety valve
16. Pressure reducing valve

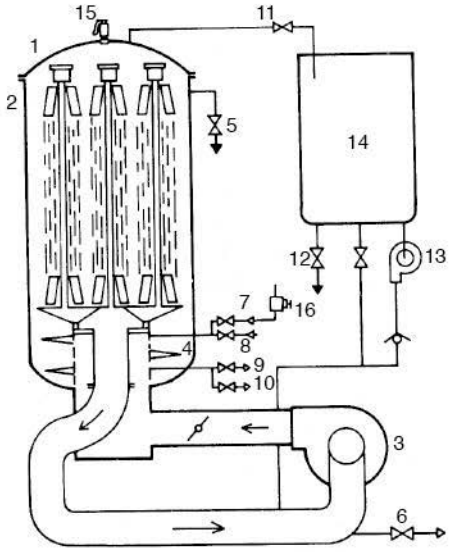


Figure 3.6

3.3.5.2 Principle of Operation of Cone Dyeing Kier

Cone fabric to be dyed is mounted on a carrier.

The dyeing liquid is mixed in the system and circulated through the cones by a circulating pump.

This type of kier may have three modes of operation, i.e. low/ medium/ fully flooded mode.

The first two modes are pressurized by air while the last mode is pressurized by the pump.

3.3.6 Steam Bowl

3.3.6.1 Proper Arrangement of Steam Bowl

The proper arrangement of the safety fittings of a steam bowl is shown in Figure 3.7 as follows:

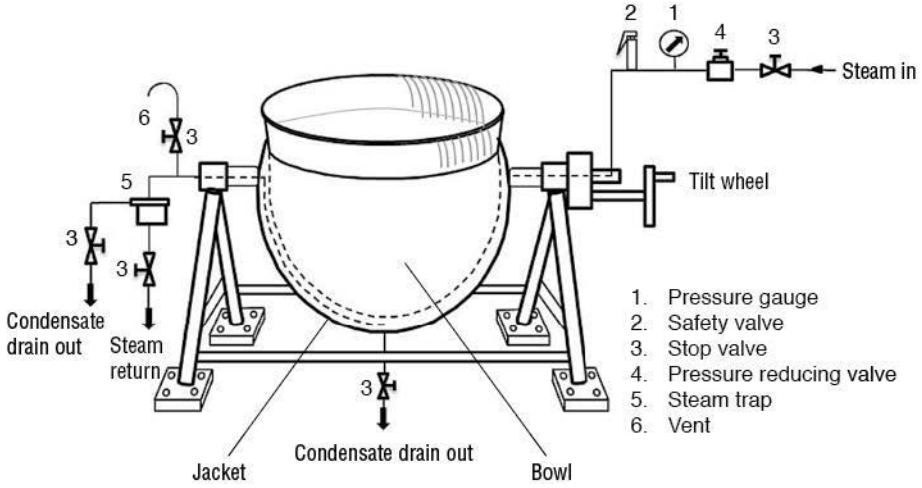


Figure 3.7

3.3.6.2 Principle of Operation of Steam Bowl

Steam bowl consists of a steam jacket chamber for heating contents inside the bowl. The steam bowl is able to be tilted to meet operational needs.

Before allowing steam passing the steam jacket chamber for heating operation, the followings shall be carried out:

(i) the bowl is placed at upright position and the vent is opened;

(ii) the condensate drain-out cocks at steam outlet and at bowl bottom are opened to drain out any water accumulating inside; and

(iii) the drain-out cocks as well as the vent are then closed only after steam could be found emerging out in preheating process by supplying steam slowly to the steam jacket chamber to drive out air and vapour content inside.

Steam is admitted gradually to the steam jacket chamber to heat the content of the bowl under atmospheric pressure. It is important to ensure emptiness of the bowl before attempting to tilt.

CHAPTER FOUR

4. OPERATION

4.1 General

The following points are to be observed for the safe operation of steam receivers:

(a) Check the validity of the Certificate of Fitness, to ensure statutory inspections have been carried out at the right time;

(b) Users should be familiar with the manufacturer instructions;

(c) Safety valve and seal must be intact and not being tampered with. Any pressure in steam receiver which is above the approved maximum working pressure is prohibited;

(d) Periodically examine the safety devices, attachments, auxiliary fittings and control equipment to ensure their proper functioning. Uses of defective parts may result in accidents;

(e) Check all the fittings that they are properly mounted and there are no leaky joints;

(f) For bolted covers, all bolts must be used. The practice of tightening or loosening only a few bolts must be prohibited;

(g) All swing bolts must be completely free and the cover loosened before swinging the bolts clear from sockets;

(h) Drain the condensate in the steam pipe completely before the steam stop valve is opened slowly to prevent water hammer;

(i) Check that the pressure in steam receiver is not higher than the predetermined working pressure to ensure the proper function of the pressure reducing valve;

(j) Always ensure that the operating pressure indicated in the pressure gauge should not exceed the red line which indicates the maximum permissible working pressure as specified in the Certificate of Fitness; and

(k) Check that the steam trap is functioning properly, and that only condensate is discharging from it.

4.2 Observation during Operation

The followings should be particularly observed and continuously monitored when operating a steam receiver:

(a) pressure, temperature and flow rate of the steam;

(b) noise and water hammer found in the pipeline due to the presence of water in steam system;

(c) the temperature difference between outlet and inlet of the steam receiver; and

(d) any leakage found at pipelines, level gauge, flanges and shaft seals of the circulating pump.

4.3 Operating Precaution for Steam Receivers

4.3.1 Water hammer occurrence

When steam is supplied to a cold steam pipe with condensate, steam condenses as it comes in contact with the cold pipe wall or the condensate, causing water hammering as illustrated below:

Figure 4.1

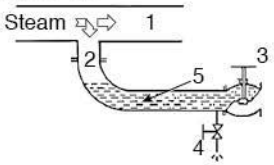


Figure 4.2

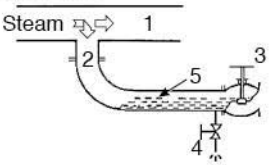


Figure 4.3

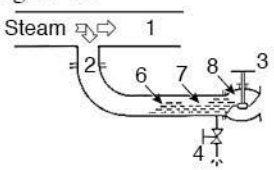
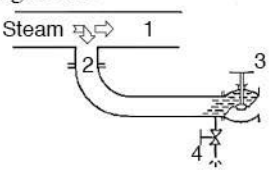


Figure 4.4



1. Steam line
2. Branch pipe
3. Stop valve
4. Drain valve
5. Waves on the condensate
6. Enormous turbulence
7. Bubble of steam enclosure
8. Partial vacuum

Figure 4.1 and 4.2
Steam is supplying to the pipe which contains condensate with the stop valve closed, and the draining of condensate from the pipe has not been completed. As steam enters the pipe, it disturbs the surface of water and causes the formation of waves.

Figure 4.3 and 4.4
When the condensate level falls, the turbulence increases rapidly and breaks the crest of the waves forming bubble-like enclosures containing steam. The pressure causes the bubble to collapse with some noise and force. A surging wave may be big enough to block the pipe. Steam condenses on the other side of the waves creating partial vacuum together with the incoming steam behind the wave forcing the water at high velocity towards the stop valve or other obstruction. This action causes rupture of steam pipe or the valve body.

To prevent water hammer in steam pipe, open the drain valve to drain the condensate completely and crack-open the stop valve to allow warming up the steam pipe. When the steam pipe is warmed up and steam comes out through the drain cock, the drain cock can be closed and the steam stop valve can be opened slowly.

4.3.2 Malfunctioning of Reducing Valve

To ensure proper functioning of a reducing valve, it should be checked and maintained regularly. Defective reducing valve may cause the following abnormalities:

(a) Over pressure of a steam receiver
Reasons:
(i) holed bellow;
(ii) blockage of steam passage to bellow;
(iii) leaky valve seat.

(b) Low steam pressure supply to steam receiver
Reasons:
(i) spring weakened;
(ii) set screw loosened.

(c) No steam supply to steam receiver
Reasons:
(i) broken spring;
(ii) set screw worn out and gone.

4.4 Important issues for operators and owners

(a) Operators must obtain the Certificate of Competency of appropriate class before operating any steam receiver. Appendix I shows the types of equipment including steam receivers which the holders of different Certificates of Competency are allowed to operate.

(b) Every steam receiver must be fitted with a suitable spring-loaded safety valve that is capable of being sealed. Do not tamper with the seal (See Figure 4.5) of the safety valve or increase the working pressure beyond the approved maximum working pressure. This endangers the safety of the operator and other persons as over-pressure can cause accident and injuries.

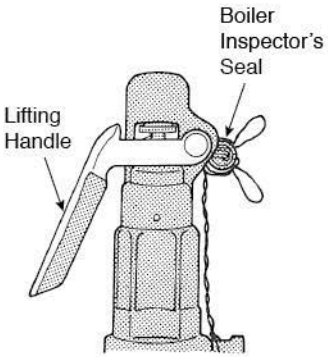


Figure 4.5

(c) The cover or locking device should never be forced into position. If there is any unusual resistance to smooth operation, the matter should be reported to the maintenance engineer for immediate investigation.

(d) Repairing or servicing should only be carried out by qualified engineers approved by the makers and under supervision of Boiler Inspector.

(e) In case of accident, owners must ensure the steam receiver and its auxiliaries are shut down immediately and report the accident to the Boilers and Pressure Vessels Authority within 24 hours.

CHAPTER FIVE

5. MAINTENANCE

5.1 General

Any steam receiver which is not properly maintained may cause injury to personnel in the event of an accident. As such, a proper maintenance scheme should be deployed to ensure every part of the equipment and its auxiliaries are properly checked. It is advisable that a planned maintenance or a preventative maintenance scheme should be adopted against that of breakdown maintenance.

In order to maintain a safe working condition, every steam receiver and its auxiliary equipment must be properly maintained. It is advised that the following shall be observed:

(a) A steam receiver transferred from one part of the premises to another shall be examined by a Boiler Inspector and a Certificate of Fitness issued before it is again put into service.

(b) During operation of a steam receiver, if the competent person discovers that it is in need of immediate repairs, the steam receiver shall be shut down immediately and the owner shall be notified.

(c) For any major repair and service on a steam receiver that may affect its structural strength, owners are strongly advised to consult a Boiler Inspector when selecting a suitable contractor. The Boiler Inspector will supervise the repair work and issue Certificate of Fitness upon satisfactory completion of the work before the steam receiver is put into use again.

(d) For any modification work to the pressure parts of a steam receiver, Boiler Inspector is responsible for reviewing the modification plan and making revision as necessary for agreement by the maker, and submitting the plan to the Authority for assessment of any necessary adjustment to the maximum permissible working pressure value of the steam receiver.

(e) Makers' operation guide books, manuals and safe working practices and procedures should be displayed in a conspicuous position of the plant for easy reference.

(f) A log book for each steam receiver shall be kept up to date with record of all the maintenance work carried out on the steam receiver.

5.2 Safety precautions to be taken for opening cover/ inspection door of a steam receiver and special attentions when operating kiers

The operator should observe the following precautions when opening a steam receiver:

(a) The steam receiver should be isolated by closing all its inlet and outlet valves. Drain and vent valves are fully opened to release the pressure or vacuum inside. If drain is connected to a common manifold with other steam receivers or apparatus, then drain valves should be closed after drainage is completed.

(b) Check pressure gauge is working correctly and indicating zero pressure.

(c) When no pressure remains inside the receiver, slacken all the nuts and slightly open the cover/ inspection door. The nuts must not be swung clear unless no steam comes out from the cover/ inspection door. Operator should stay aside from the cover/ inspection door when opening it.

(d) A responsible person must be stationed close by the equipment to prevent accidental opening of the steam isolating valve or closing the steam receiver cover/ inspection door when someone is working inside the steam receiver. Steam valves in pipework to and from the steam receiver should be locked shut and labelled "DO NOT OPEN".

(e) Appropriate measures should be taken to comply with the Factories and Industrial Undertakings (Confined Spaces) Regulation, Cap.59AE, Laws of Hong Kong.

In addition to the operating precautions for steam receivers, the following points should also be observed when operating kiers:

(f) The cover/ inspection door should never be opened when pressure still exists inside the shell and its operating temperature is above 80°C. This is especially important in the fully flooded mode of cone dyeing kiers where the pressure inside the shell can be released quickly while the liquid inside the shell is still above boiling point.

(g) The vent drain, connection of pressure gauge and level gauge glass should be checked for blockage before each operation.

(h) Do not by-pass and/or interfere with the function of the interlocking devices.

(i) After loading the kier and before the door is closed, all foreign matter, spillage, etc., should be cleaned from the locking parts of the door, and the door jointing should be examined to ensure that it is seating properly in its groove.

(j) Care should be taken to ensure that the locking ring does not bind during rotation. The entire ring may, otherwise, rotate about this fulcrum with the result that the ring does not remain concentric leading to unequal overlap of the locking lug.

(k) For quick closing doors where locking is by means of a single handle, using a piece of steel tubing or other similar arrangements to unduly increase the joint tightness should be prohibited.

(l) In using eye bolts for lifting the cone carrier, the liquid in the shell must be completely drained beforehand. The attendant should prevent the carrier from turning during lifting. The hook for lifting should be fitted with a safety latch.

(m) In all cases, the manufacturer's recommended method of operation should be strictly followed. Instructions for loading, taking sample and unloading should also be readily available for operators' reference. Brief operating and emergency/accident procedures for each steam receiver should be displayed in conspicuous position and all operators should be made fully conversant with these procedures.

(n) Concentricity of the kier cover/ door cover rotating ring is maintained by the clearance of the fit. Such clearance should not give way to possible excessive displacement by use of undue force. If the cover ring has not been rotated to the pre-determined position, the mechanical interlock will prevent the kier from proper functioning and the operator should not start the process.

(o) Dyeing chemicals containing chlorine should not be used in stainless steel vessels/ kiers without consulting equipment manufacturers. Operator should bear in mind that chlorine in contact with water is potentially aggressive to stainless steels.

5.3 Preparation for Inspection of a Steam Receiver

5.3.1 Exposed Part of a Stream Receiver

(a) External lagging and/or cladding should be removed to give good access to the material surface.

(b) Step-ladders, scaffolding or other arrangements should be provided for access, if necessary.

(c) Adequate lighting shall be provided.

(d) The external surfaces should be cleaned as far as practicable.

5.3.2 Internal of a Steam Receiver

(a) Every possible step shall be taken to ensure steam and fluid supplying to the steam receiver is isolated completely from the main steam supply, e.g. by fitting locking device onto the valve when it is in the closed position or fitting a blind flange in between the steam inlet pipes.

(b) Steam receiver must be well vented to atmosphere to ensure no residual pressure presents inside the shell.

(c) The vessel must be emptied of contents of toxic, corrosive, inflammable or explosive fluid.

(d) All manholes, handholes and/or inspection doors should be removed.

(e) Special cleaning and ventilating arrangements must be deployed if entry by personnel into the shell is deemed necessary. Continuous forced ventilation is to maintain a life-supporting atmosphere in the vessel. All safety precautions in accordance with the Factories and Industrial Undertakings (Confined Spaces) Regulation, Cap.59 AE, Laws of Hong Kong, must be observed.

(f) The vessel must be cleaned internally and cleared of all deposits.

(g) As far as it is practicable and found necessary, internal fittings may have to be removed.

(h) Step-ladders, scaffolding or other safe means of support may have to be deployed in large vessels as access ladders may not be fitted inside the equipment.

(i) Adequate lighting must be provided inside the steam receiver.

5.4 Susceptive Areas

Areas of common defects on steam receivers:

(a) Corrosion, wastage or pitting are usually found in areas adjacent to the supports and moving parts e.g. hinges and locking devices.

(b) Damages to valve, handwheel and mounting clamps.

(c) External piping, joints, flanges, nuts, bolts and fastenings are subject to corrosion and wastage if unprotected.

(d) Safety valves or relief valves pressure setting being illegally tampered.

(e) Malfunction of instrument e.g. pressure gauge, thermometer, level gauge etc.

(f) Wastage of rivet heads.

(g) Corrosion at areas where steam or water may accumulate.

(h) Mechanical damages, dents etc.

(i) Damage or deterioration of lagging/cladding or protective covering.

(j) Swing bolts and nuts or locking devices of covers can be easily damaged if operated with the aid of an extended steel bar.

(k) Area of corrosion, wastage and pitting on the internal surface of the vessel.

(l) Cracks on welded seams.

(m) Blockage or partially choked nozzle orifices.

(n) Impact damage on the internal surfaces and fittings.

5.5 After extensive repair or major maintenance

For every steam receiver which has undergone extensive repairs or any repairs carried out pursuant to the notice given by a Boiler Inspector, the steam receiver together with its auxiliary equipment shall be subjected to an hydraulic test with a pressure up to one and a half times of the maximum permissible working pressure specified in the Certificate of Fitness. The steam receiver should then be subjected to steam pressure and examined under the pressure that will be specified in the Certificate of Fitness as the maximum permissible working pressure at which it may be operated. The steam receiver should be subjected to a pressure accumulation test if the Boiler Inspector considers it necessary.

CHAPTER SIX

6. ACCIDENTS AND DEFECTS

6.1 General

It is the responsibility of the owner of a steam receiver to notify the Authority when:

(a) An accident occurs in or to the steam receiver or its auxiliary equipment; or

(b) Any defect in the steam receiver or in its auxiliary equipment is noted that is likely to cause danger to life or damage to property.

The owner must immediately stop using and operating the steam receiver and shall notify the Authority of the accident or defect within 24 hours, and at the same time, send to the Authority the latest Certificate of Fitness issued in respect of the steam receiver.

6.2 Information to be notified to the Authority

Every such notification to the Authority shall include the following particulars:

(a) The address or place at which the steam receiver is installed;

(b) A general description of the steam receiver;

(c) The purpose for which the steam receiver is or was used;

(d) Where applicable, the name and address of the Boiler Inspector who issued the latest Certificate of Fitness in respect of the steam receiver;

(e) The number of persons killed or injured, if any;

(f) Details of the part of the steam receiver that failed and extent of failure generally, if known;

(g) The pressure at which the steam receiver was being operated at the time of the accident; and

(h) Nature of the defects in the steam receiver.

It must be pointed out that a safety valve with its seal broken, whatever is the cause, is considered a defect. Even if it is uncertain whether such a defect would create an immediate danger, the owner must immediately arrange a Boiler Inspector to examine and re-seal the safety valve.

Classes of Certificate of Competency

The following are examples of the types of equipment which the holders of different Certificates of Competency are allowed to operate:

CERTIFICATE OF COMPETENCY	TYPE OF BOILERS/STEAM RECEIVER FOR WHICH THE CERTIFICATE IS VALID
A) All Classes (I to VI)	i) All Boilers (including automatically controlled with superheaters) and ii) Steam Receivers
B) Class I	i) All Water-tube Boilers (including automatically controlled with superheaters) and ii) Steam Receivers
C) Class I(A)	i) Water-tube Boilers (including automatically controlled but without superheaters) and ii) Steam Receivers
D) Class I(B)	i) Manually Controlled Water-tube Boilers (without superheaters) and ii) Steam Receivers
E) Class II	i) All Fire-tube Boilers (including automatically controlled) and ii) Steam Receivers
F) Class II(A)	i) Automatic Fire-tube Boilers and ii) Steam Receivers
G) Class II(B)	i) Manually Controlled Fire-tube Boilers and ii) Steam Receivers

H)	Class III	i) All Electrically Heated Boilers (including automatically controlled) and ii) Steam Receivers
I)	Class III(A)	i) Manually Controlled Electrically Heated Boilers
J)	Class IV	i) Sterilizing and Vulcanizing Boilers
K)	Class V	i) Special Purpose Boiler as specified
L)	Class VI	i) Steam Receivers

Certificates of Competency issued before the year 1981, namely the B&S certificates, shall remain valid for the type of equipment as specified in the certificate. Any person who has any query about such certificates should consult the Boilers and Pressure Vessels Division.

Labour Department
Occupational Safety and Health Branch

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