AYVAZ

INDUSTRIAL SOLUTIONS

FISH MEAL&OIL

Rev.1219

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Energy is getting more important day by day. According to the diminishing of energy sources in fish meal; industries are searching for alternative sources to increase the productivity.

In disc dryers, screw cookers, heat exchangers, twin screw presses or any other processes' energy efficiency can be 25-30% higher according to application investments with low redemption times.

In this case steam getting more important. Trapping steam and more heat usage depends on the correct steam equipment selection. Althought steam traps look simple and small, their mission is very complex.

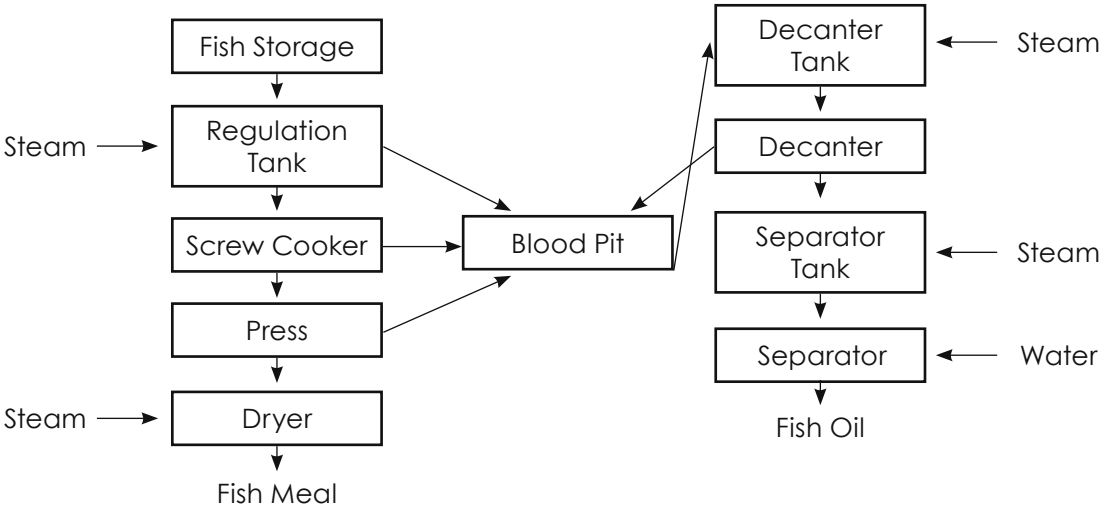
Saving more energy is related to the right chosen steam equipment and sizes. Working principles should be known well for choosing the right steam equipment for the process.

As Ayvaz, we are working for to produce best quality steam equipment in our factory in Istanbul in order to help our customers and the users to get the most efficiency from their steam systems.

We aimed to explain our audit experiences and technical knowledge to partners and introduce different type of steam.

FISH OIL AND FLOUR PRODUCTION PLANT

Anchovies collected by Fishing Boats are poured into the warehouses of the factory. Spilled fish are sent from the storage tanks to the regulation tanks with the help of augers. The water of the fish transferred by augers is filtered by the strainers under the bands and the excess water is transferred to the BLOOD PIT. With this method, the first filtration work is done to the excess water of the fish. The fish sent to REGULATION TANKS is distributed to the cooking tanks.



SCREW COOKERS

The fish transferred to the COOKING TANKS starts to be cooked here with the first heating operations. These tanks are made of cylindrical structure, the inner shaft and jacket parts on the outside, especially the fish inside the tank is exposed to the cooking process by giving open steam.

This process is done by adjusting the amount of steam depending on the amount of fish and water/oil ratio. 165 °C steam is given to the COOKERS at 6 bar pressure.

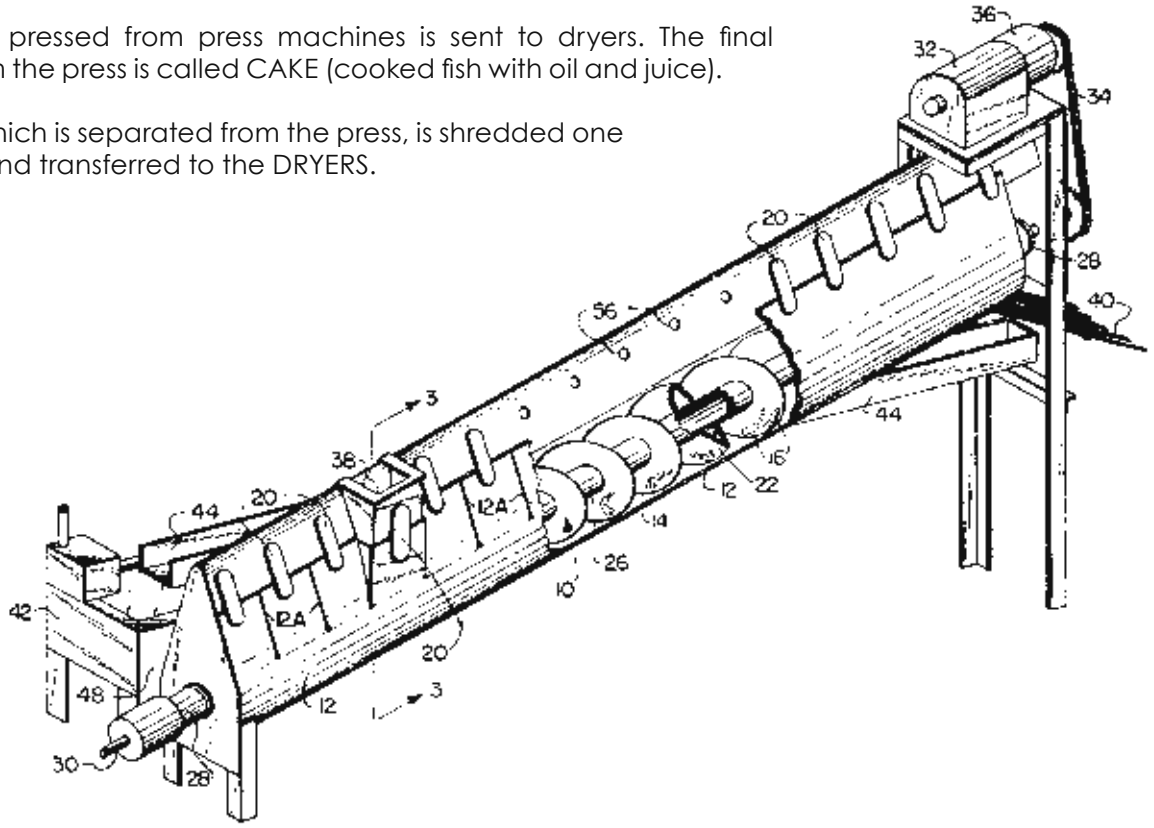
Fish cooked in the cooker comes to the oil press with carriers for separating the LIQUID and solid parts.

While the liquid part of the fish processed in the cooking tank goes to the blood hole as oil-water-sediment, the solid part (cooked fish) is sent to the PRESS UNITS.

The fish transferred to the press unit by conveyors is subjected to the process of being separated from the water inside again by the strainers in the conveyors as in the beginning. The water taken from here is sent to the blood hole.

Cooked fish pressed from press machines is sent to dryers. The final product from the press is called CAKE (cooked fish with oil and juice).

The cake, which is separated from the press, is shredded one more time and transferred to the DRYERS.



COOKING

The raw material is cooked at 95-110 °C in order to obtain maximum oil and facilitate separation of the constitution water. The fish taken from the storage tank via a conveyor is sent to the cooker. The fish is taken from one end to the other by a conveyor in the cooker.

The cooker comprises a plurality of low steam pressure taps that are separate and controllable. Steam is supplied to the cooker in three places.
1-Direct steam, **2**-Jacket steam, **3**-Belly steam.

By adjusting the steam taps, the desired amount of steam is delivered to the fish. Steam helps to remove some of the oil and water in the fish. The cooking process takes approximately 20-25 minutes. is applied. (The vapor pressure is between 0.1-2.5 Atu.) The purpose of cooking is to provide protein coagulation without burning all sides of the fish. In fish that is not sufficiently cooked, the desired amount of water and the extraction of the oil cannot be fully achieved.

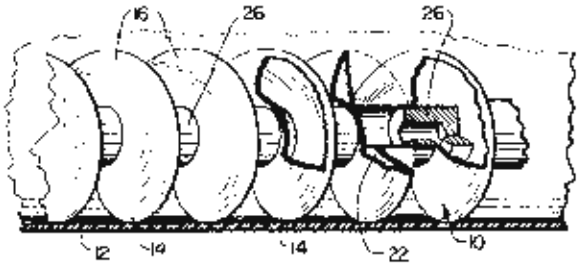
The cake is greasy. This affects both the quality of the fish meal negatively and the efficiency in oil production is low. In case of over-cooking, the structure becomes extremely soft (porridge). The porous state makes pressing difficult, with the solid particles exceeding 1/5 of the proportion in the underpressure fluid. The transfer of proteins to the press fluid also deteriorates the quality of the press-cake. Cooking time is applied according to the type of fish, freshness degree, size, experience and skill of the master working in cooking.

The product coming out of cooking is sent to the press by a perforated conveyor. With the help of a perforated conveyor, the extra free water of the product going to the press is automatically removed from the environment and the head volume to the press decreases. The water and oil mixture separated from the perforated conveyor is collected in the lower tank and pressed under a press with a pump.

PRESS

The oil press squeezes the cooked fish with double-shaft squeezing augers, separating the oil, water and solids. The resulting solid portion goes to the dryer as a cake. The driers contain serpentine pipes with helical structure. By giving steam to these pipes, the cakes are dried completely by high temperature by means of heat exchange method and FISH FLOUR is obtained.

Fan dehumidifiers are available to remove the moisture formed in the dryers. Steam does not come into contact with cakes in dryers. The fish flour from the dryer is broken down in the mills and sent to packaging with fans.



PRESSING PROCESS

It is the process of passing the cooked fish through the press machine in order to separate the water and oil part from the solid part (press-cake). With increasing pressure, the oil and water separated from the fish passes through the holes of the press to the bottom table and is conveyed to the decanter with a pipe. From the last part of the press, the solid is separated from the press-cake. Pres-Cake contains 50-55% water and 4-5% fat.

This oil is 2/5 of the total fish oil. Pres-cake contains 4/5 times of the fish. In the liquid portion coming out of the press (under-press fluid), 1/5 of the solid component of the fish (in very small particles) also contains 3/5 of the total fish oil. It is useful to place the presses directly below the cookers. Because the fish should be pressed from the cooking accident while still in the hot state. Pressing is an important stage in fish meal production. It should be shipped to the decanter at 90-95 °C.

SEPARATOR

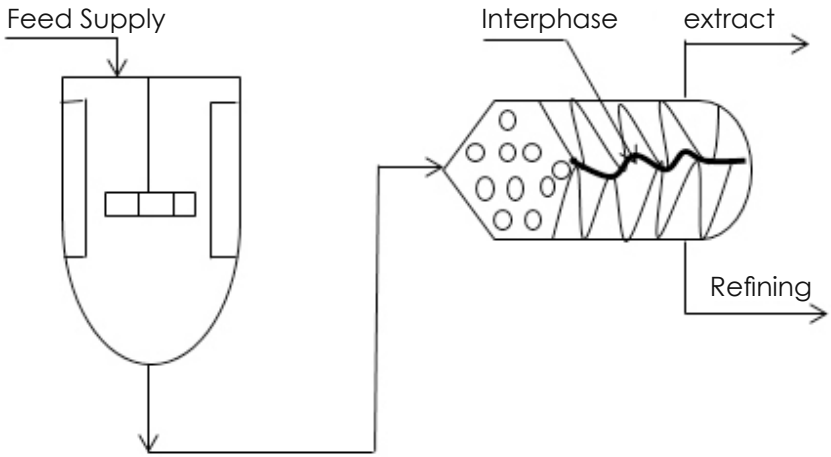
The oil and water part is stored in raw fish oil tank by separations made by pumps and decanter and separator.

Water-Oil and Sediment accumulated in BLOOD PITS are sent first in decanter preheating tanks. This liquid accumulated in open system tanks is heated up to 90-95 °C inside the tank.

Oil and water are separated from the sediments for the last time in the liquid decanter that reaches the desired temperature.

The sediment taken from here enters the dryers with the belts and performs the same operations.

The oil and water separated in the decanter are sent to the separator preheating tanks by pumps. Here, as in the decanter preheating tanks, the liquid is heated up to 90-95 °C and sent to separators operating by centrifugal method, separating the oil and water from each other. The fish oil obtained here is sent to tanks and stored. If there is water, it is sent to evaporator. Or it will be thrown out.



DECANTOR & SEPARATING PROCESS

The solid particles in the press-in fluid as fine particles are separated from the decanter and added to the press-cake. Decanter-cake is the ideal solid which is separated from the oil in decanter and reduced to pH 4.5 with H2SO4. Water and oil are separated from the decanter.

The water and oil content is collected in the middle of the decanter. This liquid part is taken out of a plate by means of a valve. In the absence of decanter, vibratory screen is used. However, this screen is not suitable for separating very fine particles. The liquid part separated from the decanter (water + oil) is accumulated in the heated tank and it is provided to reach 90-95 °C. In order to separate water and oil from each other, it is pumped to centrifugal separator (Thick oil separator). It turns into purified fish oil and pumped into oil tank.

Glue water separated in the separator is pumped to the insulated tanks. The nutrients in this liquid phase, which contain 8-10% dissolved protein, must be concentrated in order to recover the nutrients.

EVAPORATION

Glue water stored in insulated tanks is passed through a three-stage vacuum evaporator. The first stage pressure is 1.0-1.5 kg./cm2. The temperature is 110-115 °C. Heating of glue (starched) water is done in this stage. The steam released heats the water in the other stage. II. atmospheric pressure prevails in the stage. 0.6-1 kg / Cm2 pressure and 105 °C are applied. III. step pressure is 0.4-0.8 kg / cm2 and the temperature is 54-70 °C. Thus, glue (starched) water is concentrated to 50%. In this manner, the fish water that is thickened is called soluble fish soluble.. It contains 50% water, 38-40% protein / 3-5 fat, 3% salt, 1.5% phosphorus, 0.3% calcium in its structure. Soluble Fish soluble a If the flour is added into the press-cake, the flour obtained is called full flour. It can be sold alone.

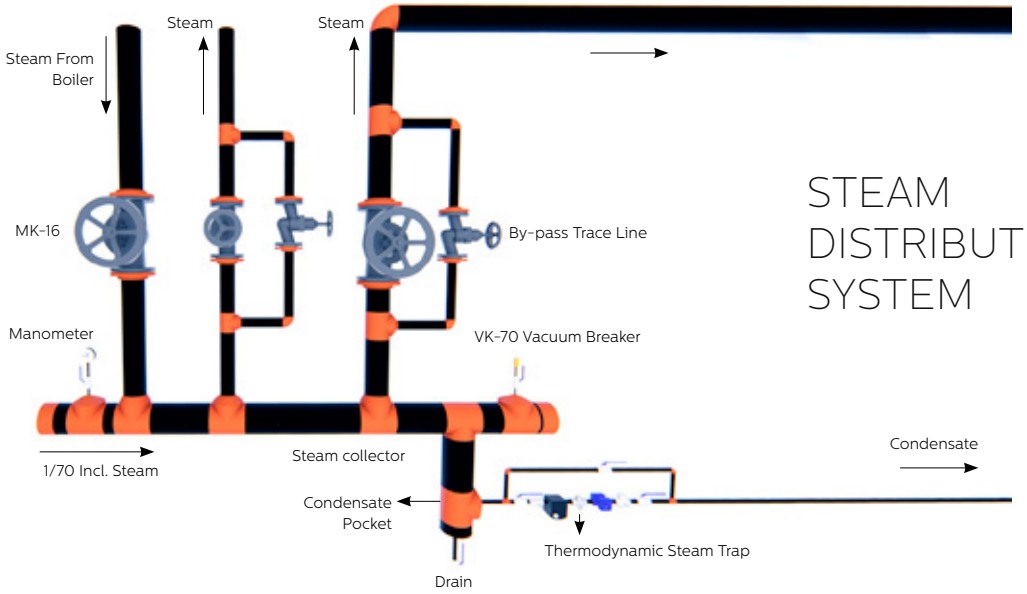
DRYING PROCESS

This is the first step necessary for the flour making of cakes. Drying is done in the device. Although it is a simple process, being able to achieve full drying requires skill. The aim is to reduce the amount of water which is 50-55% below 10% in order to stop the enzyme and bacterial activity in the press.

The dried commodity is sent to the conical flour cyclone via a fan. There is a stream of air that sweeps the solid particles to the top of the conical cyclone. The inflated air circulates through the cyclone, this time throwing the solid particles into the boiler wall. In this impact, the crumbled and falling parts are subjected to cyclone again. The hot air circulating in the cyclone repeatedly circulates and becomes very saturated in terms of moisture and passes to the second cyclone. In this cyclone, sea water which is pressed to 90 tons / hour with 6 atmospheric pressure, curtains the dirty air by means of fountains and is given to the sea. The cleaned hot air is reactivated (sent to the burner).

BOILER ROOM

Cook & beverage industries have different applications such as; steam distribution systems, feed water systems, condensation collection systems, blowdown systems and deareation systems.



The system that distributes steam is called "collector". Steam condensates in the collectors. The condensate is usually charged by thermodynamic steam traps from the collectors.

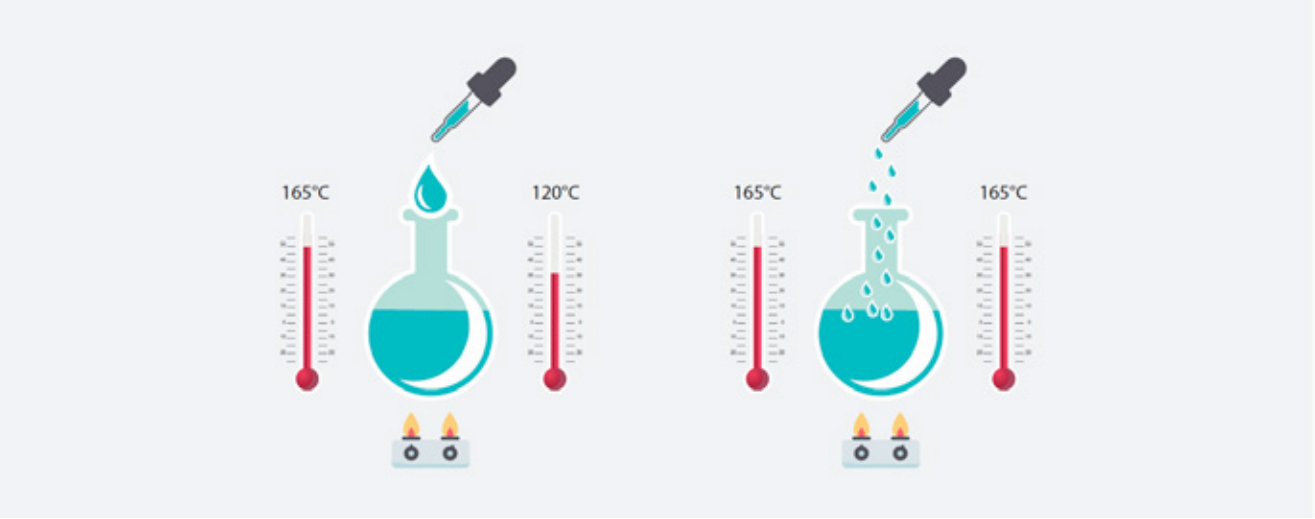
Steam collectors are the first stop in steam distribution. Saturated steam comes directly from boiler. MK-16 bellow seal valves are best option instead of globe valves at this installation.

Collector sizes can calculated $D=\sqrt{(d_1^2+d_2^2+d_3^2...d_n^2)}$ with formula.

Steam trap's pocket size can select according to selection table below;

LINE END PIPE CALCULATION	
Main Steam Line (D)	**Pocket Dia (d1)**
15-100mm	d1= D
125-200 mm	d1= 100 mm
250 mm +	d1= D/2

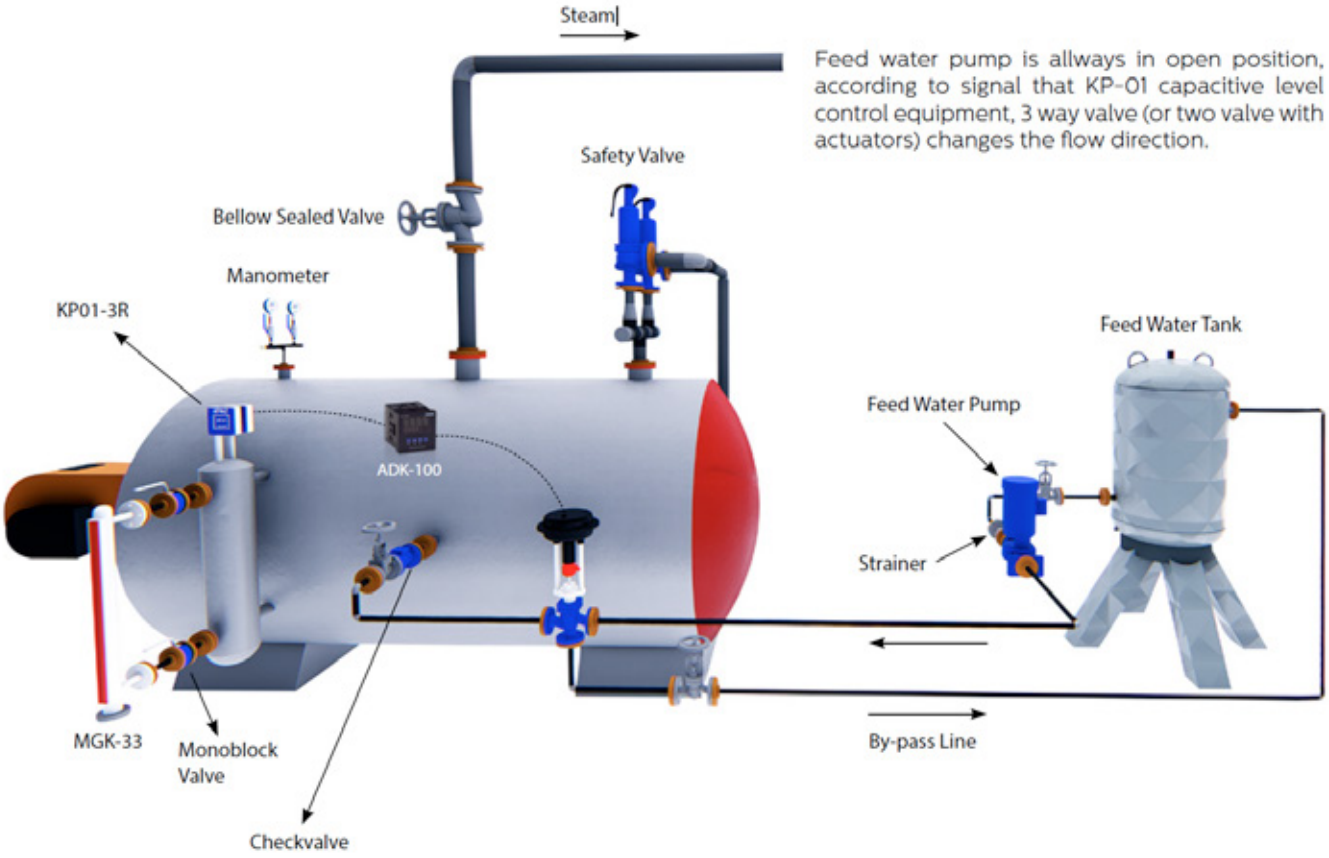
FEED WATER SYSTEMS



There are 2 general types of feed water system, such as; proportional and on-off. Main differences between proportional and on-off systems are;

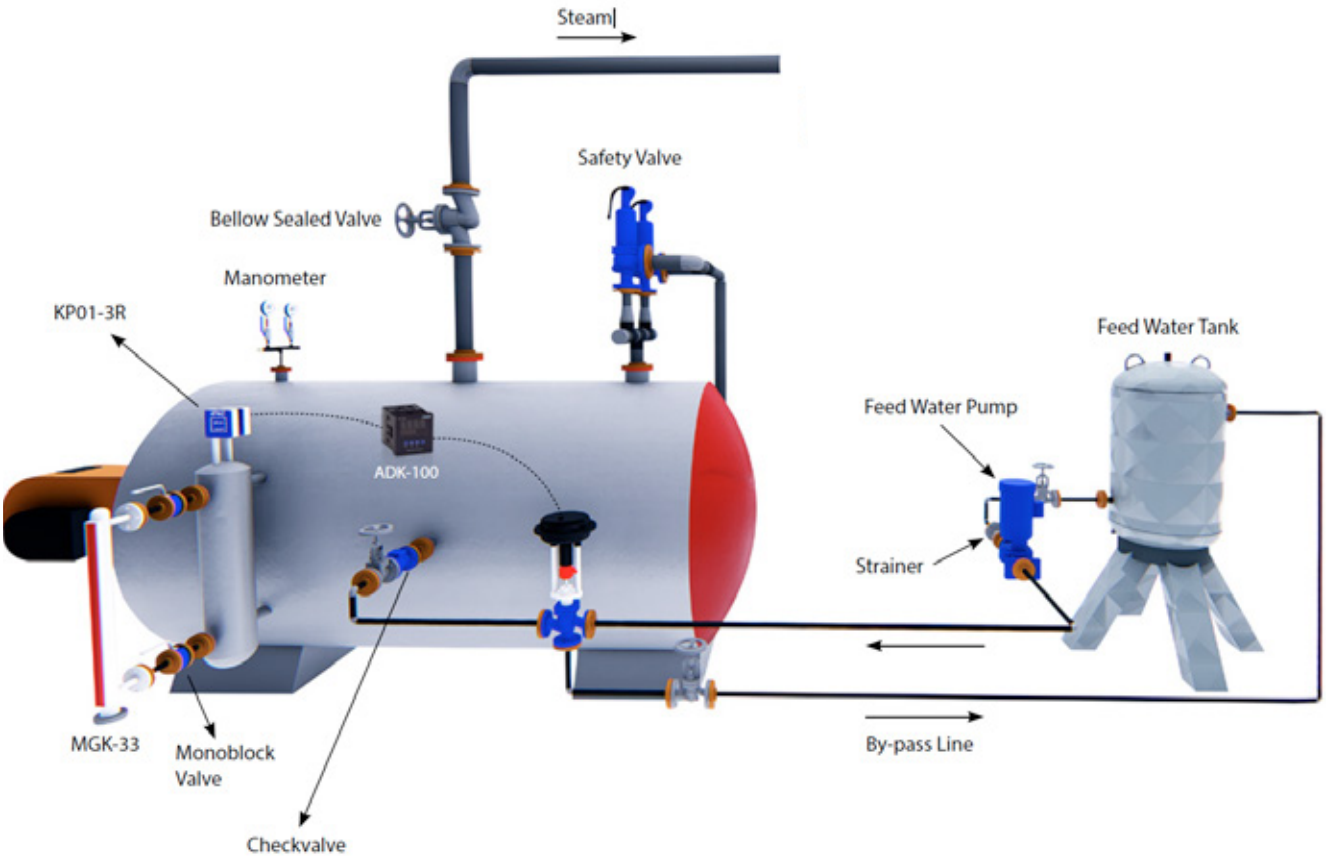
- On-off systems are more economical than proportional systems.
- With proportional systems, pressure and temperature drops will be prevented.

PROPORTIONAL FEED WATER SYSTEMS



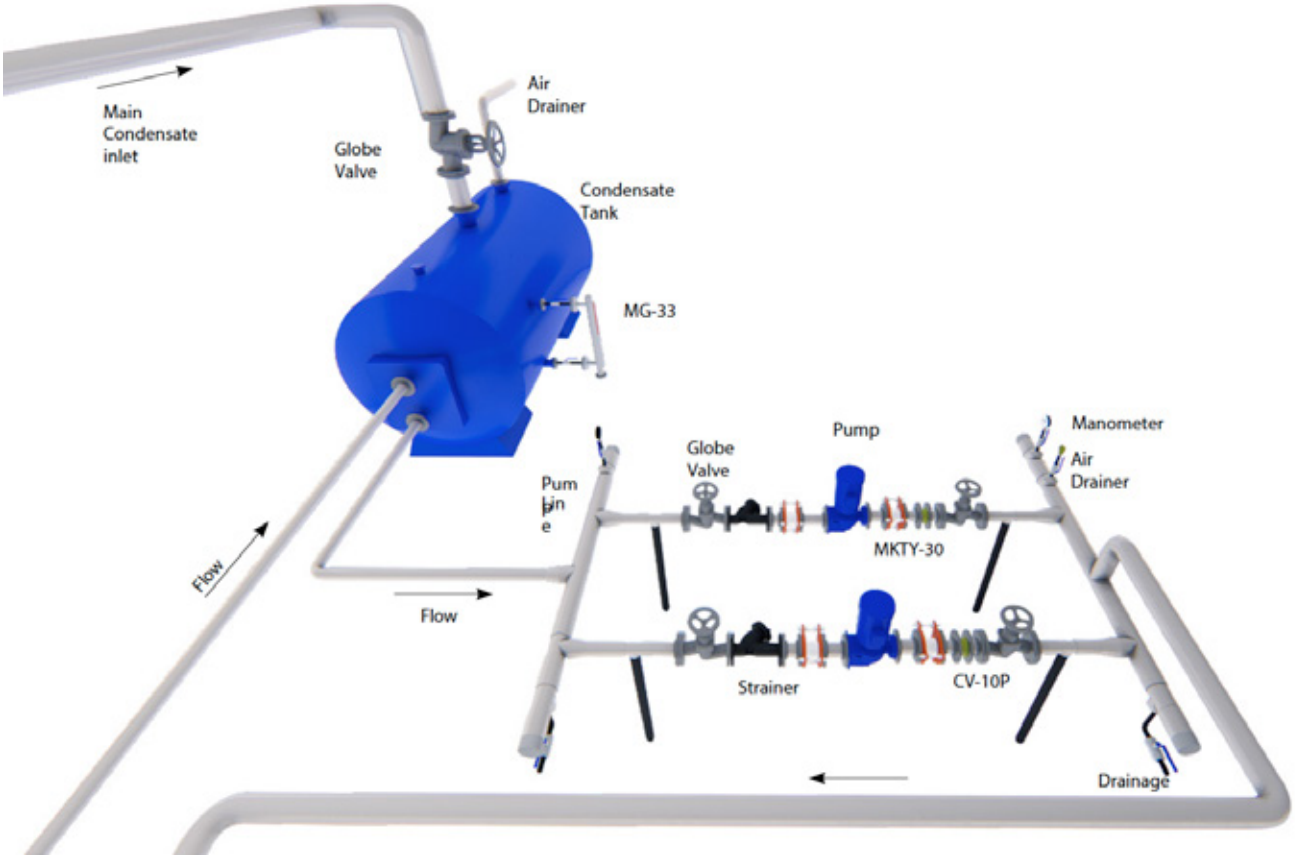
ON-OFF FEED WATER SYSTEMS

Feed water pump is opening and closing continously, according to signal that ELK-4 probe level control equipment, control valve changes the flow direction.



CONDENSATION RECOVERY LINE

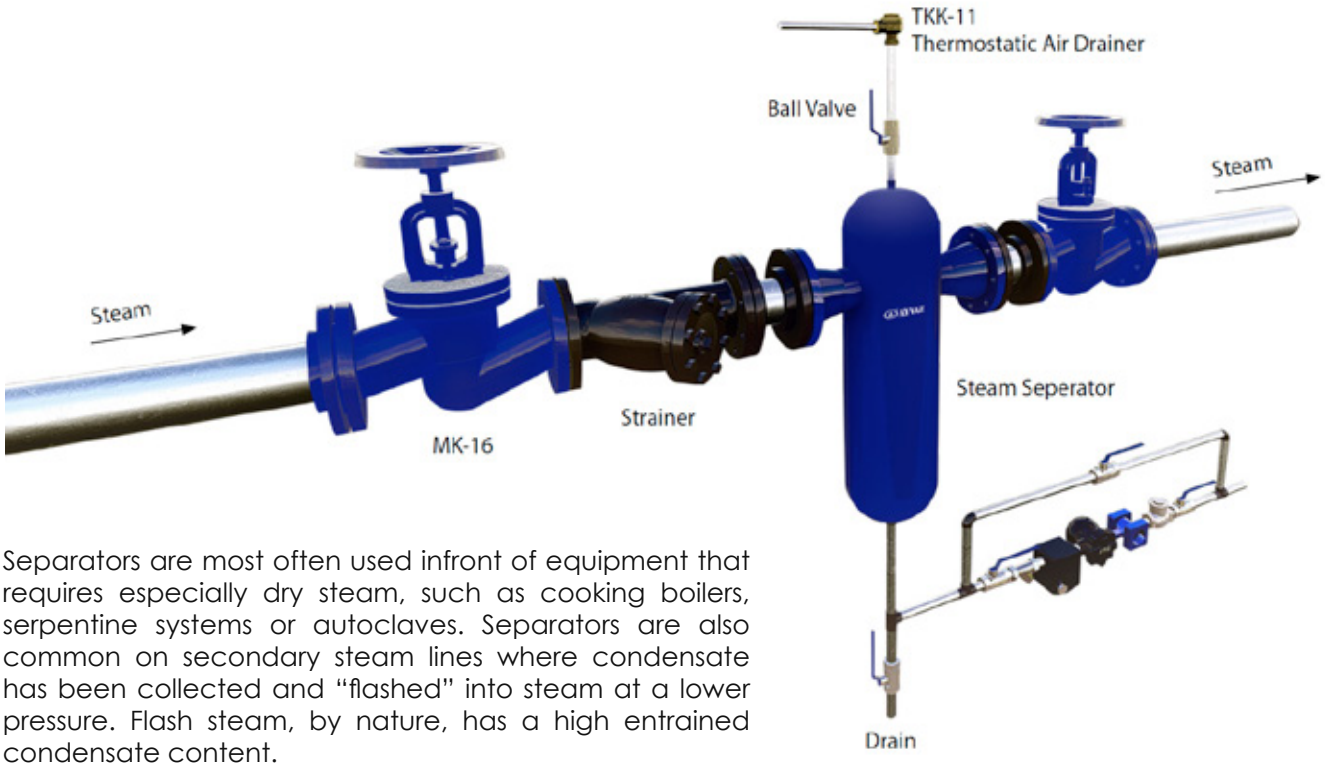
After process, saturated steam will transfer the energy and condensation will collect with steam traps to the condensate tanks. Condensate will mix with water supply in feed water tank by pumps, like the diagram below.



STEAM SEPARATOR SYSTEMS

In some cases, saturated steam may distribute directly with single line from boiler. That distribution may cause water draggings at system start up. To prevent that problem, SPR Steam Separator Systems must be installed directly to the steam lines.

In cases where dry and clean steam is required, branch line should be connected to the machine and process with a steam separator. This will help to collect the water at the bottom of the separator and to be discharged from the steam trap.



Separators are most often used infront of equipment that requires especially dry steam, such as cooking boilers, serpentine systems or autoclaves. Separators are also common on secondary steam lines where condensate has been collected and "flashed" into steam at a lower pressure. Flash steam, by nature, has a high entrained condensate content.

BLOWDOWN SYSTEMS

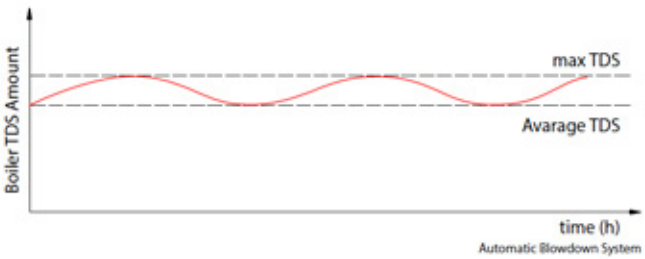
Surface blowdown and bottom blowdowns are required to ensure a continued safe transmission of the boiler. Sludge deposits are formed in the boiler and must be cleaned at regular intervals.

Sediments must be evacuated periodically to prevent the formation of the sludge layer. Bottom blowdown valves are used for this purpose. The bottom blowdown valve is opened and the pressurized boiler water is discharged from the lower zone of the boiler.

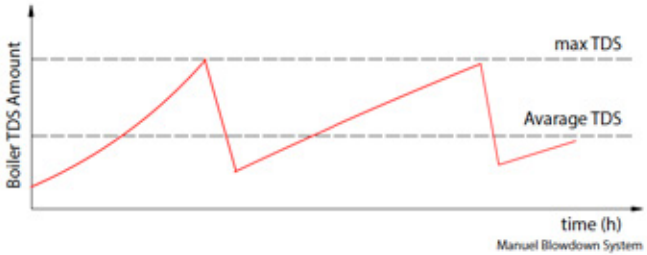
When the valve is opened, the sludge in the lower area of the boiler is effectively discharged by the high water velocity due to the pressure difference. Depending on the type of water preparation system and the dosing system, the steam boiler reaches salt and other foreign substances.

As a result of evaporation, the salinity in the boiler water increases. Salt concentration higher than the limit value causes the boiler stone, boiler corrosion and foam formation.

The foam can also reach the steam installation. Thus, the steam quality decreases and the accumulation of water forces the armatures.

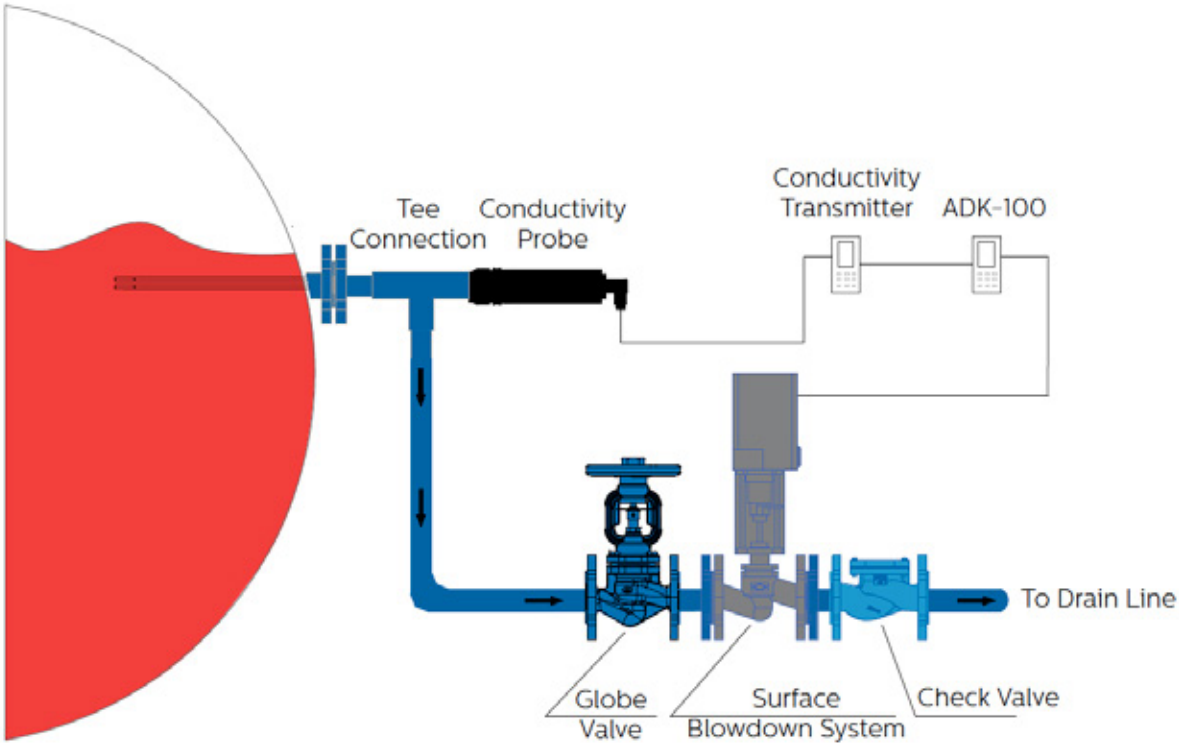


Automatic Blowdown System



Manuel Blowdown System

APPLICATION EXAMPLE

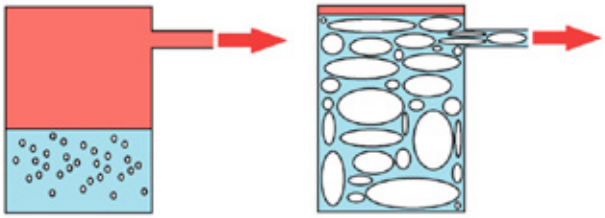


WATER DRAGGING IN STEAM LINES

In some cases hot boiler water can mix with steam and may drag to the system. This gets steam wet and may caouse hugh water mass in system. This happens in that 3 case bellow;

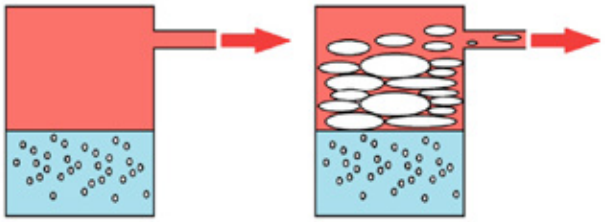
PEAK REQUESTS (PRIMING)

At the system startup, if all machines open in the same moment, boiler tank can not produce steam for request. It cause water dragging to the system and pressure loss in the steam boiler. When the pressure reduce suddenly, for balance the pressure, steam boiler start to boil and try to produce steam as fast as it can. This water steam mix drags to the system.



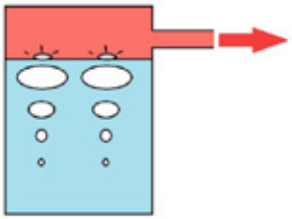
FOAMING

The components in the raw water which do not process properly process the water treatment process or the mixed condensate mixed with the condensate, cause the formation of bubbles in the cauldron. These foams fill the boiler and are dragged into the system due to the effect of steam. Foams contain water that is released when it explodes. This water damages the system.



BUBBLING

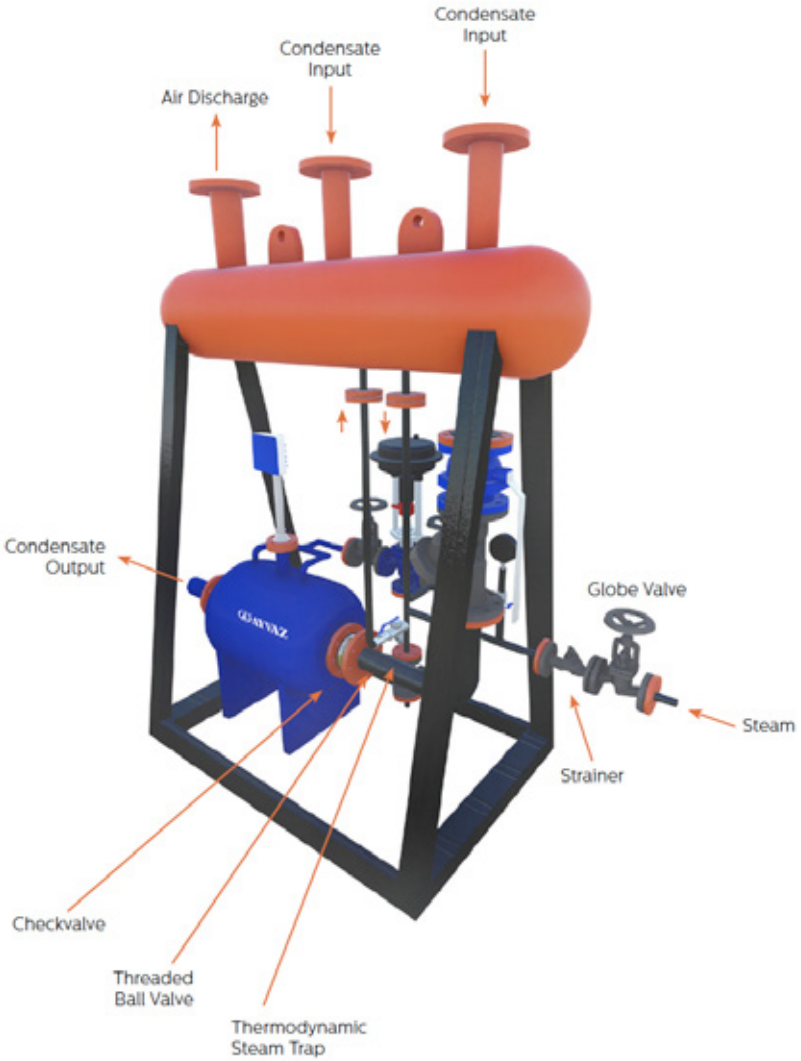
When water starts to boil on a metal heating surface, a steam bubble is formed in the water. This steam balloon rises rapidly and rises to the surface of the water. When the bubble breaks the surface of the water, some water is discharged from the surface. Discharged water continues to exist as mist at the same temperature as steam. It is usually discharged from the boiler together with the rapid flow of steam. The rest is suspended at the surface of the water since it is less dense than the density of water.



CONDENSATE PUMP SYSTEM

Condensate comes from the input collector and goes on internal pipe and access check valve than enter in condesate pump body so tank is getting full . In tank when the condensate comes on the upper limit, ELK-2 level gauge check the conductivity and change it to electrical signal and send it to 3 way pneumatic valve for the giving contact which is on the steam line than allows it to be opened. In normally steam has more high pressure than the condensate pressure. When 3 way valve is close, system discharge condensate from the system with thermodynamic steam trap.

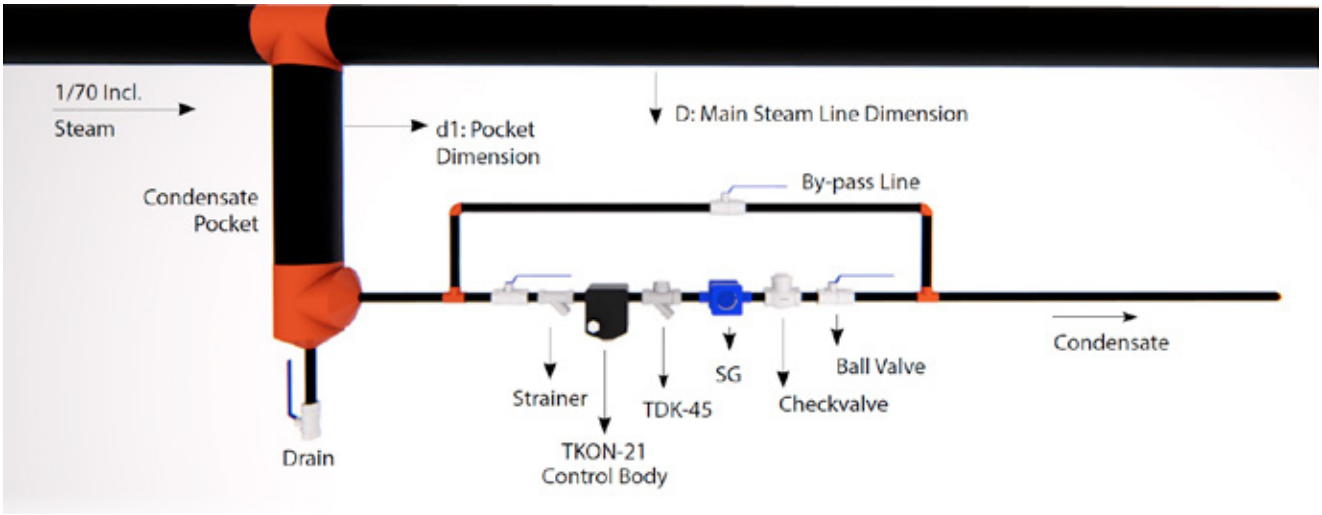
When the condensate pressure is smaller than the opposite pressure in condensate pump, discharge operation do not ocur. Steam is occurs the condensate discharging with entering the body, which have more pressure than the opposite pressure. When the condensate limit is gettin bottom limit of the tank, ELK-2 level gauge send electrical signal to 3-way pneumatic valve for close the system for entering steam. After that condens enter again and getting full tank . This operation frequency is connect between the condensate quantity.If the users want they can be follow the condensate quantity, from contoller.



STEAM LINE APPLICATIONS

MAIN STEAM LINE APPLICATION

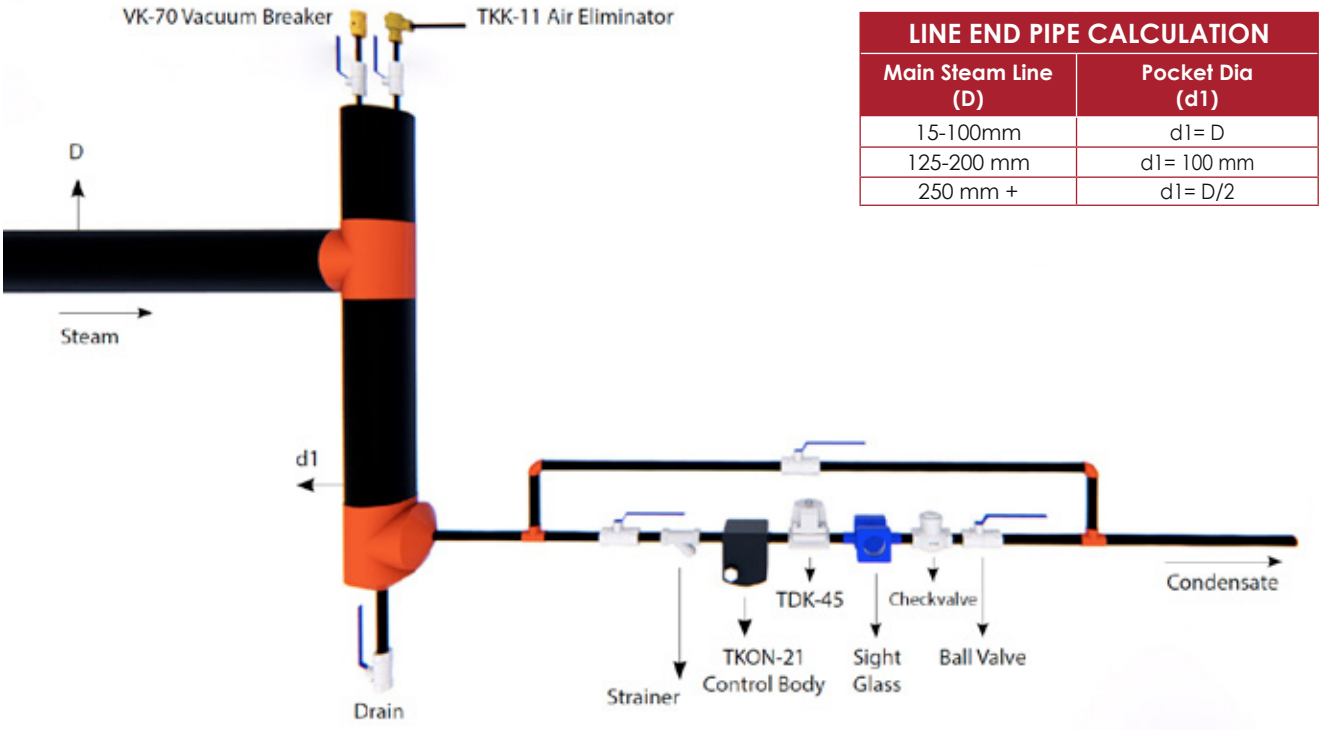
Condensate discharge unit should be placed in main steam lines in every 50 meters if the line is indoor and insulated or in every 30 meters if the line is outdoor and insulated. If any equipment like pressure reducer, pressure holder or proportional valve is installed in the line, a condensate discharge unit must be placed before these equipment.



LINE END APPLICATION

If the steam systems are closed by the process, the steam will turn to condensation until it is turned on again. The volume difference will be filled with air. When the system is switched on again, the air must be evacuated to allow the steam to easily fill the line. This is only possible with "End of Line Application".

The occurred air and condensate around connection areas in the pipelines are dragged to the end of the line. If that air and condensate are not discharged, they may block the steam flow. In such cases, formed air and condensate are discharged with a line end application shown below. The steam trap kind must be thermodynamic.

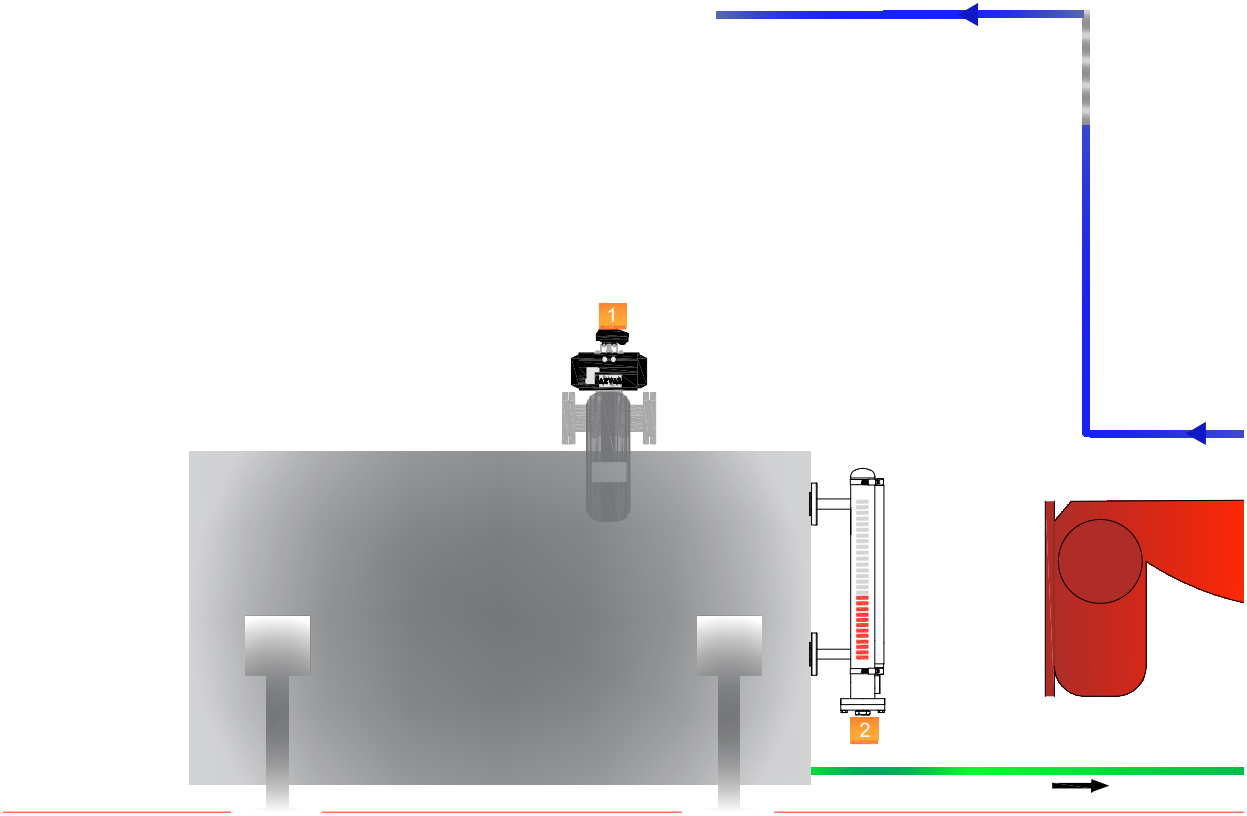


LINE END PIPE CALCULATION	
Main Steam Line (D)	**Pocket Dia (d1)**
15-100mm	d1= D
125-200 mm	d1= 100 mm
250 mm +	d1= D/2

BOILER ROOM

TANK SECTION (FEED WATER, DEAERATOR, CONDENSATE RECOVERY)

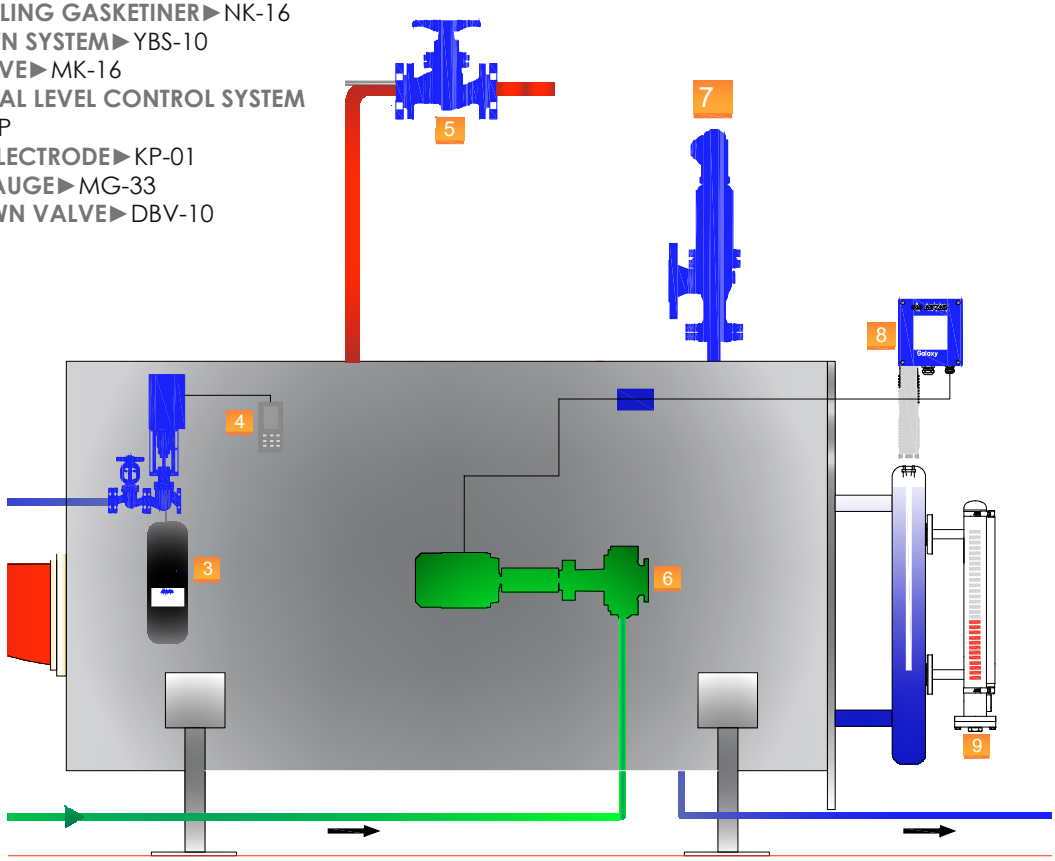
(1) **DEAERATOR**▶ASD
(2)**MAGNETIC LEVEL GAUGE**▶MG-33S



BOILER ROOM

BOILER

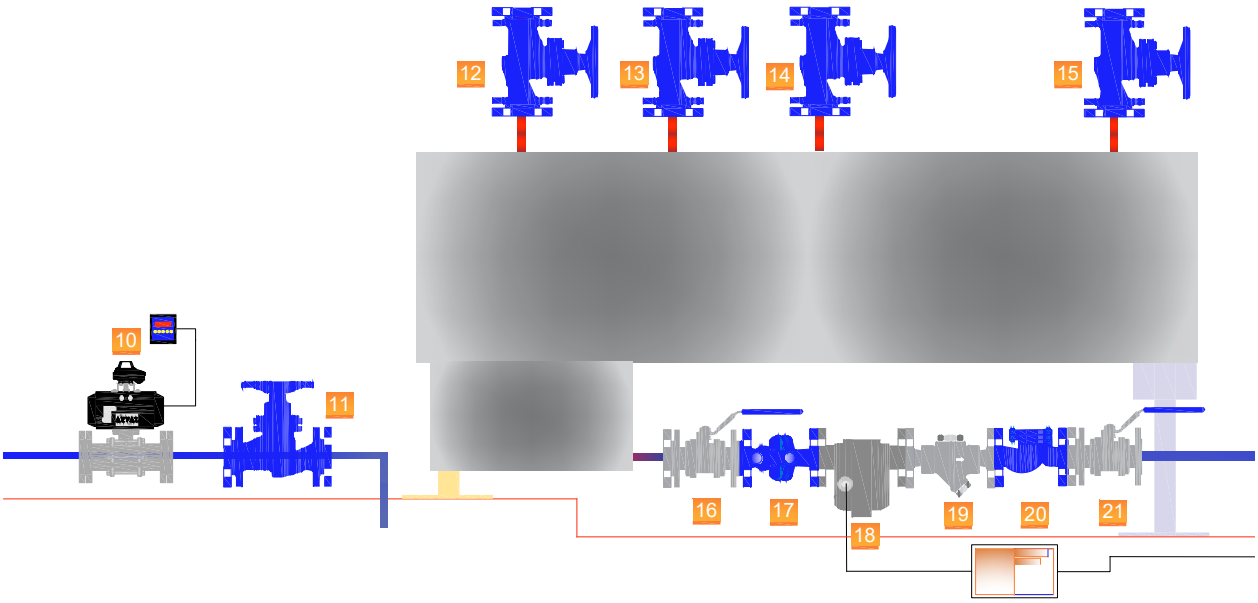
(3)BOILER WATER SAMPLING GASKETINER▶NK-16
(4)SURFACE BLOWDOWN SYSTEM▶YBS-10
(5)BELLOW SEALED VALVE▶MK-16
(6)BOILER PROPORTIONAL LEVEL CONTROL SYSTEM
(7)SAFETY VALVE▶L9-BP
(8)CAPACITIVE LEVEL ELECTRODE▶KP-01
(9)MAGNETIC LEVEL GAUGE▶MG-33
(10)BOTTOM BLOWDOWN VALVE▶DBV-10



BOILER ROOM

COLLECTOR (HEADER)

(12-13-14-15)**BELLOW SEALED VALVE**▶MK-16
(16-21)**STAINLESS STEEL BALL VALVE**▶V3-F
(17)**STRAINERS**▶PTY-40
(18)**STEAM TRAP CONTROLLING UNIT**▶TKON
(19)**THERMODYNAMIC STEAM TRAP**▶TDK-45
(20)**CHECK VALVE**▶CLV-50



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