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THE COMPANY

Ayvaz holds the production experience of flexible connection parts at various types and customized designs for the industry since 1948.

The reputation of our company remains high thanks to our capability of providing innovative and reliable solutions for our cooperators.

We work day and night to make our partners feel close to our expertise of "flexible solutions" wherever their businesses are located.

CONSULTING

We offer a wide range of products for all possible industries. We also provide engineering activities from product specification to project estimation and work on to provide the most specific solution for each case.
We delightfully share our expertise with the potential clients who experience problems with calculation for piping systems and product selection in new plants.

CERTIFICATION

As being the leader of installation sector, Ayvaz operates its production complying with the standards that recognized by the most important national and international bodies and industrial associations.

This philosophy brings benefit to the users as well as helps to improve general quality and harmony at expansion joint, flexible metal hose applications and other product groups.

QUALITY POLICY

The primary goal of Ayvaz quality systems is meeting customer expectations while acting responsibly towards the environment and society.

While realizing this goal, we recognize our obligations to:

• Maintain an efficient quality management system that strives for continual improvement
• Comply with applicable national and international standards
• Decrease costs and increase productivity and profitability, to elevate our competitive edge without sacrificing quality
• Ensure employee satisfaction
• Cooperate closely with suppliers.

OCCUPATIONAL HEALTH & SAFETY POLICY

With its over seven decades of experience, Ayvaz maintains its reliability of production for the installation sector. The occupational safety and health policy of the company is based on the respect to the human. In this respect, Ayvaz always aims;

• To protect human health by abiding the laws and the regulations with team spirit.

• To assure managers and employees are trained and accountable for preventing work related injuries and illnesses to protect themselves and the visitors as well.

• To operate an occupational health and safety management system that ensures continuous improvement through risk assessment, risk minimization and performance reporting in order to keep being an example for the others.

• Cooperate closely with suppliers.

BUSINESS DIVISION WHOLE SALE AND RETAIL SERVICES

The main business activity of Ayvaz's whole sale is providing products for large scale projects and customized goods for business partners. Retail sale of core products is fulfilled by 12 domestic sales offices and over 500 distributors globally.

AYVAZ ACTIVITIES

• Apart from being the biggest manufacturer of its sector in Turkey. Ayvaz operates exportation to 96 countries all around the world.
• Ayvaz has ten international sales offices located in Italy, Russia, Ukraine, Bulgaria, Germany, Polland, UAE, China, Kazakhstan and Serbia.

EXPERIENCE

Ayvaz holds the production experience of different type and designed products for over seven decades.

We provide engineering activities from product specification to project estimation and work on to provide the most specific solution for each case.

HUMAN RESOURCES

• AYVAZ employs over 900 employees.

• Workforce and know-how present key values to our business success

• Care for employees and their development is our continuous strategic priority.

• We continuously invest in the education and training of our employees.

• We develop and promote good team relations and efficient communication among employees.

• We promote acknowledgements and awards for employee commitment and achievements

CUSTOMER RELATIONS

Communication:

• Pre-sales operations enable our sales team to identify and analyse customer needs and problems. We very much value gathering the feedbacks and suggestions of the customers in order to develop ourselves and our communication skills.

Engineering:

• The data gathered from the customers by the sales team is analysed carefully by our expert engineering team.

• We provide engineering activities from product specification to project estimation and work on to provide the most specific solution for each case.

Consulting:

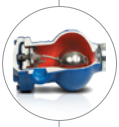
• We delightfully share our expertise with the potential clients who experience problems caused by wrong product selection, improper working conditions etc. with the products that are not even manufactured by our brand.

HISTORY

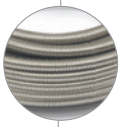
1948
Ayvaz was established in Karaköy, İstanbul.

1975
The first Turkish expansion joint manufacturer with the license of Calorstat.

1983
The first company who developed and manufactured Steam Traps in Turkey with its own patent.



1984
The first Turkish flexible metal hose manufacturer.



1987
Began to exportation. The first international dealership was signed in Germany.

2005
The first Turkish flexible metal hose and expansion joint manufacturer who achieved ISO 9001:2008.

2010
The first International production plant was established in Moscow/Russia.

2010
Sale office opened in Italy.

2011
Began to manufacture flexible metal gas hoses in Bulgaria.

2012
Became a member of European Flexible Metal Hose and Expansion Joints Manufacturers Association (AEQ).

2015
Sale office opened in Germany.

2018
Became 70 years of experience.

2019
Sale office opened in Vietnam.

2012
The first Turkish flexible metal hose and expansion joint manufacturer who achieved BS OHSAS 18001: 2007.

2013
Sale office opened in Dubai.

2017
Sale office opened in Serbia.

2018
Sale office opened in Kazakhstan.

WORKPLACE RIGHTS OF EMPLOYEES AND SOCIAL RESPONSIBILITY POLICY

AYVAZ, monitors and supports human rights which have gained recognition in the international area. While maintaining and developing its activities, AYVAZ considers primarily health and wealth of its employees and protection of environment. It manages its activities related to Work health and Security, rights of employees, and environment according to national, legal and other requirements. AYVAZ values its employees and the contributions that they have provided.

Equal opportunities are given to everyone without regard to nationality, race, sex, religion, belief, age, citizenship, sexual orientation, marital status, pregnancy, disability in the direction of our selection/evaluation criteria such as experience, skill level and competence during the process of recruitment and employment (positioning, promotion, social rights etc.) of our employees. For this purpose, it is acted according to principles and criteria determined in all subjects within institutional social responsibility areas such as human resources and investment to human projects, partner culture, company vision, training support activities, applications for the development of culture and art.

AYVAZ respects to personal information and confidentiality rights and importance of our employees, our liability for protection of confidentiality of personal information of our employees continues in case when he quits his job in our company, it is not shared with anyone including family members and friends, unless legally required.

Our company undertakes to provide a working environment, away from illegal harassment, bullying, intimidation and discrimination, where people may realize their best works by behaving fairly and respectfully to each other, in peace and in order. No tolerance is shown to such circumstances. AYVAZ bans all types of forced employment of workers.

Required opportunities are provided to the employees working in AYVAZ in order for them to mention their complaints and suggestions, easily. There are complaint and suggestion boxes at the places where everyone may easily access, boxes are controlled and suggestions and complaints are evaluated. Our success depends on the contributions of each one of our employees.

Serhan ALPAGUT

CEO

SYMBOLS FOR PRODUCT FEATURES AND QUICK SELECTION

Float Type Steam Traps

Thermodynamic Steam Traps

Thermostatic Steam Traps

Max. Product Pressure

Flange Connections

Flange Connections

Level Regulator

Level Electrodes

Level Indicators

Horizontal Installation

Vertical Installation

Installation on Both Direction

Condensate

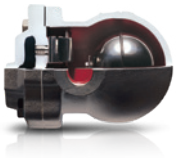
Threaded Connection

Max. Product Temperature

Level Sensors

Suitable for Steam Applications

Suitable for Oil



Float Type
Steam Trap

Free Float Type
Steam Trap

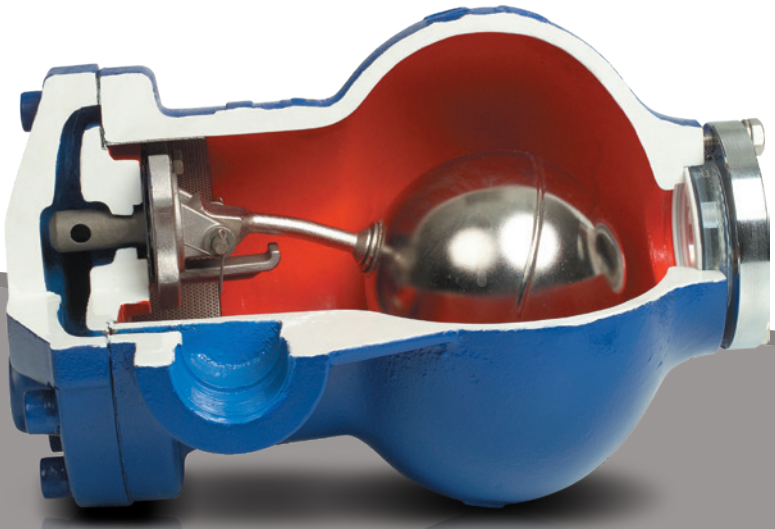
Thermodynamic
Steam Trap

Thermostatic
Steam Trap

AYVAZ

STEAM EQUIPMENT HAND BOOK

CHAPTER I
STEAM TRAPS



CHAPTER I

ACKNOWLEDGEMENT

Energy is getting more important day by day.
According to the diminishing of energy sources all the industry sectors searching for alternative sources for increasing the productivity.

In this case steam which is one of the energy carrier is also getting more important. Trapping of steam and using more heat of steam is up to choosing right steam traps. Although steam traps look simple and small their obligation is very complex.

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

As Ayvaz, we are working for to produce best quality steam product 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 traps and all related products in detail in this book.

Purpose of Steam Traps;

The aim of a steam trap is discharging the condensate from the steam pipe line while trapping the steam.

Steam use its potential heat during the applications and by the radiation heat loses on pipelines, steam turns to condensate. In case this condensate not discharged from the pipeline, it causes cavitation and water hammer beside reducing the quality of the steam.

An ideal steam trap should have the ability of air venting together with discharging the condensate. There is no "Universal Type Steam Trap" that has no disadvan-tages according to the application conditions.

All the steam trap types have different working principles that has advantage and disadvantages. In general there is always a best trapping solutions for all kind of steam applications with its alternative. This solution depends on the temperature, pressure and amount of the condensate.

In principle steam traps have to do the followings;

1- Discharging the condensate from the pipeline,
2- Trapping the steam,
3- Discharging the air and gas.

STEAM TRAP KINDS

Mechanical	Float Steam Trap
	Bucket Steam Trap
	Free Float Steam Trap
Thermostatic	Liquid Expansion
	Balance Pressurized
	Bi-metallic
	Bellowed
Thermodynamic	Disc Type
	Steam Jacketed
	Accellerated (orifice and piston)

1) MECHANICAL STEAM TRAPS

Most important characteristic of the mechanical steam traps is that they operate according to the difference of the density of steam and condensate which allows the condensate to flow.

The weight of the float, acting through the lever, keeps the valve closed when the trap is empty. As the condensate enters the trap, it raises the float and opens the valve overcoming the pressure acting on it. If no more condensate load is steady the float sets to produce a continues discharge.

The condensate level in body is always above the valve creating perfect water seal the closed float trap is able to discharge the air through thermostatic air venting unit installed inside the body.

2) THERMOSTATIC STEAM TRAPS

Typical characteristics of thermostatic steam traps is to aperate according to the difference in temperature of steam and condensate.

As the condensate cool, the liquid condenses lowers the internal pressure of the membrane. The resultant pressure differential will favor the external pressure acting on the membrane to retract and open the orifice, permitting the condensate discharge.

3) THERMODYNAMIC STEAM TRAPS

Thermodynamic steam traps operate periodically according to the difference in dynamic pressure of steam and condensate and discharge the condensate at the same temperature of the steam. Steam entering the trap expands suddenly as it reaches the backside of the disc.

The resulting high flow velocity causes a decrease in pressure under the disk. Steam above the disc gets high
pressure force and this pressure balance forces the disc onto the seat to close the orifice in other words to trap the steam.

When condensate appears at the trap inlet under and above the disc the pressure force above the disc disappears and allows the condensate discharge.

1- MECHANICAL STEAM TRAPS

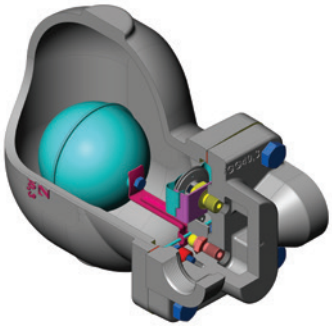
A-FLOAT STEAM TRAPS

Operation Principals;

While the system is cool, the coming air is discharged from the discharge unit. As the condensate enters the steam trap, float rises with the effect of density difference and activates discharge by opening the valve. As the temperature of condensate increases, air discharge unit closes, just because the float has already been risen, condensate discharge continues.

When the steam gets in the steam trap, float drops down and discharge valve system closes. The condensate level in body is always above the valve creating perfect water seal.

Steam traps with thermostatic air vents are able adjust themselves according to unsteady pressure loads. Operation principals enable float type steam traps to work at heat exchangers, evaporators and heaters with high efficiency.



Advantages of Float Type Steam Traps:

1- Automated Systems: The most ideal steam trap for automated systems.

2- Operation At Very Low Pressure Difference: With the adaptability to the systems with very low pressure difference and high discharge capacity, can meet the expectations.

3- Orifice According To Pressure Difference: 3 different type of orifice (14,10 and 4,5) provides the most suitable selection feature according to system conditions.

Disadvantages of Float Type Steam Traps:

1- Water Hammer: At the sudden loads or when the air formations create shock pressures, the float mechanism may get damaged and breaks the operation of the steam trap downs.

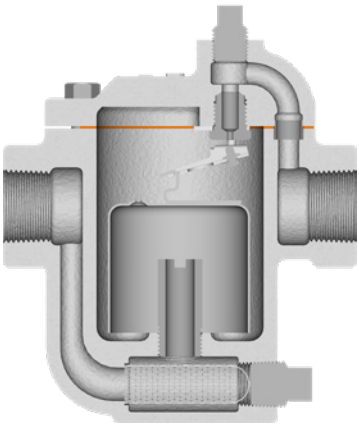
2- Air Vent and Super-Heated Steam: Super-heated steam may damage the thermostatic air vent inside the steam traps.

B-INVERTED BUCKET TYPE STEAM TRAPS

Operation Principals;

At first, the bucket is at the bottom and discharge nozzle is fully open. As condensate generates and fill inside the body, the bucket stays on the bottom. Steam enters the steam trap from the underneath the bucket, rises and generates at the top as lifting the bucket above. As the bucket rises and pushes the valve towards the seat.

Air and CO2 constantly pass through the holes on the bucket and collected around the top of the body, also steam gets collected and condensate here, at this stage buoyancy force decreases and the bucket starts drowning. As the bucket goes down it pull the attached valve from the seat. The collected air is discharged from the condensate first, at this moment orifice is open and condensate is also being discharged. Discharge continues until the steam lifts the bucket and keep cycles.



Advantages of Inverted Bucket Type Steam Traps;

1- Strong structure
2- Resistant to water hammer
3- Resistant to corrosion
4- Resistant against pollution thanks to built-in strainer

Disadvantages of Inverted Bucket Type Steam Traps;

1- Slow discharge
2- Steam leakage possibility at low loads
3- Not suitable for super-heated steam lines

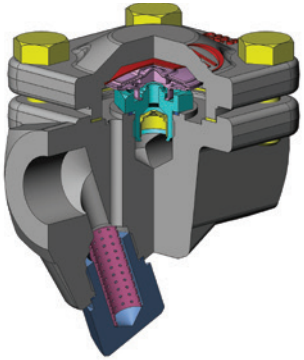
2- THERMOSTATIC STEAM TRAPS

A- THERMOSTATIC STEAM TRAPS WITH MEMBRANE CAPSULES

Operation Principals;

The operating principles is based on the balance between the steam pressure and internal pressure of the thermostatic membrane capsule that is filled with special liquid whose saturation temperature is slightly lower than steam at any pressure. At the start up position, the trap is completely open and removes the air and discharges the condensate. When the temperature reaches the saturated steam level related to the pressure, vaporization of the liquid inside the thermostatic capsule membrane creates a pressure differential causing the close the orifice.

As the condensate cool, the liquid condenses lowers the internal pressure of the membrane. The resultant pressure differential will favor the external pressure acting on the membrane to retract and open the orifice, permitting the condensate discharge, cycles continue.



Advantages of Thermostatic Steam Traps:

1- Maximum Efficiency: Acc at benefit from the hidden energy of steam.

2- Easy Maintenance: During any case of break down, maintenance could be completed by losing only 4 bolts placed on the cover of the steam trap instead of replacing all steam trap.

3- Easy Installation: Unlike thermodynamic steam traps, thermostatic steam traps do not have to be installed to the steam lines as horizontally to the x axis. This type of steam traps can be installed horizontally, vertically or with an angle to the steam line and are able to operate with 100 % efficiency.

4- Discharge of Air or Other Gasses: Thanks to their thermostatic capsules, thermostatic steam

traps are able to discharge air and the other gasses that can't be condensate and protect the system against water hammer.

5- Increase the Discharge Capacity: Condensate discharge capacity could be increased by increasing the number of the capsules used in the body design. The discharge capacity is dependent on the type and number of the capsules as well as the size of the steam trap.

Disadvantages of Thermostatic Steam Traps;

Not Suitable for Super-Heated Steam: The liquid in the capsules is adjusted according to the pressure for saturated steam temperature. Because of that, at super–heated temperatures, the capsule may get stuck and not operate properly.

THERMOSTATIC CAPSULE

Features, types and the application areas of thermostatic capsules;

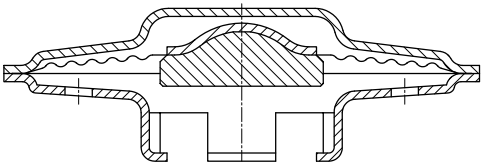
Thermostatic capsule and all other internal parts are made in anti-corrosive stainless steel material. Hastelloy membrane is resistant against even the acidic condensate conditions very well. There are three different types of capsules that we manufacture.

1-High temperature capsule "H": Specially designed for the applications which dry steam should be used such as tire industry, textile industry. And this capsule discharges the condensate under 5°C below the saturated steam temperature at related steam pressure.

2-Standard temperature capsule "S": Standard designed for any applications which saturated steam should be used. And this capsule discharges the condensate under 10°C below the saturated steam temperature at related steam pressure.

3-Low temperature capsule "L": Specially designed for applications which steam is used for heating. And this capsule discharges the condensate under 30°C below the saturated steam temperature at related steam pressure and allows the equipment to use enthalpy of the hot condensate as well.

TKK-42

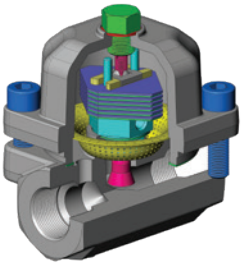


BI-METALIC STEAM TRAPS

The operating principle is based on a balance between the steam force that depends on pressure, trying to open the discharge valve and the opposing bi-metal force that depends on temperature that tends to close the valve. The trap is adjusted so that at saturated steam temperature the bi-metal force will prevail while with under cooled condensate and air, the force of pressure will prevail and open the valve.

Operation Principals;

Conical end stem valve and composite material that is consisted of two plates that have different expansion coefficient are the main components of bimetallic steam traps. As the fluid is cold, bimetal elements are compressed and the valve is open. Air, non-condensable gasses and condensate are discharged during this stage. When the hot condensate enters the system, bi metallic plates expand with different amounts and pull the valve toward to the seat and stop discharging.
When cold condensate enters the steam trap again, cycle continues.



TK-1

Advantages of Bimetallic Steam Traps:

1- Water Hammer Resistance: Highly resistant against corrosive condensate and water hammer.

2- Freeze Resistance: Not being affected from freezing.

3- High Efficiency: Condensate is discharged below the steam temperature. It is possible to adjust the bimetallic plates and benefit from the hidden energy of the steam.

4- High Temperature Applications: Can be used at high temperature and super-heated steam lines.

5- Check Valve Function: The valve which is attached to the bimetallic plates works as Check Valve and protect the system from the back pressure increases.

6- Easy Installation: Unlike thermodynamic steam traps, bimetallic thermostatic steam traps do not have to be installed to the steam lines as horizontally to the x axis. This type of steam traps can be installed horizontally, vertically or with an angle to the steam line and are able to operate with 100 % efficiency.

Disadvantages of Bimetallic Steam Traps:

1- Long reaction time: Reaction time of bimetallic steam traps may be too long at the system where condensate and steam temperatures are very close. Long reaction time for load and temperature changes may cause trouble at the equipment.

2- Setup Difficulties: Adjustment of the valve that the bimetallic plates are attached may be difficult especially after maintenance. Adjustment requires to be done by experts.traps are able to discharge air and the other gasses that can't be condensate and protect the system against water hammer.

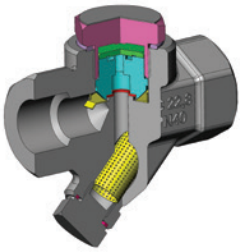
3- THERMODYNAMIC STEAM TRAPS

DISC TYPE THERMODYNAMIC STEAM TRAPS;

This type of steam trap operates by the internal energy and pressure of steam. Condensate that reaches to trap raise the disc and open the orifice and flow continuously by the help of the steam pressure which is behind the condensate through the discharge orifice. Steam entering the trap expands suddenly as it reaches the backside of the disc. The resulting high flow velocity causes a decrease in pressure under the disk. Steam above the disc gets high pressure force and this pressure balance forces the disc onto the seat to close the orifice in other words to trap the steam. When condensate appears at the trap inlet under and above the disc the pressure force above the disc disappears and allows the condensate discharge and this cycle repeats.

Operation Principals;

The principal of the thermodynamic steam trap is based on Bernoulli's law, which states that the sum of the static pressure and dynamic pressure is constant at all points in a fluid flow. If cold condensate flows into the steam trap on start-up, the valve disc is forced upwards and the condensate is discharged from the outlet holes.



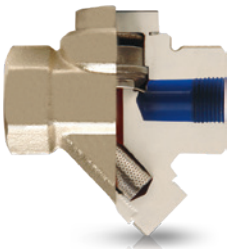
The trap is fully open. As the start-up phase progresses, the condensate becomes hotter and the pressure rises. Part of the static pressure is then converted to velocity in the chamber between the seat and the disc.

Advantages of Thermodynamic Steam Traps:

1- No adjustment required: Thermodynamic traps can operate across their entire working range without any adjustment or change of internals.

2- Body design: They are compact, simple, lightweight and have a large condensate capacity for their size.

3- High Pressure Use: Thermodynamic traps can be used on high pressure and superheated steam and are not affected by water hammer or vibration.



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Disadvantages of Thermodynamic Steam Traps:

1- Stuck Risk: During the start-up, high amount of air may come in the steam trap and stuck the disc. This may cause water hammer.

2- Opposite Pressure: If the opposite pressure exceeds 80% of the inlet pressure, disc loses its function, likely if the system pressure drops below 0,25bar, disc can't operate.

3- Insulation: Horizontal installation obligation may cause trouble at some applications.

COMPARISON OF STEAM TRAPS

The main criteria for the selection of the type are as follows, although they can not be listed in order of importance since it varies from application.

Resistance to freezing: Trap should resist to freezing for instance outdoor using in cold countries, body of the trap should not broken because on the difference on temperature when the steam line and/ or process shout down.

For such applications body should not keep condensate. The ideal traps are thermostatic, thermodynamic and bi-metallic. Inverted bucket and float traps should not install such processes.

Installation versatility: Traps that should install with certain position should be chosen accordingly to the line. For instance thermodynamic steam traps should be installed on the horizontally otherwise they cannot work properly and have less cycle life, float steam traps should be also installed horizontally otherwise they will be failed as either open or blocked/closed all the time.

Air venting: Traps especially for steam line where lots of air rooms and gas occurs should be able to discharge this gas otherwise they will be failed as either open or blocked:/closed all the time.

Resistance to water hammer: Traps especially for steam line where lots of air rooms and gas occurs and becomes a water hammer should be either able to discharge this gas or have strong mechanism that can resist against water hammer otherwise they will be damaged easily.

Discharging capacity: Traps especially for big sized lines such as 1 ½" and 2" should be able to discharge all the condensate that occurs on the process otherwise accumulated condensate can damage the pipe-line and as well to the equipment, plus it will be a result of losing the heat of steam.

Heat Exchange efficiency: traps such as thermostatic types which are discharging the sub cooled condensate do not allow an efficient heat exchange and should not be installed for super-heated steam lines. Otherwise they will be blocked immediately and cause lots of important problems such as damaging turbines.

Sensitivity to back pressure: Traps such as thermodynamic types should not be installed on steam lines where the back is more than 80 % of inlet pressure. In such cases thermodynamic traps failed as either open or blocked / closed all the time.

Resistance to corrosive conditions: The initial parts of all traps should be stainless steel but for such cases where even the outer conditions are corrosive traps should have stainless steel body and cover as well.

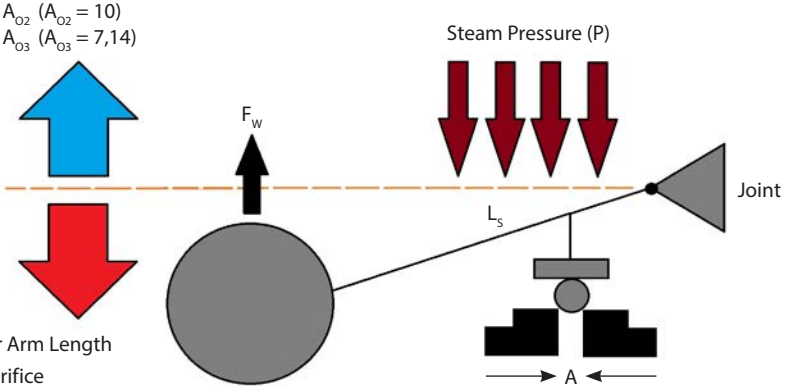
Trap Type	Advantages	Disadvantages
Thermostatic	- Easy maintenance - Spare parts available - Installation in every position - Long service life - Works under back pressure more than 80 % inlet pressure - Easy to clean the filter - Air venting - Resists to water hammer - Resists to corrosion - Resists to freezing - Slim and light - Built-in screen - Easy replaceable seat and capsule	- Not suitable for super-heated steam
Thermodynamic	- Installations at super-heated steam - Easy to clean the filter - Resist to water hammer - Resist the corrosion - Resist the freezing - Spare parts available - Built-in screen - Low cost, easy maintenance - Fixed orifice	- Installation only horizontally - Cannot install under back pressure which is more than 80 % of inlet pressure - Difficult to maintenance - Discharges steam during discharges condensate - Cannot discharges the air
Bi-Metalic	- Installation at super-heated steam - Easy to clean the filter - Resist to water hammer - Resists the corrosion - Resist the freezing - Spare parts available - Acting as non-return valve - Energy saving - Works under back pressure - Installation in every position	- Difficult to adjust - Difficult maintenance
Float	- Installation both horizontal and vertical - High discharge capacity - Air venting - Can use at different ΔP applications	- Difficult maintenance - Excluding filter - Cannot resists to water hammer - Cannot resists to freezing
Inverted Bucket	- Strong structure - Resistant against water hammer	- Difficult maintenance - Cannot resists to freezing - Slow air vent - Steam discharge at low loads - Not suitable for super-heated lines.

ORIFICE SIZE AND WORKING PRESSURE RELATION

To lift the float for discharging the condensate from the orifice hole; lifting force of the condensate must be higher than the force wich is created by the pressure that effects to the A area.

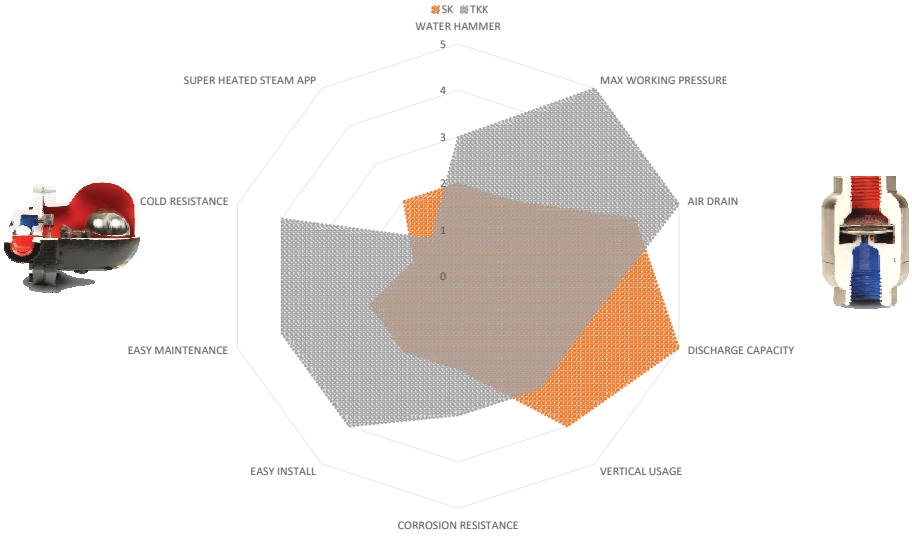
Lever are size of float type steam traps(L_S) are standard. Buoyancy of water(F_W) is also fixed according to weight of ball. For easy explanation:

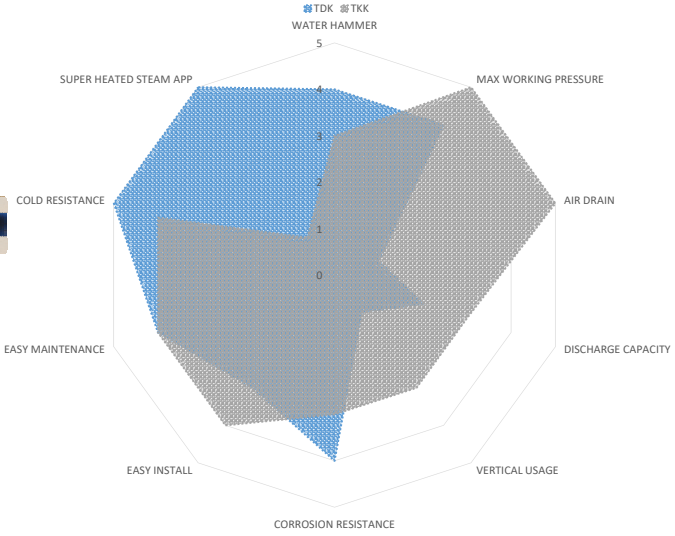
If; $F_W \times L_S = 100$;
$F_W \times L_S > P_S \times A_O$
$100 > 4{,}5 \times A_{O1}$ ($A_{O1} = 22{,}2$)
$100 > 10 \times A_{O2}$ ($A_{O2} = 10$)
$100 > 14 \times A_{O3}$ ($A_{O3} = 7{,}14$)



L_S= Lever Arm Length
P_S= ΔP Orifice

COMPARATION OF STEAM TRAPS




TDK
TKK
WATER HAMMER
MAX WORKING PRESSURE
AIR DRAIN
DISCHARGE CAPACITY
VERTICAL USAGE
CORROSION RESISTANCE
EASY INSTALL
EASY MAINTENANCE
COLD RESISTANCE
SUPER HEATED STEAM APP
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3
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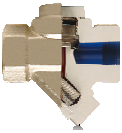
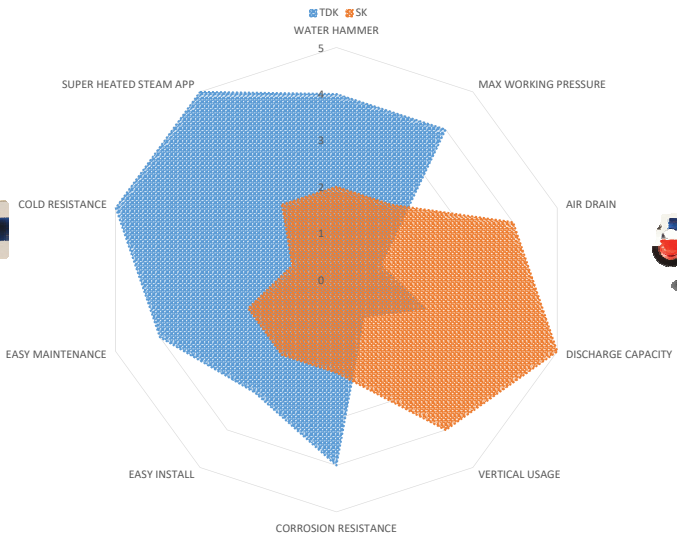


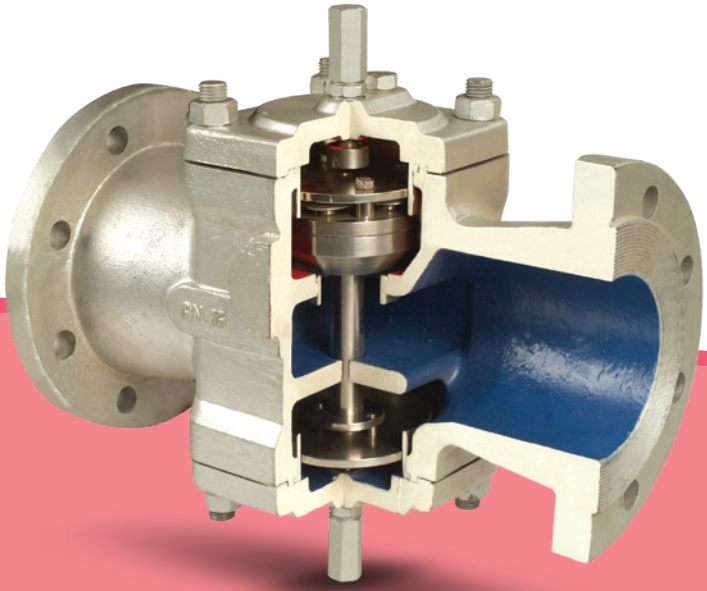

TDK
SK
WATER HAMMER
MAX WORKING PRESSURE
AIR DRAIN
DISCHARGE CAPACITY
VERTICAL USAGE
CORROSION RESISTANCE
EASY INSTALL
EASY MAINTENANCE
COLD RESISTANCE
SUPER HEATED STEAM APP
5
4
3
2
1
0

AYVAZ

STEAM EQUIPMENT HANDBOOK

CHAPTER II

STEAM TRAP INSTALLATION



CHAPTER II

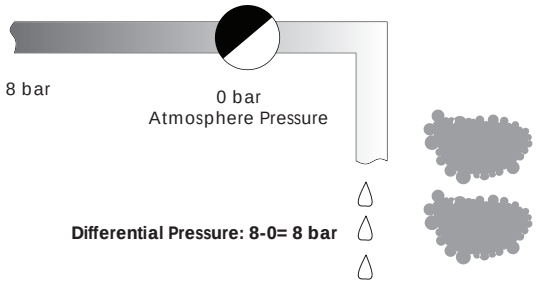
REQUIRED INFORMATION FOR STEAM TRAP INSTALLATION

For the optimum result of trap applications following points shall be noticed;

1- Application area
2- Differential pressure
3- Condensate flow rate (kg/h)
4- Capacity diagram of the manufacturer

1- Application Area

Best type or the alternative type shall be chosen from the trap selection table.



2- Differential Pressure

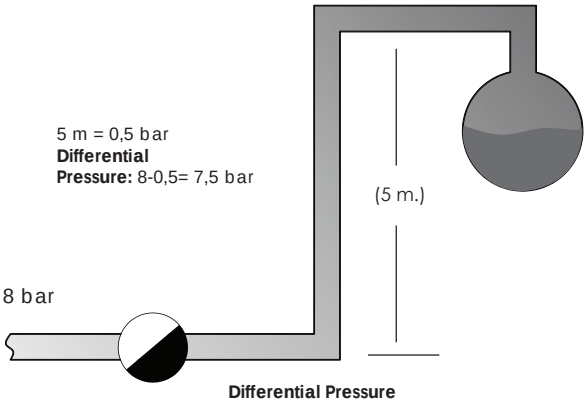
Differential pressure is the difference between steam trap inlet pressure and outlet pressure.

For example; if the inlet pressure is 8 bar and the steam trap discharges to the atmosphere, differential pressure is 8-8=0 bar. After steam trap, each meter of elevation of the pipeline equals 0,11 barg back pressure.

If in the previous example, condensate line elevates 5 meters after the steam trap,

Back pressure is: 0,11x5: 0,55 bar
So, the differential pressure is:
8-0,55=7,45 bar

If the condensate is connected different condensate lines, total back pressure is to be calculated and steam trap selection is done accordingly.



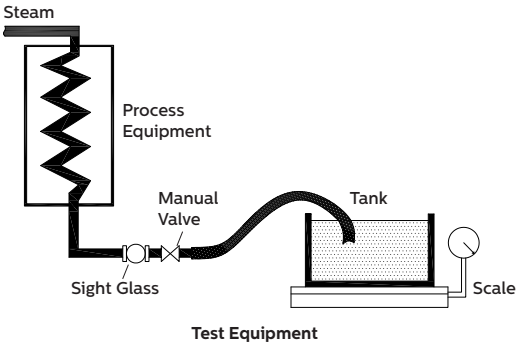
3- Condensate Flow Rate

Usually, the information provided by the machine manufacturer is accepted.

Flow rate is indicated in the machine technical specifications. If this information is not reachable,

it could be calculated according to process information (steam inlet diameter, flow density, etc…)

Also, if it is not a special process, typical machine steam consumptions are given in the tables.



4- Capacity Diagrams

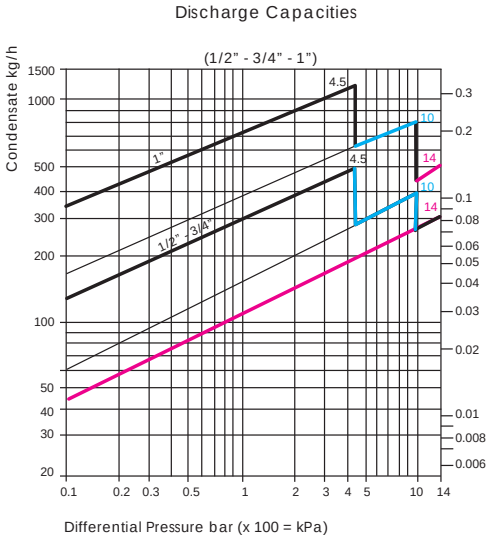
Capacity diagrams of Ayvaz float type steam traps SK-51 and SK-55 are given below.

Example for SK-51

For the steam trap, condensate flow rate is given 180 kg/h from the heat exchanger at 6 bar, condensate is discharged under 0,2 bar back pressure.

Differential Pressure	6-0,2 =5,8 bar
Condensate Rate	180x3 = 540kg/h
Safety Factor	3

1" (DN 25) sized steam trap which has 540 kg/h condensate discharge capacity at 5,8 bar differential pressure, indicated with blue line and number "10" in the diagram (steam trap capacity : 700 kg/h) is selected. "10" represents the steam trap orifice number. From the diagram, 1/2" and 3/4" sized steam traps are below the condensate capacity.

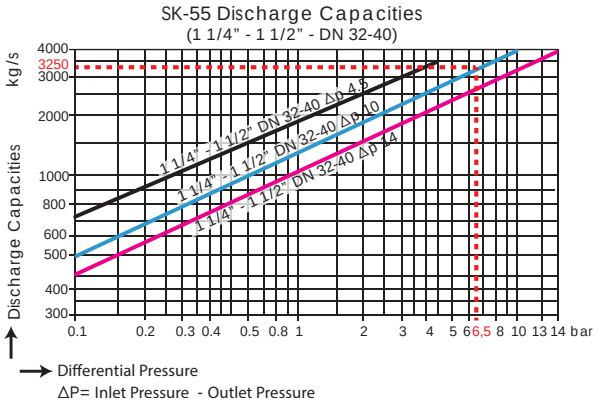


Example for SK-55

Condensate flow rate is given 1200 kg/h, steam trap is to discharge from 10 bar to condensate tank at 3,5 bar.

1 1/4" (DN 32) sized steam trap which has 2400 kg/h condensate discharge capacity at 6,5 bar differential pressure, indicated with blue line and number "10" in the diagram (steam trap capacity: 5000 kg/h) is selected.

"10" represents the steam trap orifice number.



C- STEAM TRAP SIZING CRITERIAS

a) Steam trap inlet pressure must define exactly. If there are steam equipment before the steam trap, inlet pressure should accept as 15% under the main line pressure.

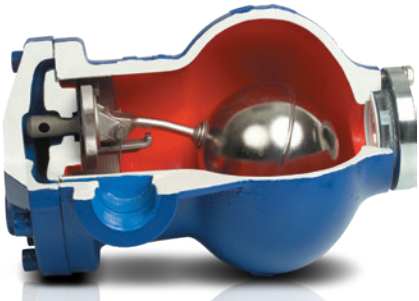
b) Back pressure must calculate. Each meter of elevation of the pipeline equals 0,11 bar back pressure.

c) Differential pressure must calculate.
Differential pressure = Steam Trap Inlet Pressure – Back Pressure

d) Condensate amount must calculate with the manufacturer information.

e) Safety factor must be apply to the condensate rate. Condensate Amount at main steam lines, heat exchangers and similar equipment, it is accepted as 2,5 to 3 times. For other equipment, it is 1,5 to 2 times.

f) After applying the safety factor to the condensate rate, according to condensate amount, the steam trap size must calculate from the manufacturer's diagrams.



SK-55
WITH SIGHT GLASS

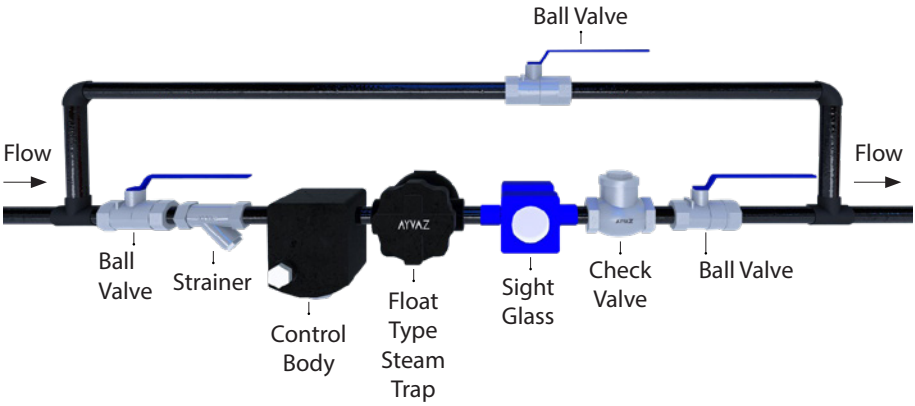
STEAM TRAP UNITS IN SYSTEMS

In steam trap unit application install, you must follow this installation criterias;

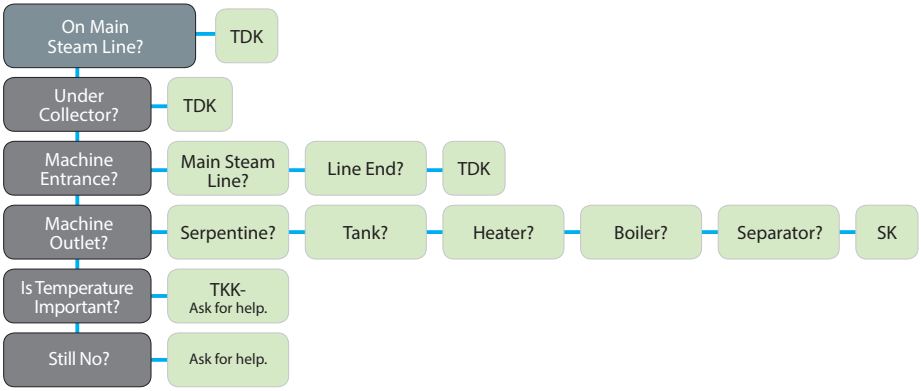
Steam trap units includes;
Ball valves before and after unit
Ball valve for bypass line
Strainer before steam trap
Non return valve after steam trap

Optional Products

Control body before steam trap
Flow sight glass after steam trap
AYVAZ KTV-10 steam trap test valve instead of shut off valve after steam trap

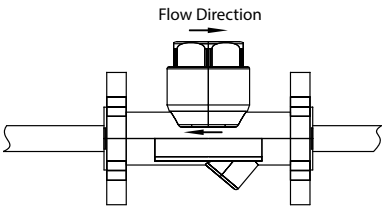


STEAM TRAP SELECTION DIAGRHAM

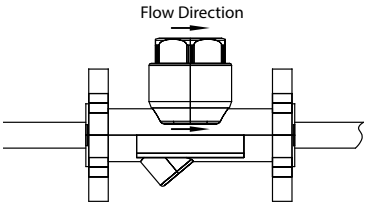


STEAM TRAPS INSTALLATION

1-The arrow on the steam trap body must be in the flow direction.

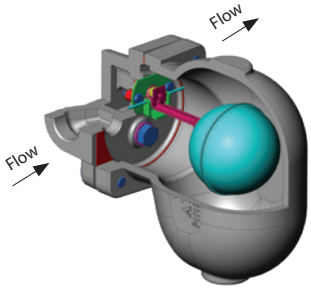


False



True

2- Make sure that the arrow on the plate shows downward during installation.



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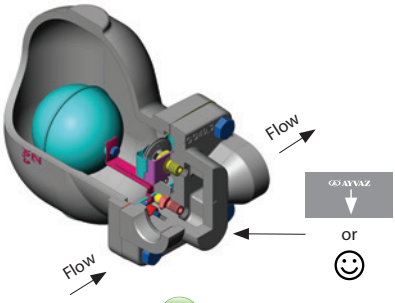
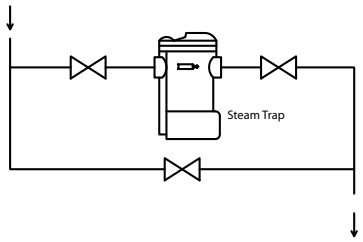


True

3- By pass valve should be above the steam trap. Same is advised for other types as well.



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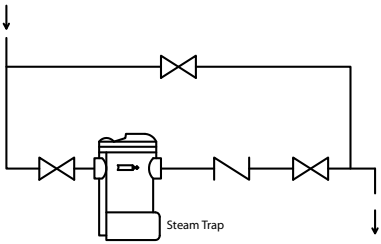
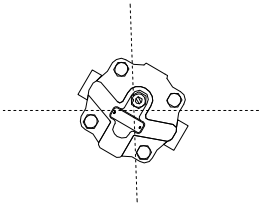


True

4- Float type steam traps must be installed horizontally to horizontal lines. Steam inlet for the steam traps that can be installed vertically like SK-51/ SK-55L must be from the upper side.



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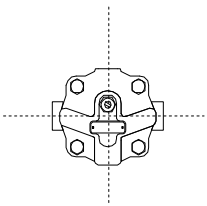
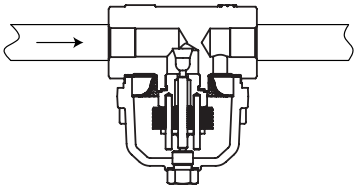


True

5- Termostatic and bimetallic steam traps must not installed horizontally or backward. Piping after the steam trap should be 3-5 cm lower than steam line.



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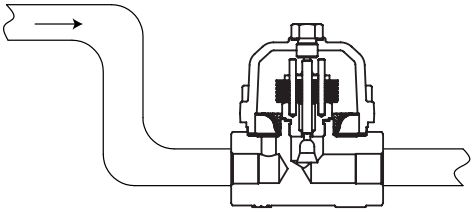
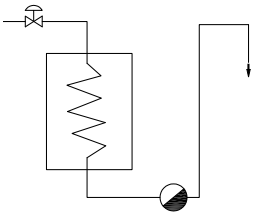


True

6- Steam traps must be installed lower than the connected machine. Otherwise generated condensate flows back. In cases that upper installations, creating elbowed condensate pocket is necessary.



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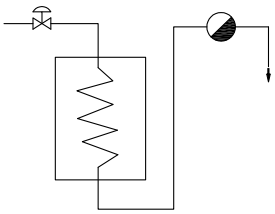

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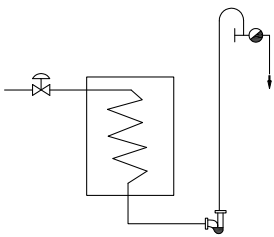
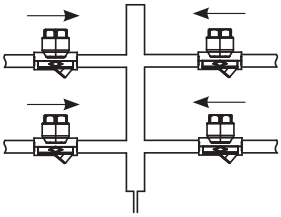


True

7- Steam trap's outlets must be in different axis to prevent water hammer.



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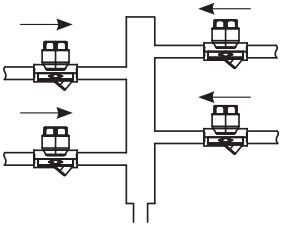
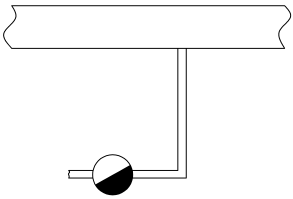


True

8- In cases that the condensate discharge is done to a upper level, connection inlet must be above condensate return line. Piping diameter after steam trap should be selected according to flash steam production.



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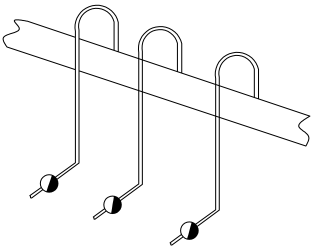
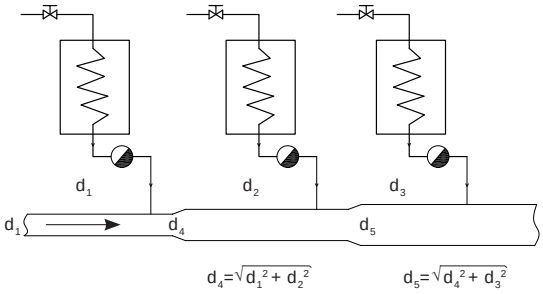
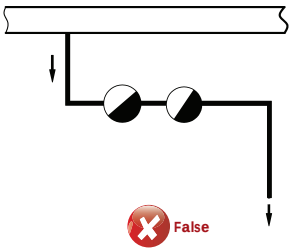


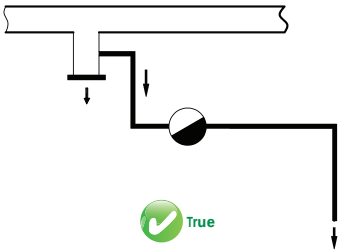
True

9- If more than one steam trap to be connected to the condensate return line, diameter of the return line can be calculated like shown below.

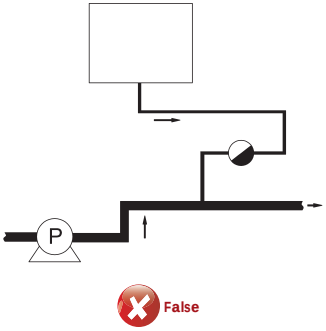


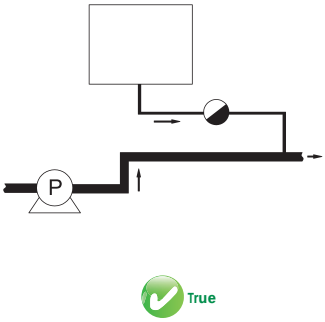
10- Steam traps must never be connected one after another in any case. Otherwise, first steam trap is affected negatively from the back pressure generated by the second steam trap.



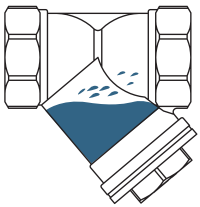


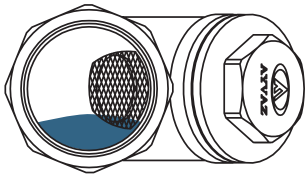
11- In examples where the condensate is pumped to the condensate tank, hot condensate outlets from the steam trap connects the cold condensate and means serious water hammering risk to the system. In these cases, there must be at least 5 meters of distance between the main condensate line and the line after steam trap.



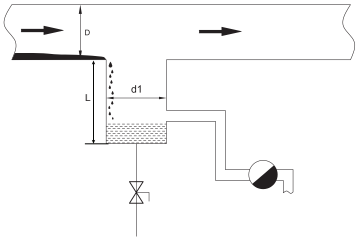


12- Strainers before steam traps must be installed as the bottom of the "Y" shape to face left or right instead of up or down. If strainer is installed up or down, condensate forms up in the screen and causes water hammer.





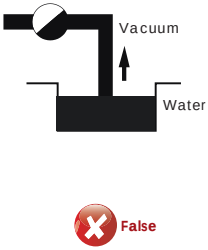
13- Condensate pocket dimesioning must be like below.



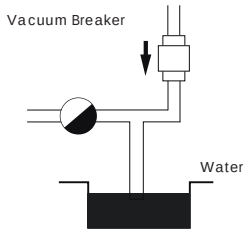
Condensate Pocket Dimensioning

Main Steam Line Diameter : D
Pocket Diameter: d1
Pocket Depth: L
Up to 100 mm d1= D L=100 mm
Between125-200 mm d1=100 mm L=150 mm
Above 250 mm d1=D/2 L=d

14- If condensate is to be discharged in to water, a vacuum breaker must be installed with a tee connection opposite of the steam trap where the discharge is done. Otherwise, when the system is stand-by, as the steam traps cools down, vacuum occurs and causes corrosion when the system re-activated.



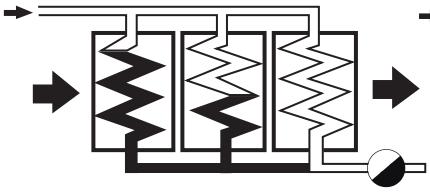
False



True

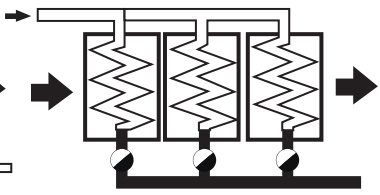
15- Group Trapping In the equipment that is fed up with multiple steam sources, condensate line should never be installed to single steam trap. In such applications, during a possible installation, the nearest machine to the steam trap works properly but the others can't operate properly because of the condensate formation inside and temperature drops. Because of this, group trapping is a wrong application, for such cases, individual trapping is compulsory.

Group Trapping



False

Individual Trapping

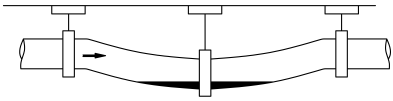


True

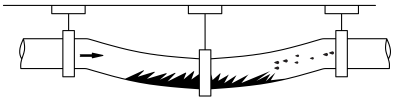
PREVENTING THE PHYSICAL DAMAGES

Water Hammering

In the pipelines where condensate collecting is permissible, steam drags the condensate, this condensate damages the Gasketcted armatures like valves, filters or steam traps. Movement of the occurred condensate by steam is called water hammering. Water hammering may cause serious damages to the armatures in the system. In order to prevent this, water in the system must be drained.



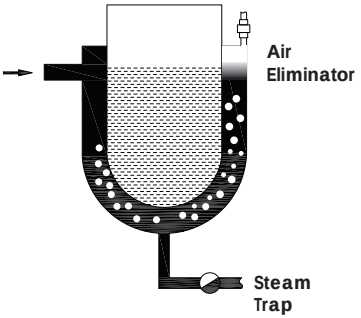
Occurred condensate blocks the steam pass.



Condensate is dragged with the steam.

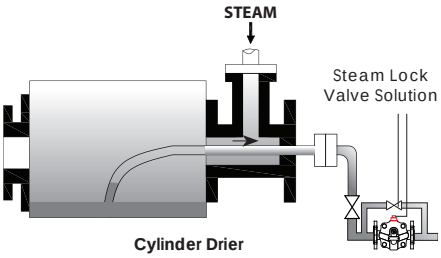
Air Elimination

The steam in the system cools down in time and becomes condensate. Pressure drops and vacuum occurs, this results with air to get in the system from flange gaskets or other connection areas. Some air with the steam also enters the system. The air in the machine is compressed by the steam in the machine and may lock the steam trap. Because of that, air in the system must be eliminated by an air eliminator. In such cases, steam traps with air and gas ventilation function are suggested.



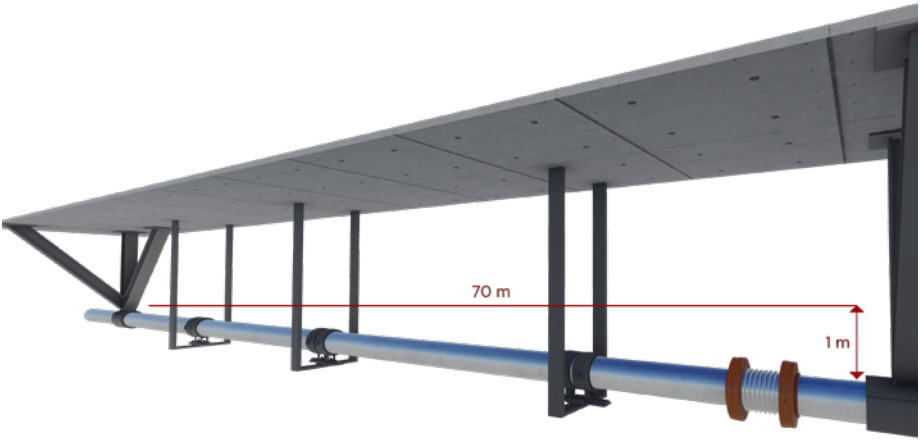
Steam Lock

Usually, the steam to get inside the steam trap by an un-desired way in cylinder drier units is called steam lock.
As the drier cylinder rotates in a constant speed, the steam gets inside the cylinder condensates, sometimes this condensate reaches the steam trap passing through the pipe and makes steam trap to remain as closed. That may cause a problem like the condensate can't be discharged because of the closed steam trap. This may be solved by a built-in steam lock mechanism valve or the by-pass valve to be opened as to be in quarter position. As the steam starts to be taken out by these valves, flow re-starts and condensate rises through the pipe to get inside the steam trap to be discarged.

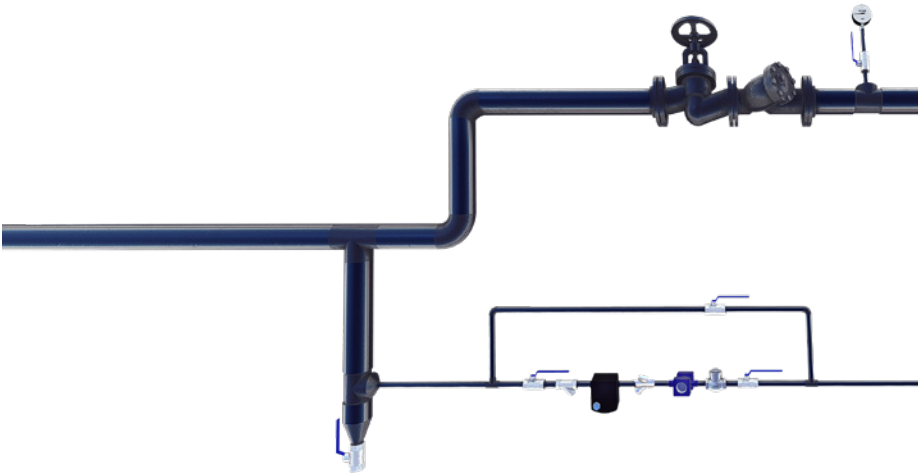


CONDENSATE DISCHARGE FROM MAIN LINES

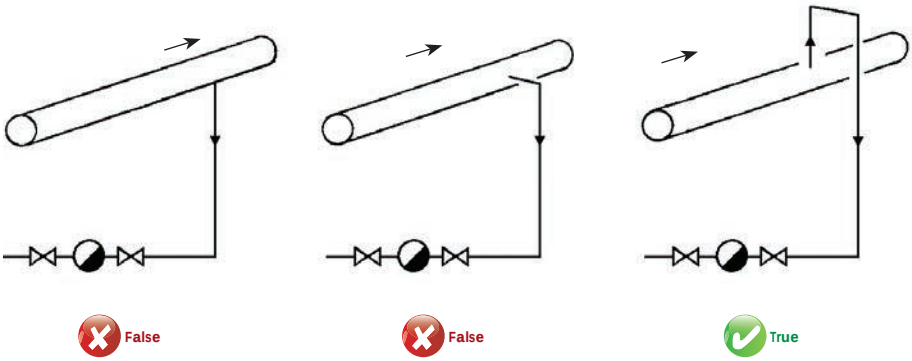
Because of the low energy loss and low costs, thermodynamic steam traps are preferred in main lines. In order to drag down the condensate, steam lines must be constructed with an angle as it is seen below.



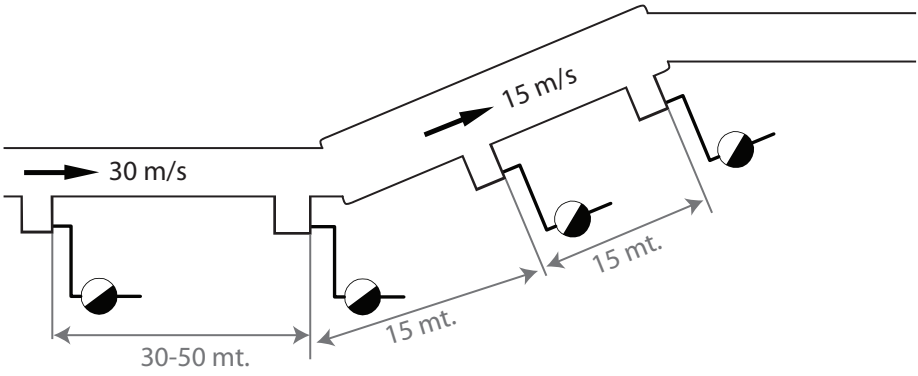
The points where the main lines are elevated, condensate collecting pockets should be created at the bottom turning points and thermodynamic steam traps to be placed.



Branch lines to the steam equipment should not be taken from the bottom or side walls of the main lines because of the formation of dirt or residues. Branch lines should always be taken from the top of the main steam lines.

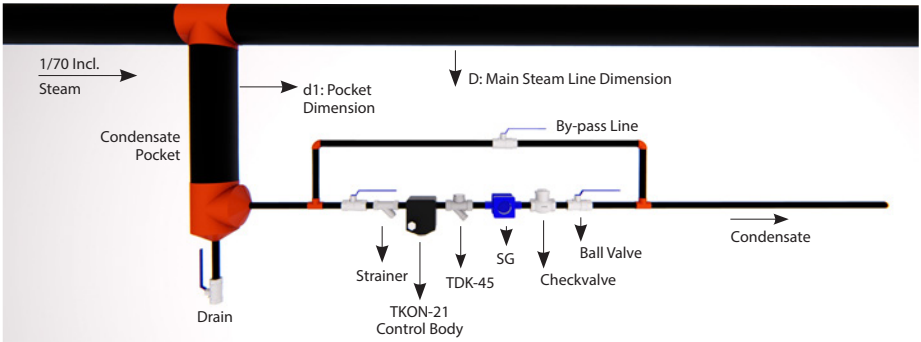


If any elevation in the pipeline after the boiler is applicable, the pipeline diameter of the elevated area is built bigger. That helps to reduce the speed of the condensate and flows back to the discharge unit. In elevating parts of the pipelines, creating condensate discharge units in every 15 meters is advised.

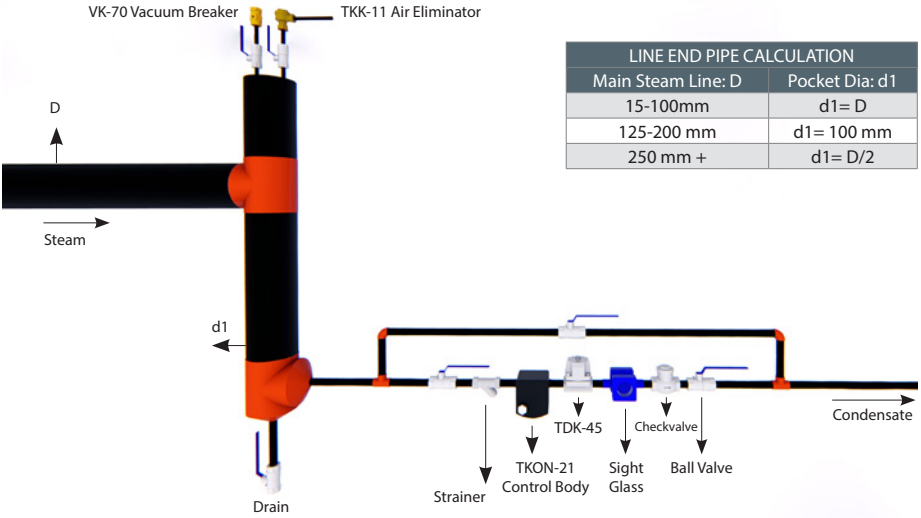


STEAM TRAPS INSTALLATION

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.

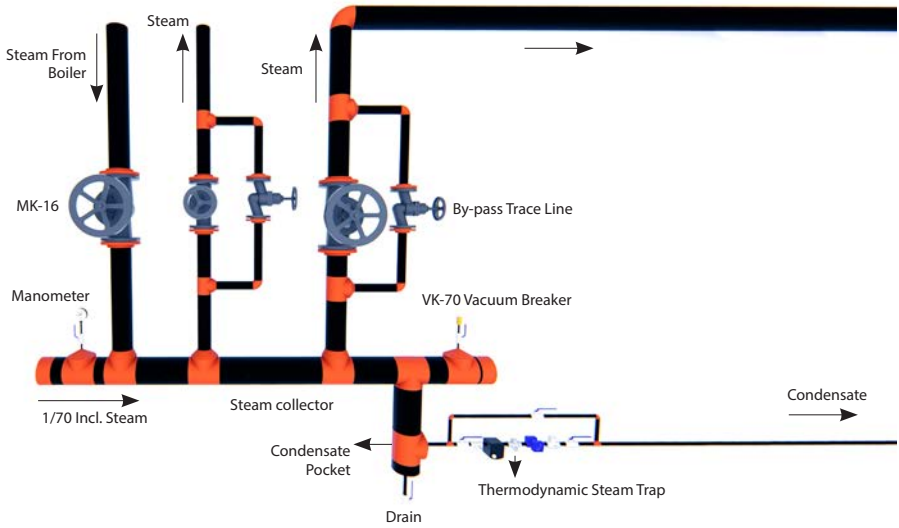


The occurred air and condensate around connection areas in the pipelines are dragged to the end of the line. If that air and condensate are not discharged, they may block the steam flow. In such cases, formed air and condensate are discharged with a line end application shown below. The steam trap kind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

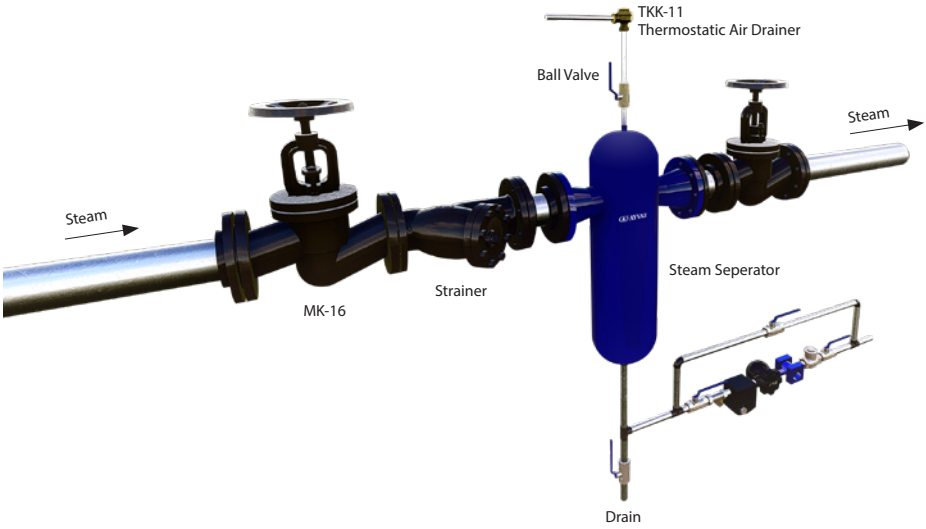


LINE END PIPE CALCULATION	
Main Steam Line: D	Pocket Dia: d1
15-100mm	d1= D
125-200 mm	d1= 100 mm
250 mm +	d1= D/2

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.



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.



STEAM TRAPS INSTALLATION

SYSTEM	Float Type (Air and Gas Vent) (SK50-SK51-SK55-SK60-SK70)	Inverted Bucket Type (BT-16)	Thermodynamic (TDK-45)	THERMOSTATIC		Bimetallic (TK-1)	Super Condensate Discharger (HK-23)
				Thermostatic (TKK-2Y-2N,TKK-21,TKK-41)	Thermostatic With 3 Capsules (TKK-3)		
Main Steam Lines	B		A				
Horizontal Lines	B	B	A	B			
Before Seperator	A	B	B	B			
Line Ends	B	B	A	B			
Line Discharge				B			
Trace Lines				A			
Collector (Collect- Distribute)	B	B	A				
Volume Heating Equipment	A	B					
Heat Exchanger	A				B		B
Plate Tanks	A				B		B
Fuel-Oil Pre Heaters	A				B		B
Water Heaters	A	B					B
Heating Batteries	A	B	B				
Panel Or Plate Heaters	B			A		B	
Radiator Or Convector	B	B		A	B		B
Roof Heating Serpantine	B			A	B		B
Drying Rooms	B			A	B		B
Green House Heaters	B			A	B		B
Air Tool	B			A	B		B
Sugar Drier	A			B			
Kitchen Appliances	A		B	B			
Fixed Cooking Boilers	A			B			
Movable Cooking Boilers	B			A			
Standing Cooking Boilers				A			
Steam Oven	B			A			
Hot Plates	A		B	B			
Medical Equipment	B	B		A			
Autoclaves	B	B		A			
Sterelizers	A		B			B	
Pressurized Cookers	B		A	B			
Process Tools	A		B	B			
Fixed Boilers	A			B			
Movable Boilers	A	B					
Beer Boilers	A	B	B				
Grinders	A	B					
Evaparators			B	A			B
Hot Plates (Jacketed)	A	B					
Distillation Equipment	A	B					
Tanks	A	B					

A: Best Option
B: Acceptable, Alternative

SYSTEM	Float Type (Air And Gas Vent) (SK50-SK51-SK55-SK60-SK70)	Inverted Bucket Type (BT-16)	Thermodynamic (TDK-45)	THERMOSTATIC		Bimetallic (TK-1)	Super Condensate Discharger (HK-23)
				Thermostatic (TKK-2Y-2N,TKK-21,TKK-41)	Thermostatic With 3 Capsules (TKK-3)		
Dip Oil Boilers	**A**			B	B		B
Cheese Boilers	**A**			B	B		B
Candy Boilers	**A**			B	B		B
Drying Cylinders	**A**			B			
Constant Drying Serpantines	**A**	B		B		B	
Grid Drying Serpantines		B		B		**A**	
Drying Cylinders	**A**	B					
Multiple Drying Serpantines	**A**	B		B			
Multi Cylinder Driers	**A**	B					
Rotating Driers	**A**				B		B
Paper Dough Driers	**A**				B		B
Fabric And Paper Drier Cylinders	**A**				B		B
Laundry Equipment	A			B			
Apparel Presses	B	B	**A**				
Irons	B	B	**A**	B			
Solvend Collecting Unit	**A**	B	B				
Drum Driers	**A**	B					
Tanks	A		B	B			
Process Tanks (Upper Outlet)	B	B	**A**	B			
Process Tanks (Bottom Outler)	**A**	B	B	B			
Short Serpantine Heating Tank (Fast)	**A**	B		B			
Oil And Asphalt Tanks	**A**				B		B
Paint And Polish Tanks	**A**				B		B
Evaparators	**A**				B		B
Mixer Tanks	**A**				B		B
Fuel-Oil Tanks	**A**				B		B
Presses	B		**A**				
Multi Plate Preeses (Parallel)	B	B	**A**				
Multi Plate Preeses (Serial)		B	**A**				
Tyre Presses	B	**A**	B				
Vulcanization Presses			B	**A**		B	B
Moulding Presses			B	**A**		B	B
Plywood Presses			B	**A**		B	B
Fuel Heating	A			B			
Main Fuel Tank Heaters		**A**	B				
Line Heaters	**A**	B					
Straight Line Heaters, Jacketed Pipelines			B	B		B	B
Turbines			**A**			B	B
Marine Applications			**A**	B		B	B

A: Best Option
B: Acceptable, Alternative

AYVAZ

STEAM EQUIPMENT HAND BOOK

CHAPTER III

ENERGY EFFICIENCY

CHAPTER III

EFFICIENCY LOSS ON STEAM PROCESSES

1- Quality of The Steam: Process steam shall be dry, air vented and has the required pressure rating.

2- Wrong trap selection: In case the trap is chosen wrong, then this will reduce the efficiency of the steam on process and efficiency of the steam consuming equipment. Means lots of energy.

3- Mistaken Installation of The Trap: In case the trap installed on the line with wrong direction this can block the line and damage both the process and the steam consuming equipment.Float type steam traps are mistaken with the inverted bucket types and are installed upside down in the steam lines. Because of this, steam trap is either get locked or remains as constantly open and causes steam loss.

4- Dirt, Water – Hammer, Freezing: In case of any these has chance to appear on process the traps shall chosen accordingly and necessary improvement shall be done on process lines.

5- Air Accumulations: One of the most important effects of steam for losing the efficiency is the air inside the lines. This air shall be vented otherwise water – hammers can appears and / or heat of the steam will be consumed by useless air which can also block some traps such as thermodynamic steam traps.

6- Differential Pressure: Inlet pressure shall be more then outlet pressure of the trap. In case of an increase on the back line pressure this can damage all system, such as equipments, boiler, traps steam process lines etc.

ENERGY LOSS AT STEAM TRAP LEAKAGES

Steam leakage as a result of steam trap multifunctioning is a serious energy loss and must be stopped immediately. Many factors are affective on the amount of the leakage Difference between inlet and outlet pressures, valve position, steam trap type and orifice diameter are affective on this amount. In order to help the steam trap users, steam amount which goes through an orifice discharges to the atmosphere is calculated in below example. An orifice differencial pressures are selected according to all steam trap types.

Steam Trap Diameter	Steam Loss-ΔP (kg/h)			
	4,5 bar	8 bar	10 bar	14 bar
DN 15	14	25	30	35
DN 20	30	60	80	100
DN 25	70	130	170	210
DN 32	100	200	230	280
DN 40	150	250	300	370
DN 50	210	320	460	600

The values are given in the table are theorical values, to be able to accept this values directly as energy loss, condensate must be discharged to the atmosphere. Returning condensate to the condensate tank is not complete energy loss of loss steam. Leaked steam goes to condensate tank and heat up the condensate before the feed to the boiler, this may even provide a positive effect. In such cases, taking half of the given values is a better option.

FLASH STEAM ENERGY

Under a certain pressure, heated water's temperature and enthalpy is increased. This continues until the boiling point of the water. At this point, temperature of the water remains same as all the water turns in to steam. After this, in order to benefit from the heat of the steam, steam is trapped. The condensate which is in Gasketct with steam is at the steam temperature. When discharged condensate by steam trap gets in a lower pressure ambient, condensate cools down to the saturated temperature of the ambient pressure and some of it gets evaporated because of the temperature difference.

The outcome energy causes some of the condensate to get evaporated, the steam which is the result of this evaporation is called "flash steam".

In another word, the steam which is the result of the movement of condensate from high temperature and high pressure ambient to low pressure ambient.

Important points of gathering flash steam;

1- For minimum amount of flash steam, huge condensate amount is required. Steam trap capacities should be selected carefully. Closing of the control valves provide pressure drop to the system, this should be estimated.

2- Application area should be appropriate for flash steam use, flash steam consumption should be equal or above flash steam amount.

3- Use of flash steam must be close to outlet of the high temperature condensate. Transport of low pressure condensate requires high diameters of pipeline and increases invest costs.

Flash steam armatures and tanks can be seen below,

Calculation of flash steam amount:

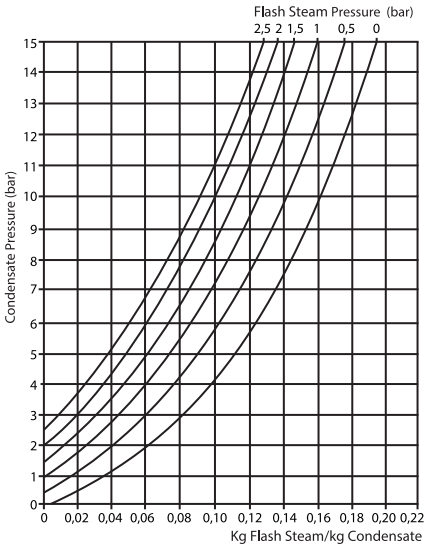
Ch: Sensible heat in the condensate at the higher pressure before discharge (kj/kg)

Cl: Sensible heat in the steam at the condensate at the lover pressure after discharge takes place (kj/kg)

Lh: Latent heat in the steam at the lower pressure to which the condensate has been discharge (kj/kg)

$$\text{(\%) Flash Steam Amount} = \frac{\text{Ch-Cl x 100}}{\text{Lh}}$$

As a result, as the pressure difference increases, flash steam amount is also increases. Also, steam trap type is also affective on the flash steam amount. Mechanical steam traps discharge close to the saturated temperature. Meanwhile, thermostatic discharge lower than saturated temperature and the flash steam amount is lower accordingly. The amount of generated flash steam is lower because they are drained under the traps vaporization temperature.



1 Kg Flash Steam/kg Condensate

Example 1:

If the discharge of the same system is done by AYVAZ TKK-2Y thermostatic steam trap with 10K and 30K capsule options.

Condensate temperature for 10 K:
170.5 – 10 = 160.5 °C

Condensate temperature for 30 K :
170.5 - 30= 139.5 °C

From the saturated steam table, enthalpies for these temperatures are;

For 10 k: 678.2 kj/kg
For 30 k: 593.3 kj/kg.

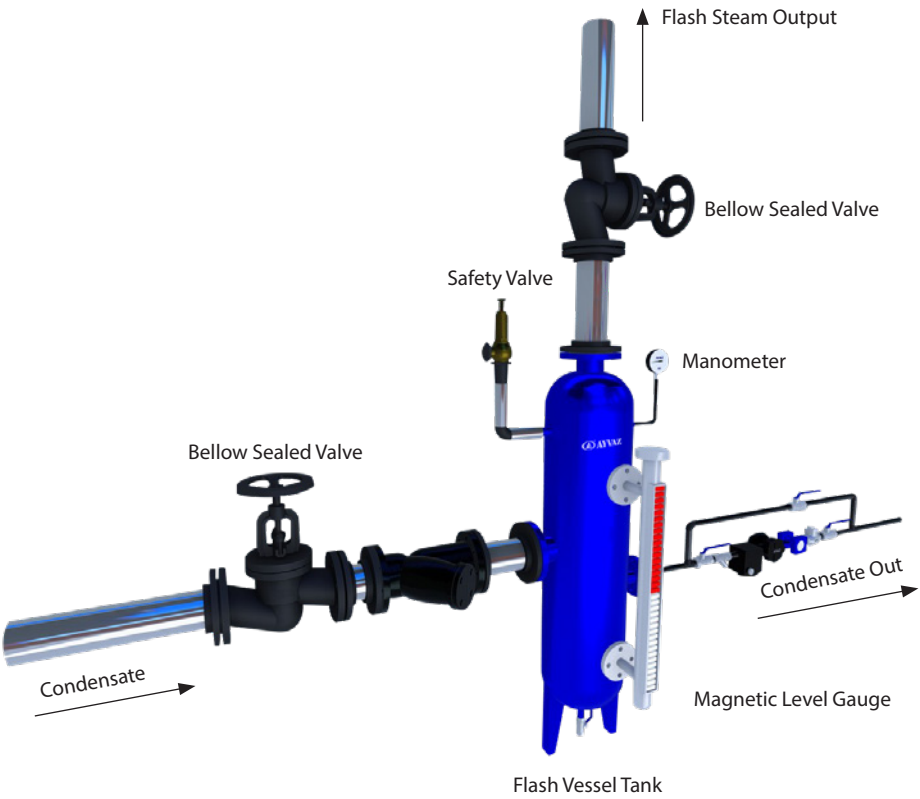
Example 2:

Calculation of the flash steam amount for below system
From the saturated steam table;
At 8 bar, 170.5 °C, enthalpy of condensate = 720.94 kj/kg
At 1 bar, 100.0 °C, enthalpy of condensate = 419.00 kj/kg
Difference of enthalpy is 301.94 kj/kg.

Hidden heat of the water vaporized at 1 bar is:

$$\text{fsa} = \frac{\text{ch-cl x 100}}{\text{Lh}} = \% \ 13.3$$

If steam consumption of the system is 1000 kg, flash steam amount is 133 kg.



At 1 bar, 100.0 °C, enthalpy of condensate = 419.00 kj/kg. Difference enthalpies are;

10 K: 678.2-419.0 = 252.2 kj/kg
30 K: 593.3-419.0 = 174.3 kj/kg

Hidden heat of the water vaporized at 1 bar is LH =2.257 kj/kg. So, the flash steam amounts are;

For 10 K, FSA (292.2 / 2257).100 = % 11.48
For 30 K, FSA (174.3 / 2257).100 = % 7.72

If steam consumption of the system is 1000 kg, flash steam amounts are;

For 10 K: 114.8 kg
For 30 K: 77.2 kg

As it is seen in the above examples, thermostatic steam traps provide less flash steam than mechanical and thermodynamic steam traps. In abroad meaning, thermostatic steam traps are the most efficient steam traps in the manner of "Energy Saving". This is the main reason that this type of steam traps are preferred especially for the tracing lines and heating equipment at petrol refineries.

Also, Just because Ayvaz thermostatic capsule has 3 different options as 5K, 10K, 30K , it provides optimum efficiency advantage in relation with request and operation conditions. It is also used especially tyre production.

The diameter of the flash steam tank should be a diameter that allows the passage of the condensate without coming into turbulence.

If the difference between high and low pressure is small.

The amount of steam is less than the amount of condensate. Flash steam outlet pipe
selecting the diameter according to the speed will cause the tank to remain small.
in which case the tank must be selected to be two diameters larger.

Choosing Flash Vessel

1- Maximum condensation amount is required to obtain maximum flash steam.
For this reason, the capacity of steam traps must be selected carefully, taking into consideration the counterpressure.

It should also be noted that in systems where temperature control valves are used, the valve will be closed and the pressure will drop.
2- The amount of use of flash steam systems must be equal to the amount of flash steam.

Steam can be provided by pressure drop from a higher pressure steam line when the flash steam is missing.

If flash steam is excessive, some of the flash steam must be thrown out.

Also, since the flash used in heating will not be needed in summer, a heat recovery system will not be necessary.

Therefore, the amount of flash steam required must be prepared.

3- It is beneficial if the system to be used with flash steam is close to the outlet of the condensate at high pressure.

The transport of low-pressure condensate requires large diameters and will increase investment costs.

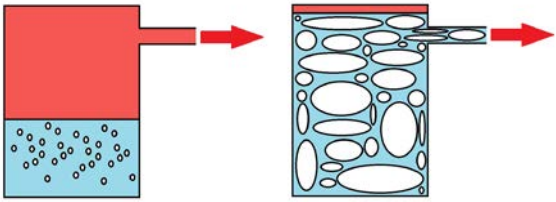
In addition, the heat losses that will occur on large pipe diameters will reduce the benefits of flash buckets.

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;

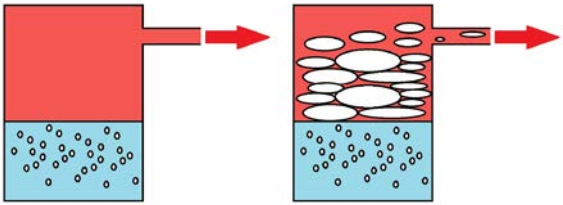
Peak requests (Priming)

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.



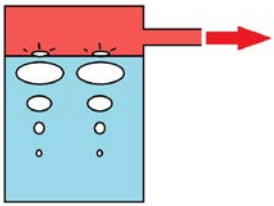
Foaming

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.



To Prevent Water Dragging

- Sudden pressure drops should be avoided.
- The water fed to the boiler and the recirculating condensate should be treated and processed correctly.
- The water level should be kept under control and the high water level should be avoided.
- The steam boiler must be operated at the specified capacity and design pressure ranges.
- The most suitable and correct blowdown systems should be developed and implemented.

Blowdown Applications

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.

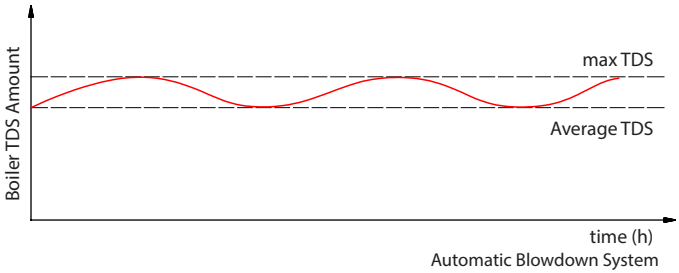
Sediments must be evacuated periodically to prevent the formation of the sludge layer. Bottom blowdown valves are used for this purpose. The bottom blowdown valve is opened and the pressurized boiler water is discharged from the lower zone of the boiler.

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.

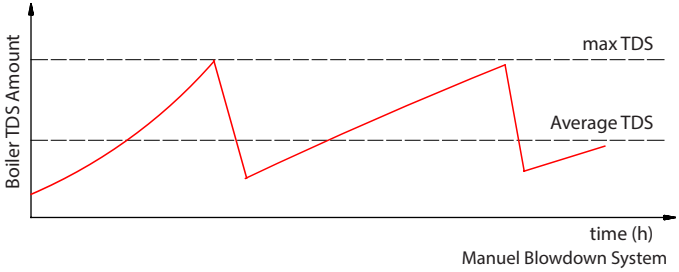
As a result of evaporation, the salinity in the boiler water increases. A salt concentration higher than the limit value causes the boiler stone, boiler corrosion and foam formation. The foam can also reach the steam installation. Thus, the steam quality decreases and the accumulation of water forces the armatures.

The salinity concentration of the boiler water over the proportional surface blow down valve can be kept below the permissible limit value. Here, the conductivity of the boiler water is measured by a conductivity electrode (the more salty water is more conductive) and the desirable salt concentration is achieved by draining the boiler water through a proportional valve (just below the upper water level).

Differences Between Manuel and Automatic Blowdown System:

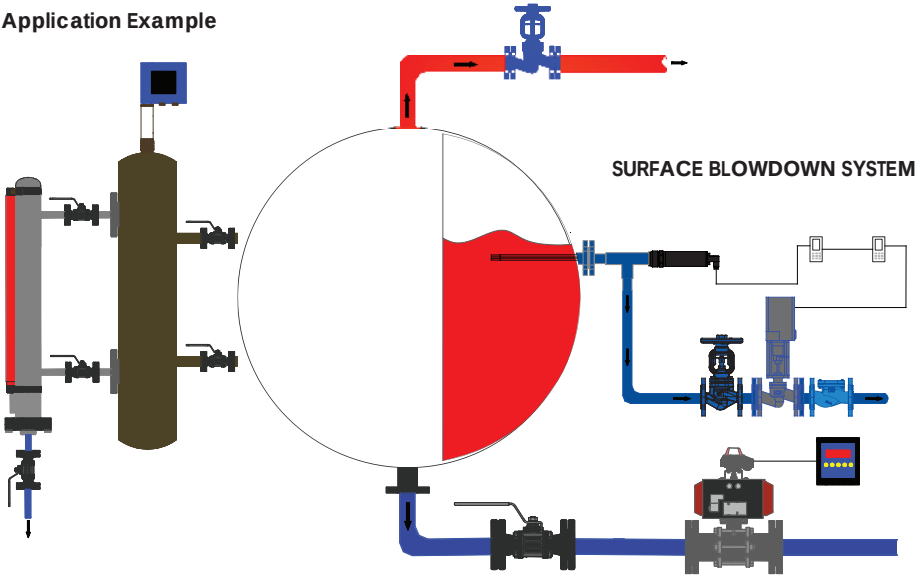


Automatic Blowdown System



Manuel Blowdown System

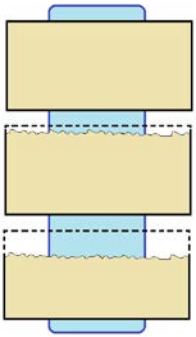
Application Example



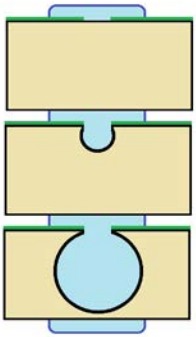
Pitting Corrosion

Pitting corrosion is a localized form of corrosion by which cavities or "holes" are produced in the material. Pitting is considered to be more dangerous than uniform corrosion damage because it is more difficult to detect, predict and design against. Corrosion products often cover the pits.

Standart Corrosion



Pitting Corrosion



Boiler Deaerators

Boiler deaerators are used to remove oxygen and other gases from the water that feeds into boilers that generate steam.

Water temperature must be more than 85 degree celcuis to remove oxygen and the other gases from the water. At 85 degree celcuis deaeration starts. At 105 degree celcuis 95% of the oxygen in the water is dissolved.

Deaerators remove the gases that attach to the metallic components of the steam system and cause corrosion by forming oxides, or rust. Oxygen and carbon dioxide are responsible for corrosion. There are two types of boiler deaerators: Tank model or compact deaerators.

When water passes from the feed water tank into the boiler deaerator, it enters through the inlet water connection. The water flows through a heating and venting section that is filled with steam. The water temperature rises, which releases most of the undissolved gases in it including oxygen and carbon dioxide. When the water flows through the deaerator, it passes to the scrubber section. It is in this section where the last step of deaeration takes place because it scrubs the water with steam that is free of oxygen. Then, the steam goes through a stainless steel spray valve that breaks down the high-velocity steam into a fine mist. The deaerated water flows over to the storage compartment and is ready for use by the boiler while the gases vent to the atmosphere. By virtually eliminating the amount of dissolved oxygen and carbon dioxide in the feed water, boiler deaerators help lower operating costs and improve steam quality for facilities.

The steam boiler must be large enough to meet the required load. If too large, the efficiency will be lower and the installation costs will be higher. In cases where a single boiler operates at full capacity, the establishment of a second boiler will be a rational solution to meet the possible needs of the main boiler in which the production peaks and the system load increases.

Boiler Applications

There are two main types of boilers: flame smoke tube boilers and water tube boilers.

Flame smoke tube boilers are the most commonly used type of boiler in the steam industry. With their economy, operating pressures and steam production capacities are sufficient for many industrial applications.

Water tube boilers are used in power generation turbines where high pressure is required and high steam flow rate is required.

A steam boiler should be designed according to the desired pressure and steam capacity.

Ayvaz Hygenic Steam Generator Applications

HYGIENIC STEAM / PURE STEAM GENERATOR

Today, there are four steam grades commonly used in the industry:
System (Plant) Steam, The Filtered Steam, Hygienic Steam, Pure Steam.

Steam Purity Range	Steam Application Area
Pure	Pharmaceutical Industry
	Biotechnology
Clean	Hospital
	Cosmetic
	Food & Beer
Filtered	Food & Beer
Plant	Hvac
	Textile
	Petrochemical

System is perfect for heat transfer application for petrochemicals, pulp mill and paper industries. Food companies should use filtered steam at a minimum level or use hygienic steam to remove the risk of contamination. Pure steam is the highest grade choice and is required for pharmaceutical and biotechnological applications.

Hygienically and pure steam; It is used for sterilization, vacuuming, humidification and heating processes in Food, Pharmaceutical, Cosmetic and Hospital establishments. Since steam used in these processes must meet the hygiene norms, Hygienically Steam Generation is provided by Sekonder Hygienically Steam Generators which are suitable for sterile steam conditions.

HYGIENIC STEAM

When "Steam Cleaning" is mentioned, it is often referred to as "Hygienic Steam" rather than system steam.

This is usually divided into 4 different categories:

System Steam - FDA approved standard boiler chemicals are used in a typical conventional water treatment and inside the steam generated boiler. The tubing is standard carbon steel or even black pipe can be cast iron. All the condensate is recovered.

Filtered Steam - Steam, which is generated by conventional boiler, is filtered to remove condensate and solid particles. FDA approved chemicals used in standard boilers. If the pipe is a standard carbon steel or black iron, it must be replaced with 316 Stainless Steel. All the condensate is recovered.

Hygienic Steam - is not include any addiction (boiler chemicals etc.) and iyonized or produced by reverse osmosis systems. All materials, components and pipes are 316 L Stainless Steel. Rarely recovered condensate is typically sent to a settling tank and then it is for water purification.

Pure Water - is not include any addiction (boiler chemicals etc.) and which is production of pure water. All materials, components and pipes are 316 L Stainless Steel.

INSULATION APPLICATIONS

Steam traps and valves require periodic maintenance, easily applicable and removable jacket type insulations are more appropriate rather than fixed insulation applications for these armatures. A valve jacket is a simple and smart solution for preventing heat losses around the valves at hot or cold liquid transporting pipelines.

Thermal energy benefit by jacket type insulations is dependent on some factors likewise process temperature, ambient temperature and wind speed.

Un-insulated valves cause energy loses, reducing energy loses to the minimum level by using valve jackets helps to reduce operation costs. Easily removable valve jackets make the maintenance easier.

FABRIC TYPES

There are many kind of fabrics that use for insulation; Aerogel, rockwool, glass wool, ceramic fibre, PVC foam, calcium silicate, expanded perlite etc. These are the common use material that you can find below.

JACKET FABRIC

Figure A - Ceramic fabric with 1260 °C resistance.

Figure B - Outer layer is Silicon Fabric with 200 °C resistance; inner layer is opt. for low temperatures.

Figure C - Inner layer is Fiber Glass Fabric with 500 °C Resistance.

Silicon Fabric **Figure-B**

Fiber Glass Fabric **Figure-C**

COVER MATERIALS

Rope **Figure-A**

Metal Wire Hook

Velcro Bant

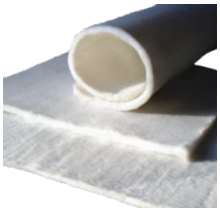
INSULATION MATERIALS

ROCK WOOL

- It is obtained by making the basalt stone melt and fibrous.
- The thermal conductivity value k= 0,040 W/m-K.
- The water vapor diffusion resistance is m= 542 mgm/Nh Mu (μ)
- Rockwool is also an open-pored material. 99% of the material covers the air gap. In this respect, it is easy to get wet if measures are not taken.

PYROGEL XT

- Thickness: 5 mm - 10 mm
- Max Usage Temperature: 0 °C + 650 °C
- The thermal conductivity value k = 0.021 W / m-K.
- Color: Beige
- Density: 0.15 g / cc
- Hydrophobic: Yes
- It has 3-5 times better k value than other insulation materials.
- It is resistant to pressure and impact.
- According to ISO 1182:1990 flammability is Passed.
- Fire performance reaction according to BS EN 13501-1: 2007 is A2 passed



CRYOGEL X

- Thickness: 5 mm - 10 mm
- Max Usage Temperature: -200 °C + 90 °C
- The thermal conductivity is k = 0.015 W / m-K.
- Color: White
- Density: 0.15 g / cc
- Hydrophobic: Yes
- It has 3-5 times better k value than other insulation materials.
- It is resistant to pressure and impact.
- According to ISO 1182:1990 flammability is Passed.
- Fire performance reaction according to BS EN 13501-1: 2007 is A2 passed

SELECTION CRITERIA

- **Resistance to Different Operating Temperatures:** Protects physical and thermal properties.
- **Physical Strength:** It should not lose its original properties during (vibration), storage, loadings, operation and application.
- **Mechanical Strength:** should not deteriorate in expansion and contraction.
- It must be easy to install.
- **Resistance to Flammability:** must be considered and covered with appropriate coating techniques.
- **Resistance to Corrosive Effects:** Water, steam etc. resistance to leaks or condensation.
- **Insulation Thickness and Weight:** Investment cost should be observed.

COMBINATION OF ROCKWOOL AND AEROGEL

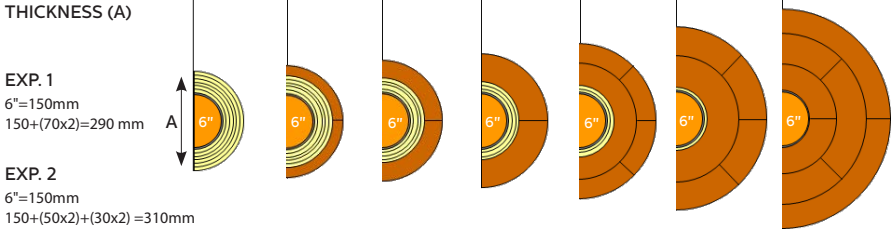
- Combined use reduces surface area.
- Aerogel can be use at high temperatures.
- Rockwool can be use at low temperatures.
- It also reduces the installation cost.
- At temperatures above 175 °C, rockwool is damaged and the insulation quality is reduced.
- Combined use will also increase the lifetime and thermal resistance capacity of the line.

INSULATION ADVANTAGES

- Healthy materials keeps safe from burn injuries
- Heat economy >> Energy, competition, business advantages
- Providing thermal comfort conditions
- Sound insulation
- Fire protection
- Prevent from sweating, humidty, evaporation and frost
- Prevents the temperature drop in pipelines, provides using of thermal capacity efficiently

COMBINED APPLICATION EXAMPLE

		EXP. 1	EXP. 2					
PYROGEL	(mm)	70	50	40	30	20	10	-
ROCKWOOL	(mm)	-	30	50	80	110	160	230
TOTAL THICKNESS (A)	(mm)	290	310	330	370	410	490	610



In this example, Pipe Size is 6", Pipe Inlet Temperature T_{in} = 550 °C, Ambient Temperature T_{AMB}= 20 °C and insulation surface temperature T_{SRF}= 40 °C.

STANDARD OF THERMAL HEAT UNIT (R)

Insulation Scale	50 mm Rockwool	10 mm Pyrogel	10 mm Pyrogel + 50 mm Rockwool	20 mm Pyrogel + 50 mm Rockwool	30 mm Pyrogel + 50 mm Rockwool
R Unit Value*	1,428 m^2.K/W	0,476 m^2.K/W	1,904 m^2.K/W	2,380 m^2.K/W	2,856 m^2.K/W

*R value calculation: Insulation Thickness (mm) / Thermal Conductivity (k).

PLATE HEAT EXCHANGERS

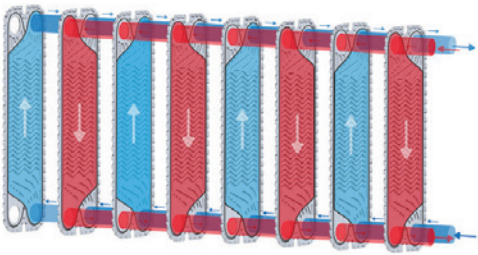
Working Principle of Plate Heat Exchangers

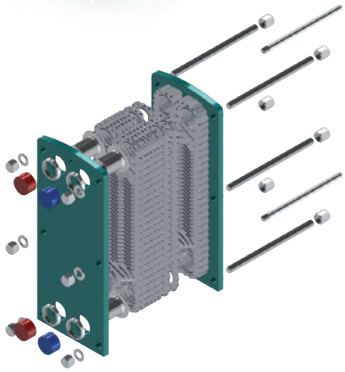
Plate heat exchangers are items that operate according to the principle of heat transfer between two different fluids with temperature difference. Heating fluid and the fluid to be heated are completely separated by plates.

The standard plate heat exchangers have a total of four inlet-outlet ports, two of which are the inlet and outlet of the heating fluid and the other two of the fluid to be heated. It is also possible to produce heat exchangers with more than one heater or heating fluid with customized production.

Components

• Front body with input-output connections and information
• Upper and lower carrying bar used to secure the plates
• The first plate that prevents the liqu id from contacting with the body
• Flow plates that allow the passage of fluids and heat transfer
• Completely closed end plate which prevents fluid from coming into contact with the rear body
• Rear body that can move on the bar
• It consists of studs and knots, which ensure that the plates are kept at a certain size





HVAC - HEATING, COOLING AND VENTILATION

Domestic Hot Water
Domestic hot water in industry and housing is a must for comfort. With plate heat exchangers, your domestic water can be produced centrally or individually. Compared to old systems, it is more hygienic, more efficient, longer lasting, more economical and more compact. With this system, your system can achieve its old performance with minor revisions, instead of replacing the system in case of problems such as residual calcification and excess chlorine-induced deformation.

Radiator Heating
By using hot water from sources such as regional heat centers, geothermal resources and electricity generation facilities; a region, a district, even a complete province can be heated. With the plate heat exchangers specially designed according to the type of the source, the zone can be separated into zones and placed under each building and hot water can be produced according to the needs of the buildings.

Floor Heating Systems
The plate heat exchangers, which are used to prevent the heating source from being affected by corrosion in underfloor heating systems, which are frequently used in areas where more heating comfort is desired recently, serves as a protective wall between the heated area and the heating source. Thanks to its high corrosion resistance, carbon steel body, stainless steel plate and special designs, plate heat exchangers guarantee years of trouble-free operation.

Central Heating Systems
As a part of new laws in our country, central systems are encouraged and it has been becoming mandatory in some situations. The main cause of this is that central system is more efficent compared to individual use and consumes less energy. Plate Heat Exchangers are able to produce hot water for heating of residental areas and for utility purposes.

Heat Recovery Systems
In today's conditions, where energy is getting more expensive day by day, there is no need to waste energy in industry or individual use. The budgets allocated to energy in industrial establishments have increased by 20% -40% in recent years and they are at the top of the expenses section. Taking all these points into account, the recovery of energy has become very important. Ayvaz plate heat exchangers prevent the waste of your thermal energy with wide variety of plate and gaskets suitable for each system.

Waste Heat Recovery
Industrial facilities have many wasted heat sources such as rotten steam and hot water returning from fabric washing. At the same time, there are applications that require heat, such as domestic hot water production and office heating. With the Ayvaz plate heat exchanger you will use to transfer heat from existing heat sources to the partthat needs heat, you do not waste your heat and you need to save extra heat for the heat requirement.

Nowadays, the most important factor that will relax businesses is to reduce costs. Energy expenses, one of the biggest factor in expenses, are now worth the gold for everyone and cannot be ignored. A heat exchanger to be used for heat recovery with a rough calculation now pays off in 3-6 months and starts to add value to the operation in a short time.