MASCOT

High End Technology

Tight Shutoff

Reliability

Expertise you can trust

DEFLO Desuperheater MSD/VSD

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A plant generates steams for either heating purpose or for generating electricity or for both.

Steam produced by evaporating water is known as saturated steam. Because of its moisture contents this steam spreads evenly over heating surface and therefore heat transfer is good. This steam has a definite temperature at which it is generated. It is best to use saturated steam for heating requirement of plant.

For running the turbine blade, it is good to use superheated steam, another kind of steam produced by further heating the saturated steam. Saturated Steam is made to pass through Superheater coils in which, the moisture of saturated steam are evaporated. This steam has higher temperature compared to the saturated steam at the same pressure. Superheated steam, because of lack of moisture, behaves like a gas containing more of kinetic energy.

To run turbine blades the steam needs to be having more of a kinetic energy and must be free from moisture as moisture is undesirable with moving parts. Superheated steam is therefore the best medium to run turbine and generate electricity.

Often the turbine has a bleeding and has exhaust steam coming out, after it has been used by turbine. This steam can be used in heating process by DESUPERHEATING it.

In DESUPERHEATING process the moisture, which was earlier evaporated in Superheater, is added by injecting water, making it evaporate by absorbing superheat.

Advantage of using Desuperheater:

Using Desuperheater has following advantages:

- Superheated steam behaves like gas, leaving hot and cold patches over a heating surface, resulting in poor heat transfer, wasting valuable steam. Heat transfer is even with Desuperheated steam as it behaves like vapour.
- Generates equal amount of steam, as injected water is converted in to steam.
- Heating process becomes faster enhancing plant efficiency.

How does a Desuperheater work ?

Moisture particles of saturated steam, that were further heated (and almost eliminated) to produce Superheated steam, are gained again by injecting water in to superheated steam, through a Desuperheater. A simple heat balance formula "The amount of heat to be absorbed should be equal to the amount of heat gained by water is used to calculate the required amount of water for required temperature reduction.

A job of a Desuperheater is to evaporate the injected water in a shortest time so that temperature –sensing element can be placed as close as possible from the point of water injection (but only after the water is converted in to steam and the required superheat is eliminated). Change in the direction of outlet pipe of Desuperheater should be effected only after the water is evaporated. This will prevent water logging and worst still, water hammering in the pipelines. An efficient Desuperheater can therefore allow change in pipe direction in a shorter distance offering that much more flexibility in piping.

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DEFLO MSD

Factors enhancing the efficiency of a Desuperheater:

Pressure Differential between water and steam (Superior pressure):

This has to be as high as possible as water is to be accepted by steam and therefore must be at a higher pressure then that of steam to be Desuperheated. Higher the pressure differential, better will be the atomizing effect and smaller will be the size of water particles. Smaller water particles evaporate faster then the bigger ones resulting in a speedy Desuperheating process.

Velocity Differential between water and steam:

This is an inherent property of piping engineering. Pipe for water are sized at about 1.5~2 M/sec. velocity as against that of steam pipes, which are sized at 40~50 M/sec. Higher velocity deferential helps water to tear apart, resulting in better atomization.

Temperature differential between water and steam:

This should be as minimum as possible. Water at near saturation temperature, evaporates faster as it has to take a very little amount of heat for getting converted in to steam. This calls for higher amount water but will produce more steam too and has substantial importance on the efficiency of a Desuperheater.

Turbulence:

This too has a great importance. Water coming out of a Nozzle with swirl will ensure through mixing with steam as turbulent water particle mixes with steam with impact and that will further enhance the efficiency of a Desuperheater.

Whilst the first three factors are in control of the Desuperheater users the fourth one is engineered by a Desuperheater manufacturers. Users must see the importance of these factors and provide them, so that he, in turn can have an efficient Desuperheater in his plant.

We manufacture two types of Desuperheaters:

The Mechanical Spray Desuperheater (MSD) or Simple Spray Desuperheater.

This is the most basic type of Desuperheater, consisting of a fixed area nozzle arranged to face downstream at or near the Desuperheating pipe. The MSD relies on the pressure differential available across the nozzle to achieve the conditions for rapid absorption of the water into the steam.

Cooling water control valve install in the line ahead of the MSD will very in water supplied to the nozzle to maintain the down stream steam temperature at the measuring point. Whilst the MSD is working between about 5 and 100% of maximum rated capacity, there will be adequate pressure differential across the nozzle to ensure a spray pattern in the form of a hollow cone of finely divided water particles.

When Desuperheating loads goes about the maximum, the steam velocity at the exist of the nozzle will ensure turbulent flow, helping mix water particles in to the steam thoroughly. With reduction in steam flows the steam velocity through the pipe reduces proportional to flow and the turbulence will also reduce. With the reduced steam flow the water requirement will also be proportionately reduced in order to maintain the constant temperature. Plug of the control valve will automatically move towards the closed position to achieve this.

Since, the nozzle has a fixed orifice; the pressure differential across it will reduce proportional to square of the reduction flow in accordance with Bernoulli's law. This causes a reduction in differential velocity between the steam and the water particles, a reduction in the cone angle so that the water is projected more directly downstream, and an increase in water droplet size and all of these phenomena adversely affect the ability of the Desuperheater to work efficiency.

MSD or Simple spray Desuperheaters relies upon the pressure drop across the spray nozzle to achieve the necessary atomization. The unit consists of an orifice plate or nozzle through which the water is discharge and the pressure drop across this creates a spray pattern to achieve the necessary atomization. The orifice plate can only be design for maximum flow condition and since the pressure drop across the orifice plate follows, the square laws, as the flow is reduced the pressure drop across the orifice plate is substantially reduced and the atomizing characteristic is rapidly lost. For, example, if the flow is reduced by 50% of pressure drop across the orifice is reduced by 4.

As the load further reduces a stage would be reached where the nozzle ceases spraying and the water is projected straight downstream unit and collects at the bottom of the steam pipe. Since the steam is not being Desuperheated the temperature senses a rise in steam temperature, the control valve plug moves towards the open position and the nozzle commences to spray again, but at too high a rate of steam flow at that time. The steam is thus over-cooled causing the control valve to close again the whole cycle the repeats with consequent swings in temperature and intermittent flooding of the steam line with cooling water.

Many attempts have been made to produce a nozzle having a better range-ability such as swirl nozzles but they still suffer the fact that as steam and water flow reduces, this mechanical phenomena result in Desuperheating efficiency fall away proportional to the square of the flow.

More recently different designs of variable nozzle spray type Desuperheaters have been attempted. In these designs it is intended to maintain constant water pressure differential to ensure good atomizing, a wide angle cone and high water velocity at all loads, changing the orifice area proportionally to load varies throughout.

However, the MSD is widely used with good results in those installation whore the load is relatively steady. The inevitable variation in the steam temperature downstream of the Desuperheater and the water, which collect and trapped out, are of law order to be acceptable.

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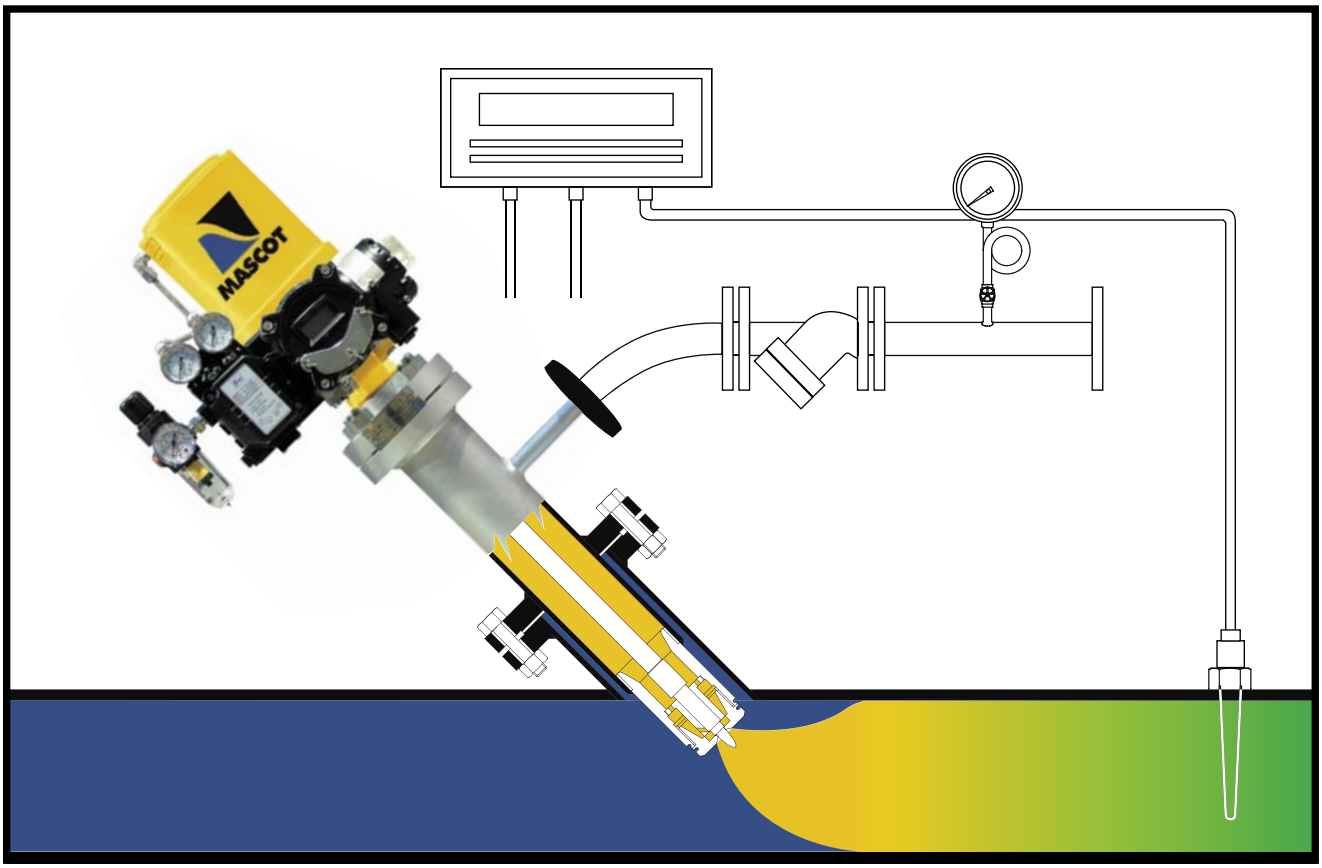
DEFLO VSD



Variable Spray Desuperheater

In order to recover lose of performance in a MSD or simple spray Desuperheater under low load conditions, variable nozzle spray type Desuperheater are recommended where as the load is reduced the spray nozzle area is also reduced.

The variable nozzle spray Desuperheater represents major advance in the design of Desuperheaters. It is small enough through to mount through a ND 100mm flange in the steam main having a minimum of 6 meters of straight pipe work downstream of the nozzle.

The variable nozzle spray Desuperheater (VSD) provides more economical control of steam temperature by introducing cooling water into the steam flow and through a nozzle of advance design. In this design water pressure above steam pressure is used to produce a thin film of conical spray of water which soon as evaporates as it is injected

into the steam flow. The design of the Desuperheater eliminates the need for a separate water control Valve.

The valve is accurately built into the Desuperheater. Because there is no external water control valve and there is always maximum water pressure at the nozzle.

The equal percentage characteristic plug controls the amount of atomized water being injected. As per signals of the temperature controller the valve plug varies the area of the nozzle and the water which is directed through a cage has 12 water inlet orifices, progressively uncovers as per the lift of the plug. Water flow is controlled at the point of injection into the steam.

The VSD Desuperheater utilizes constant water pressure to create a fine conical spray of which is injected into the moving of steam. The Desuperheater water spray evaporates quickly, eliminating the impingement on the piping walls.

The actuator moves the Desuperheater control plug, which regulates the quantity of water not the pressure injected into the steam.

Due to its unique design the VSD Desuperheater offers considerable advantage to the users.

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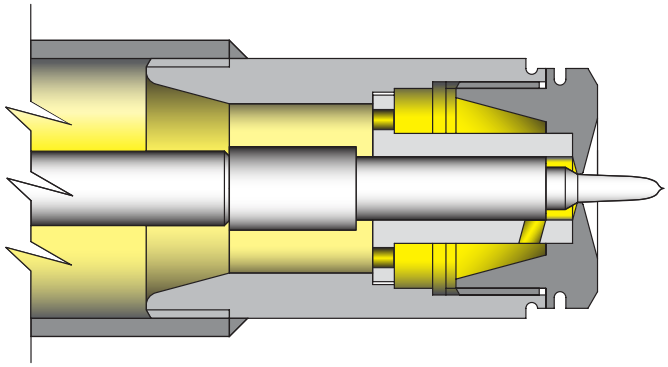
DeFlo VSD / MSD

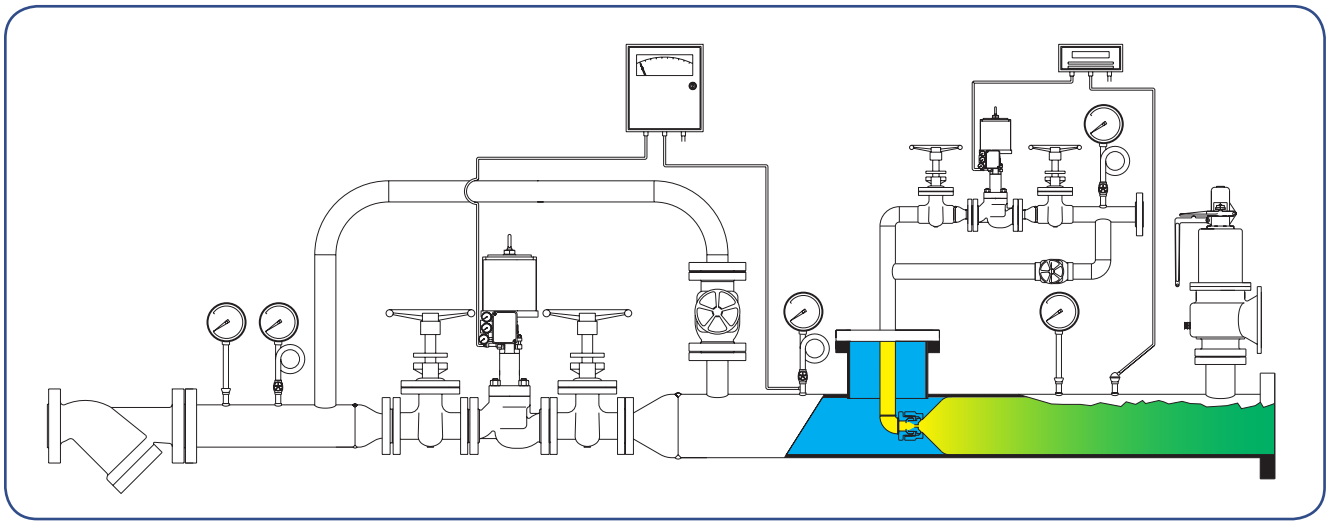
For us to design most efficient Desuperheater for you, we need following parameters:

- Operating pressure of Steam
- Maximum Inlet temperature of Steam**
- Required Outlet temperature of Steam
- Steam Flow Rate**
- Available Cooling water Pressure
- Available Cooling water Temperature

** You can give all possible values for these parameters



Typical Pressure Reducing and Desuperheating unit (PRDS)



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