BOMAFA®
Special Valve Solutions

TURBINE BYPASS VALVES
SEVERE SERVICE CONTROL VALVES
DUMP TUBES
DESUPERHEATERS

BOMAFA®
Special Valve Solutions

BOMAFA: THE NUMBER ONE SPECIALIST IN INDIVIDUAL SOLUTIONS

BOMAFA develops and produces high quality control valves for steam, gas and water. The valves are used in conventional and nuclear power stations, chemical and petrochemical plants and a range of other industrial applications.

Our extensive range of custom manufactured valves is of the highest quality and renowned for their impressive durability. Our product range consists of:·

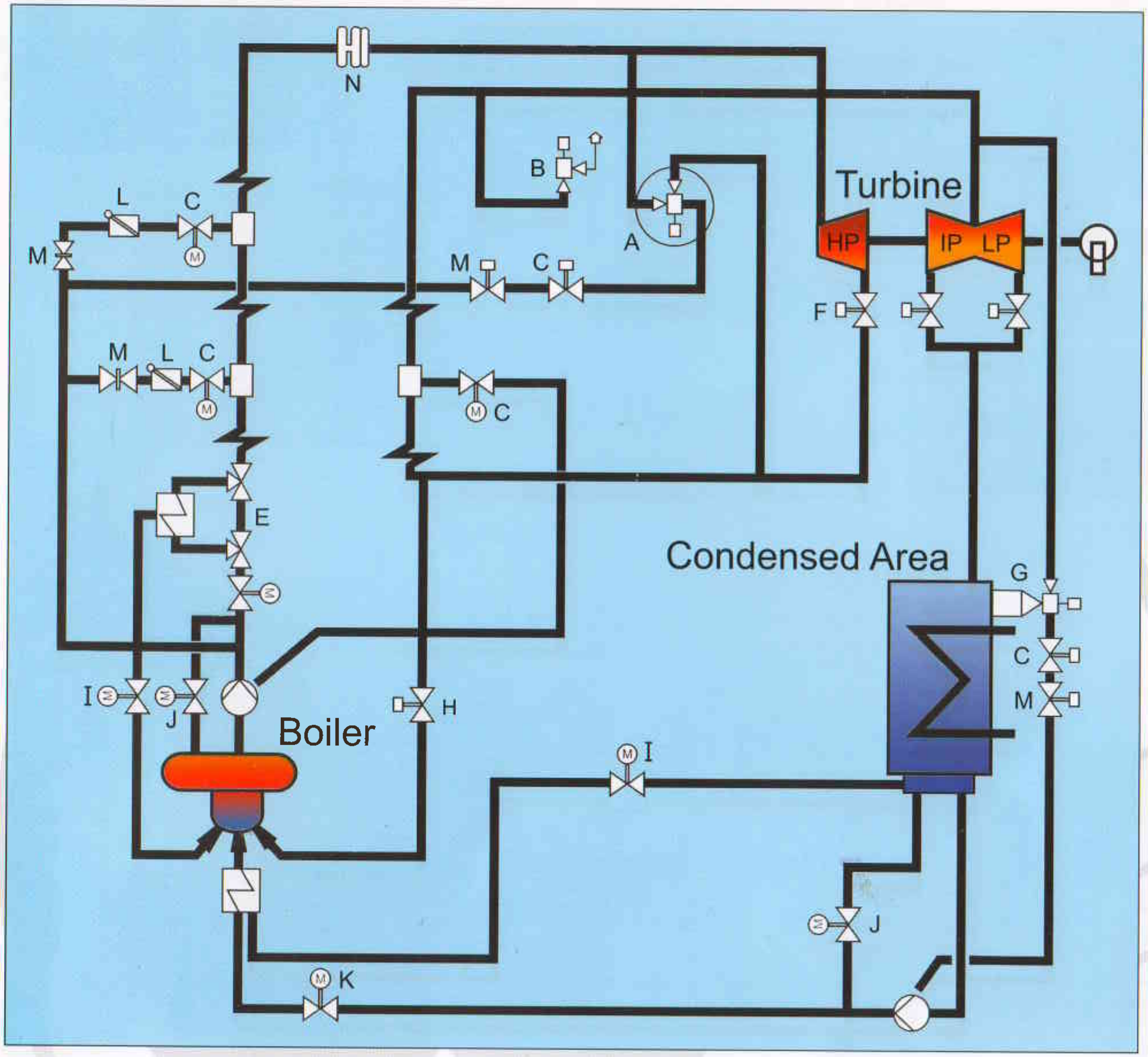
01. HP Bypass Valve
02. LP Bypass Valve
03. Spray Water Valve
04. Extraction Valve
05. Desuperheaters Combined
06. Desuperheaters Stand Alone
07. PRDS Valve/ System
08. Dump Tube
09. Spray Nozzle
10. Customized Control Valve
11. Steam Engineering Equipment

The construction is made in accordance with the requirements of modern construction techniques and of current statutory regulations.

This is how we work – Applying the highest quality with the greatest professionalism:

- Low noise designed special valves.
- Short maintenance time thanks to easily removable internal components.
- Highly robust yet easy to disable, if required.
- High Precision.
- High quality of steam through atomisation by the desuperheater.
- Design that takes into account plant outlay. Short maintenance time thanks to easily removable internal components.

TYPICAL HEAT FLOW DIAGRAM OF A POWER PLANT



A. High pressure By-pass Valve.
B. Re-heater Safety Valve.
C. Spray - Water Valve.
D. Feed Water Control Valve.
E. Pre-Heater By-pass Valve.
F. Extraction Stop Valve.
G. Low Pressure By-pass Valve.
H. Pressure Reducing Valve.
I. Level Control Valve.
J. Minimum Load Control Valve.
K. Single Seat Control Valve.(globe type)
L. Check Valve.
M. Gate Valve.
N. Orifice.

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PHOTOGRAPHS

Plug of Bypass valve

View of labyrinth Disc Stack

Inspection underway

Seat cage of bypass valve

Bypass valve ready
for shipment

Dump tube with spray water injection

Outlet of Hp Bypass valve

Control valve with junction
box and accessories

Plugs machined with
special characteristic

Forged severe service HP control valve

Flow nozzles

Spray water valves

PHOTOGRAPHS


PWHT treatment going on


Pressure reducing cum desuperheating station


HP bypass valve ready for shipment in F 91 material


On-going welding on Bypass valve


Top view of labyrinth disc stack assembly


Side view of Bypass valve Z shape in F 91 material


Forged severe service HP control valve


On-going welding of LP Bypass valve


Dump tubes with spray water injection


IP Bypass valve ready for shipment in F 91 material


HP LP and Spray water valves ready for shipment


Huge inventory of stock

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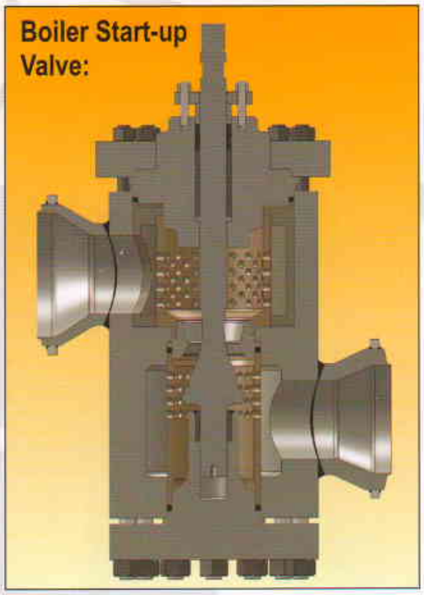
Feedwater System

Boiler Start-up Valve:

- During start-up, once-through boilers normally require a minimum evaporator flow so as to cool down the boiler tubes.
- There is a recirculating system which recirculates the water from the water separator back into the feed water tank or to the economiser/ evaporator to ensure a minimum flow is maintained.
- There are normally two types of recirculating system:

1. Recirculating water from the separator back to the economiser with the recirculation pump: During initial start-up, there will be a volumetric expansion due to the rise in temperature and a valve is required to dump saturated water from the evaporator to a flash tank. These valves are in operation at high flow and large differential pressures for a short time. In addition, the valves are also used during boiler filling and air purging, which normally requires higher flow at low differential pressure.
2. Recirculating water from the separator back to the feed water tank: In this system, the start-up valve is operating continuously at large differential pressures when the boiler load is less than 30%. At the inlet it is saturated water which immediately saturates to flash as soon as the pressure is reduced. Thus, the outlet condition is a mixture of water and steam with very high velocities.

- Typical requirements of a Boiler start-up valve are:
- To handle impurities that would come into the valve during start-up. Properly designed seat and trim so as to prevent the particles being trapped between seat and plug when the valve is closed.
- The smallest flow area of the trim is downstream of the seat thereby greatly enhancing the seat life and also the valve should maintain the required tightness.
- Trim parts should be easily dismantled at site.
- An angle design is the most preferred.



Boiler Feedwater Regulating Valve:

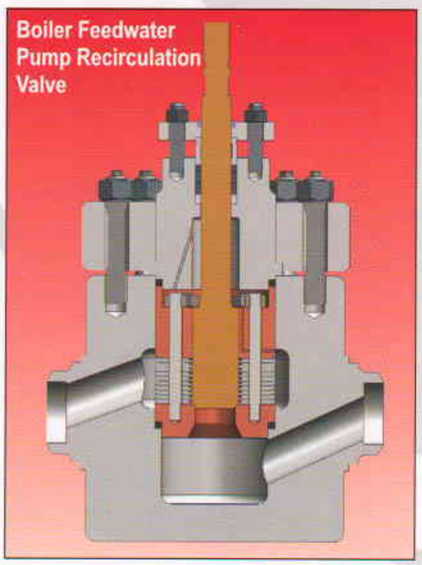
- The feedwater flow is controlled either by a variable speed feed pump or a large capacity control valve.
- The boiler pumps are normally operating at a constant speed and therefore constant outlet pressures are maintained. A control valve for regulating the feedwater to the boiler accepts water from the pump outlet and regulates the outlet flow which is based on the boiler demand.
- This valve therefore has to address cavitation during initial operation and also provide high rangeability for the entire feedwater requirement. Turndown more than 50:1 are very common.
- During start-up the service conditions of this valve are very similar to the feedpump recirculation valve with the exception of flow rate.
- This valve will begin to transit the flow from the recirculation valve and will open as recirculation valve closes.
- Inlet pressures can reach as high as 350 bar or even higher depending upon the plant type.
- BOMAFA characterised Labyrinth disc stack design provides the perfect solution. The characterised trim utilising anti-cavitation design protects the valve at low opening and this is important since the pressure drop is the highest and can cause the highest amount of damage.
- As the pressure in the drum rises the valve travel also increases thereby decreasing the requirement of anti-cavitation protection. The design is such that from anti-cavitation process to the normal additional flow requirement, the transition is a smooth one.
- Tight shut-off is recommended. High pressures will be seen at the valve inlet with minimum pressure on the valve outlet. If any leakage occurs, the valve trim will be completely washed out in a very short period of time leading to a high level alarm in the steam drum which could lead to dumping the treated feedwater to the waste water system and let alone effect the controllability of the valve.
- The application or service of this valve is similar to a de-aerator level control valve; however this valve has extremely high pressures.

Feedwater System

Boiler Feedwater Pump Recirculation Valve:

- Water is taken from the de-aerator to the boiler feed pump and it is raised to extremely high pressure (mostly over 200bar(g). During start-up and low load the pumping load is small while the pumping outlet pressure is very high. This is a typical application where there is a requirement for prevention of cavitation as also the flow capacity is very low. Once the plant load increases, the boiler drum pressure increases and accordingly the flow rate also increases.
- It is not possible for the pump to maintain same high pressure at higher flows and as a result we not only have low inlet pressure but also high back pressure on the valve.
- This specific requirement calls for a specialised valve with a characterised trim coupled with adequate number of pressure reducing stages. Quite a few plants have two valves in parallel – one during start-up while the other will be operated at main load.
- The start-up valve would be a specialised valve for catering to low flow application combating flashing and cavitation whereas the main valve would have a relatively simpler trim design as the differential pressure across it is significantly reduced.
- BOMAFA can provide Labyrinth disc stack technology for a very specific tailor made characterised trim which can cover the complete range of the plant requirement in a single valve also.

1. The modulating type of boiler feedpump recirculation valve is the most efficient method of recirculating. Normally for each boiler feedpump, the manufacturer gives the pump curve on which NPSH (Net Positive Suction Head) is furnished. For each power plant there is a certain NPSH available as a function of the actual plant layout. To prevent cavitation from occurring in the pump, the NPSH available should be above the NPSH required. Therefore, boiler feedpump recirculation valve is designed so as to provide the minimum amount of feedwater to the feedpump to ensure that NPSH available is above NPSH required.
2. Another method is an on-off method of recirculation valve. For this method, a recirculation valve provides a constant amount of feedwater flow to the feedpump upto a specific plant load and at that time boiler feedpump recirculation valve will close. This type of on-off valve is less efficient than the modulating one because some energy is wasted since feedwater is recirculated at quite high plant loads.
3. Continuous recirculation method would probably be found in old power plant. This type of method recirculates a certain amount of feedwater irrespective of plant load, feedwater pressure or feedwater temperature. Since normally most feedpumps require only recirculation at low load conditions, this method is the most inefficient as excess recirculation is nothing but loss of energy. Besides since a certain amount of feedwater is always being recirculated, the feedpump will only obtain its maximum rated output capacity.



- Typical requirements of a Boiler Feed Pump Valve are:

-- To handle massive pressure drop across the valve
-- Trim should be designed to avoid erosion due to flashing services conditions.
-- Trim should be designed to avoid cavitation.
-- Trim should be designed to avoid mechanical vibration and noise.
-- Trim should be designed for maintaining tight shut-off.
– Trim should be designed to give low resistant at high load.
-- Trim should be designed for high rangeability.

- This service is probably the most severe application for a control valve in power plant.

Condensate System

Condensate Pump Recirculation Valve:

- A condenser is one of the most important equipment in a power plant. Its job is to provide a high vacuum environment wherein the turbine exhaust steam can be condensed.

- It is located at the exhaust of the low pressure turbine and is typically installed under turbine. In new turbine designs, it can also be located at the back end of the turbine.

- Condensor is also responsible for providing a collection point for condensate so that it can be returned back to the steam generator.

- It acts as a reservoir to adjust to the load fluctuation in the unit while providing the suction head for the condensate pumps.

- The hotwell is designed and sized to provide full condensate load for a period of time, which is typically 2-3 minutes.

- In order to protect the condensate pump from overheating and cavitation it must have a minimum flow passing through it at all times. In view of this a condensate pump recirculation valve is installed which pumps the water from the pump outlet line back to the condenser.

- During low boiler load requirements, the flow of condensate passing through the pump is less than the minimum flow required for normal operation of the pump. At this stage the recirculation valve is opened and pumps in the additional flow required through the pump.

- Since the recirculation line puts the water into the condenser which is operating under vacuum, a conventional valve if used is bound to fail immediately as there would be extensive cavitation (this is because the outlet pressure of the valve is higher than the condenser vacuum because of pipe friction, bends, elevation and sparger back pressure). The valve should have tight shut-off pressure.

- Typical requirements of a condensate pump recirculation valve are:
  - Trim should be designed to avoid erosion due to flashing services conditions.
  - Trim should be designed to avoid cavitation.
  - Trim should be designed to avoid mechanical vibration and noise.
  - Trim should be designed to give low resistant at high load.
  - Trim should be designed for high rangeability.

Condensate Pump Recirculation Valve

Condensate System and Main Steam Line

De-aerator Level Control Valve

- The aim of a de-aerator level control valve is to maintain a pre- determined level in the de-aerator.
- The operating conditions of this valve change directly with respect to change in the plant load conditions.
- During initial start-up, the condensate pumps are operating at high pressure and minimum load with minimum downstream pressure since the de-aerator pressure has not yet been built. This leads to nearly a full pressure drop to be taken across the valve. As such with this case, there is no need for cavitation. Prevention and flow capacity is also to a minimum.
- However, as the plant operating load increases, the requirement for higher flow also increases and the condensate pump will not be able to maintain the same pressure at high loads. This will result in lower inlet pressure to the valve and the line pressure of the de-aerator builds up and puts back pressure on the valve.
- This means that for higher flow with lower pressure drop will need a higher capacity valve but with minimum resistance to the trim. These varying conditions demand a valve that possesses a large turndown.Tight shutoff is recommended and this protects the valve from the damage when the valve is closed and the condensate pumps are running. Any leakage in this valve will change the de-aerator water level resulting in treated water being dumped to a waste water system.
- Typical requirements of De-aerator control Valve are:
  - Trim should be designed to avoid erosion due to flashing service conditions.
  - Trim should be designed to avoid cavitation.
  - Trim should be designed to avoid mechanical vibration and noise.
  - Trim should be designed to give low resistant at high load.
  - Trim should be designed to have high rangeability.

MAIN STEAM LINE
Soot Blower:

- Most soot blowing systems utilise either air or steam. Use of water is limited due to the possibility of thermal stress and thermal shock on the tube banks.
- Air systems have simple piping arrangements; however the number of compressors, its capacities and the soot blower flow requirement limits the use of this system. Steam on the other hand has an advantage in terms of expansion.
- It is quite obvious that a precise and good modulating valve is needed for modulating pressure in the soot blower header.
- The valve should have a trim which has an exceptional rangeability since there is a large amount of load variation during the soot blower cycle.
- In addition to this the valve should act quickly and open and close so as to avoid increase in the pressure which would blow the safety valve installed in the line.
- The valve is normally closed for most of the time and will not be subjected to elevated temperature, however when opened, the trim rapidly heats up much faster than the body.
- Another important aspect to be considered is that the valve should have tight shut-off since it is going to remain closed for most of the time and any leakage will ultimately lead to increase in the header pressure and the safety valve being blown.
- BOMAFA soot blower header control valves are designed to meet the demanding conditions. For this application, the trim is characterised and has a multi-stage, multi-path Labyrinth disc stack so as to dramatically reduce velocities and at the same time offer extremely high rangeabilities.
- The trim is characterised for specific applications and normally the flow is kept over the plug so as to save the seat from trash damage. The valve is coupled with double acting cylinder piston actuator that would offer excellent tight shut-off requirements.
- It is also important that the velocity is controlled so as to achieve the best soot blowing effect and at the same time control the temperature so as to reduce the erosion effect on account of wet steam.

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Main Steam Line

Reheater Spray Control Valve:

- To increase the thermal efficiency of a steam generator and also the overall heat rate of a unit, a reheater is incorporated into the power cycle.

- It involves steam that is extracted from a turbine prior to complete expansion. In most plants, it involves removal of the exhaust steam from the HP turbine which is sent to the reheater and then injected into the IP turbine or LP turbine to expand completely before entering into the condenser.

- A double reheat is also possible but is more common in supercritical once-through units. This process reheats the exhaust from the IP turbine prior to entering into the LP turbine. As with main process, this will improve thermal efficiency but the additional reheat stage will provide lesser gains on the overall efficiency while still impacting the capital expenses.

- As would be the case with any superheated steam cycle, the temperature of the superheat nees to be maintained so as the temperature does not exceed the permissible material limit to the steam turbine. Temperature control is achieved by injecting a fine spray of water in the steam line through an attemperator or a desuperheater.
  The desuperheater utilises the water from a spray control valve and sprays the water in the steam thus lowering and maintaining the steam temperature, however it also reduces thermal efficiency as it takes heat away from the steam.

- In most of the coal-fired plants, reheat spray water valve is installed in the cold reheat piping between the outlet of the HP turbine and the reheat inlet header.

- A feedback control system tied back with the spray water valve is used to control the temperature of the hot steam.

- The reheat attemperator mostly uses water from the main boiler feedwater line and in some case the spray water maybe diverted from an interstage bleed in the boiler feedpump. Since the spray water is from the main feedwater line, while the reheat at a much lower pressure, a large amount of pressure drop across the valve is to be taken care of. Not only anti-cavitation trim is required but the flow rate requirement is also very low since the spray water is generally required at reduced loads and transient conditions.

- To add to this, a tight shut-off is the need for the valve to protect against water carryover into the turbine making this valve one of the very critical component in the power plant.

- As regards reheater spray control valve is concerned, the pressure drop across the valve

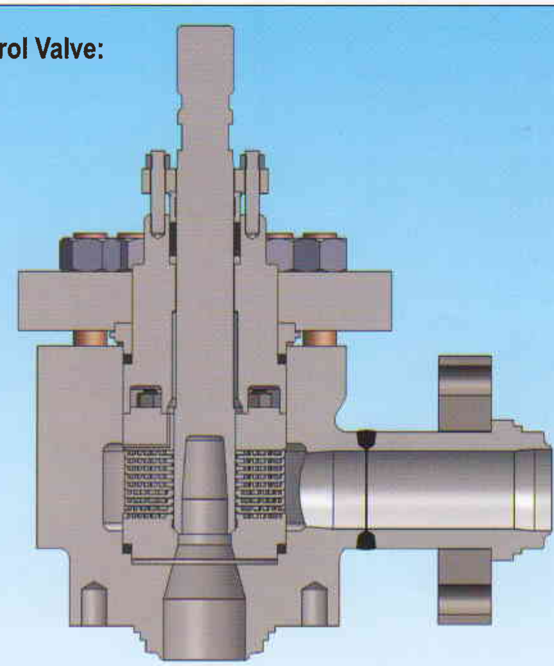
Reheater Spray Control Valve

Main Steam Line

is very high and advance characterised trim with adequate multi-stage pressure drop is required.

- BOMAFA recommends for both the applications (reheater and superheater control) its characterised Labyrinth disc stack trim so as to reduce velocities and also cater to high rangeability applications.
- The flow direction is over the plug so as to save the seat from trash damage. The valve is coupled with double acting cylinder piston actuator that would offer excellent tight shut-off requirements.

Spray Control Valve:



Superheater Spray Control Valve:

- Due to varying load requirements in a power plant, varying steam temperatures are inevitable. In a drum style and once-through design, this is caused by things such as burner orientation and fuel to air ratios. In combined cycle plants, varying gas turbine exhaust temperature and in the inclusion of duct firing can affect steam temperatures.
- In order to ensure the best operating heat rate and also protect the steam turbine, the steam temperature in the superheater and reheater senses all the boiler needs to be controlled.
- The superheater section of the boiler typically includes what is commonly known as primary and secondary superheaters. They mainly constitute two separate banks of boiler tubes used to heat the steam to the desired temperature. Once the steam passes through these sections it then proceeds to the high pressure turbine.
- Optimum efficiency and protection of the turbine are directly related to the temperature of the steam which must be properly controlled. Temperature control is usually achieved by providing an attemperator or a desuperheater which is typically located between primary and secondary desuperheater.

The desuperheater utilises water from a separate control valve and injects water in the steam thereby lowering the steam temperature. At the same time, it also reduces thermal efficiency as it takes away heat from the steam. The superheater outlet temperature via a feedback control loop controls the spray water quantity.

- For this application, pressure drop across the valve is low and many a times conventional valves are employed, however the rangeability requirement is quite large and conventional valves do have history of failures like wire drawing and seat leakage.

Capacity and capability

Particulars	Inlet	Outlet
Nominal width	DN 25 to 250/ 1" – 10"	DN 25 to 250/ 1" – 10"
Nominal pressure	PN 16 to 630/ ASME 150 to 4500#	PN 16 to 630/ ASME 150 to 4500#
Material	1.0460/A 105, 1.5415/A 182 F11, 1.7380/A 182 F22	
End Connection	Butt-weld and Flanged	
Characteristic Curve	Linear/ Equal Percentage/ Modified/ Characterised	
Seat	As per FCI 70-2 Class-V	
Trim	**Labyrinth disc stack/ Perforated Cage**	
Rangeability	1:10/ 1:25/ 1:40/ 1:50	
Actuator	**Pneumatic/ Hydraulic/ Electric**	
Opening/ Closing Time	**Less than 1 sec**	

**For higher & smaller sizes consult factory*
**For higher rangeability consult factory*

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HP Turbine Bypass Valve

Introduction:

- During start-up, shut-down and load disturbances in power plant, the boiler and steam turbine needs to be isolated from each other. This is required so as to not only protect the turbine from any water carryover but also additional plant equipment from large thermal transients.
- By isolating the boiler and turbine, it is also possible to reduce fuel consumption during start-up and shut-down. In the event of a load rejection, reloading times can also be improved for the turbine bypass system.
- The turbine bypass system is designed to accommodate the quickest start-up time by controlling both boiler pressure and temperature. Bypassing the steam around the turbine allows the steam to maintain the desired qualities before being routed through the turbine.
- In case the turbine bypass system is not used, the firing rate of the boiler would have to be reduced which may lead to tube failures and allows the boiler to be fired at full capacity without developing large thermal gradients in the thick walled components of the boiler drum, separators or flash tanks.

Functions:

- For safe operation of boiler with the turbine shut-off to quickly bring the unit into operation after a short trip (perform warm and hot start-up).
- To perform rapid and cost-effective start-up which would include cold start, warm start and hot start which would improve the life of critical components in boiler and turbine.
- To manage two shift operation.
- To avoid steam loss to the atmosphere and reduce the noise during start-up to the ambient conditions of the plant.

Applications:

- There are two basic different applications:

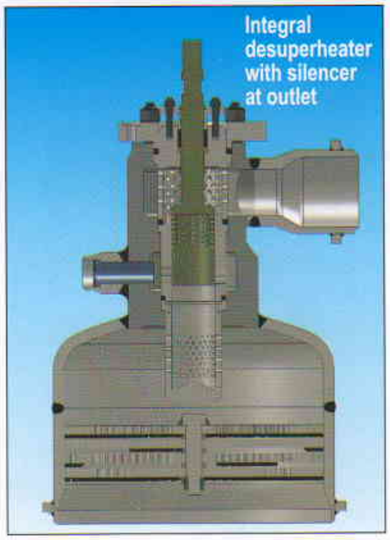
1. Bypass systems which are permanently or frequently in operation.
2. Bypass systems which are seldom in operation.

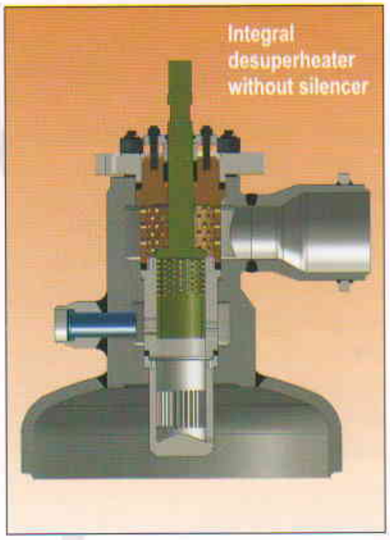
Requirements:

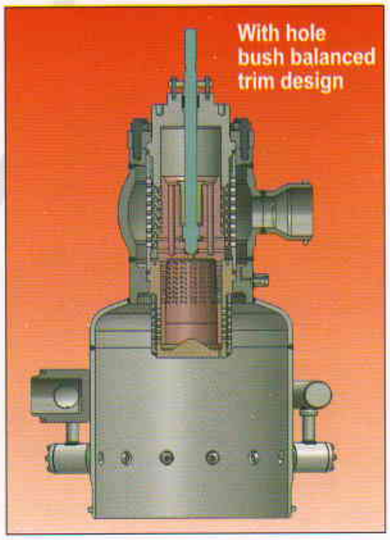
- Quick response for steam bypassing (< 1 sec.)
- Safe and quick desuperheating
- High controllability
- Safe function
- Long life time
- Low noise emission
- Maintenance effective design for short shut down times
- Safety function by spring (mechanical)
- Spare strokes by pressure accumulators
- Tight shut-off

Precise Control:

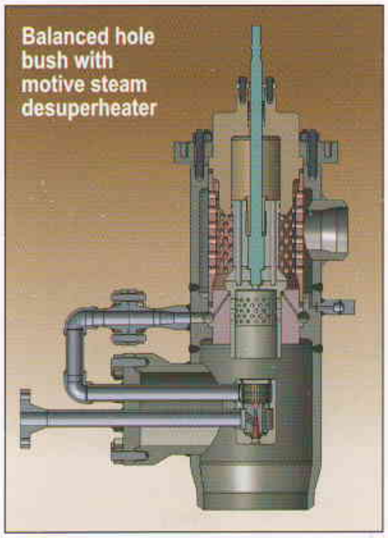
- BOMAFA's long history of almost a century has resulted in development of advanced technology actuation systems, which are one of the most reliable available in the industry today.
- Pneumatic and Hydraulic systems have been extensively installed all over the globe.
- Quick response time of less than 1 sec can also be achieved with

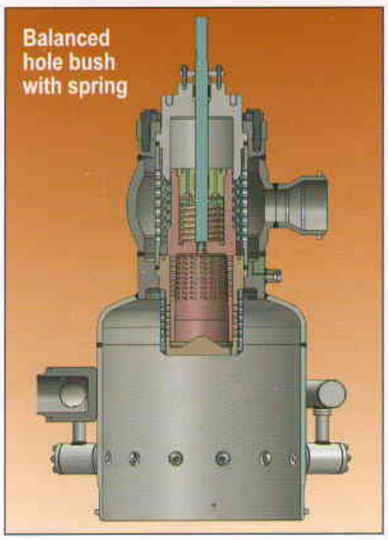


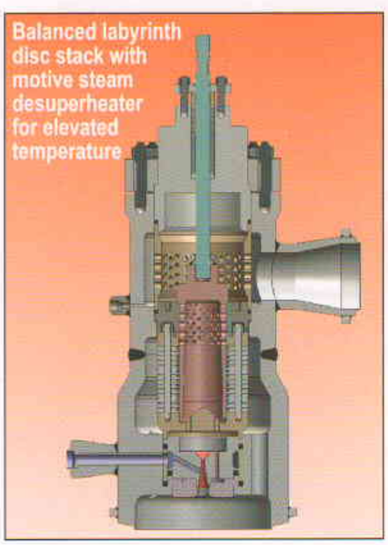




HP Turbine Bypass Valve







pneumatic systems and the selection of a particular actuator is more often than not a function of the valve designed for that particular application as well as customer's preference.

Pressure Reduction:

- BOMAFA has a wide range of characterised trim designs that handle large pressure drops across the valve.
- On one hand BOMAFA has trim designs which consists of spindle and hole bushes which forces the steam to change direction and flow through various holes. Between single stages, there exist chambers, which allow for the expansion of steam.
- On the other hand, BOMAFA has Labyrinth state-of-the-art disc stack design such that it provides optimum tortuous flow path. Each disc is designed so as to have a very specific predetermined value of trim exit velocity which would reduce erosion, cavitation, vibration and noise.

Desuperheating:

- BOMAFA has a wide range of options for injection of water. This would vary as follows:

Integrated Injection:

- Optimum for conditions with limited working.
- Highest steam velocity at optimum mixing.
- Water is completely mixed owing to high turbulence as the water passes through the pressure reduction steps.
- Accurate controllability.
- Most economic desuperheating.
- Quick evaporation and short distance required downstream of the valve.
- Protection of the piping from water droplets.

Separate Spray Nozzle:

- Desuperheating is being done after the pressure reduction.
- Internals of the valves are not susceptible to water droplets touching them.

Motive Steam :

- Desuperheating is being done after the pressure reduction.
- The ultimate design in terms of efficiency.
- High pressure motive steam leads to extremely high velocities at the point of water injection which shears off the water droplets instantaneously.
- Short distance for evaporation.
- Best design for accurate temperature control.
- Internals of the valves are not susceptible to water droplets touching them.
- Desuperheating close to saturation is possible.
- The design is unique such that the atomising steam is calculated to shear off the injected water for maximum condition. The atomising steam quantity is constant at all fluctuating load. In the event of reduction in the steam load, this atomising steam quantity remains constant. This results in improved atomisation at lower

HP Turbine Bypass Valve

loads since the same amount of atomising steam will be shearing off lesser quantity of injected water. As such this is the only design where the performance of the unit improves at lower loads as compared to higher load. This characteristic is unique and is the opposite of most other type of desupeheaters.

- In addition, the mixture that comes out of the atomising nozzle is further covered by a complete steam shield which ensures that the water droplets do not touch the hot boundary walls and therefore eliminates requirement of expensive Thermal Sleeve/ Liner in the downstream piping.

Reduced Noise Level:

- In today's industrial scenario, elimination of noise is very important. BOMAFA trim designs ensure that velocity of the fluid is controlled which leads to removal of noise, vibration and erosion.
- To ensure the optimum performance, BOMAFA can provide hole bush design or disc stack configuration which are tailor made to suit the requirements of each application for the customer.

Boost's Plant Output:

- It is a quite obvious fact that any leakage across the turbine bypass valve means loss in production and i.e. loss of revenue.
- Funds spent on generation of steam goes down the drain.
- Steam that leaks through the valve is not fed in the turbine whch results in non-generation of electricity and also no revenues for the plant.
- Steam leaking across the valve reduces the efficiency of the condensor since the condensor will not be able to maintain the vacuum and will also raise the condensor temperature.
- The leakage would very quickly damage and erode the seat which would only go on increasing over a period of time and will need mandatory maintenance downtime.
- The special BOMAFA seat design ensures that tight shut-off is maintained right from the start till the very end.

HP Bypass valve

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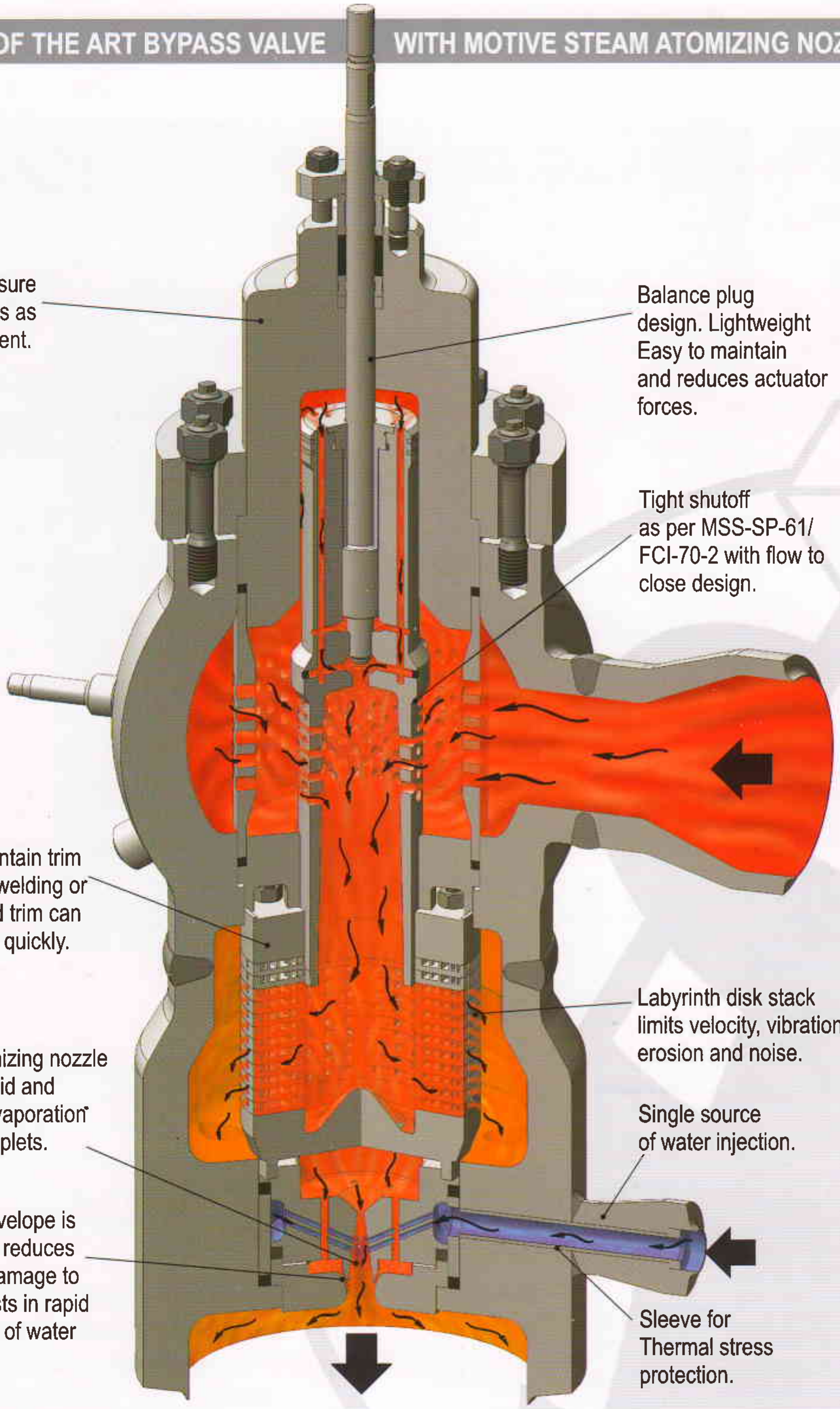
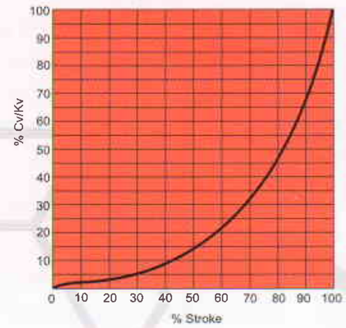
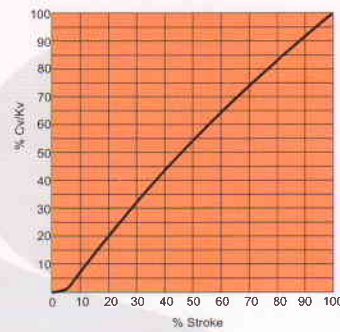
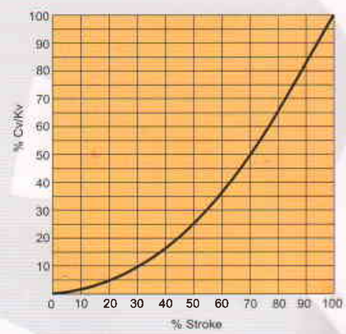
STATE OF THE ART BYPASS VALVE WITH MOTIVE STEAM ATOMIZING NOZZLE

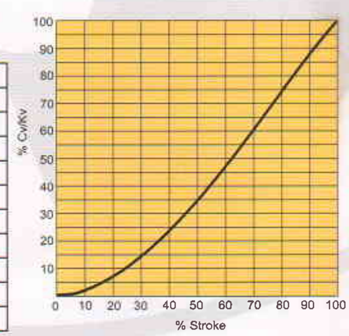


"VARIABLE OPTIONS AVAILABLE"









Capacity and capability

Particulars	Inlet	Outlet
Nominal width	DN 50 to 450/ 2" – 18"	DN 80 to 1400/ 3" – 56"
Nominal pressure	PN 16 to 630/ ASME 150 to 4500#	PN 16 to 630/ ASME 150 to 4500#
Material	1.0460/A 105, 1.5415/A 182 F11, 1.7380/A 182 F22,1.4903/A182F91	
End Connection	Butt-weld and Flanged	
Characteristic Curve	Linear/ Equal Percentage/ Modified/ Characterised	
Seat	As per FCI 70-2 Class-V	
Trim	Labyrinth disc stack/ Perforated Cage/Additional Cylinders & Plates	
Rangeability	1:10/ 1:25/ 1:40/ 1:50/1:100	
Actuator	Pneumatic/ Hydraulic/ Electric	
Opening/ Closing Time	Less than 1 sec	

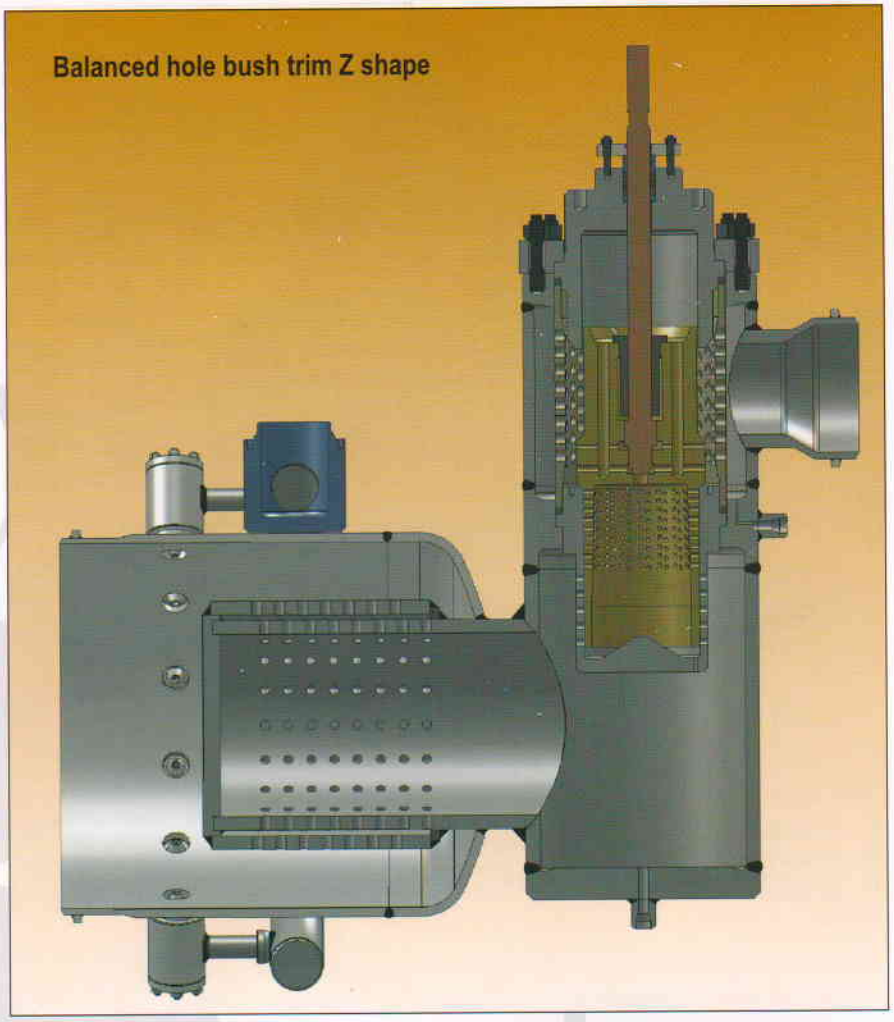
**For higher & smaller sizes consult factory*
**For higher rangeability consult factory*

BOMAFA®
Special Valve Solutions

LP Turbine Bypass Valve

Introduction:

- During start-up, shut-down and load disturbances in power plant, the boiler and steam turbine needs to be isolated from each other. This is required so as to not only protect the turbine from any water carryover but also additional plant equipment from large thermal transients.
- By isolating the boiler and turbine, it is also possible to reduce fuel consumption during start-up and shut-down. In the event of a load rejection, reloading times can also be improved for the turbine bypass system.
- The turbine bypass system is designed to accommodate the quickest start-up time by controlling both boiler pressure and temperature. Bypassing the steam around the turbine allows the steam to maintain the desired qualities before being routed through the turbine.
- In case the turbine bypass system is not used, the firing rate of the boiler would have to be reduced which may lead to tube failures and allows the boiler to be fired at full capacity without developing large thermal gradients in the thick walled components of the boiler drum, separators or flash tanks.
- In conventional units and combined cycle power plant, without hot reheat the low pressure bypass valve should be able to pass the entire mass flow in the case of an upset condition.
- Also the temperature of the steam should be reduced to almost saturated condition to reduce the size of the condenser and prevent thermal fatigue due to high temperatures.
- One of the main concerns is the noise generated when the pressure is let down from low pressure to the condenser, which is under vacuum and it can lead to vibration that can damage the downstream equipment.
- Another concern is the temperature , which can vary between 400-600°C and has to be dropped down to almost saturated condition at the valve outlet so as to facilitate heat transfer in the condenser as well as to protect the condenser from thermal fatigue.



Functions:

- For safe operation of boiler with the turbine shut-off to quickly bring the unit into operation after a short trip (perform warm and hot start-up).
- To perform rapid and cost-effective start-up which would include cold start, warm start and hot start which would improve the life of critical components in boiler and turbine.
- To manage two shift operation.
- To avoid steam loss to the atmosphere and reduce the noise during start-up to the ambient conditions of the plant.

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Special Valve Solutions

LP Turbine Bypass Valve

Applications:

- There are two basic different applications:
  1. Bypass systems which are permanently or frequently in operation.
  2. Bypass systems which are seldom in operation.

Requirements:

- Quick response for steam bypassing (< 1 sec.)
- Safe and quick desuperheating
- High controllability
- Safe function
- Long life time
- Low noise emission
- Maintenance effective design for short shut down times
- Safety function by spring (mechanical)
- Spare strokes by pressure accumulators
- Tight shut-off

Precise Control:

- BOMAFA's long history of almost a century has resulted in development of advanced technology actuation systems, which are one of the most reliable available in the industry today.
- Pneumatic and Hydraulic systems have been extensively installed all over the globe.
- Quick response time of less than 1 sec can also be achieved with pneumatic systems and the selection of a particular actuator is more often than not a function of the valve designed for that particular application as well as customer's preference.

IP Bypass valve

Pressure Reduction:

- BOMAFA has a wide range of characterised trim designs that handle large pressure drops across the valve.
- On one hand BOMAFA has trim designs which consists of spindle and hole bushes which forces the steam to change direction and flow through various holes. Between single stages, there exist chambers, which allow for the expansion of steam.
- On the other hand, BOMAFA has Labyrinth state-of-the-art disc stack design such that it provides optimum tortuous flow path. Each disc is designed so as to have a very specific predetermined value of trim exit velocity which would reduce erosion, cavitation, vibration and noise.

Desuperheating:

- BOMAFA has a wide range of options for injection of water. This would vary as follows:

LP Turbine Bypass Valve

Integrated Injection:

- Optimum for conditions with limited working.
- Highest steam velocity at optimum mixing.
- Water is completely mixed owing to high turbulence as the water passes through the pressure reduction steps.
- Accurate controllability.
- Most economic desuperheating.
- Quick evaporation and short distance required downstream of the valve.
- Protection of the piping from water droplets.

Separate Spray Nozzle:

- Desuperheating is being done after the pressure reduction.
- Internals of the valves are not susceptible to water droplets touching them.

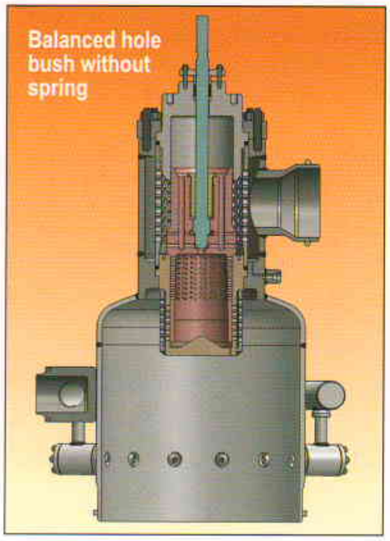
Motive Steam :

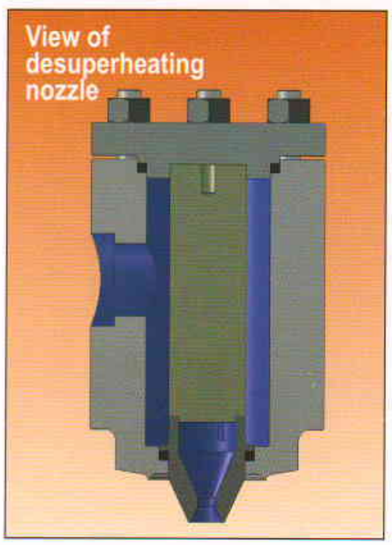
- Desuperheating is being done after the pressure reduction.
- The ultimate design in terms of efficiency.
- High pressure motive steam leads to extremely high velocities at the point of water injection which shears off the water droplets instantaneously.
- Short distance for evaporation.
- Best design for accurate temperature control.
- Internals of the valves are not susceptible to water droplets touching them.
- Desuperheating close to saturation is possible.
- The design is unique such that the atomising steam is calculated to shear off the injected water for maximum condition. Theatomising steam quantity is constant at all fluctuating load. In the event of reduction in the steam load, this atomising steam quantity remains constant. This results in improved atomisation at lower loads since the same amount of atomising steam wil be shearing off lesser quantity of injected water. As such this is the only design where the performance of the unit improves at lower loads as compared to higher load. This characteristic is unique and is the opposite of most other type of desupeheaters.
- In addition, the mixture that comes out of the atomising nozzle is further covered by a complete steam shield which ensures that the water droplets do not touch the hot boundary walls and therefore eliminates requirement of expensive Thermal Sleeve/ Liner in the downstream piping.

Spring loaded desuperheating :

- Spring loaded water injecting nozzles are deployed at the valve outlet which optimises water injection over wide fluctuating flow rate.
- The design is such that the flow area varies as the water flow changes so as to assist in forming extremely fine water droplet size required for

LP Turbine Bypass Valve





instantaneous atomisation.

- This design provides the smallest water particle size and would not be limited in terms of spray water flow requirement.
- Nozzles are normally circumferentially mounted on the steam pipe force so as to achieve an egalitarian, full and free distribution of spray water droplets.
- The design of the spray nozzles ensure that it has a pre-determined pressure drop which is adequate for efficient atomization and is available constantly for spray water injection, which ensures that the spray water droplets do not fall out even at low spray water requirement.

Reduced Noise Level:

- In today's industrial scenario, elimination of noise is very important. BOMAFA trim designs ensure that velocity of the fluid is controlled which leads to removal of noise, vibration and erosion.
- To ensure the optimum performance, BOMAFA can provide hole bush design or disc stack configuration which are tailor made to suit the requirements of each application for the customer.
- Normally for LP bypass valves, hole bush design with cage is selected. The main flow of the steam is isolated into fine jets through this cage and primarily the noize frequency is determined based on the size of the hole.
- This technology is ideally suited for LP bypass applications and the holes are specifically designed so as to ensure that there is adequate spacing between each hole and allows the jets to regroup and form larger jets when they exit the cage thus reducing the noise level to the specified requirement.

Boost's Plant Output:

- It is a quite obvious fact that any leakage across the turbine bypass valve means loss in production and i.e. loss of revenue.
- Funds spent on generation of steam goes down the drain.
- Steam that leaks through the valve is not fed in the turbine whch results in non-generation of electricity and also no revenues for the plant.
- Steam leaking across the valve reduces the efficiency of the condensor since the condensor will not be able to maintain the vacuum and will also raise the condensor temperature.
- The leakage would very quickly damage and erode the seat which would only go on increasing over a period of time and will need mandatory maintenance downtime.
- The special BOMAFA seat design ensures that tight shut-off is maintained right from the start till the very end.

BOMAFA®
Special Valve Solutions

Dump Tube

Introduction:

- These devices are kept at the downstream of the HP bypass valve or Steam Conditioning Valve and are used for dumping the steam in the condenser.
- Each dump tube is a characterised dump tube and is built for a particular application.
- Dump Tubes help in interfacing the pipe size between the bypass valve and the condenser. It also helps in reducing the outlet of the steam conditioning or bypass valve size as it creates a back pressure thereby making the whole system cost-effective.

Application & Function:

- A dump tube is coupled together with a Steam Conditioning Valve or a Bypass Valve where the application is to dump the steam in the condenser.
- This would facilitate reducing the outlet size of the bypass valve since the specific volume of the steam is comparatively lower as compared to sub-atmospheric conditions.
- The dump tube is a fixed nozzle (orifice) design so as to reduce the pressure down to the pressure of the condenser.
- Based on the installation, the holes are arranged such that for installation in a condenser the holes are arranged in two 90° sections, which does not allow the steam to impinge in the tube of the condenser.
- For dump tubes which are installed in the turbine exhaust, there is no restriction in the arrangement of holes and they are selected along the complete diameter i.e. 360°.
- It is important that dump tubes are installed such that they do not interfere with the steam turbine outlet steam flow path during normal turbine operations.

BOMAFA®

Contact us

An ISO 9001:2008 and OHSAS 18001:2007 certified company

Germany Address:

Bomafa Armaturen GmbH
Hohensteinstr. 52
44866 Bochum
Germany:
Tel: +49 (0)23 27 9 92-0
Fax: +49 (0)23 27 3 14-43
E-Mail: info@bomafa.de
Website: www.bomafa.de