MIL Controls Limited
AKSB Company

CONTROL VALVES FOR POWER PLANTS

Application Handbook

MAJOR SYSTEMS

VALVE SELECTION

MATERIAL SELECTION

INSTALLATION & MAINTENANCE

VALVES FOR POWER PLANTS

MIL Controls Limited. The Machining Shop, a part of the world class manufacturing facility at Meladoor near Cochin in Kerala.

ABOUT THIS HANDBOOK

For the past 15 years, **MIL Controls Limited** has been one of the premier suppliers of high speciality Control valves for the Indian Power Plant sector. Over these years our engineers have gained enormous experience in all aspects of valve design, selection and maintenance.

The MIL Power Plant Application Handbook tries to translate this experience into a readily accessible reference tool, the need for which has long been expressed by many of our clients and associates. the handbook thus encapsulates MIL's continuing focus on the power sector.

At a second level, The MIL Power Plant Application Handbook, also serves as a mini catalogue for MIL's wide range of products. It offers specific data on Valve Selection and Operational Characteristics.

REFERENCE DOCUMENT: **ISA HANDBOOK** FOR CONTROL VALVES.

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MIL Controls Limited. The factory premises at Meladoor near Cochin in Kerala

Ever since its inception in 1983, MIL has been unrivalled as a supplier of high performance Control Valves to the Indian power sector.

The company, which stamped its class in it's very first set of major project supplies to the 210 MW Neyveli TPS (Unit III&IV), the 210 MW MSEB Chandrapur TPS (Stage II), the 210 MW GEB Wanakbori TPS (Stage II) and the 120 MW NALCO CPP (all 5 units) way back in 1984-85, has gone on to excel in the design and manufacture of custom-built special application Control Valves to meet the challenging process control requirements in thermal power stations.

In May 2000, MIL achieved another milestone when it unveiled the MATRIX Series extreme pressure, multistage, multi path axial flow Control Valves. A product of months of specialised R&D, the MATRIX Series valves have been designed to kill upto 420 Kg/cm^2 pressure in 40 stages. This ingenious and unique design has a progressively declining resistance flow path and is designed to eliminate Cavitation and limit Velocity in any severe service condition.

In December 2001, MIL had it's crown of glory when it became the first Indian company to be accredited with the coveted **CE** marking (refer page 71) for Control Valves, mandatory for exports to the European Union beyond May 2002. The first lot of MIL valves with **CE** marking is being installed in high pressure steam / Feed Water service in a power plant at Salvimona, Finland being built by M/s Foster Wheeler.

Today MIL is the preferred vendor in the country for the rugged, critical application Control Valves for thermal power stations, be it a 33 MW captive power plant or a 250/500 MW utility power plant.

With a comprehensive product range, world-class manufacturing and testing facilities, and a highly skilled work force, we are today fully geared to meet any critical process control requirements in the power plant sector.

POWER PLANT APPLICATIONS

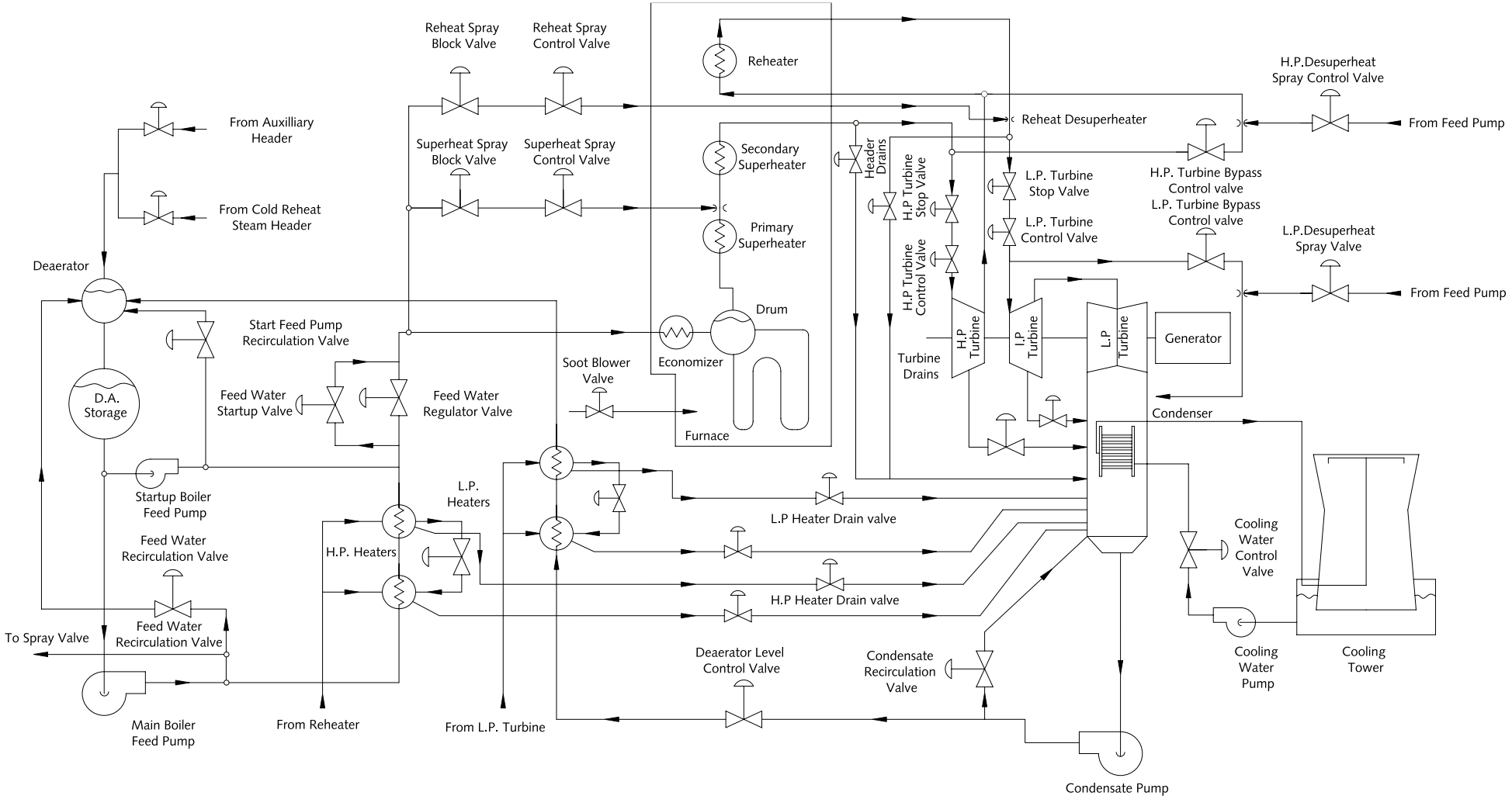
Factorsdetermining selectionofValves.

Extraordinarydemandsareplacedon ControlValves usedintheEnergySector.Theiroperationalparameters vary widelyin termsofpressure,pressuredrops,flow ratesandtemperature.

Inaddition,othercrucialfactorslikeNoise,Cavitation, Wiredrawing,LeakageClassandFlashingalsoplayan important partintheselectionofControlValvesfor powerstationapplications.

1. HIGH TEMPERATURE
2. HIGH PRESSURE
3. HIGH PRESSURE DROP
4. COMBINED HIGH TEMPERATURE, PRESSURE & PRESSURE DROP
5. CONTINUOUS THROTTLING
6. TIGHT SHUT OFF CAPABILITIES
7. AERODYNAMIC NOISE
8. HIGH RANGEABILITY
9. CAVITATION AND FLASHING

FIG. 1. GENERAL BOILER (DRUM STYLE) FLOW DIAGRAM



Power plant applications

4 major systems, their characteristics and valves used in such applications.

The 4 major systems and critical valves .

1. CONDENSATE SYSTEM

Condensate Pump Minimum Recirculation Valve

Deaerator Level Control Valve

2. FEED WATER SYSTEM

Boiler Feed Pump Minimum Recirculation Valve.

Boiler Feed Water Startup Valve.

Boiler Main Feed Water Control Valve.

3. MAIN STEAM SYSTEM

Superheater Attemperator Spray Valve

Reheater Attemperator Spray Valve.

Turbine Bypass Valves.

Deaerator Pegging Steam Valves.

Soot Blower Steam Pressure Reducing Valves.

PRDS System valves

4. HEATER DRAIN SYSTEM

High pressure heater drain valves.

Low pressure heater drain valves.

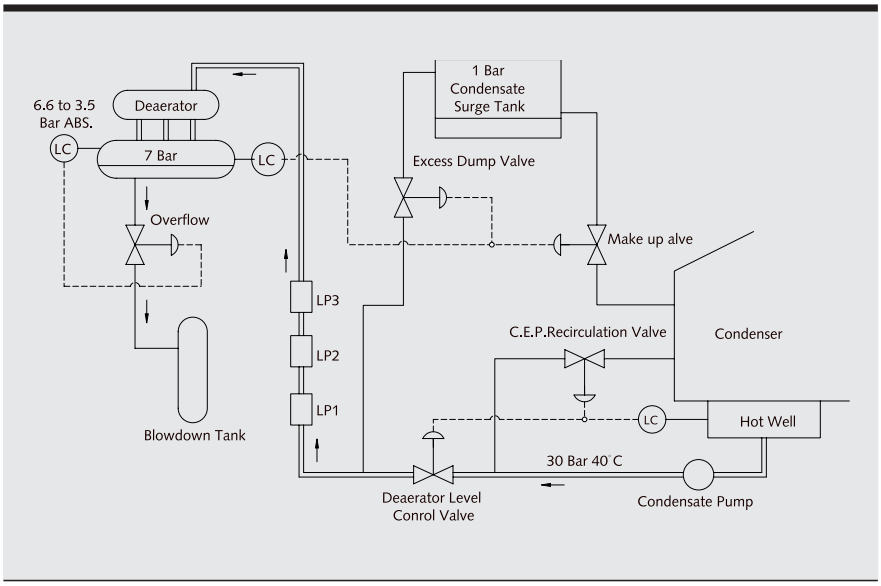


Fig. 2. Condensate System.

Condensate system

The Condensate system consists of the Feed Water Circuit starting from the Condenser Hotwell to the Deaerator. The Condenser is a form of heat exchanger that condenses the exhaust steam of the Turbine.

The exhaust steam of the Turbine which is very low in pressure and temperature passes on its heat to the cooling water, is condensed and collects in the hotwell. The low pressure steam which is very high in volume creates a vacuum when it is condensed into water. The vacuum in the Condenser increases the Thermodynamic efficiency of the cycle. The most critical valves which have a bearing on the smooth operation of the plant are Condensate Extraction Pump Minimum Recirculation Valve and Deaerator Level Control Valve.

Condensate Recirculation Valve

The Condensate Pump extracts the Feed Water from the Condensate Hotwell and discharges to the Deaerator.

The Condensate Pump must have a minimum Recirculation or Flow to avoid overheating of the pump and protect it from Cavitation. The Condensate Recirculation Valve recirculates water from the pump back to the Condenser to ensure minimum Recirculation of the pump. The Condensate Recirculation Valve has to absorb the full pressure drop ie., from pump discharge pressure to the Condenser pressure. Due to very near saturated conditions existing in the downstream side of the valve and relatively higher pressure drops, the valve is subject to Cavitation and Flashing.

Control Valves for this application should also have good shut off capability to eliminate seat damage during shut off conditions. Any leakage should be taken into account as a form of lost energy.

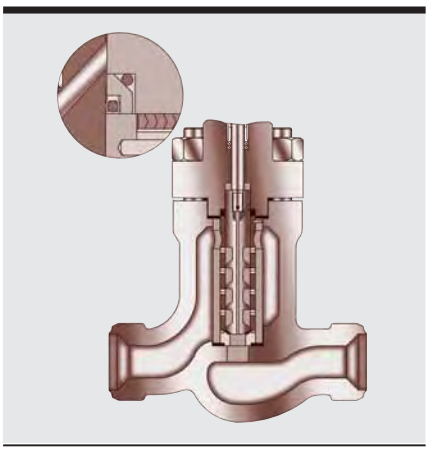


Fig. 3. MIL 78000 Series. Condensate Minimum Recirculation Valve.

TYPICAL PARAMETERS
Inlet Pressure: 40-45 bar(a)
Outlet Pressure: 0.1 bar(a)
Temperature: 40-50°C

The typical valves for such applications have anti Cavitation features which eliminate any possibility of Cavitation by dropping pressure over stages.

Also material selection should be very discrete in such applications taking into account of highly Erosive Cavitating conditions. Use of 17-4PH and 440C Martensitic Steel have yielded excellent results.

The typical valves for such applications are 3" or 4" 78000 Series Multi Step / Multi Stage design or 41008 Series MultiCage/Multistage design.

Deaerator Level Control Valve.

The apparently mild service conditions mislead many Control Valve manufacturers in the design of valves for this service.

The function of this Control Valve is to maintain correct levels in the Deaerator.

The Deaerator is an open contact type Feed Water Heater which purges any non condensable and dissolved gases. Also the Deaerator acts as a reservoir for Feed Water to smoothen the Feed Water supply at varying loads.

The Feed Water level in the Deaerator also helps in maintaining the Net Positive Suction Head (NPSH) of the Boiler Feed Water Pump. The DALCV has to cater to the widely varying flow demand from start up conditions to full load conditions.

Valve selection and design should be based on the following factors:

During the start up the pump discharge pressure will be high owing to low flow requirements. Deaerator pressure during the start up of the plant will be low.

These factors result in the valve working at very low Cvs and the associated low lift operations.

Also the relatively higher pressure drops in these conditons can lead to occurance of Cavitation.

When the pump picks up load, the flow rate increases and the pump discharge pressure goes down. At the same time, the back pressure in the Deaerator increases. This obviously warrants a higher flow capacity.

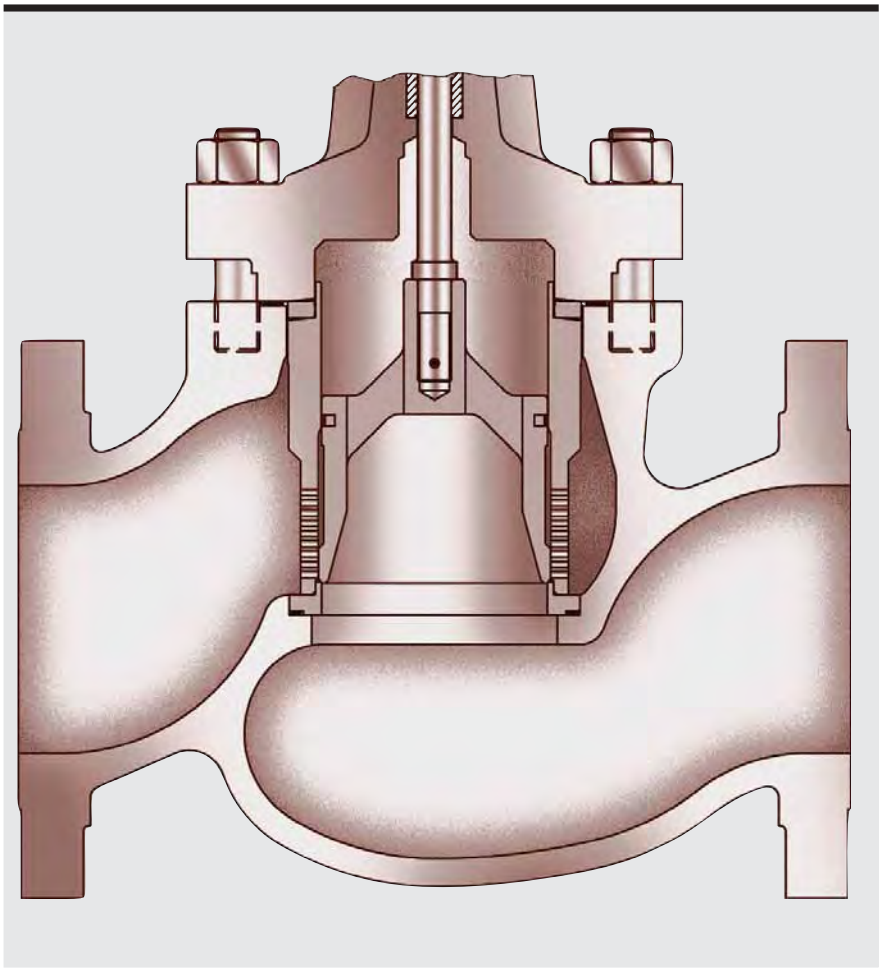


Fig. 4. MIL 41000. Deaerator level Control Valve.

Such extreme conditions call for valves with exceptionally high Rangeability, besides Cavitation protection at lower flow conditions.

Typical designs for such applications are the MIL 41921 or the MIL 41621 Series which incorporate an equal percentage characterized Trim which takes care of the high Rangeability.

The basic design is a Cage Guided Plug with the Cage having characterized ports.

TYPICAL PARAMETERS
Inlet Pressure: 20-42 bar (a)
Pressure drop: 7-42 bar (a)
Temperature: 50-100ºC

The Cage design combines small sized, drilled, anti Cavitation holes in the lower portion, and larger holes at higher lifts.

This design gives the necessary Cavitation protection at lower lifts and higher flow capacity at higher lifts ensuring very wide Rangeability.

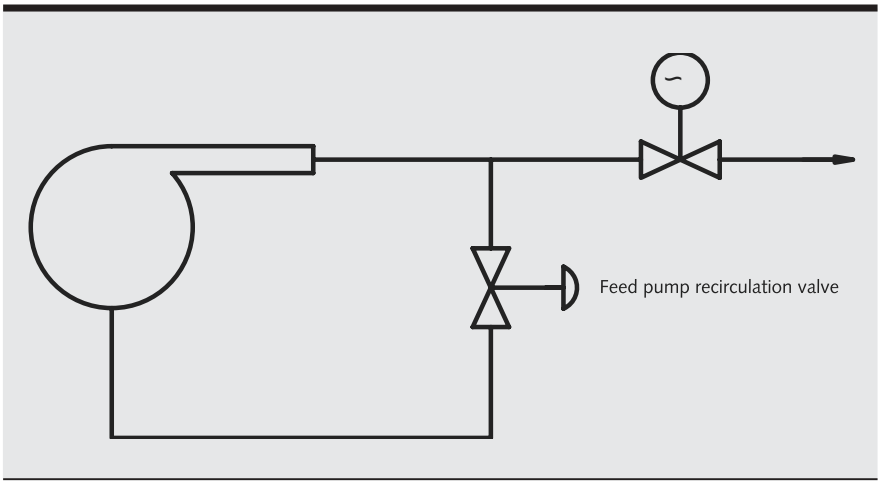


Fig. 5. Boiler Feed Pump Minimum Recirculation System.

Feed Water system

The Feed Water system includes those parts of the system from Deaerator to the Boiler inlet.

The system consists of Feed Water piping, Feed Water pumps, high pressure heaters and the associated accessories.

The Feed Water pressure is raised to the Boiler pressure and the temperature is also raised to near saturation conditions by the high pressure heaters and Economisers.

The critical Control Valve applications in this system are Boiler Feed Pump Minimum Recirculation Valve, Boiler Feed Water Startup Valve & Boiler Main Feed Water Control Valve.

Boiler Feed Pump Minimum Recirculation Valve.

The most critical application in a Power Station is the Boiler Feed Pump Minimum Recirculation Service. A pump should have a minimum Flow through it to take care of the cooling requirements of the Pump.

Hence even if the Feed Water requirements are very low (due to low load conditions) the pump should handle a minimum flow.

To ensure this minimum flow, a certain amount of Flow has to be recirculated back to the Deaerator as the Flow requirements of the Boiler may not be sufficient to satisfy the minimum Recirculation requirements of the pump.

The parameters are obviously very detrimental for any valve to handle. The valve has to drop a pressure of 220-250 bar to 10 bar (Deaerator pressure). Also it may be noted that the outlet conditions of the valve are near saturation, and hence the valve is very susceptible to high energy Cavitation and Flashing.

TYPICAL PARAMETERS
Inlet Pressure: 220-250 bar (a)
Outlet Pressure: 10-12 bar (a)
Temperature: 200°C

3 methods of providing Feed Pump Recirculation.

1. The Modulating Type System employs a Modulating Valve which throttles the Flow to the minimum required which is a function of the Flow required by the Boiler.

Suppose the required minimum Recirculation of the pump is 100 tons/hr, and the Boiler requirement is 90 tons/hr, the minimum Recirculation valve will open so that it passes 10 tons/hr and the minimum Recirculation condition is satisfied (90 tons/hr through the main line and 10 tons/hr through the bypass line. Total flow through the pump will be 100 tons/hr ie., 90 + 10).

2. The On/Off System employs an On-Off valve which passes a constant Recirculation Flow. Suppose the required minimum Recirculation of the pump is 100 tons/hr, and the Boiler requirement is 90 tons/hr, the Minimum Recirculation Valve will fully open so that it passes 100 tons/hr so that the minimum Recirculation condition is satisfied. Once the Boiler requirement goes above 100 tons/hr the Recirculation Valve closes fully since the Boiler requirement is sufficient to satisfy the minimum Recirculation requirements of the pump.

3. A third method employed by older power plants, recirculates a constant flow, regardless of the plant load. The pressure is killed by Series of multi hole plates.

Of the above methods the ideal system would be the Modulating System, since it is the most energy efficient. However it exerts taxing demands on Control Valve functioning.

Valve are subjected to high pressure drop throttling of very low flows to full flow conditions.

The high pressure drop throttling at low lift conditions adversely affect Trim durability due to wire drawing effects and Trim Erosion.

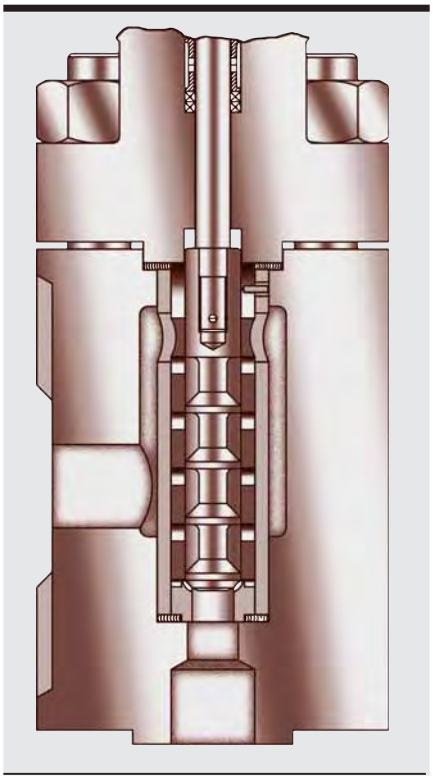


Fig. 6. MIL 78000. Boiler feed pump minimum Recirculation valve.

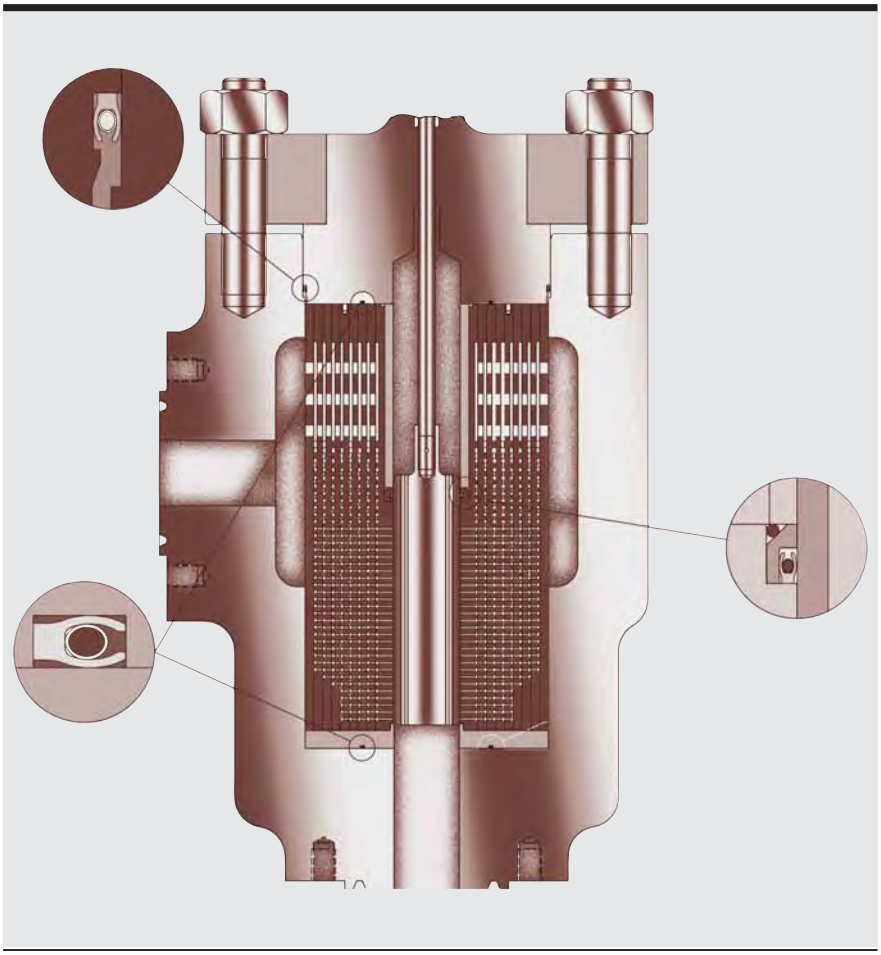


Fig. 7. MIL 91000. Multi stage multi path, axial flow MATRIX Series valve for Boiler feed pump minimum Recirculation service

In this context, the most cost effective solution is obviously the On-Off system.

The typical valve for such application is the MIL 78000 Series which incorporates a unique Multi Step, Multi Stage design which kills pressure over a number of stages.

The 78000 Series ensures a metal to metal Class V leakage.

Another salient feature is the unique Sliding Collar Seat Ring design for Class VI leakage shut off.

MIL's continuous research and innovations in Power Plant application valves has borne fruit in the successful development of the Axial Flow, Multi Stage, Variable Resistance design, the MATRIX Series Valve which is suitable for a Modulating System.

The prototype was developed for a Pump Recirculation application with pressure drops of 420 bar. The salient feature of this design is the wide scope for customizing the valve to suit specific process applications.

The Trim can be customized to various high pressure drop applications by varying the number of stages.

The characteristic can be customized by reallocating the pressure drop ratio in different stages. The expanding flow passages also enhance the Rangeability allowing smooth and precise Flow Control even at low lift operating flow conditions.

Feed Water Regulator Valve

Another critical application in the Feed Water System is the Boiler Feed Water Regulating Valve which controls flow to the Boiler for varying loads of the system.

The valve takes the signal from the Feed Water Control which employs a three-element control. The signal is generated as a function of Drum level, Steam flow and Feed Water flow.

Two kinds of valves are used for Feed Water regulation.

One valve is employed during the low load conditions or the startup conditions of the Boiler.

Another valve is used during full load conditions. Apparently the applications may seem similar.

However the selection philosophy and design are entirely different for the two valves. This is because of the different pressure drop conditions existing at the time of Startup and Full Load.

The typical parameters of Low Load Feed Water Control Valve and Full Load Feed Water Control Valve are given below.

LOW LOAD FEED WATER VALVE

TYPICAL PARAMETERS
Inlet Pressure: 170-200 bar (a)
Outlet Pressure: 30-110 bar (a)
Temperature: 230°C

FULL LOAD FEED WATER VALVE

TYPICAL PARAMETERS
Inlet Pressure: 220-250 bar (a)
Outlet Pressure: 210-230 bar (a)
Temperature: 247°C

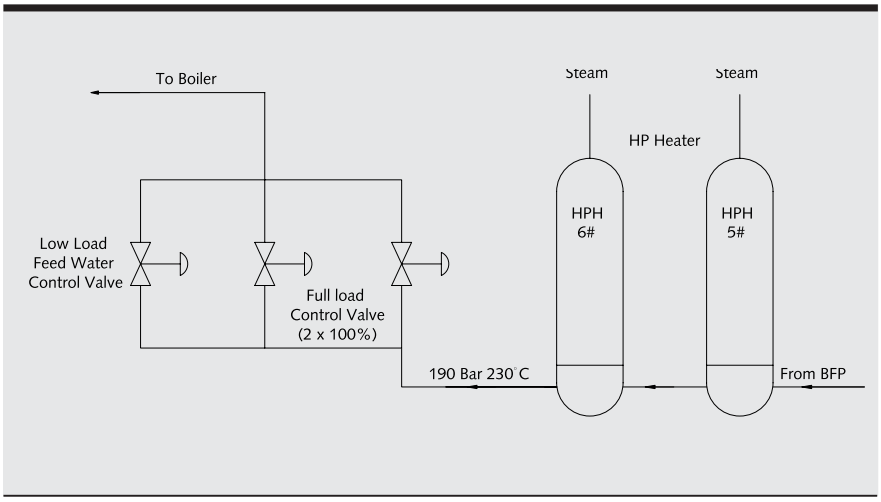


Fig. 8. Feed Water Regulating System.

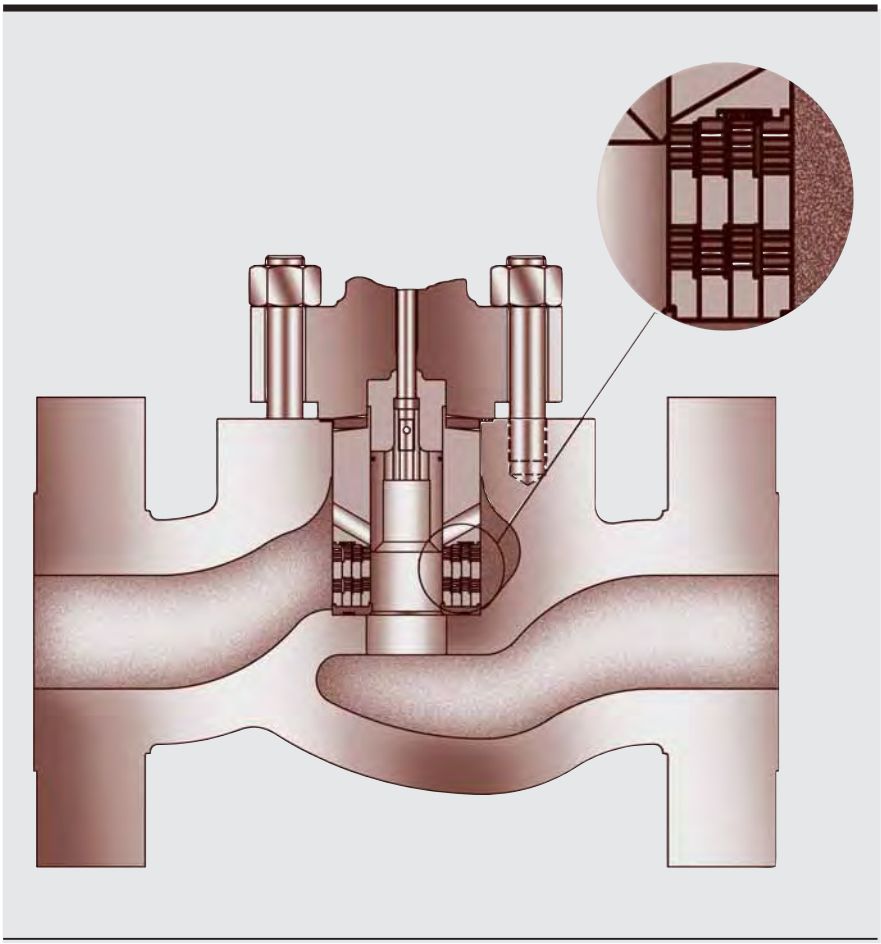


Fig. 9. MIL 41008. Multistage, Low Load, Feed Water regulating valve.

The typical design for low load and full load applications is the MIL 41000 Series Valves which employ Heavy Duty Cage Guided features.

The Cage Guided design ensures good Throttling Stability and good Rangeability to cater to widely varying flow conditions.

Where the pressure drop during start-up condition is very high, which can be detrimental in conventional valves, 41008 Series Multi Cage design finds its typical application for the low load valve.

This design which features a Multi Stage Pressure Drop Trim, will take care of the very high pressure drops encountered during start-up conditions where the drum pressure is very low and the pump discharge pressure is very high.

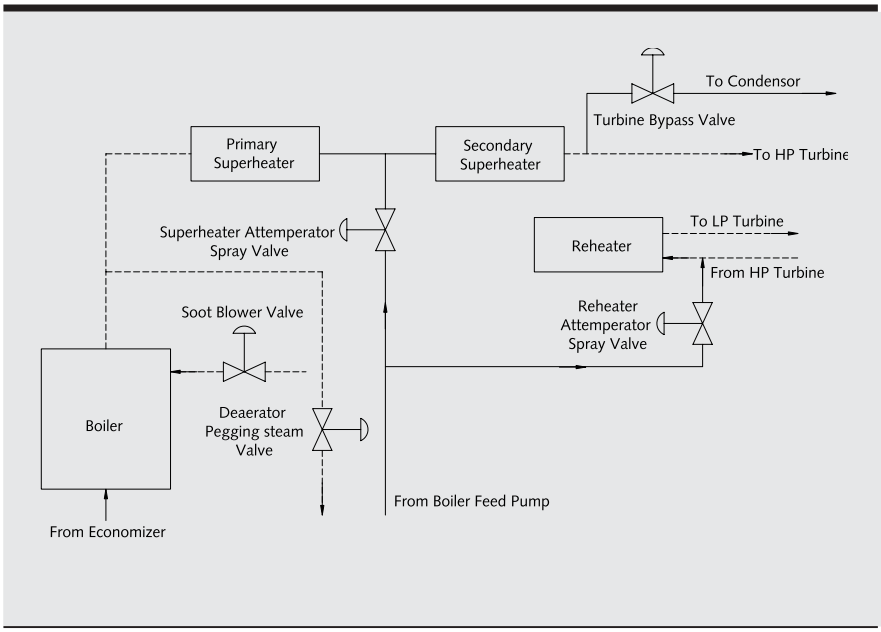


Fig. 10. Critical Control Valves in Main Steam Line

Main Steam System

The Main Steam System consists of the steam circuit from the Boiler outlet, Superheater System, Soot Blowing system, Turbines, Reheater System to Condenser. The steam fully extracted of the energy is finally dumped into the Condenser, which is the heat sink.

The most critical application valves in this system are: Superheater Spray Control Valves, Superheater Spray Block Valves, Reheater Spray Control Valves, Reheater Spray Block Valves, Soot Blower Pressure Control Valves, PRDS System Control Valves, Main Steam Pressure Reducing Valves, PRDS Spray Control Valves and Deaerator Pegging Steam Valve.

Super Heater Attemperator Valve

The temperature of the main steam coming out of the Boiler is very critical from the point of Thermodynamic Efficiency of the heat cycle and the Turbine blade protection.

Boiler manufacturer employ various methods like burner tilt mechanism, spray water systems etc. to control the temperature of the Main Steam. A poor temperature control system may result in damages to Turbine blades, Superheater tubes, Reheater tubes etc.

Hence Attemperator valves are of critical relevance

The typical problems faced by super heater spray Control Valves are throttling instability and wide Rangeability.

The design parameters of the spray system include those conditions which account for the excessive heating of the Turbine at full load, with the Feed Water at its maximum temperature, clean Boiler tubes and most favourable conditions.

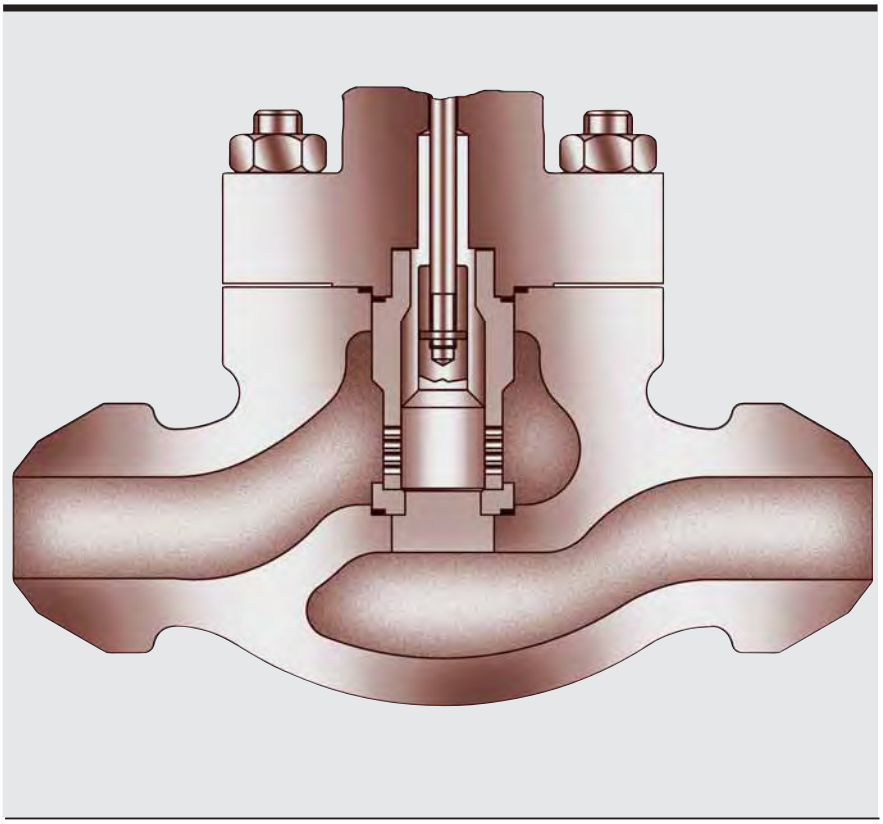


Fig. 11. MIL 41100. Superheater Attemperator valve.

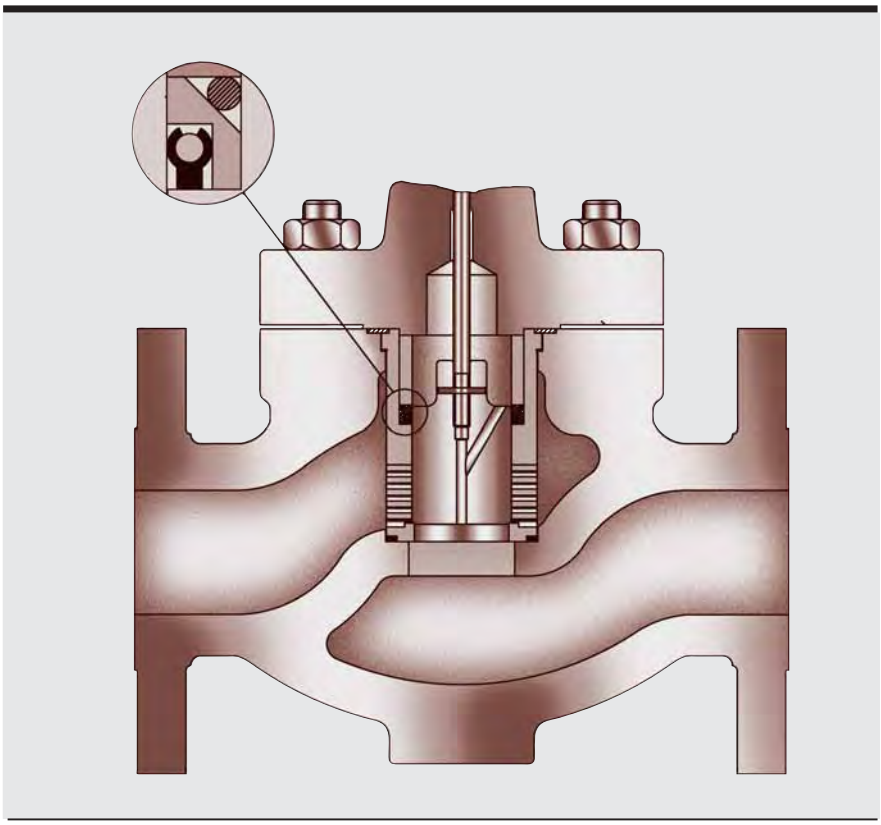


Fig. 12. MIL 41200. Superheater Attemperator valve.

However the above conditions seldom come into play due to deterioration of Boiler tubes due to Scale build up and the consequent heat transfer loss.

Also the situation is further compounded by withdrawal of heat through the Soot Blower. All these factors result in a drastic reduction of spray water requirements.

Hence in practice the Spray Water Valve will be seldom taken into full capacity. The valve will be working at lower lift conditions due to above said reasons.

Another critical factor influencing the selection of Control Valve is the Leakage Class.

Any excessive leakage will result in thermal shocks in Secondary Superheater Tubes and erosion of Turbine blades.

MIL offers special designs like the 41100 Series and the 41200 Series for such applications.

The 41100 Series features an unbalanced Cage Guided design. This combines the twin benefits of the good throttling stability of Cage Guided valves with the shut off capability of single seated unbalanced designs.

TYPICAL PARAMETERS
Inlet Pressure: 181-200 bar (a)
Outlet Pressure: 161-180 bar (a)
Temperature: 247°C

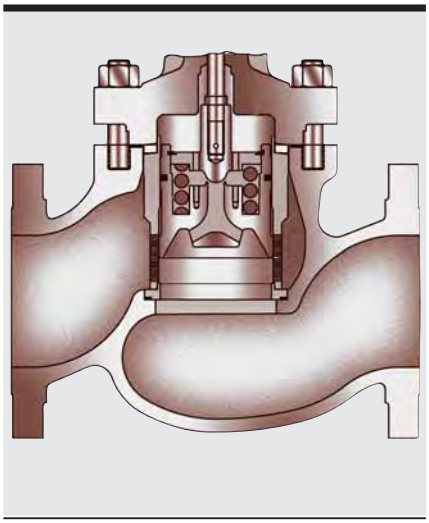


Fig. 13. MIL 41400. Superheater Attemperator block valve.

For higher sizes (2" and above) the Actuator thrust requirements will be very high due to the unbalanced design of the 41100 Series design.

The 41200 features a balanced design with a novel Static Seal concept. The 41200 design has the same advantages that the 41100 Series besides the added feature of a balanced plug.

Another application of Spray System is the block valve.

The block valves assists the spray Control Valves effecting a tight shut off. Another requirement of a block valve is faster response. Hence the Spray System employs a pneumatically operated On Off Control Valve for this application.

The typical MIL designs for block valve applications are the 41400 Series and the 41200 Series. The 41400 design is a Cage Guided design where the main plug is assisted by an auxiliary pilot plug to effect tight shut off.

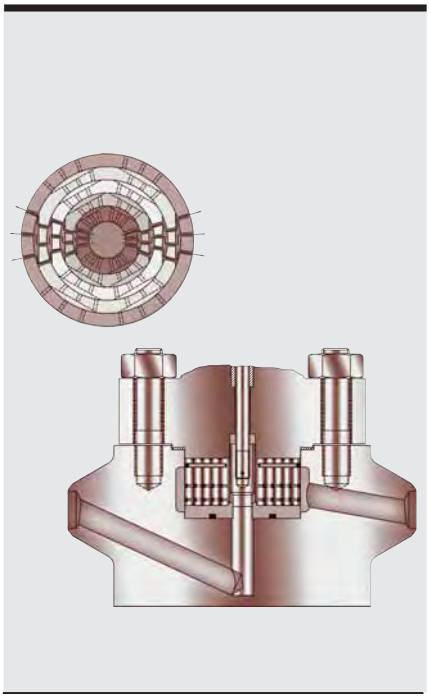


Fig. 14. MIL 78000. Reheater Attemperator Control Valve.

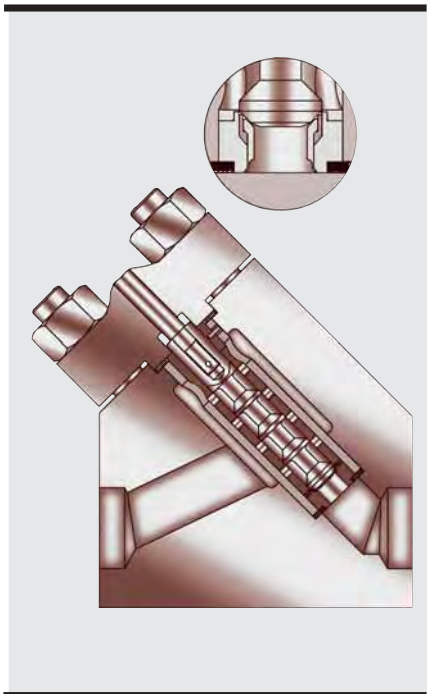


Fig. 15. MIL 41008. Reheater Attemperator Control Valve.

Reheater Attemperator Valves

This application is also similar to the Superheater Spray Control Valve application.

However fluctuations in temperature is not varying as in Superheater Spray Control.

The Leakage Class is very critical since excessive leakage can lead to Erosion of low pressure Turbine blades.

The valve selection depends on the pressure drop across the valve. It may be noted here that reheater pressure is the outlet pressure of the high pressure Turbine. The pressure drop across the valve depends on the source of the spray water.

The source of the Spray Water can either be the Feed Water pump outlet or the interstage tapping of the pump.

In case of the former, the pressure drop can be as high as 100-120 bar, and latter, it can be upto 60-70 bar.

The MIL solution to such applications are the 78000 Series or the 41128 Series for high pressure drops (100-120 bar). In the case of moderate pressure drops, it is the 41121 Series or the 41221 Series.

The Reheater Spray Block Valve application is similar to Superheater Spray Block applications, and the selection philosophy is similar to that for Superheater Spray Block service.

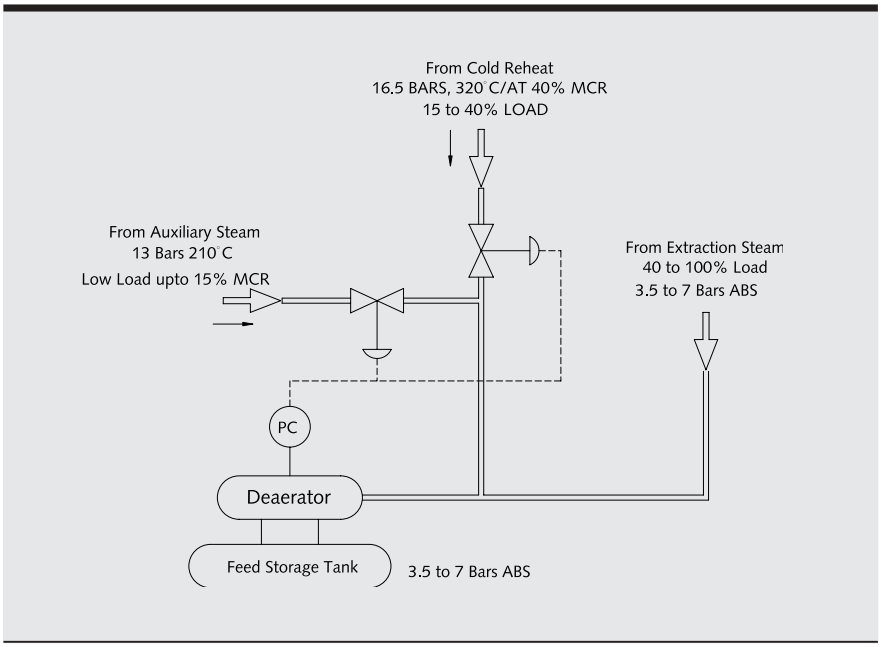


Fig. 16. Deaerator Pegging Steam System.

Deaerator Pegging Steam Valve

The Deaerator is a direct contact type heater which removes non condensable gases like Oxygen and Carbon dioxide from the Feed Water. These gases, if not expelled, will attack and corrode piping and Boiler tubes. The hot steam is mixed with the Feed Water entering the Deaerator bringing it to saturation temperature and thereby liberating any undissolved or non condensable gases.

Steam is supplied to the Deaerator for deaeration of Feed Water and also to maintain a positive pressure in the Deaearator. Deaerator acts as a Feed Water storage tank to the Boiler Feed Pump. Maintaining a higher pressure in the Deaerator helps in maintaining the NPSH of the pump.

Normally the steam is taken from the Auxiliary Steam Header upto 15% MCR condition. Above this and upto 40% MCR, the steam is taken from the Cold Reheat Header (Steam tapped after the High Pressure Turbine). In full load conditions, steam is taken directly from the Turbine extraction line.

Typical valves in this system are:

1. DEAERATOR PEGGING FROM AUXILLIARY STEAM HEADER

TYPICAL PARAMETERS
Inlet Pressure: 16 bar (a)
Outlet Pressure: 3.5 bar (a)
Temperature: 220°C

2. DEAERATOR PEGGING FROM COLD REHEAT STEAM HEADER

TYPICAL PARAMETERS
Inlet Pressure: 21 bar (a)
Outlet Pressure: 3.6 bar (a)
Temperature: 330°C

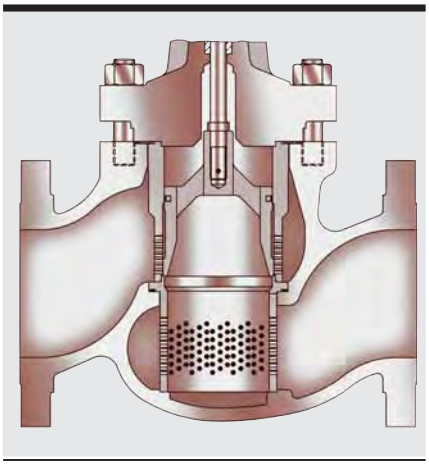


Fig. 17. MIL 41003. Deaerator pegging steam Control Valve

The problems encountered in valve selection for such applications are the high noise levels associated with this valve. MIL offers special low noise Trims (Lo-dB Design) for such applications. The 41000 Series Cage Guided valves with special Low Noise Trim have been found excellent for such services. Additional noise attenuation can be achieved with double stage pressure drop designs such as double Cage or diffuser options in the 41000 Series.

Another problem associated with this service is high exit velocities due to volumetric expansion of the steam when the pressure drops. MIL offers special low noise cartridges which divide the pressure drop between the valve and the cartridges.

The effective pressure drop ratio across the valve is reduced which results in low exit velocities and noise levels.

Soot Blower Valve

The effectiveness of the heat transfer through Boiler tubes is adversely affected by the build up of soot. Also the rapid build up of soot in the tubes can lead to the development of hot spots in the Boiler tubes. The Boiler tubes should be frequently cleaned to remove the soot. The normal practice is to use high velocity steam jets to blow the soot from the tubes. The soot removal is effected through Soot Blowers. Some Soot Blowers use air also for the removal of soot.

One of the major challenges here is to select and design a Control Valve for the Steam Soot Blowers.

The problems unique to this service are High pressure drop, High noise levels and Thermal cycling of the valve body and valve internals.

Soot blowing valves are normally isolated by an upstream isolation valve. Hence the valve is not subjected to high pressure and temperature when not in service. However when the Soot Blowing is being done, the valve is subjected to very high pressures and temperatures.

TYPICAL PARAMETERS
Inlet Pressure - 170 bar (a)
Outlet Pressure - 20 bar (a)
Temperature - 540°C

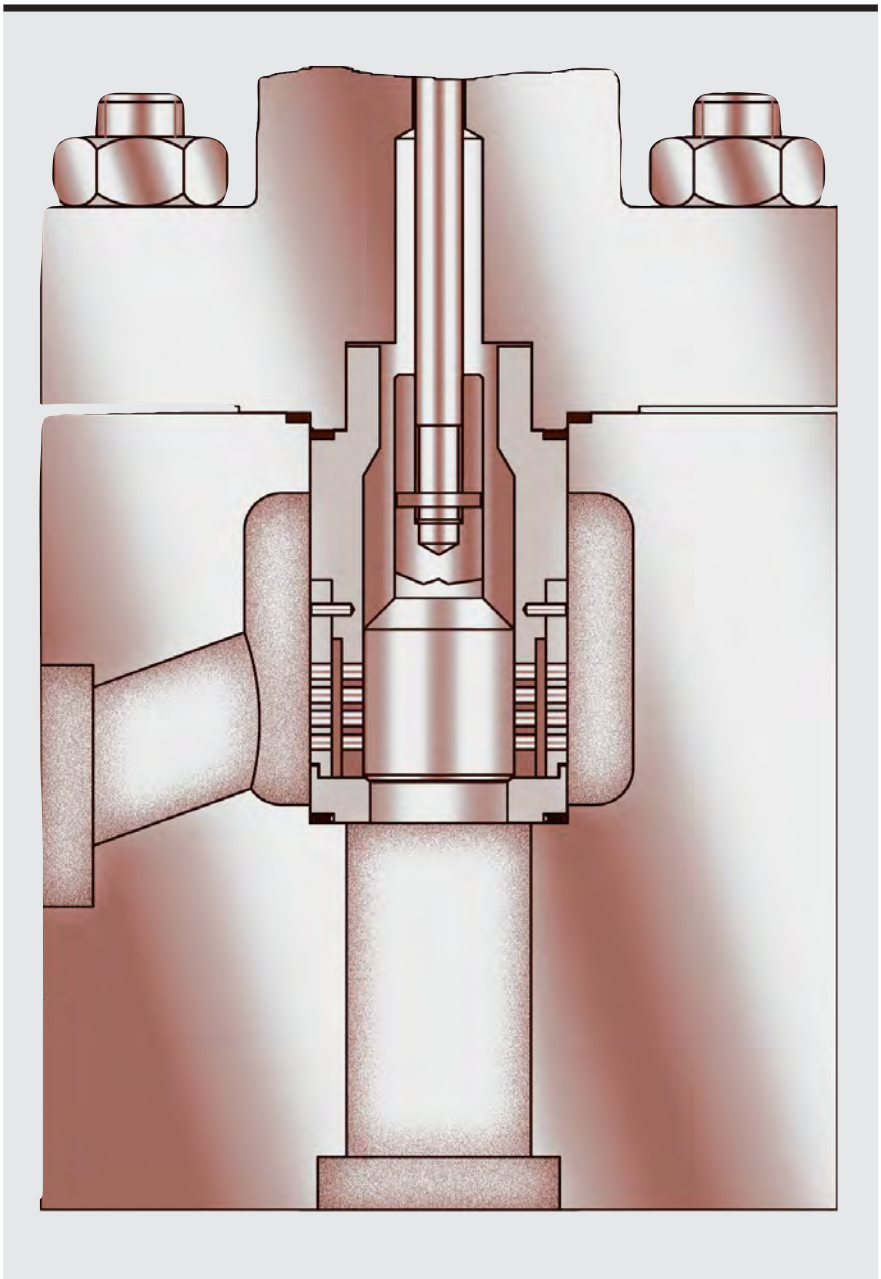


Fig. 18. MIL 71114. Soot blower pressure reducing Control Valve

Hence the valve is subjected to thermal cycling which can cause Warpage and Creep in the conventional cast globe valve bodies.

The obvious solution would be to use forged angle bodies or forged inline bodies with special multi stage low noise Trims.

Here MIL offers it's 41114 Series (Cage Guided inline body with double stage pressure drop), or it's 71114 Series (Cage Guided angle body with double stage pressure drop). The body shall be forged design and chrome molybdenum steel (ASTM A 182 Gr. F22)

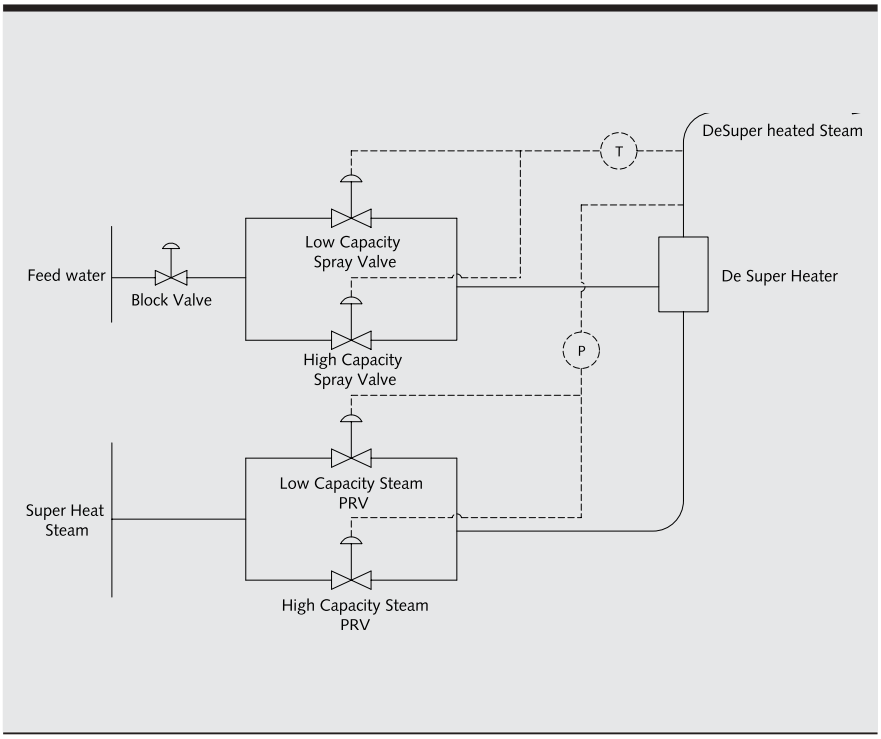


Fig. 19. Typical Auxiliary PRDS System

PRDS Station Valves.

Apart from steam being used for power generation and soot blowing, steam is used for other auxiliary services like gland sealing of Turbines, Steam Ejectors in Condensers and Deaerator pegging.

The main steam has to be Desuperheated by reducing its pressure and temperature to utilise the steam for the above mentioned applications.

The steam Desuperheating is effected through PRDS stations – Pressure Reducing Desuperheating System.

The PRDS system consists of a Desuperheater pressure reducing valve and a temperature Control Valve. The pressure reducing valve reduces the pressure of the steam before entry into the Desuperheater.

The temperature Control Valve regulates the spray water quantity into the Desuperheater.

MAIN STEAM PRESSURE REDUCING VALVE

TYPICAL PARAMETERS
Inlet Pressure - 170 bar (a)
Outlet Pressure - 16 bar (a)
Temperature - 540°C

TEMPERATURE CONTROL VALVE (SPRAY WATER)

TYPICAL PARAMETERS
Inlet Pressure - 185 bar (a)
Outlet Pressure - 16 bar (a)
Temperature - 170°C

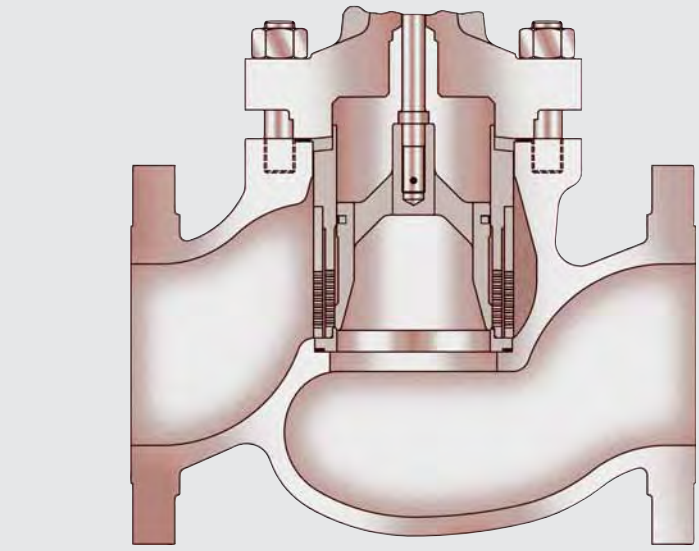


Fig. 20. MIL 41914 Main Steam Pressure Reducing Valve.

The critical factors that govern selection of Main Steam PRV are: High pressure drop, High temperature, High noise levels and Material selection for high temperature.

MIL offers the 41912 Series or the 41914 Series for this application. This design features a Cage Guided Trim with special Low Noise multiple holes controlling the flow. Optional double stage design is also available which is very effective in noise attenuation at higher pressure drop ratios.

For Class V leakage, the 41413 Series is the appropriate selection. The 41413 Series design is a Cage Guided design where the main plug is assisted by an auxiliary pilot plug to effect the tight shut off.

The Cage design includes multiple holes to attenuate the noise. The flow direction of the valve is Over the Plug.

A seat ring - basket diffuser is provided for effective noise attenuation at higher pressure drop ratios.

The temperature Control Valve is another critical valve coming in the system. As in the case of Reheater Spray Control Valve, the selection of this valve is also governed by the source of the Spray Water. The source of the Spray Water can either be from Feed Water Pump outlet or inter stage tapping of the pump.

In the case of the former, the pressure drop can be as high as 100-120 bar, and in the latter case, it can be up to 60-70 bar.

The MIL solution to such applications are the 78000 Series or the 41128 Series for high pressure drops (100-120 bar).

In the case of moderate pressure drops the design shall be the 41121 Series or the 41221 Series.

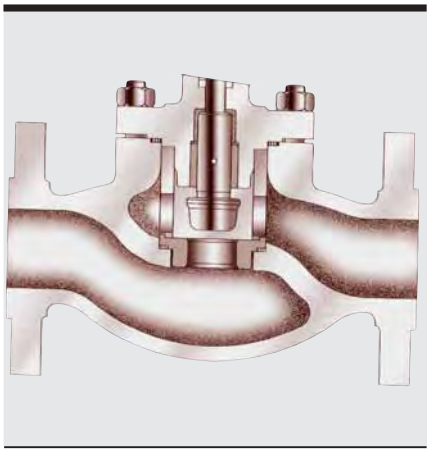


Fig. 21. MIL 21000. Heater Drain Valve

The Heater Drain System

The heater drain system consists of the Feed Water heaters coming in the Condensate system and Feed Water system. The Feed Water heaters coming in the Condensate system are called low pressure heaters which heats the Condensate to saturation point before entry into Deaerator.

The heaters coming in the Feed Water system are the High pressure heaters which heat the Feed Water to near saturation point before the entry into Boiler.

The HP heaters and LP heaters are basically heat exchangers – shell and tube type. The heating media for HP heaters is the steam extracted from the reheat cycle, whereas for LP heaters the steam is extracted from the low pressure Turbine.

The heating media, i.e., the steam is introduced into the heaters, cooled and ultimately condensed back to liquid. The level in the heaters are to be closely controlled to maintain the Thermodynamic efficiency of the system. The Condensate in the heaters are at saturation condition, and when the Condensate is drained to either Deaerator or the Condensate flash tank, the fluid losses pressure and flashes.

The critical factors that influence the selection of the valves are: Body and Trim material, Valve size and Valve flow capacity

Flashing problems encountered in these services cause material erosion.

The liquid droplets accelerated by relatively high velocity vapour phase, impinges on the material surface of body and Trim causing heavy wear.

Generally Chrome Molybdenum steels have exhibited excellent resistance to Flashing Erosion.

Even though ASTM A 217 Gr C5 is recommended by some users, it is being increasingly replaced by ASTM A 217 Gr WC9 material as C5 has some significant manufacturing problems, in addition to poor weldability, and is thus difficult to weld repair.

Another issue is the selection of valve body size. It is always recommended to select higher body sizes with a reduced capacity Trim.

The body size selection criteria is the outlet Flashing velocity.

MIL offers it's 21000 Series and the 4100 Series Valves for these applications. The body material is either WC6 or WC9.

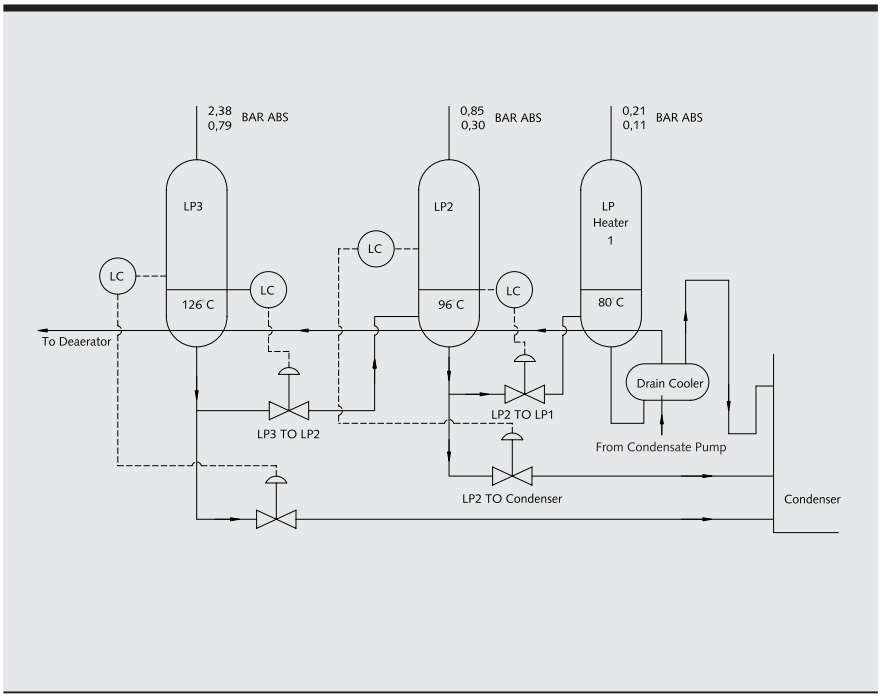


Fig. 22. LP Heaters System

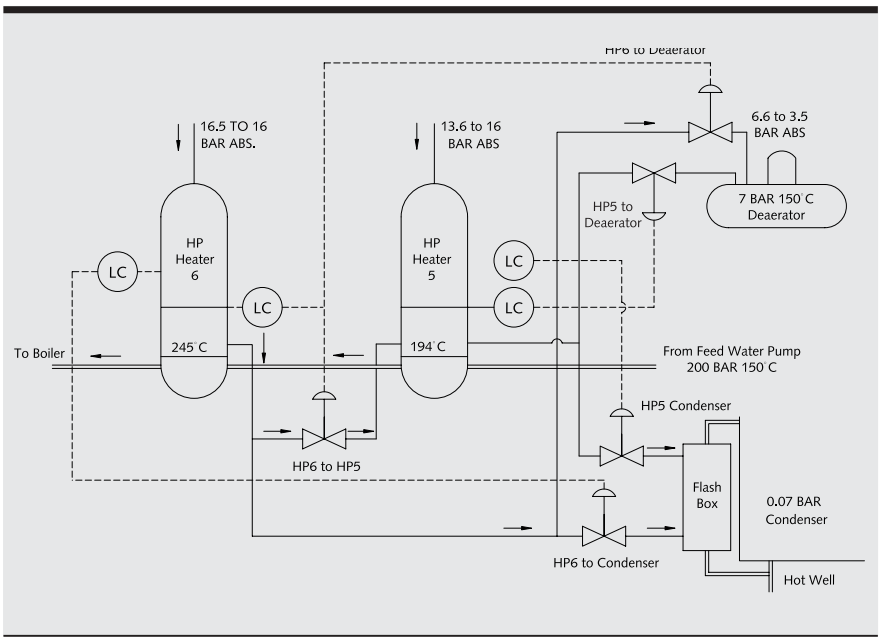


Fig. 23. HP Heaters System

Typical Installations

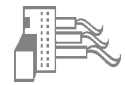
Choosing the right valve makes all the difference

Capacity **67.5 MW**

FEEDWATER CONTROL VALVES			Project: TISCO 1X67.5MW						Customer: BHEL Madras	
No.	Tag	Service	Model	Size	Rating*	Body	Cv	Pr.	Temp.	Qty.
1	FW-5	LOW LOAD FEED WATER FLOW CONTROL	38-78101	3 in.	1500	F11	15	170 kg/cm^2	235^{0}C	1
2	FW-2	FULL LOAD FEED WATER FLOW CONTROL	38-41921	6x3 in.	1500	WC6	140	170 kg/cm^2	235^{0}C	1
3	FW-8	FULL LOAD FEED WATER FLOW CONTROL (BY-PASS)	90-41921	6x3 in.	1500	WC6	140	170 kg/cm^2	235^{0}C	1
SPRAY & SOOT BLOWER VALVES			Project: TISCO 1X67.5MW						Customer: BHEL Trichy	
No.	Tag	Service	Model	Size	Rating*	Body	Cv	Pr.	Temp.	Qty.
1	SD-5.SD-6	SH SPRAY CONTROL	38-41024	2 in.	1500	WCC	8	185 kg/cm^2	250^{0}C	4
2	SD-23	SH SPRAY BLOCK	38-414X1	2 in.	1500	WCC	40	185 kg/cm^2	250^{0}C	2
3	SD-7	INTERMITTENT BLOWDOWN VALVE	38-78001	2 in.	1500	A105	4	110 kg/cm^2	350^{0}C	2
4	S57. S69	SH SPRAY BYPASS VALVES	90-41024	2.5 in.	1500	WCC	20	186 kg/cm^2	242^{0}C	4
5	SB4	SOOT BLOWER STEAM PR.REDUCING VALVE	38-70571	2 in.	2500	F11	6	173 kg/cm^2	413^{0}C	2
6	SD-8	SOOT BLOWER STEAM PR.REDUCING VALVE	38-70571	2 in.	2500	F22	10	110 kg/cm^2	420^{0}C	4
PRDS VALVES			Project: TISCO 1X67.5MW						Customer:BHEL Madras	
No.	Tag	Service	Model	Size	Rating*	Body	Cv	Pr.	Temp.	Qty.
1	AS-9	HIGH CAPACITY STEAM PRESSURE REDUCING	38-41912	6x3 in.	1500	WC9	120	100 kg/cm^2	520^{0}C	1
2	AS-3	LOW CAPACITY STEAM PRESSURE REDUCING	38-41412	2 in.	1500	WC9	12	100 kg/cm^2	520^{0}C	1
3	BV-01	COMMON BLOCK VALVE FOR PRDS SPRAY	37-211X4	2 in.	1500	WCC	15	185 kg/cm^2	175^{0}C	1
4	SW-10	HIGH CAPACITY SPRAY WATER CONTROL VALVE	38-78101	1.5 in.	1500	A105	1.2	185 kg/cm^2	150^{0}C	1
5	SW-4	LOW CAPACITY SPRAY WATER CONTROL VALVE	38-78101	1 in.	1500	A105	0.3	185 kg/cm^2	150^{0}C	1

* ANSI

4.2 Typical applications. 116 MW



Capacity **116 MW**

FEED CONTROL VALVES			Project: Ahemedabad Electricity Company.					Customer: BHEL Bangalore		
No.	Tag	Service	Model	Size	Rating*	Body	Cv	Pr.	Temp.	Qty.
1	CV-5.6	FEED REGULATING VALVE IN HP BFP DISCH.LINE	38-41621	2 in.	300	WCC	26	15 kg/cm^2	121^{o}C	2
2	CV-7.8	FEED REGULATING VALVE IN HP BFP DISCH.LINE (FULL LOAD)	37-41612	3 in.	900	WC6	95	115 kg/cm^2	121^{o}C	2
3	CV-9.10	FEED REGULATING VALVE IN HP BFP DISCH.LINE (LOW LOAD)	38-78001	2 in.	900	A105	4	115 kg/cm^2	120^{o}C	2
SPRAY VALVES			Project: Ahemedabad Electricity Company.					Customer: BHEL Bangalore		
No.	Tag	Service	Model	Size	Rating*	Body	Cv	Pr.	Temp.	Qty.
1	CV-11.12	HP STEAM BYPASS VALVES	38-41412	6 in.	1500	WC6	145	70 kg/cm^2	480^{o}C	2
2	CV-13.14	HP BYPASS SPRAY VALVES	37-211X5	2 in.	600	WCC	46	13 kg/cm^2	50^{o}C	2
3	CV-15.16	LP STEAM BYPASS VALVES	38-41421	8 in.	150	WCC	640	7 kg/cm^2	147^{o}C	2
4	CV-17.1	LP BYPASS SPRAY VALVES	38-211X5	1 in.	600	WCC	3.8	13 kg/cm^2	50^{o}C	2
PRDS VALVES			Project: Ahemedabad Electricity Company.					Customer: BHEL Bangalore		
No.	Tag	Service	Model	Size	Rating*	Body	Cv	Pr.	Temp.	Qty.
1	CV-23	PRDS PR. REDUCING VALVE IN HP STEAM LINE TO AUX.HDR.	38-41412	2 in.	1500	WC6	30	70 kg/cm^2	480^{o}C	1
2	CV-24	PRDS SPRAY CONTROL VALVE	38-78003	1 in.	900	A105	0.3	119 kg/cm^2	121^{o}C	1

* ANSI

Capacity **116 MW**

FEED PUMP RECIRCULATION VALVES			Project: Ahemedabad Electricity Company.					Customer: BHEL Bangalore		
No.	Tag	Service	Model	Size	Rating*	Body	Cv	Pr.	Temp.	Qty.
1	CV-25.26.27	RECIRCULATION VALVE FOR HP BFP	37-78003	1.5 in.	900	A105	4.5	115 kg/cm^2	122°C	3
2	CV-28.29.30	RECIRCULATION VALVE FOR LP BFP	37-211X5	1in.	600	WCC	3.8	18 kg/cm^2	122°C	3

HEATER DRAIN VALVES & CONDENSATE SYSTEM VALVES			Project: Ahemedabad Electricity Company.					Customer: BHEL Bangalore		
No.	Tag	Service	Model	Size	Rating*	Body	Cv	Pr.	Temp.	Qty.
1	CV-1	MAIN CONDENSATE CONTROL VALVE	38-41621	6 in.	300	WCC	360	13 kg/cm^2	48°C	1
2	CV-2	MIN. FLOW RECIRCULATION CONTROL VALVE	37-41612	2 in.	300	WCC	25	13 kg/cm^2	48°C	1
3	CV-3	EXCESS RETURN CONTROL VALVE	37-41621	2 in.	300	WCC	65	13 kg/cm^2	48°C	1
4	CV-4	DEAERATOR OVERFLOW TO DM STORAGE TANK	38-414X1	3 in.	150	WCC	155	7 kg/cm^2	120°C	1
5	CV-19	PRESSURE REDUCING VALVE TO DEAERATOR	38-41621	3 in.	150	WCC	95	7 kg/cm^2	147°C	1
6	CV-20	PRESSURE REDUCING VALVE TO DEAERATOR	38-41621	8 in.	150	WCC	500	7 kg/cm^2	147°C	1
7	CV-21.22	PREHEATER INLET CONTROL VALVE	37-41621	4 in.	300	WCC	225	13 kg/cm^2	118°C	2
8	CV-31	NORMAL MAKE-UP VALVE	37-21125	1 in.	600	CF8M	6	10 kg/cm^2	40°C	1
9	CV-32	DUMP MAKE-UP VALVE	38-21125	2 in.	600	CF8M	46	10 kg/cm^2	40°C	1

* ANSI

4.3 Typical applications. 210 MW

Capacity **210MW**

FEED CONTROL VALVES			Project : Raichur TPS Unit IV							Customer: BHEL Madras
No.	Tag	Service	Model	Size	Rating*	Body	Cv	Pr.	Temp.	Qty.
1	FW-FCV-1	FULL LOAD FEED WATER FLOW CONTROL (MAIN&BYPASS)	38-41921	12x8 in.	2500	WC6	575	286 kg/cm²	250°C	2
2	FW-FCV-2	LOW LOAD FEED WATER FLOW CONTROL	38-41412	6x4 in.	2500	WC6	45	285 kg/cm²	250°C	1
SPRAY & SOOT BLOWER VALVES			Project : Unchahar TPS 2x210 MW							Customer:BHEL Trichy
No.	Tag	Service	Model	Size	Rating*	Body	Cv	Pr.	Temp.	Qty.
1	SD-4	SH STAGE I BLOCK	38-410X4	6x4 in.	2500	WCC	195	265 kg/cm²	260°C	2
2	SD-5.6.7.8	SH STAGE I CONTROL	38-41024	2.5 in.	2500	WCC	30	265 kg/cm²	260°C	8
3	SD-9	SH STAGE II BLOCK	38-410X4	2.5 in.	2500	WCC	60	265 kg/cm²	260°C	2
4	SD-10.11.12.13	SH STAGE II CONTROL	38-41024	1.5 in.	2500	WCC	3.8	265 kg/cm²	260°C	8
5	SD-14	RH BLOCK COMMON	38-410X4	2.5 in.	2500	WCC	60	265 kg/cm²	260°C	2
6	SD-15.16.17.18	RH BLOCK BRANCH	38-410X4	1.5 in.	2500	WCC	40	265 kg/cm²	260°C	8
7	SD-19.20.21.22	RH CONTROL	38-78103	1.5 in.	2500	A105	3.6	265 kg/cm²	260°C	8
8	PCV-8502A.B	SOOT BLOWER STEAM PR.REDUCING VALVE	38-41012	2 in.	2500	F11	25	185 kg/cm²	440°C	4
PRDS VALVES			Project : Raichur TPS. Unit IV							Customer:BHEL Madras
No.	Tag	Service	Model	Size	Rating*	Body	Cv	Pr.	Temp.	Qty.
1	MSPCV-1	AUX.PRDS 100% STEAM PR. CONTROL VALVE	38-41412	6x3 in.	2500SPL	WC9	50	165 kg/cm²	540°C	1
2	MSPCV-2	AUX.PRDS 10% STEAM PR. CONTROL VALVE	38-41012	2 in.	2500SPL	WC9	6	165 kg/cm²	540°C	1
3	SPTCV-1	AUX.PRDS 100% SPRAY FLOW CONTROL VALVE	38-78102	1.5 in.	2500	A105	2.4	286 kg/cm²	250°C	1
4	SPTCV-2	AUX.PRDS 10% SPRAY FLOW CONTROL VALVE	38-78101	1 in.	2500	A105	0.3	286 kg/cm²	250°C	1
5	V2505111	BLOCK VALVE ON SPRAY WATER TO AUX. PRDS	37-211X4	2 in.	2500	WCC	15	286 kg/cm²	250°C	1

* ANSI

Capacity **210 MW**

FEED PUMP RECIRCULATION VALVES			Project : Ropar TPS						Customer: BHEL Hyderabad	
No.	Tag	Service	Model	Size	Rating*	Body	Cv	Pr.	Temp.	Qty.
1		FEED PUMP MINIMUM RECIRCULATION	37-78103	4x2 in.	2500	A105	15	260 kg/cm^2	250°C	2
HEATER DRAIN VALVES & CONDENSATE SYSTEM VALVES			Project : Vijayawada TPS Stage II Unit V&VI						Customer:BHEL Delhi	
No.	Tag	Service	Model	Size	Rating*	Body	Cv	Pr.	Temp.	Qty.
1	PAS-1	PEGG. STEAM FROM AUX. STEAM HEADER TO DEAERATOR	38-41912	6 in.	300	WCC	300	20 kg/cm^2	230°C	2
2	PCR-1	PEGG. STEAM FROM CRH TO DEAERATOR	38-41912	10 in.	600	WCC	430	48 kg/cm^2	350°C	2
3	DR-2	HPH-6 NORMAL DRAIN TO HPH-5	38-41321	3 in.	600	WC6	56	48 kg/cm^2	215°C	2
4	DR-6	HPH-6 NORMAL DRAIN TO DEAERATOR	38-41321	3 in.	600	WC6	56	48 kg/cm^2	215°C	2
5	DR-9	HPH-6 NORMAL DRAIN TO FLASH BOX-2	38-41321	3 in.	600	WC6	56	48 kg/cm^2	215°C	2
6	DR-12	HPH-5 NORMAL DRAIN TO DEAERATOR	38-41321	4 in.	300	WC6	90	20 kg/cm^2	180°C	2
7	DR-15	HPH-5 NORMAL DRAIN TO FLASH BOX-2	38-41321	4 in.	300	WC6	90	20 kg/cm^2	180°C	2
8	DR-17	LPH-3 NORMAL DRAIN TO LPH-2	38-41621	3 in.	300	WCC	140	8 kg/cm^2	130°C	2
9	DR-20	LPH-5 NORMAL DRAIN TO FLASH BOX-1	37-41621	4 in.	300	WCC	225	8 kg/cm^2	130°C	
10	DR-22	LPH-2 DRAIN TO LPH-1	38-41621	8 in.	300	WCC	575	8 kg/cm^2	100°C	2
11	DR-25	LPH-2 DRAIN TO FLASH BOX-1	37-41621	8 in.	300	WCC	575	8 kg/cm^2	100°C	2
12	DR-41	DEAERATOR OVERFLOW TO DRAIN TANK	38-416X1	10 in.	300	WCC	1000	11 kg/cm^2	170°C	2
13	CD-14	MAIN CONDENSATE	38-41621	10 in.	300	WCC	900	25 kg/cm^2	55°C	2
14	CD-23	CONDENSATE EXCESS RETURN	38-41612	6x4 in.	300	WCC	145	25 kg/cm^2	55°C	2
15	CD-19	CONDENSATE MINIMUM RECIRCULATION	37-78003	6 in.	300	A105	70	25 kg/cm^2	55°C	2
16	CD-78	HP DRAINS MANIFOLD SPRAY	37-211X5	1 in.	300	WCC	12	25 kg/cm^2	55°C	2
17	DM-1	DM MAKE-UP TO HOTWELL (LC)	37-41611	2 in.	300	CF8M	30	10 kg/cm^2	50°C	2
18	DM-2	DM MAKE-UP TO HOTWELL (HC)	37-41611	3 in.	300	CF8M	60	10 kg/cm^2	50°C	2
19	CD-47	CONDENSATE FOR VALVE GLAND SEALING	38-41621	1.5 in.	300	WCC	14	25 kg/cm^2	55°C	2

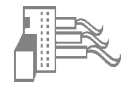
Capacity **250 MW**

FEED CONTROL VALVES			Project : CESC Budge Budge TPS. 2*250 MW						Customer: BHEL Delhi	
No.	Tag	Service	Model	Size	Rating*	Body	Cv	Pr.	Temp.	Qty.
1	0728.1&2	FULL LOAD FEED WATER FLOW CONTROL (MAIN&BYPASS)	38-41921	14x10in.	2500	WC6	900	330 kg/cm²	248°C	4
2	728.3	LOW LOAD FEED WATER FLOW CONTROL	38-41921	6x4in.	2500	WC6	225	330 kg/cm²	248°C	2
SPRAY & SOOT BLOWER VALVES			Project : BSES DAHANU 2x250 MW						Customer:BHEL Trichy	
No.	Tag	Service	Model	Size	Rating*	Body	Cv	Pr.	Temp.	Qty.
1	SD-4	SH SPRAY STAGE I BLOCK	38-414X1	6in.	2500	WC6	240	262 kg/cm²	260°C	2
2	SD-5 TO SD-8	SH STAGE I SPRAY CONTROL	38-41024	2.5in.	2500	WC6	30	182 kg/cm²	260°C	8
3	SD-9	SH STAGE II SPRAY BLOCK	38-414X1	3in.	2500	WC6	75	262 kg/cm²	350°C	2
4	SD-10 TO SD-13	SH STAGE II SPRAY CONTROL	38-41024	1.5in.	2500	WC6	8	182 kg/cm²	350°C	8
5	SD-14	RH SPRAY MAIN BLOCK	38-414X1	3in.	2500	WC6	30	282 kg/cm²	350°C	2
6	SD-15 TO SD-18	RH BRANCH BLOCK	38-211X4	2in.	2500	WC6	15	282 kg/cm²	350°C	8
7	SD-19 TO SD-22	RH SPRAY CONTROL	38-78003	2in.	2500	F11	3.5	182 kg/cm²	350°C	8
8	SD-23	SOOT BLOWER STEAM PR.REDUCING VALVE	38-70571	2in.	2500	F22	13	182 kg/cm²	450°C	2
PRDS VALVES			Project : BSES DAHANU 2x250 MW						Customer:BHEL Bangalore	
No.	Tag	Service	Model	Size	Rating*	Body	Cv	Pr.	Temp.	Qty.
1	AS-22	MS PRDS STEAM CONTROL	38-41412	6x4in.	2500SPL	WC9	110	169 kg/cm²	545°C	2
2	FD-22	MS PRDS SPRAY CONTROL	38-78002	1.5in.	2500SPL	A105	2.4	267 kg/cm²	170°C	2
3	FD-23	MS PRDS SPRAY CONTROL	38-41024	1.5in.	2500	WCC	6	267 kg/cm²	170°C	2
4	AS-32	CRH STEAM PRDS	38-41012	2.5in.	600	WCC	20	48 kg/cm²	360°C	2
5	FD-29	CRH PRDS SPRAY CONTROL	38-78001	1in.	2500	A105	0.3	267 kg/cm²	170°C	2
6	FD-30	CRH PRDS SPRAY CONTROL	38-78001	1in.	2500	A105	0.3	267 kg/cm²	170°C	2

Capacity **250 MW**

FEED PUMP RECIRCULATION VALVES			Project : Kothagudem TPS, 2*250 MW				Customer: BHEL Hyderabad			
1		FEED PUMP MINIMUM RECIRCULATION	37-78103	4x2 in.	2500	A105	15	260 kg/cm²	250°C	2
HEATER DRAIN & CONDENSATE SYSTEM VALVES			Project : Kothagudem TPS, 2*250 MW				Customer: BHEL Delhi			
1	AS-2	PEGG. STEAM FROM AUX. STEAM HEADER TO DEAERATOR	38-41912	8 in.	300	WCC	315	14 kg/cm²	220°C	2
2	CRH-2	PEGG. STEAM FROM CRH TO DEAERATOR	38-41912	10 in.	600	WCC	500	48 kg/cm²	360°C	2
3	DR-2	HPH-6 NORMAL DRAIN TO HPH-5	38-41521	3 in.	600	WC6	50	48 kg/cm²	215°C	2
4	DR-6	HPH-6 ALT. DRAIN TO DEAERATOR	38-41921	3 in.	600	WC6	50	48 kg/cm²	215°C	2
5	DR-9	HPH-6 ALT. DRAIN TO HP FLASH TANK	37-41921	3 in.	600	WC6	56	48 kg/cm²	215°C	2
6	DR-13	HPH-5 NORMAL DRAIN TO DEAERATOR	38-41521	4 in.	300	WC6	120	20 kg/cm²	175°C	2
7	DR-16	HPH-5 ALT. DRAIN TO HP FLASH TANK	37-41921	4 in.	300	WC6	120	20 kg/cm²	175°C	2
8	DR-19	LPH-3 NORMAL DRAIN TO LPH-2	38-41521	4 in.	150	WCC	170	8 kg/cm²	130°C	2
9	DR-22	LPH-3 ALT. DRAIN TO LP FLASH TANK	37-41621	4 in.	150	WCC	170	8 kg/cm²	130°C	2
10	DR-25	LPH-2 NORMAL DRAIN TO LPH-1	38-41521	8 in.	150	WCC	575	8 kg/cm²	105°C	2
11	DR-28	LPH-2 ALT. DRAIN TO LP FLASH TANK	37-41621	8 in.	150	WCC	575	8 kg/cm²	105°C	2
12	DR-38	DEAERATOR OVERFLOW TO LP FLASH TANK	38-419X1	3 in.	300	WCC	100	11 kg/cm²	170°C	2
13	CD-14&CD-17	MAIN CONDENSATE CONTROL	38-41521	12 in.	300	WCC	900	27 kg/cm²	55°C	4
14	CD-25	CONDENSATE EXCESS PUMP MIN. RECIRCULATION	37-78003	3 in.	600	A105	45	27 kg/cm²	55°C	2
15	CD-21	EXCESS CONDENSATE DUMP CONTROL	38-41612	6x3 in.	300	WCC	95	27 kg/cm²	55°C	2
16	CD-53	HP DRAINS FLASH TANK SPRAY	37-211X5	1 in.	300	WCC	1,7	30 kg/cm²	55°C	2
17	CD-58	EMERGENCY MAKE-UP TO CONDENSATE HOTWELL	37-41612	3 in.	150	WCC	95	8 kg/cm²	55°C	2
18	DM-2 (LOW)	DM MAKE-UP TO HOTWELL (LC)	37-41512	3 in.	300	CF8M	45	8 kg/cm²	40°C	2
19	DM-5 (HIGH)	DM MAKE-UP TO HOTWELL (HC)	37-41612	4 in.	150	CF8M	120	8 kg/cm²	40°C	2

4.5 Typical applications. 500 MW



Capacity **500 MW**

FEED CONTROL VALVES			Project : NTPC Talcher TPS 2x500 MW STPP					Customer: Keltron Controls		
No.	Tag	Service	Model	Size	Rating*	Body	Cv	Pr.	Temp.	Qty.
1	FCV-0657	LOW LOAD FEED WATER FLOW CONTROL	37-41512	12x8 in.	2500	C5	475	360 kg/cm²	200°C	2

SPRAY & SOOT BLOWER VALVES			Project : NTPC Vindhyachal TPS 2x500 MW STPP					Customer: BHEL Trichy		
No.	Tag	Service	Model	Size	Rating*	Body	Cv	Pr.	Temp.	Qty.
1	SD-10	SH SPRAY BLOCK	38-414X1	8 in.	2500	WCC	380	340 kg/cm²	260°C	2
2	SD-11 TO SD-14	SH SPRAY CONTROL	38-41621	4x3 in.	2500	WCC	26	340 kg/cm²	260°C	8
3	SD-15	RH SPRAY BLOCK	38-414X1	4x3 in.	2500	WCC	155	340 kg/cm²	260°C	2
4	SD-16 TO SD-19	RH BRANCH BLOCK VALVE	38-414X1	3 in.	2500	WCC	75	340 kg/cm²	260°C	8
5	SD-20 TO SD-23	RH SPRAY CONTROL	38-41024	2.5 in.	2500	WCC	12	340 kg/cm²	260°C	8
6	SD-24	SOOT BLOWER STEAM PR. REDUCING VALVE	38-41012	4x2 in.	2500	F11	25	213 kg/cm²	482°C	4

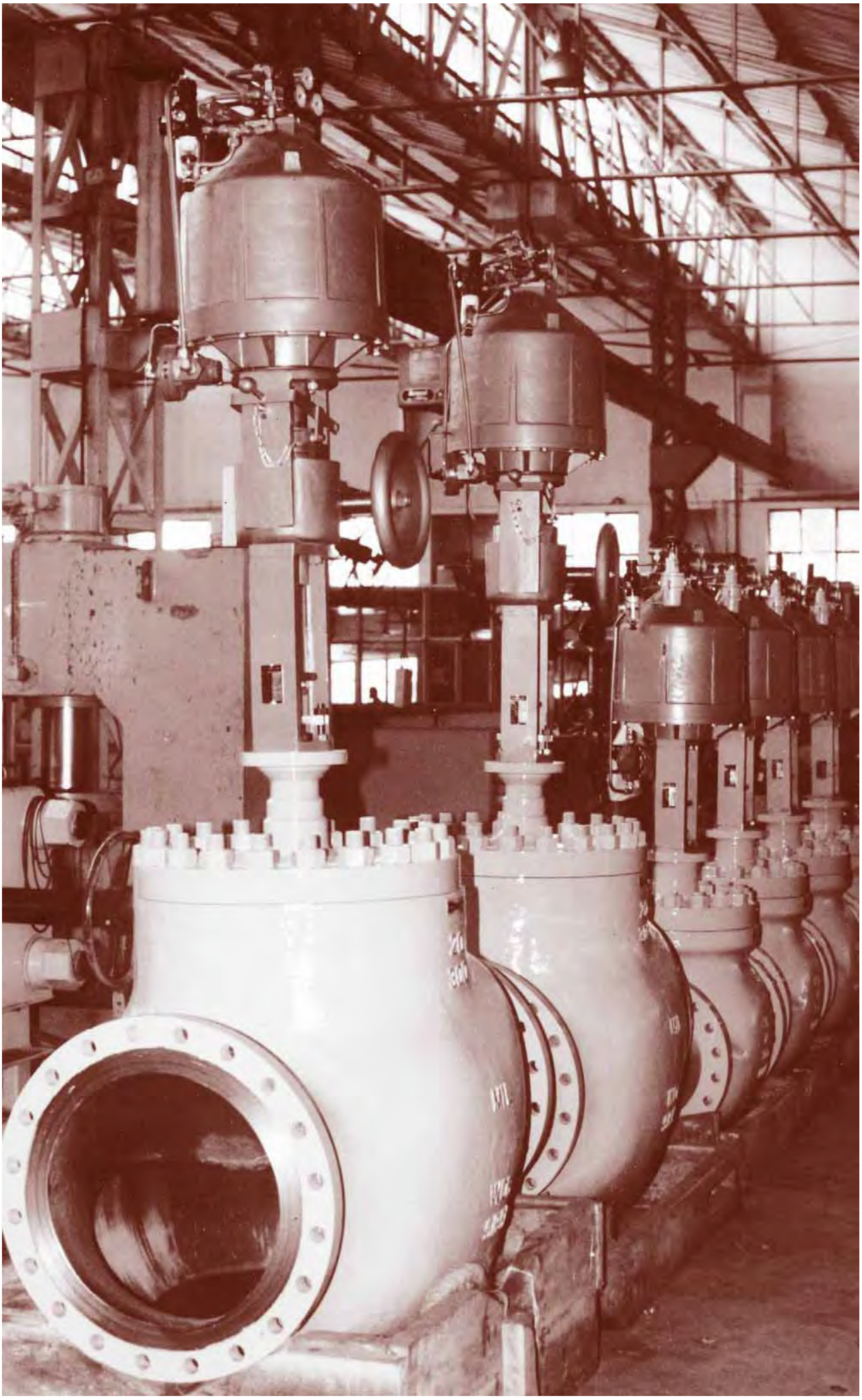
HEATER DRAIN & CONDENSATE SYSTEM VALVES			Project : NTPC Talcher TPS 2x500 MW STPP					Customer: Keltron Controls		
No.	Tag	Service	Model	Size	Rating*	Body	Cv	Pr.	Temp.	Qty.
1	PCV-0326A	AUX. STEAM TO DEAERATOR	37-41512	12 in.	300	WCC	725	20 kg/cm²	295°C	2
2	PCV-0326B	CRH FLOW TO DEAERATOR	38-41512	16 in.	600	WC6	1200	57 kg/cm²	410°C	2
3	FCV-01514/0519/0524	CONDENSATE PUMPS A.B.C MINIMUM FLOW RECIRCULATION	37-78103	4 in.	600	A105	55	47 kg/cm²	47°C	6
4	FCV-0559 A/B	CONDENSATE FLOW TO DEAERATOR	38-41521	10 in.	300	WCC	900	47 kg/cm²	47°C	4
5	LCV-0507	CONDENSATE SPILL TO CONDENSATE STORAGE TANK	38-41612	8 in.	300	WC6	315	47 kg/cm²	50°C	2
6	LCV-0508	CONDENSATE NORMAL MAKE-UP	37-41621	4 in.	300	CF8M	140	10 kg/cm²	40°C	2

* ANSI

Capacity **500 MW**

HEATER DRAIN & CONDENSATE SYSTEM VALVES			Project : NTPC Talcher TPS 2x500 MW STPP					Customer:Keltron Controls		
No.	Tag	Service	Model	Size	Rating*	Body	Cv	Pr.	Temp.	Qty.
7	LCV-0509	CONDENSATE EMERGENCY MAKE-UP	38-41621	8 in.	150	CF8M	575	10 kg/cm²	40°C	2
8	LCV-0526	GSC MAIN FLOW	37-78103	4 in.	600	WC6	55	47 kg/cm²	50°C	2
9	1-HDH-LCV-0701/23	HP HEATER 6A & B NORMAL LEVEL	38-41512	3 in.	600	WC6	45	57 kg/cm²	230°C	4
10	LCV-0703/0722	HP HEATER 6A & B EMERGENCY LEVEL	37-78103	4 in.	600	C5	55	57 kg/cm²	240°C	4
11	1-HDH-LCV-0712/34	HP HEATER 5A & B NORMAL LEVEL	38-41512	3 in.	300	WC6	60	34 kg/cm²	190°C	4
12	LCV-0714/0736	HP HEATER 5A & B EMERGENCY LEVEL	38-78103	4 in.	600	C5	55	34 kg/cm²	190°C	4
13	1-HDL-LCV-0746A	LP HEATER 3 NORMAL LEVEL	38-41511	3 in.	300	WC6	155	4 kg/cm²	110°C	2
14	1-HDL-LCV-0746B	LP HEATER 3 EMERGENCY LEVEL	37-41611	3 in.	300	C5	155	4 kg/cm²	110°C	2
15	1-HDL-LCV-0757A	LP HEATER 2 NORMAL LEVEL	38-41511	6 in.	300	WC6	400	3 kg/cm²	90°C	2
16	1-HDL-LCV-0757B	LP HEATER 2 EMERGENCY LEVEL	37-41611	6 in.	300	C5	400	3 kg/cm²	90°C	2
17	1-HDL-LCV-0722	LP HEATER 1 NORMAL LEVEL	37-41511	8 in.	300	WC6	640	3 kg/cm²	60°C	2
18	1-HDL-LCV-0768	LP HEATER 1 EMERGENCY LEVEL	37-41611	8 in.	300	C5	640	3 kg/cm²	60°C	2
19	1-CO-PCV-0530	VALVE GLAND SEALING PRESSURE CONTROL	37-41612	2 in.	300	WC6	12	47 kg/cm²	50°C	2
20	FCW-PCV-8701	EQUIPMENT COOLING WATER DIFFERENTIAL PR. CONTROL	37-41521	12 in.	150	CF8M	1660	10 kg/cm²	40°C	2
21	LCV-8701	DM WATER OVERHEAD LEVEL CONTROL	37-41621	1.5 in.	300	CF8M	35	10 kg/cm²	46°C	2
SCAPH CONTROL VALVES			Project : NTPC Vindhyachal TPS 2x500 MW STPP					Customer:BHEL Trichy		
No.	Tag	Service	Model	Size	Rating*	Body	Cv	Pr.	Temp.	Qty.
1	ASS-2 TO ASS-7	SECONDARY SCAPH	38-41921	8 in.	300	WCC	575	20 kg/cm²	250°C	4
2	ASS-20 TO ASS-25	PRIMARY SCAPH	38-41321	4 in.	300	WCC	200	20 kg/cm²	250°C	4

* ANSI



Material selection Guidelines

Standardised Materials for high performance

MATERIAL SELECTION

Correct material selection is extremely important to ensure proper functioning and longevity of Control Valves in Power Plant applications. The service conditions vary widely in pressure and temperatures, design pressure can go up as high as 360 kg/cm^2 and temperatures up to 566ºC. The Body and Trim material selection should also take into account the detrimental effects of Cavitation/Flashing/High Velocity which are inherent to such severe applications.

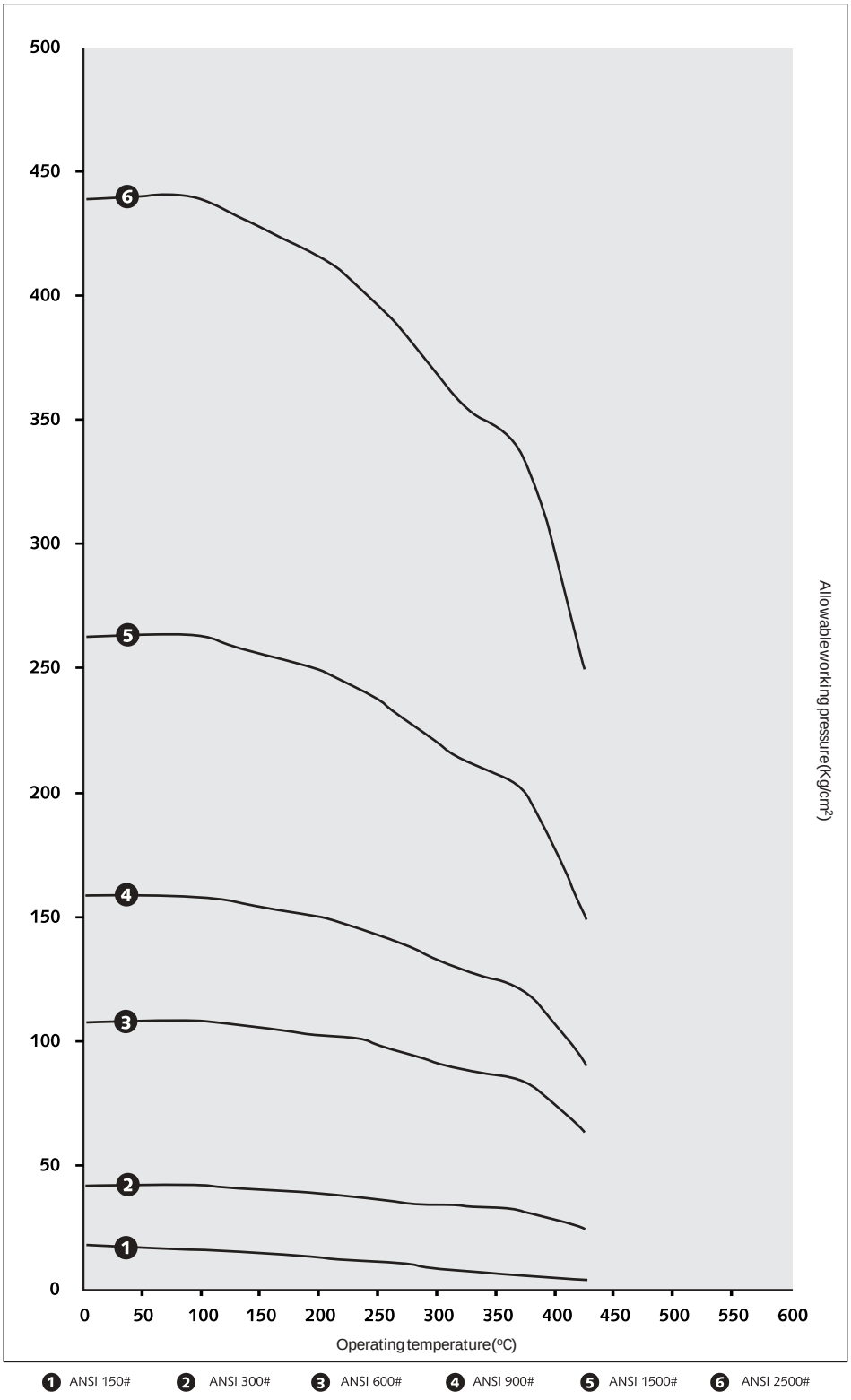
CONTROL VALVE. PRESSURE CONTAINING MATERIAL			
General Classification	Castings	Forgings	Max. Operating Temp.
Carbon Steel	ASTM A 216 Gr. WCB / WCC	ASTM A 105	427ºC
Alloy Steel, 1¼Cr - ½ Mo	ASTM A 217 Gr. WC6	ASTM A 182 Gr. F11	566ºC
Alloy Steel, 2¼Cr - 1 Mo	ASTM A 217 Gr. WC9	ASTM A 182 Gr. F22	566ºC
Alloy Steel, 5 Cr - ½ Mo	ASTM A 217 Gr. C5	ASTM A 182 Gr. F5a	566ºC
Stainless Steel, Ty. 316	ASTM A 351 Gr. CF8M	ASTM A 182 Gr. F316	566ºC

PRESSURE RATING. CEILING VALUES *						
Temp.	150#ANSI	300#ANSI	600#ANSI	900#ANSI	1500#ANSI	2500#ANSI
< 93ºC	18.3	52.7	105.5	158.2	263.7	439.4
149ºC	16.2	51.3	102.3	153.6	255.9	426.8
204ºC	14.1	49.6	99.1	148.7	248.2	413.4
260ºC	12.0	46.8	93.5	140.3	233.8	389.5
316ºC	9.8	42.5	85.1	127.6	212.7	354.4
371ºC	7.7	40.1	79.8	119.9	199.7	332.6
427ºC	5.6	35.9	71.4	107.2	178.6	297.4
482ºC	3.5	31.6	63.3	94.9	157.8	263.3
538ºC	1.4	25.7	51.0	76.6	128.0	213.0
593ºC	0.0	22.9	45.3	67.8	113.2	188.8

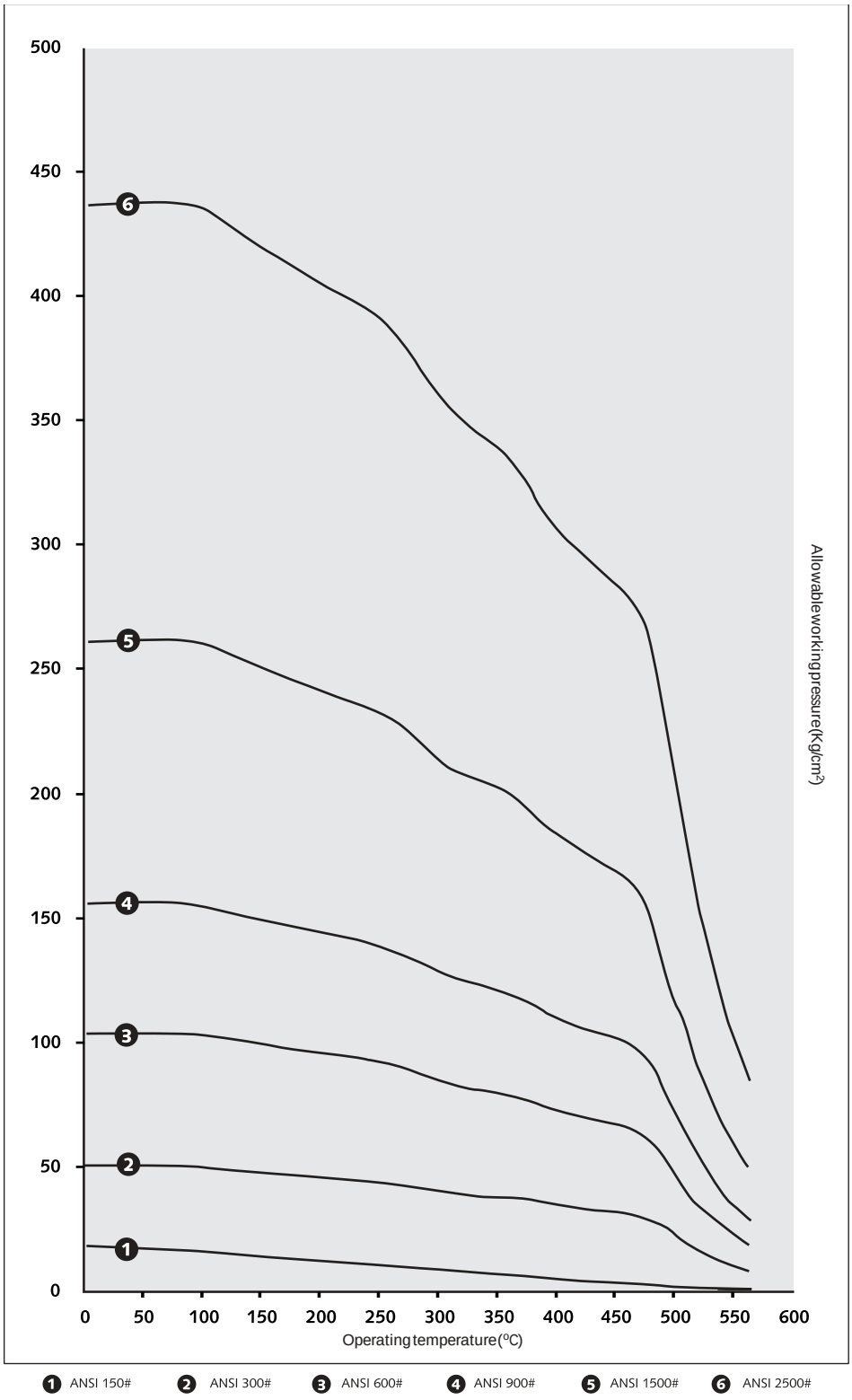
* Max.. Working Pressure in Kg/cm^2 for ANSI 150# to ANSI 2500#, Extracted from ANSI B16.34 - 1996. Varies with material, See pages 48-50 for max. allowable working pressures for WCC, WC6 & WC9, the most common body material used for Control Valves in power plant applications.

5.2 Allowable working pressure

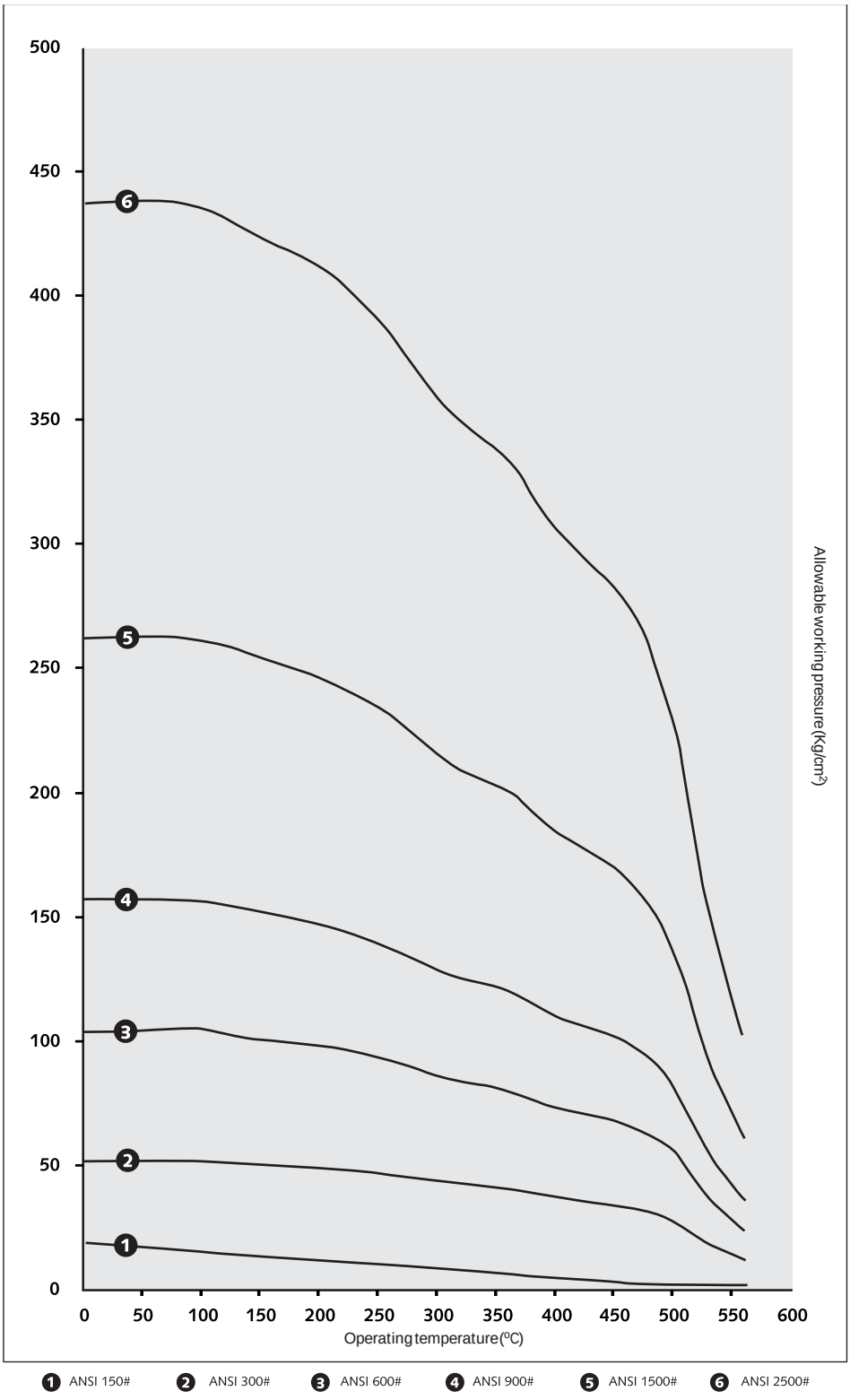
Allowable working pressure for ASTM A216 Gr. WCC



Allowable working pressure for ASTM A217 Gr. WC6



Allowable working pressure for ASTM A217 Gr. WC9



GENERAL CLASSIFICATION.	ASTM CODE	MAX. TEMP.	HARDNESS	GENERAL APPLICATION
GENERAL SERVICE				
SS 316	Bar Stock: ASTM A 479 Ty. 316 Castings: ASTM A 351 Gr. CF8M	593ºC	14 HRC max.	Non-Erosive, Corrosive, Mod. Press. Drop. Most corrosion resistant of 300 Series
TOUGH SERVICE				
Ty. 410 Stainless Steel (Hardened & Tempered)	Bar Stock: ASTM A 479 Ty. 410	400ºC	35 HRC min.	Corrosive & Non-Corrosive Service
Ty. 416 Stainless Steel (Hardened & Tempered)	Bar Stock: ASTM A 582 Ty. 416	400ºC	31-38 HRC	Erosive & Non-Corrosive Service
No. 6 Stellite Hard Facing	NA	650ºC	38-47 HRC	Slightly Erosive & Corrosive Service
No. 6 Stellite Solid (<2")	NA	650ºC	38-47 HRC	Erosive & Corrosive Service
No. 5 Colmonoy Hard Facing	NA	650ºC	45-50 HRC	Erosive & Corrosive Service. Corrosion resistance similar to Inconel
No. 6 Colmonoy Hard Facing	NA	650ºC	56-62 HRC	Erosive & Corrosive Service. Corrosion resistance similar to Inconel
17.4 PH Stainless Steel	Bar Stock: ASTM A 564 Gr. 630 Castings: ASTM A 747 CB7CU1	400ºC	40 HRC min (H900) 32 HRC min (H1075)	Erosive & Corrosive Service
CA6NM Stainless Steel	Casting: ASTM A743 Gr. CA6NM (Heat Treated)	650ºC	28 HRC min. after Nitriding)	Erosive & Corrosive Service. (700-1000 HV After case hardening, excellent for high temperature service.
Ty. 440C Stainless Steel	Bar Stock: ASTM A276 Ty. 440C	400ºC	58 HRC min.	Very Erosive Service.

Handling and Installation

A list of safe practices

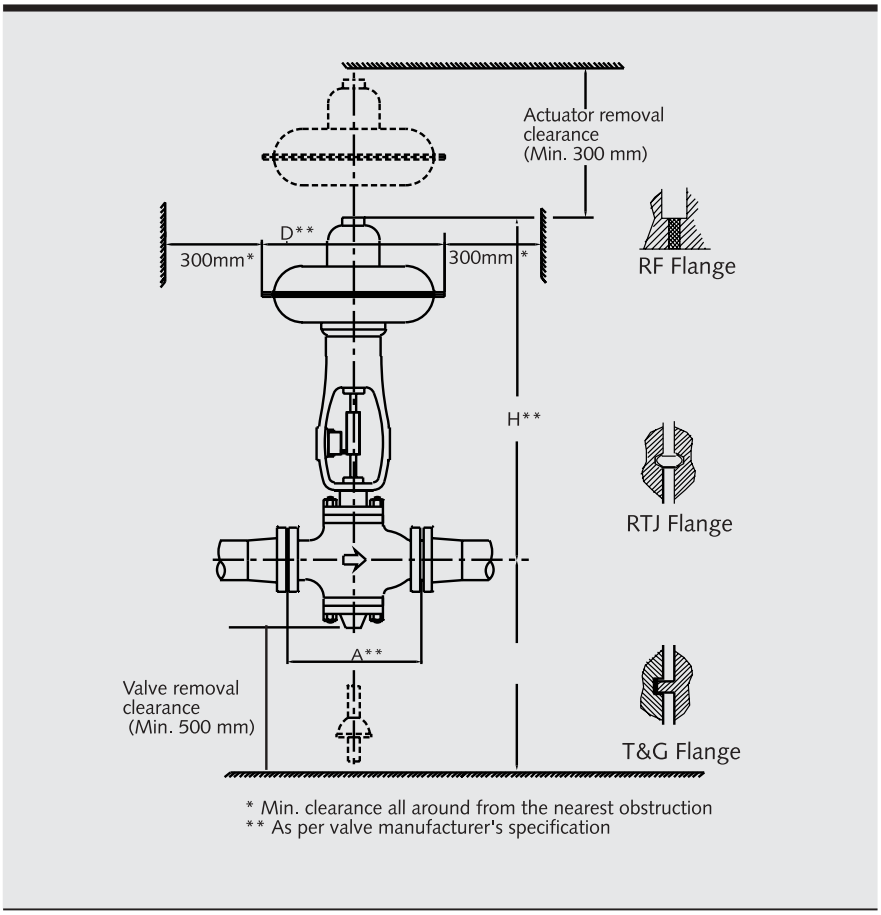


Fig. 24. Clearance requirements for Globe Control Valves

1. Do not lift large size valves by the Actuator. Lifting Lugs provided on the Actuators are for lifting the Actuator alone.

2. The Actuator Diaphragm case, Eye Bolts etc. are not designed to lift the heavy valve body assembly.

3. Do not turn the Actuator, keeping the coupling tight.

4. In case of Bellow Sealed Valves, never rotate the Valve stem.

5. Valves on smaller piping and tubing may need to be mounted in Brackets.

6. While choosing the location to mount the valve, provide adequate space for future occasions when it may become necessary to remove the Body and Actuator for repairs.

7. Ensure that recommended mounting orientations are always followed.

8. Ensure that the Flange Bolts or Tie Rods can be removed easily.

9. Leave adequate space for opening/adjusting Positioners and Accessories.

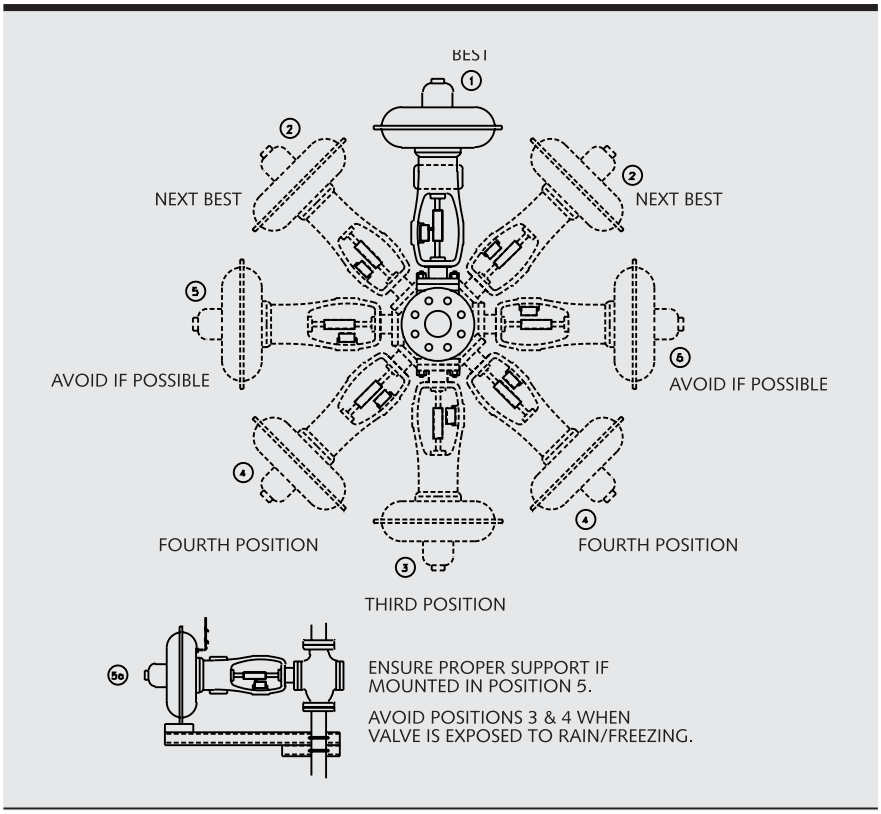


Fig. 25. Alternate orientations for Control Valves (position-1 is preferred)

10. Positioner Gauges and Travel Indicators must always remain clearly visible.

11. Careful choice of location helps prevent Cavitation. When flow is upward, and if the fluid partially vaporizes because of lower hydrostatic head, locating the Valve towards the lowest part of the piping can prevent two phase flow through the Valve thereby minimizing Cavitation.

12. Valves in Flashing service are to be located as close to the receiving vessel as possible. A very short length of Discharge Pipe, and an Isolation Valve are permitted.

13. Special attention must be given not to place an elbow or pipe T less than 5 pipe diameters downstream of a valve to avoid interference with the Valve's Flow Capacity. In high pressure gas or steam pressure reducing applications, try to have only straight pipes downstream of the valve, or alternatively use a long sweeping elbow to avoid added pipe noise.

14. In critical applications, provide a manually operated throttling valve in a bypass around the valve. This allows for replacement or repair of the Control Valve without shutting down the process.

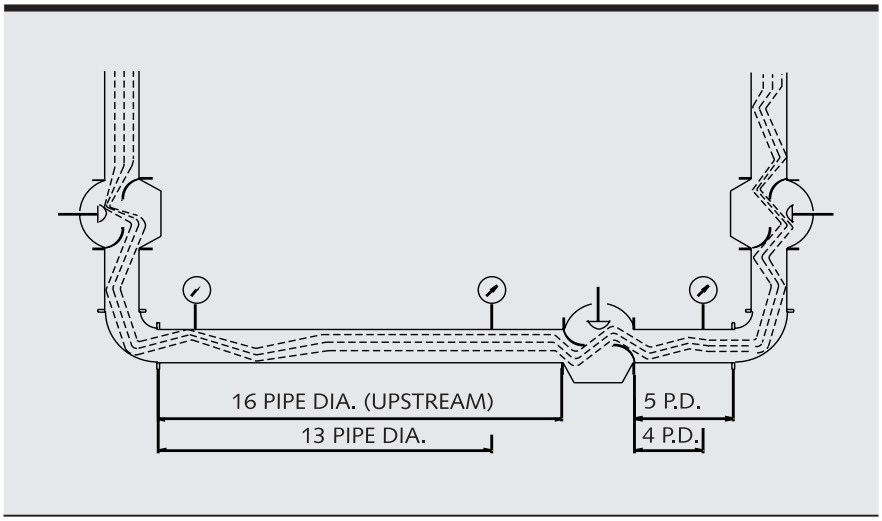


Fig. 26. Typical satisfactory arrangement of upstream and downstream piping

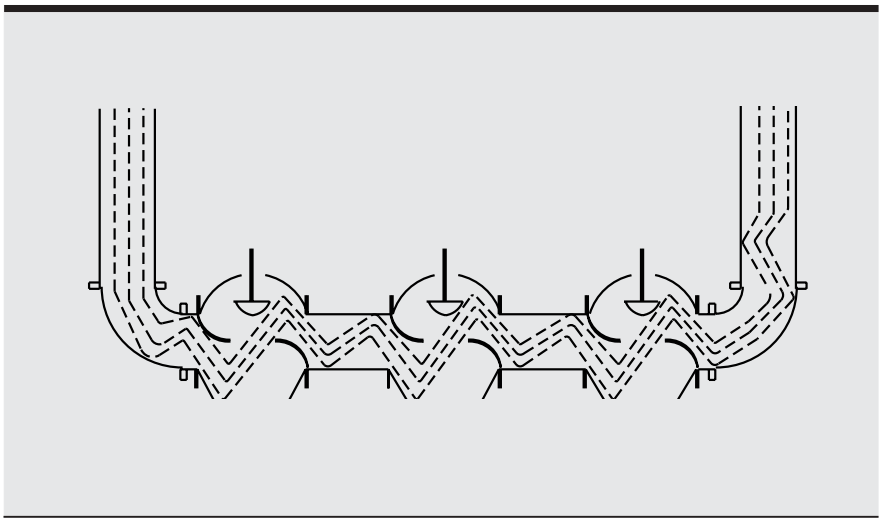
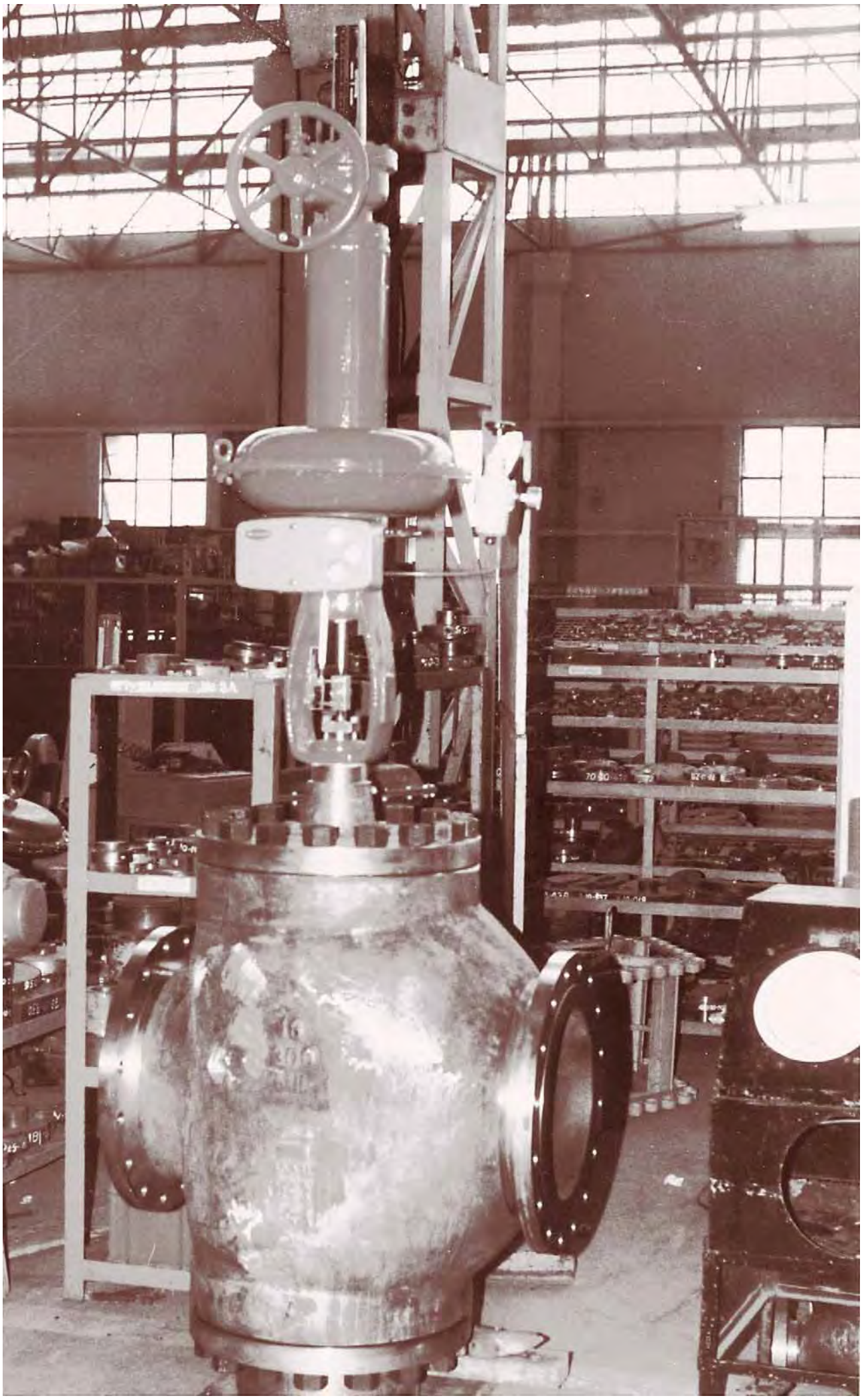


Fig. 27. Less satisfactory arrangement of upstream and downstream piping

15. Since Control Valves will require maintenance from time to time, Block Valves at Upstream and Downstream are essential. Bleed and drain valves may be necessary for safety.

16. On occassions when the Control Valve is out of service, if a Bypass Valve is being provided along with isolation valves in order to have flow, the style of the Bypass Valve should be similar to that of the Control Valve. Or else an identical Control Valve should be chosen as the Bypass Valve.

17. In cases of extreme ambient temperatures (over 80ºC) where a valve is located, the valve and accessory manufacturers should be consulted for proper, high temperature replacement material.



Maintenance Guidelines

How to ensure peak performance of Control Valves in power plant applications

1. PREVENTIVE MAINTENANCE

BEFORE START-UP

1. It should be appreciated that during plant start ups, abnormal operating conditions can adversely affect the performance of the Control Valve and some times severely damage the valve. It is very important that these abnormal conditions be recognized and the Control Valve is selected taking into account these conditions.

2. Ensure that misalignment along the pipeline is not corrected using the valve. Pipeline stress on the valve may cause misalignment of the stem or plug/seat joint. It can also cause flange leak or packing leak.

3. Ensure that the recommended mounting orientation is followed. If a valve is mounted with it's stem travelling in the horizontal plane, it must be properly supported.

4. Ensure that the mandatory 'flow through' direction indicated on the Control Valve (by an arrow mark) is always followed.

5. Piping should be flushed before installing the valve. If additional flushing is done after installation, it may be necessary to remove the internals, Especially if anti-Cavitation or low noise Trim is in place.

Continued in next page

AFTER START-UP

1. Periodic field inspections should be made.

2. Remember that high-friction packing needs to be compressed after insertion. Packing will compress further in service, and the packing compression may have to be readjusted. Tighten the packing nuts when found necessary.

3. It dusty or dirty conditions prevail, provide a rubber boot around the stem to protect the packing.

4. Cover the valve suitably when process dripping or corrosive atmospheric conditions prevail. Special care to be given to the valve accessories.

5. Air sets usually have filters that can clog; the drain cock should be opened from time to time to be sure trapped liquid is drained.

6. Monitor the performance of the valve accessories as it has a significant effect on the valve performance.

2. SHOP OVERHAUL

1. Valves and valve internal in hazardous service should be cleaned thoroughly before undertaking any repair. Depending on contaminant, water wash, steaming or special heat treatment may be resorted to.

2. Ensure that the person who is disassembling the Control Valve is thorough with the relevent procedure.

3. Before disassembly, mark the Actuator orientation with respect to the body flanges.

4. Remove the bonnet from the body, and then the gland packing components. Further remove the Trim and the bottom flange.

5. Disassemble the Actuator and examine components for damage. Afterwards clean the parts carefully

6. Inspect the disassembled components thoroughly and determine the extent of reconditioning and repair that is required.

Continued in facing page

Maintenance. Before start up

CONTINUED FROM PREVIOUS PAGE

6. If line trash like weld chips, rust etc. are expected in the pipeline, temporary strainers should be installed upstream. If the process stream normally contains Scale, dirt or other foreign material, it is recommended that permanent strainers or filters be installed. Strainers should be installed far enough to allow non-swirl flow at the valve inlet. Note that strainers that efficiently protect the pump may not be adequate when it comes to removing debris that can damage the valve Trim.

7. Ensure that the air supply is clean and devoid of oil.

8. Air lines to be connected to the Control Valves should be blown clean of oil and debris before they are attached.

9. Avoid using Teflon® tapes in instrument air lines. While Teflon® tape is an excellent thread lubricant and seal for screwed connections, it nevertheless can break off in small bits if not carefully applied. And these bits often migrate to orifices in pneumatic accessories and can clog them.

10. Do not start up a Control Valve without first checking the packing tightness.

Shop Overhaul

CONTINUED FROM PREVIOUS PAGE

7. If the body is rusted, descale the body. While handling the body, the flange surfaces must be protected to prevent any gasket leakage.

8. Assess the need for remachining of Body and Trims. First the plug and seat should be perfectly matched, by precise machining, then by hand grinding or lapping. Make sure that even fine traces of lapping compound is cleaned off.

9. The lapped contact should not be too wide. If the contact band is too wide, a machine cut to renew the angles of the mating pieces is necessary. The angles of the mating pieces are slightly different to allow a narrow seating band.

10. For problems like marred stem surface, replacement with a factory finished stem is the only practical solution. The finish of the Control Valve stem is so fine that highly polished surfaces are required to give the best possible packing seal, and to minimize the hysteresis.

11. If the Trims are beyond repair, replace them with genuine spare parts. Valve Trims are amongst the most precision of instrumentation components.

12. Avoid use of non standard Trims. These cannot match the metallurgy and workmanship of factory finished spares.

13. Reassemble the valve body using the reconditioned /new parts. Ensure that gland packing and gaskets are changed every time the valve is opened and reassembled. Use only OEM* gland packing and gaskets. Low quality gaskets can cause irreversible damage to the valve by seat area Erosion, body bonnet Erosion etc.

14. While tightening the bonnet and bottom flanges, it is important to tighten the diagonally opposite bolts to ensure even gasket loading. Over tightening can cause excessive elongation of the gaskets thereby resulting in poor joints.

15. Assemble parts of the Actuator barrel, install the diaphragm case using new cap screws and nuts, and check for pneumatic leaks.

16. Adjust the spring range and stroke of the Actuator.

17. Giving air supply to the Actuator, keep the Actuator in mid stroke and mount the Actuator on the valve body.

*Original Equipment Manufacturer

Shop Overhaul

CONTINUED FROM PREVIOUS PAGE

18. Tighten (finger tight) the coupling. Apply air or remove air to ensure proper seating of the valve. Then tighten the coupling and adjust the travel indicator.

19. Mount the accessories back on to the Control Valve. Several of the most common accessories (Air Sets, Positioners, Transducers etc.) have Rubber Diaphragms that will harden and crack. Some have O Rings that deteriorate. It would be economical to replace the whole accessory with spares (and repair faulty models during slack time) rather than repairing them On Site.

20. Tubing connections for signal and operating air should be checked with soapy water or other leak detecting fluids.

21. Carry out hydro test, seat leakage test and calibration as per relevant standards.

22. When repair to an existing valve is uneconomical, replace it with a new valve from a high-quality OEM to avail of better sizing, better materials, better design, and most likely, better service too. Process conditions should be stabilized and determined accurately in case they were not correctly anticipated when the original valve was specified.

23. Do not buy valves or replacement parts from non OEMs. Overemphasis on short-term cost savings can sometimes lead to hazardous working environments for personnel, process downtime and increased operating costs.

The MIL Range

High performance Control Valves for power plants

MIL 21000

Rugged, heavy top Guided, single seated Control Valves

Available Sizes & Rating

½" to 2": ANSI 150# to ANSI 2500#

3" to 10": ANSI 150# to ANSI 600#

Seat leakage class as per ANSI/FCI 70.2

Standard: Class IV.

Optional: Class V & Class VI

FEATURES

Heavy Top Guiding. The Valve plug shank is Guided within the lower portion of the bonnet and this heavy and rugged guiding ensures plug stability and eliminates Trim vibration.

Anti Cavitation/Low Noise Trims replacing conventional plug with the Lo-dB plug provides excellent noise attenuation and Cavitation control.

For severe service, special double stage valves with simultaneous throttling in the plug and Cage also is available.

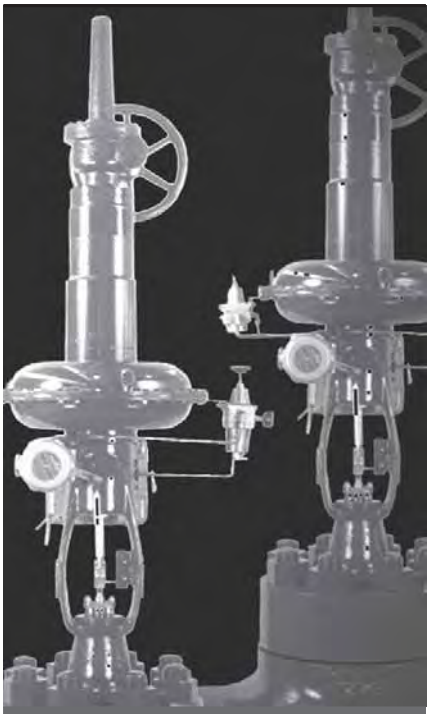
Tight Shut-Off: Class IV leakage is standard. Optional constructions meet Class V & Class IV leakage.

Quick Change Trim. Optional clamped seat ring facilitates easy Trim removal.

Angle Body (70000 Series). Optional angle body design with Venturi seat is ideally suited for special applications like Flashing liquids and other choked flow conditions.

MIL 41000

Heavy Duty Cage Guided Control Valves.



Available Sizes & Rating

¾" to 14": ANSI 150# to ANSI 2500#
16" to 20": ANSI 150# to ANSI 600#

Seat Leakage Class as per ANSI/FCI 70.2

Standard: Class III & Class IV
Optional: Class V

FEATURES

High allowable pressure drops. Cage Guided valves provide exceptional performance over a wide range of pressure drops in severe services. They also handle most shut off pressures with standard pneumatic spring diaphragm Actuators.

High capacity with low pressure recovery. Flow capacities remain at top levels, and are attained with minimum pressure recovery reducing the possibility of Cavitation in liquid service.

Standardised high performance material. This ensures trouble free operation even in applications with inherent high pressure drops and extreme temperatures.

Tight shut off valves. For lower sizes, unbalanced design results in Class V leakage.

For higher sizes, the exceptional single seated leak tightness of Class V is achieved by the following special options:

1. Auxiliary shut-off pilot plug closes the balancing holes located in the main plug in shut-off conditions.

2. Self energised seal rings pressing against walls of the Cage & Plug arrests leakage past the seal ring.

Lo-dB/Anti-Cavitation Cages: Noise attenuation and Cavitation control achieved by replacing conventional Cages with Lo-dB Cages.

SPECIAL OPTIONS

Static Seal Ring, Double Cage design, Two stage design with diffuser seat ring, Multi-Stage Valves

MIL 41008. **These Multi-Stage valves incorporate a unique Trim design to absorb high pressure drops that prevent Cavitation and maintain constant velocity throughout the pressure dropping stages. Concentric Cages incorporate a tortuous flow path, which causes numerous velocity head losses without appreciable pressure recovery. High pressure recovery factors at lower lifts eliminates Cavitation. High impedance flow path reduces pressure by friction and turbulence, maintaining constant velocity throughout.**

MIL 78000

Anti Cavitation & Low Noise Multi-step High Pressure Drop Control Valves

Available Sizes & Rating

½" to 6": ANSI 900# to ANSI 2500#

Seat leakage Class as per ANSI IFCI 70.2

Standard: Class V

Optional: Class VI

FEATURES

Multi Step Axial Flow High Resistance Trim. Pressure reduction occurs along the length of the plug in a series of throttling stages. The fluid also takes a tortuous flow path, which adds resistance and therefore velocity head loss.

The special design provides control of high pressure fluids without the Erosion, Vibration or High Noise Levels commonly associated with conventionally designed Control Valves.

High allowable pressure drops. No individual stage is exposed to the full pressure drop, thus extending Trim life substantially.

Adiabatic Flow with Friction. Reduces pressure much in the same way as pressure loss occurring in a long pipeline.

Low pressure recovery. This minimises Cavitation potential and contributes towards reduction of Noise for all fluids. Pressure recovery factors as high as 0.998.

Standardised high performance material: To ensure material integrity, 78000 Series valves are machined from solid steel forging. High performance Trim material ensures durability in any severe application.

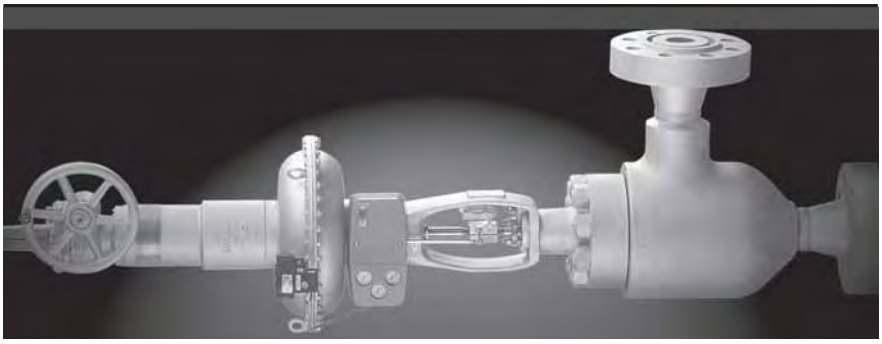
Balanced Trims: Available for sizes 2" and above, allow much higher shut-off pressures with conventional Actuators.

SPECIAL OPTIONS.

Soft seat construction with encapsulated inserts, Angle & Inline body configurations.

MIL 91000 MATRIX Series valves

Extreme Pressure Multi-stage, Multi-path, Axial Flow Anti-Cavitation High Pressure Drop Control Valves



FEATURES.

Varying and expanding flow passage. This enables near Zero Pressure Recovery thus ensuring that stage wise Pressure Drops are limited below the Critical Pressure Drop. Likelihood of Cavitation is ruled out even in extreme conditions.

Ingenious Flow Path. Reduces downstream Velocity. Exit Velocity and Kinetic Energy kept under limits. Erosion eliminated.

Pressure recovery factor (Cf) as high as 0.9999.

As many as 50 Pressure Dropping stages.

Ruggedness of design. Ensures longevity even in the severest of applications.

Axial Flow design. Eliminates wire drawing effects on the leading edges of the plug.

Flow to Open flow direction. Eliminates Dynamic Instability inherent to Flow to Close valves.

Tortuous flow path with High Impedance for energy absorption limits Trim Velocity.

Modified equal % characteristics with 100:1 Rangeability. Characteristics can be customised to suit specific process applications.

Self energised body and seat gaskets. Ensures Zero Leak, and optimises bonnet/bolting design.

Ingenious design. Results in a simpler manufacturing process. Consequently this makes MATRIX Series Valves better priced than other valves in this league.

SPECIAL OPTIONS.

Available with Soft Seat with a special sliding collar to protect the Soft Seat from high pressure fluids.

CERTIFICATE

Quality-System
for Pressure Equipment Manufacturer
according to Directive 97/23/EC

Certificate No.: 04 202 2 440 02 00004

Name and address of manufacturer:	**MIL Controls LIMITED** **Meladoor P.O, Mala – 680 741** **Dist. Thrissur, Kerala, India**

It is hereby certified, that the manufacturer had introduced and applies a quality system according to Directive 97/23/EC. The manufacturer is authorized, to affix the following sign to those equipments he produced in the range of validity of this QA-system:

CE 0044

Audited according to Directive 97/23/EC:	**QA-system (Module H)**
Audit report No.:	**20519922**
Scope:	**DESIGN, DEVELOPMENT, MANUFACTURE and SERVICING of VALVES for POWER PLANTS and INDUSTRY**
Production facility:	**MIL Controls LIMITED** **Meladoor P.O, Mala – 680 741** **Dist. Thrissur, Kerala, India**

Valid: 31. January 2005

Duisburg, 01.Febuary 2002

TÜV CERT Zertifizierungsstelle für DRUCKGERÄTE RWTÜV 0044

TÜV CERT Certification Body
for Pressure Equipment of
RWTÜV Anlagentechnik GmbH

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CONFÉDÉRATION EUROPÉENNE D'ORGANISMES DE CONTRÔLE

MIL is the first Control Valve manufacturer in India to have been awarded the prestigious **CE Marking Certificate** by RWTUV, Germany.

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ILLUSTRATIONS

MIL Controls Limited
A KSB Company

Control Valves for Power Plants. Application Handbook

The MIL Power Plant Handbook provides a broad overview of the various systems in a Thermal Power Plant to help you select the right valve for each application.

The handbook also offers expert tips for proper Installation and Maintenance of your Control valves.

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