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TURBINE BYPASS SYSTEMS, SEVERE SERVICE CONTROL VALVES AND DUMP TUBES FOR INDUSTRIAL AND UTILITY POWER PLANTS

ZickTwist™

DISC STACK TECHNOLOGY FOR SEVERE SERVICE APPLICATIONS

An assortment of Turbine bypass , Steam conditioning

and severe service Control valves

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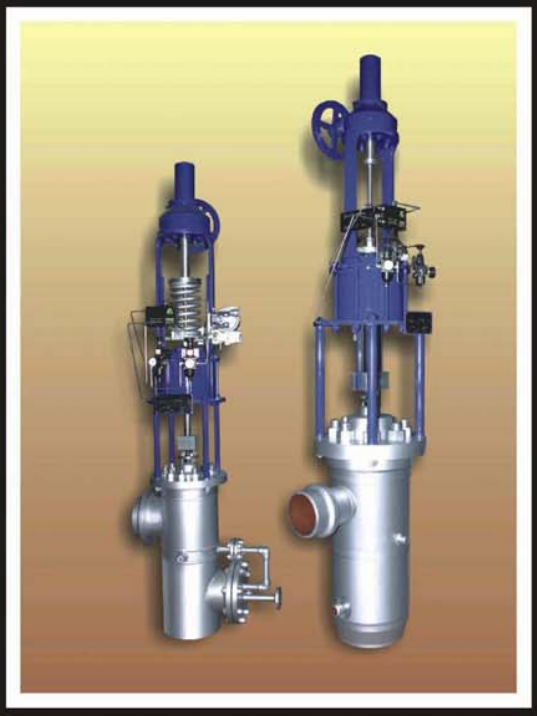
Valves ready to be shipped for Doosan Heavy Industries Korea

HP & LP Bypass valves for Atomic power plant

Valves ready for shipment for BHEL - BINA REFINERY

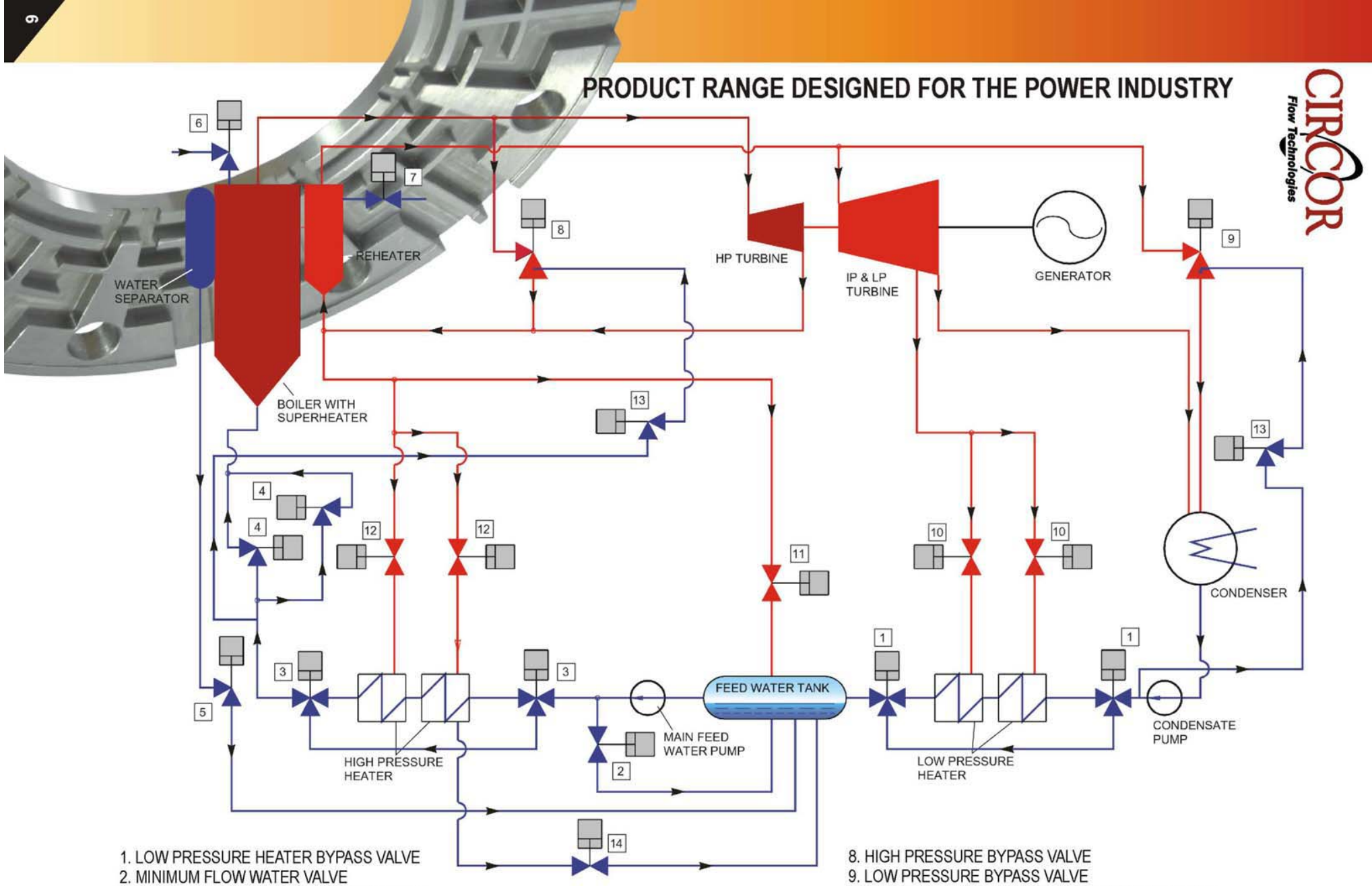
HP Bypass valve alongwith Dump Tube



HP and LP Bypass valves shipped to a Paper plant

PRDS Systems for L&T - IOCL Panipat plant

PRODUCT RANGE DESIGNED FOR THE POWER INDUSTRY



1. LOW PRESSURE HEATER BYPASS VALVE
2. MINIMUM FLOW WATER VALVE
3. HIGH PRESSURE HEATER BYPASS VALVE
4. FEED WATER CONTROL VALVE
5. WATER SEPARATOR DRAIN VALVE
6. SUPERHEATER SPRAY WATER VALVE
7. REHEATER SPRAY WATER VALVE
8. HIGH PRESSURE BYPASS VALVE
9. LOW PRESSURE BYPASS VALVE
10. LOW PRESSURE HEATER ATTEMPERATOR VALVE
11. FEED WATER TANK ATTEMPERATOR VALVE
12. HIGH PRESSURE HEATER ATTEMPERATOR VALVE
13. SPRAY WATER CONTROL VALVE
14. HIGH PRESSURE HEATER DRAIN VALVE

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CODING SYMBOL

S	A	A	h	n	2	100	250 / 500	1	2	3

FLUID

Steam	S
Water	W
Gas	G
Liquid	L
Flashing Water	F

FUNCTION

Pressure Control	P
Temperature Control	T
Shut Off	S
Pressure + Temperature Control	A
Safety Function to open	B
Safety Function to close	C
Pressure + Temperature Control + Safety Function to open	D
Pressure + Temperature Control + Safety Function to Close	E
Pressure Control + Safety Function to Close	F
Safety Function to Close	G
Else	H

BODY FORM

Angle	A
Globe	G
Z-Form	Z
Three Way	T
Else	E

TYPE

High Pressure	h
Low Pressure	l
Balanced	b
Non Balanced	n

ACTUATOR

Electric	1
Hydraulic	2
Pneumatic	3

FLOW DIRECTION

To open	1
To close	2
Else	3

BODY MATERIAL

Forged	1
Cast	2
Welded	3
Else	4

Inlet/ Outlet Diameter in mm

Seat Diameter in mm

SPRAY WATER INJECTION

By Atomizing Nozzle	1
Separate Nozzles	2
Multi Nozzle	3

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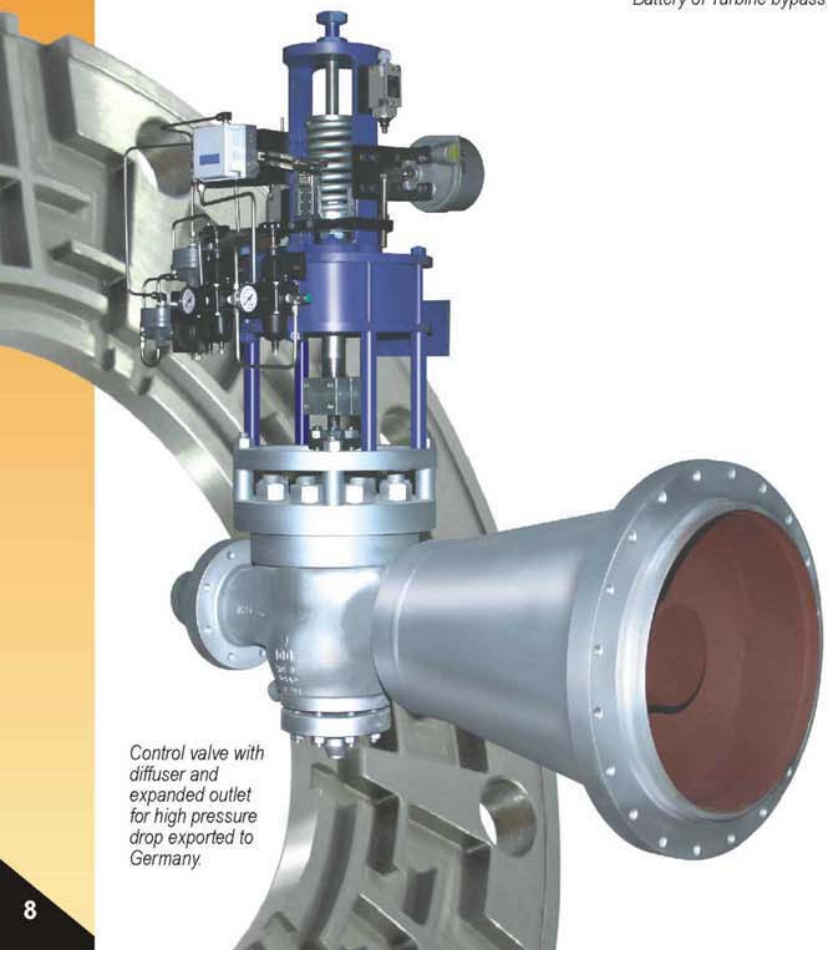
Battery of Turbine bypass, steam conditioning and spray water control valves ready for shipment to Taiwan.

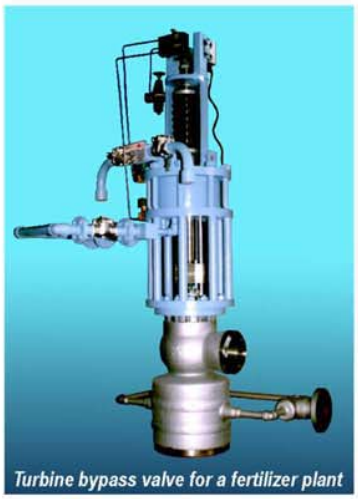
CIRCOR is the leading name for high performance, innovative and reliable equipment manufacturer for all segments of industry. Design, production and test facilities are second to none in the global market and the largest in Asia. Applications vary from conditioning of the steam, reducing and maintaining steam pressures, a vide range of critical valves for power plants.



Control valve with diffuser and expanded outlet for high pressure drop exported to Germany.

Introduction:

Turbine Bypass Valves play a very major role in Power Plant applications. Within a short period of twenty four hours, a power plant may be required to operate at minimum load, increase to maximum capacity for major part of the day, immediately lower back to minimum load and then back to maximum capacity. Bypass System permit unit start up and shutdown in a life saving manner for critical heavy components in boilers and turbines. Bypass valves are supplied with hydraulic, electric or pneumatic actuators as per the process requirements along with complete control systems as an option.



Turbine bypass valve for a fertilizer plant

Functions of HP & LP Bypass Valves:

1. To perform quick and economic start up, including cold start, warm start and hot start in a life saving manner for critical heavy components in boiler and turbine.
2. To operate boiler with the turbine shut down.
3. To perform warm and hot startup in a short time after a trip i.e. brings the unit back to load.
4. To run the unit down to house load.
5. To perform real 'two-shift operation".
6. To avoid condensate losses to the atmosphere and reduce the start up noise to the ambient outside the plant.

Applications:

There are two different applications:

1. Bypass Systems which are occasionally in operation. Among these there are startup and shutdown conditions and emergency conditions, for example after turbine trip.
2. Bypass systems which are often or permanently in operation, for example for process steam or heating application.

Turbine bypass valve and spray water control valve for a petrochemical plant.

Actuators:

Bypass Valves can be supplied with Pneumatic Piston, Electric or Hydraulic Actuators along with power pack and complete control system as per the requirements of the system.

Materials:

For most sizes, castings or forgings in Carbon and Alloy Steel can be supplied. For extremely large sizes, units are fabricated.

Bypass Valves are normally supplied with butt weld ends. However, if required can be supplied with flanged ends.

HP steam control valve

HP-Bypass System:

Independent of seeing the HP-bypass as part of the boiler or part of the turbo generator, it is branched off from the main steam leads and feeding into the cold reheat line.

Feed water, preferably branched off downstream of the HP-feed-water heaters is utilized as spray water for desuperheating the live steam down to turbine outlet conditions. A spray water pressure control/ shut off valve in front of the temperature control valve improves temperature controllability and provides automatic double shut off of the spray line.

Pressure and temperature controlled bypassing of the turbine minimizes the disturbances in the boiler after a turbine trip. It allows to adjust the live steam and reheat temperatures to the metal temperatures of the turbine prior to a hot start.

Although the HP-Bypass system includes a quick opening function, it does not replace the safety valves located on the boiler.

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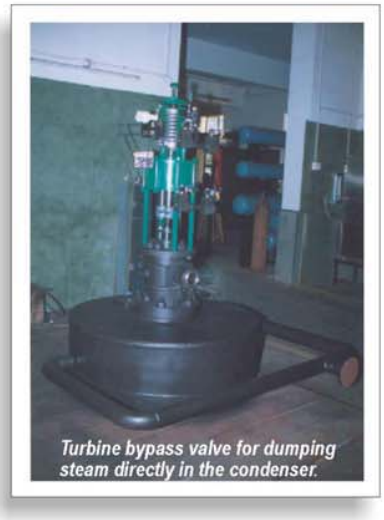
Turbine bypass valve for dumping steam directly in the condenser.


Turbine bypass valve for a steel plant.


HP and LP Turbine bypass valve for a Refinery

LP-Bypass System:

Usually the LP-Bypass valve is located in the neighbourhood of the condenser, below the turbine floor and integrated in the turbine/ condenser-concept.

The hot reheat steam is desuperheated on the downstream side of the pressure control valve by mixing it with condensate from the hotwell, branched off behind the condensate pumps.

During the startup load reject or trip conditions, the LP-bypass is controlling the reheat pressure in the unit and conducting the hot reheat steam desuperheated to the condenser.

The LP-Bypass condenser protection system has priority over all other control functions and thus protects the condenser from too high heat input in case of disturbance (for example lack of spray water) by closing the LP-Bypass and, if present, the LP-Isolation valve.

HP-Bypass Valve:

The HP Bypass is an angle type steam conditioning valve for pressure and temperature reduction. The flow direction of the steam is to close the valve. The steam pressure is reduced in a perforated control trim or **ZickTwist**™ disc stack arrangement. To reduce the temperature of the steam to cold reheat line steam conditions, spray water is injected through the laval nozzle. The atomizing of the injected spray water is refined by laval jet steam atomizing nozzle.

The main parts of the valve like the body, inlet and outlet nozzle and seat insert are made of welded parts of forged steel.

Depending on the operation data of the valve, the closure is designed either in self-tightening or in flange design and is made of forged steel. It contains a stuffing box with Graphite packing rings and is suitable for the attachment of any kind of actuator, hydraulic, electrical or pneumatic.

The exchangeable seat insert is not welded to the body. Seat and guiding surface are covered with a welded shielding of Stellite. Control trim and stem are made of 17% Chromium steel especially surface hardened or of Inconnel 718 depending upon design requirements.

The pull-out design of the valve allows an easy opening and closing for the inspection of all internals. As an option a steam strainer can be provided at the valve's inlet.

Usually a spring loaded actuator with a double acting piston is mounted. Solenoid valves for control quick opening and quick closing function are directly mounted on. The actuator is connected to the valve by a bonnet. Piston and stem are coupled together with an adjustable coupling.

LP-Bypass Valve:

The design of the low pressure bypass is similar to the HP-Bypass.

Depending on the operation data the valve's body is made either of forged or cast steel or fabricated. To reduce the forces of the stem the LP-Bypass usually is designed in a force balanced version that guarantees a tight shutoff.

For the reason that the outlet temperature of LP-Bypass systems usually is near the saturated steam conditions, the water injection is performed with steam atomizing nozzles at the valve's outlet. The atomizing steam is taken directly behind the seat of the valve, so that no additional equipment like gate valves, etc is needed.

The actuator of the LP-Bypass can be equipped with solenoid vales for a quick closing safety function.

An additional isolating valve at the inlet of the LP-Bypass is not absolutely needed.

Applications:

ZickTwist™ trim has a wide range of applications that demand velocity control and massive pressure drops to be catered to across the valve. It assists in eliminating cavitation and erosion of the conventional type trim designs, reduces velocity, decreases noise and provides stable control over the entire flow range of the fluid.

Applications are but not limited to:

- Turbine Bypass Valves
- Reheater Valves
- Soot Blower Valves
- Automatic Re-circulation Valves
- Superheater Spray Control Valves
- Boiler Feed Control Valves
- Start up Steam Vent Valves
- Heater Drain Valves
- Spray Water Valves
- Deaerator Level Control Valves

Perforated plug of Bypass valve.

View of ZickTwist™ disc stack assembly

ZickTwist™ trim design:

ZickTwist™ trim has stack of discs and each disc is tailor made for a particular flow path that has a variety of features:

The thickness of the wall of **ZickTwist™** trim is such that it ensures maximum tortuous flow path. It ensures the fluid has a uniform velocity and as it passes through the disk it is streamlined.

Its design ensures the flow to be distributed evenly throughout the disc. The open flow channel ensures even distribution.

Irrespective of flow direction, multi channels are provided. Multi channels evenly distribute fluid around the plug for full stroke thereby ensuring complete control, reliability and stability.

Each disc has a specific predetermined trim exit velocity which reduces noise, erosion, cavitation and vibration.

Multi-Stage Multi-Path Pressure Reduction via ZickTwist™ trim technology:

1. The only reliable and proven long term solution for elimination of noise, cavitation, flashing, vibration and erosion is to control velocity of the fluid. Our **ZickTwist™** trim technology uses a series of multi-stage multi-path disc stack for successful operation of our valves in severe service conditions.

2. The fluid passes through an extremely tortuous path at right angle turns thereby reducing the fluid velocity and therefore reduces the noise and eliminates erosion and vibration problems. The **ZickTwist™** disc stack is tailor-made as per the requirement of our customers.

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Detailed view of Turbine Bypass Valve with ZickTwist™ trim and laval jet nozzle: