

VALVTECHNOLOGIES®



Turbine Bypass System

ISO 9001 Certified

Turbine Bypass System



STAY ON-LINE

The steam turbine bypass system will allow the operator to keep the gas turbine and the heat recovery system generator (HRSG) on-line in the event of a steam turbine trip or to facilitate faster start-ups of the CT and HRSG. The turbine bypass system also enables a combined cycle plant to operate at turndown conditions, below that which can be achieved solely with GTGs.

CONTROL

During start-up and/or turbine trips, the steam dump control valves control the pressure and flow through the main and IP steam lines. Meanwhile, the attemperation system controls the temperature into the reheat inlet and condenser. These two components working together maintain the pressures and temperatures of the steam system, insure stable drum level control during a trip event and allows for a faster re-start of the steam turbine.

ISOLATION

The turbine bypass system's major function is to isolate the bypass loop during normal operation. The valves contained within the system must have tight isolation, as the system is isolated 95% of the time or more. Failure to properly isolate the system results in damaged seats and valves, which result in lost energy and loss of control during start-up and turbine trips. The ValvTechnologies' turbine bypass system provides the repeatable shut-off this application requires.

The ValvTechnologies' turbine bypass system is comprised of two major components:

1. The turbine bypass and control valve
2. The de-superheating spray water control system

TURBINE BYPASS AND CONTROL

Another major function of the turbine bypass system is to avoid a steam system overpressure event, resulting in the lifting of safety valves, and subsequently creating a maintenance/outage problem associated with repairing the valves. To accomplish this, the bypass valves operating in "fast-acting" (vs. modulating) mode actuates upon sensing an overpressure event in the main steam and/or hot reheat lines, or upon receipt of a steam turbine generator trip signal. The turbine bypass system diverts the system flow around the steam turbine generator to the condenser, which provides the ultimate heat sink. This serves to drop the system pressure, while still passing sufficient flow to maintain HRSG superheater and reheater section cooling. The valves on this part of the system act as "steam dump valves". The turbine bypass system incorporates ValvTechnologies' Xactrol® Mark III control technology with the patented ringed, conical disc stacks.



DE-SUPERHEATING SPRAY WATER CONTROL SYSTEM

The de-superheating spray water control system controls the temperature into the reheat inlet and the condenser. This system is made up of two components; the spray water control valve and spray nozzles and the mixer element. The spray water control valve is a ValvTechnologies' Xactrol® Mark I control valve.

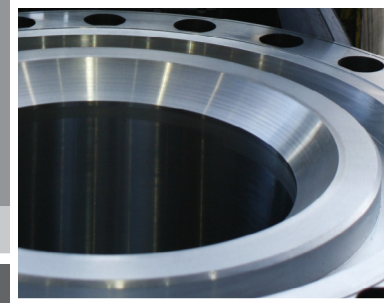
Downstream of the de-superheating section, there are several other considerations which must be given to the piping system and the steam turbine generator condensor. Proper implementation in general will require close coordination of ValvTechnologies, the condensor manufacturer and the engineering contractor.

Major considerations include:

1. Steam turbine bypass piping design and layout should be done in accordance with good engineering practice in order to minimize pocketing of condensate. This typically includes placement of generously sized drip legs with appropriate steam traps and drains.
2. Main steam and reheat piping design should follow the guidelines of ANSI/ASME TDP-1-1985 "Recommended Practices for the Prevention of Water Damage to Steam Turbines Used for Electric Power Generation"
3. Condenser design parameters must be coordinated between all three parties to ensure that operation of the steam dump system is within the process parameters associated with the condenser mechanical design (including inlet sparger). Key parameters include maximum inlet pressure (based on sparger design ΔP at design flow rate), maximum energy (typically 1200 Btu/lb), and maximum temperature (may be established to ensure minimum de-superheat in the fully mixed region downstream of the de-superheater to avoid exacerbating water hammer concerns).

| ValvTechnologies' Features and Benefits | |
|---|---|
| Features | Benefits |
| Guaranteed zero-leakage isolation | ValvTechnologies' seat test 100% of all valves to ANSI/FCI 70 -2, high and low pressure tested to class V and VI. Additionally, 1000 psi nitrogen seat-tested and documented to zero-leakage. |
| Repeatable zero-leakage isolation | The integral downstream seat serves as the isolation seat. Very little wear is taken across this seat as a result of the upstream side of the valve being designed to modulate and contain the disc stacks, which are designed to dissipate energy. |
| Accurate control and energy dissipation | The upstream stacked disc arrangement is designed with holes drilled through the disc channels. These holes are drilled along different centerlines and configurations through alternating discs, resulting in the streams of steam "colliding" with each other as they travel from disc channel to disc channel. |
| Temperature control | The spray water control valve and spray nozzles spray water into the mixer element where the water mixes with the steam passing through the system until the steam/water mixture is the desired temperature for the reheat inlet and the condenser. The spray water control valve is controlled by temperature devices and is opened or closed to maintain the desired temperature. |
| High-speed actuation | The system has been designed with a hydraulic, rotary vane actuator, which mounts directly and concentrically over the valve stem. Depending upon the rate of change of the signal source, the valve will open either slowly or fast as required. |
| High-temperature | ValvTechnologies is experienced to handle higher temperatures (experience on fuel cells at 1400°F) associated with combined cycle plants. |

Engineered Solutions



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