GE Power

Heat Conservation System

A solution for faster startup of Conventional Steam Turbines

Background

The Steam Turbine Heat Conservation System (ST HCS) utilizes heated air as the medium for warm-keeping of the high temperature rotors during periods of standstill and prior to re-start. This solution reduces start-up times by eliminating cold start conditions as well as providing preservation of the steam turbine and condenser by maintaining humidity control when the unit is in stand-still mode.

Flexibility Improvement

At a unit restart, HP and IP steam turbine modules are loaded within the admissible stress limits and load gradients. Stress limits and load gradients are highly dependent upon the metal temperatures of the ST rotor. The warmer the rotor is at restart, the faster ST can be loaded and operated at its nominal capacity.

Solution

The ST Heat Conservation maintains warm conditions for critical turbine components and counteracts the natural cool-down of the ST (blue line in Fig. 1) by injecting hot air into the flow-path. The ST HCS also keeps the steam turbine rotor(s) at warm start conditions during standstill mode.

Because the hot air injection begins operation upon breaking of condenser vacuum, the ST natural cooling is decelerated (red line in Fig. 1) and will allow for faster ST start times upon restart due to warm start conditions. Alternatively, the ST HCS can be applied to enable warm start-up conditions after a long standstill period (orange line in Fig. 1).

Keeping the unit in a warm condition during off-line periods allows the operator to eliminate the typical hold point during ST run-up in combination with increased ST acceleration. This in turn will result in lower stress on materials compared to cold start conditions.

The heated air is used to achieve the target rotor temperature in the range of 210°C (410°F). Existing ST drain piping will be modified at appropriate locations to allow the hot air to be discharged. An optional low pressure temperature control can be realized (see in Fig. 2). The ST remains in turning gear operation during the heat conservation operation.

During a restart of the plant the ST HCS operation system will shut down its air heaters and the air circuit from the steam water cycle.

The additional equipment needed for the heat conservation is colored in red (see Fig. 2).

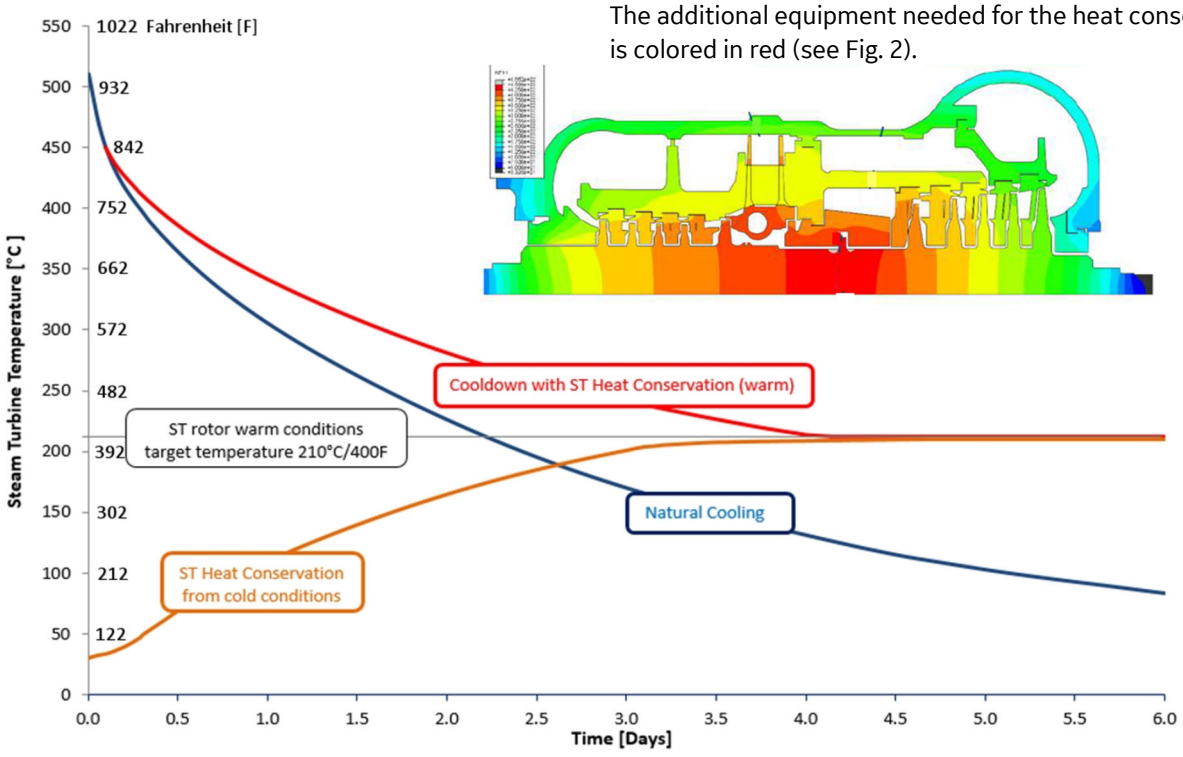

Figure 1: *Typical ST metal temperature profiles after shut-down with and without HCS and applying HCS from a cold start condition.*

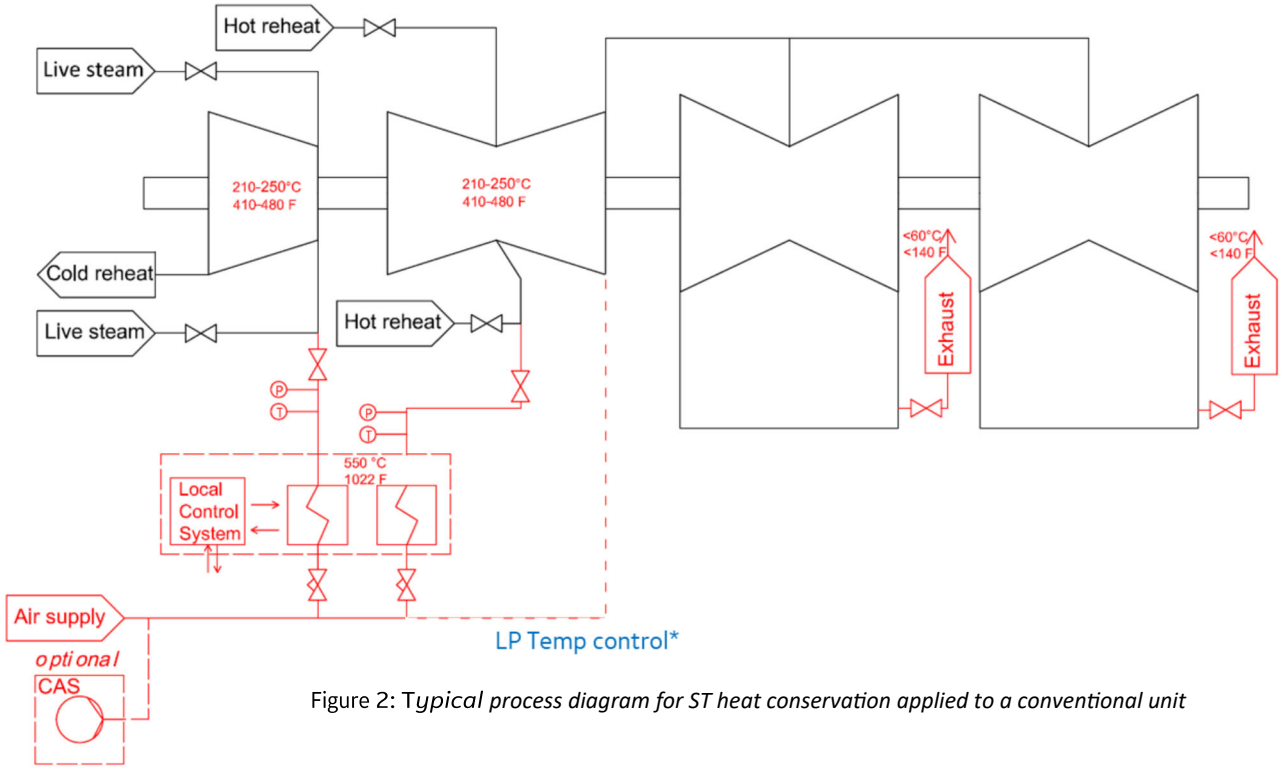

Figure 2: T*ypical process diagram for ST heat conservation applied to a conventional unit*

Scope of Supply

- ST Heat Conservation equipment
  - Compressed Air Skid*
  - Electric heaters
  - Set of piping and safety valves*
  - Instrumentation & cabling
- Heating support system for valves*
- Control System for automated operation
- Software modification on plant control system

* As Required

Benefits

Implementing the ST heat conservation system will prevent the steam turbine from entering a cold condition after the shutdown. The warm-keeping of the ST leads to the following benefits:

- Improved availability through reduced start up times
- Improved start-up efficiency
- Enhanced flexibility by shorter response time upon demands from grid
- Avoidance of penalties for late delivery to the grid
- Steam Turbine lifetime improvement
- Automated preservation of ST components and condenser by removing humidity
- *Additional benefit:* Controlled forced cooling capability for faster shut-downs and reduction of outage duration

Applicability

The Heat Conservation System is generally applicable to double shell steam turbine configurations in conventional fossil-fired power plants, of both GE and non-GE technology.

Complementary Products

- Turbine Rotor Stress Control
- Startup Optimizer
- Life Time Assessments
- Cold End Corrosion Diagnostics

For more information please contact your local GE representative

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