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| *PROJECT* |
| **ERF CONSTRUCTION WORKS FOR THE NORTH LONDON HEAT & POWER PROJECT** |
| *ORIGINATOR* |
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| *DOCUMENT TITLE* |
| **MAIN STEAM, EXTRACTIONS, AUXILIARY STEAM & BY-PASS SYSTEM FUNCTIONAL DESCRIPTION** |

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# instrument and control

## Operation Description

The Main Steam, Extractions, Auxiliary Steam & By-Pass System instrumentation is represented in the P&ID (NPE7-EAI-41XX-XXX-PD-XA-000010).

The system instrumentation is shown in P&ID No. NPE7-EAI-41XX-XXX-PD-XA-000002, “P&ID Main Steam, Extractions, Auxiliary Steam & Bypass System”

The system control diagram, document No. NPE7-EAI-41XX-XXX-PP-XA-007604, “Main Steam, Extractions Auxiliary Steam & By-Pass System - Control Logic Diagrams”, details the control, protections and automatic devices of the system and includes a block diagram with hierarchical control structure level, so all the conditions to ensure that the system will start up automatically must be fulfilled.

The system can also be controlled from the lower hierarchical levels, actuating directly on the different drives. All drives are monitored and controlled from the operating displays (Human Machine Interfaces or HMI) of the operating stations of the Distributed Control System (DCS) installed in the Central Control Room (CCR).

In order to control and supervise the regulating stations, the system includes Automatic-Manual Operating stations (A/M stations), used by the operator to select the control mode (automatic or manual), modify the setpoints and actuate manually on the demand to the final control element.

In order to actuate upon the different parameters, the A/M station is equipped with auto-manual push buttons.

When a group or equipment item is in automatic mode, it is not possible to control it from the control faceplate located on the operating screen of each system, and it will only follow the automatic orders from a higher hierarchical level.

When a group or equipment item is in manual mode, the operator has the responsibility of the control. The group or equipment ignores any automatic order received from higher hierarchical levels and the control must be done, by the operator, from the control faceplate located on the operating screen of each system.

Whatever will be the control mode, the necessary startup permissives, protections and interlocks shall be programmed into the control system to prevent any type of actuation that could cause any damage to the system equipment or dependent systems. Any equipment, whose actuation depends on a measurement’s value, will be immediately rejected to manual if that measurement turns to bad quality status. The plant operator will be warned by the corresponding alarm to solve the problem. In that way equipment improper actuations are prevented.

### Normal Operation

During normal operation, the Drain Pot valves will be closed and in auto.

The isolation valves from the boilers will be opened and the Bypass valves will be closed.

The steam generated by the Boilers will be driven to the Steam turbine (ST).

For more detail, see section 4.2.1., Analogue Control and Regulation.

### Start-Up

During the start-up, the Drain Pot valves will open to evacuate the condensate created during warm up of the lines.

As the pressure increases, the Bypass Control Valves drive the steam to the condenser, always according with the starting curves of the Boilers and Steam Turbine.

Once the Steam Turbine Floor Pressure setpoint is reached, the steam turbine will start to admit the generated steam and Bypass Control Valves will close.

### Shutdown

Boilers steam generation and ST load will decrease gradually until the value is lower enough to open the ST generator circuit breaker.

At this point, the Bypass Control Valves will be in charge to regulate pressure in the lines, keeping the lines pressurized.

## Instrumentation and Control

### Main Steam

#### Analogue Control and Regulation

There is no analogue control and regulation in this sheet.

#### Logic Control and Protections

##### Boiler #1 Main Steam isolation MOV B1LBA10AA301

The task of this valve is to isolate the boiler #1 main steam header.

* Opening and closing conditions

The valve is operated manually. It will not be allowed to close if the steam turbine is operating

* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close

##### Boiler #2 Main Steam isolation MOV B2LBA10AA301

The task of this valve is to isolate the boiler #2 main steam header.

* Opening and closing conditions

The valve is operated manually. It will not be allowed to close if the steam turbine is operating

* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close

##### Boiler #1 Main Steam to Auxiliary Steam Isolation MOV B0LBA30AA301

The task of this valve is to isolate the boiler #1 main steam to the auxiliary steam.

* Opening and closing conditions

The valve is operated manually.

* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close

##### Boiler #2 Main Steam to Auxiliary Steam Isolation MOV B0LBA30AA302

The task of this valve is to isolate the boiler #2 main steam to the auxiliary steam.

* Opening and closing conditions

The valve is operated manually.

* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close

##### B1LBA10 Pot Drain valve B1LBA10AA302

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when the Boiler 1 is in service and Steam Pressure, measured by the average between the pressure transmitter B1LBA10CP001 and B1LBA10CP002 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve closes to an intermediate position.

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B1LBA10CT004) in the drain pot is below the saturation temperature plus A VALUE, and will close 15 seconds after an adequate steam superheating value (H) is achieved.
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close

##### B2LBA10 Pot Drain valve B2LBA10AA302

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when the Boiler 1 is in service and Steam Pressure, measured by the average between the pressure transmitter B2LBA10CP001 and B2LBA10CP002 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve closes to an intermediate position.

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B2LBA10CT004) in the drain pot is below the saturation temperature plus A VALUE, and will close 15 seconds after an adequate steam superheating value (H) is achieved.
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close

### Main Steam & Extractions

#### Analogue Control and Regulation

There is no analogue control and regulation in this sheet.

#### Logic Control and Protections

##### B0LBA10 Pot Drain valve B0LBA10AA302

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when the Boiler 1 or 2 are in service and Steam Pressure, measured by the average between the pressure transmitter B1LBA10CP001 and B1LBA10CP002 or B2LBA10CP001 and B2LBA10CP002 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve closes to an intermediate position.

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B0LBA10CT001) in the drain pot is below the saturation temperature plus A VALUE, and will close 15 seconds after an adequate steam superheating value (H) is achieved.
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close

##### Main Steam Vent MOV B0LBA10AA301

The task of this valve is to isolate the boiler #2 main steam to the auxiliary steam.

* Opening and closing conditions

The valve is operated manually.

* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close.

##### B0LBA11 Pot Drain valve B0LBA11AA301

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when the Boiler 1 or 2 are in service and Steam Pressure, measured by the average between the pressure transmitter B0LBA11CP001 and B0LBA11CP002 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve closes to an intermediate position.

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B1LBA11CT001) in the drain pot is below the saturation temperature plus A VALUE, and will close 15 seconds after an adequate steam superheating value (H) is achieved.
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close

##### B0LBA12 Pot Drain valve B0LBA12AA301

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when the Boiler 1 or 2 are in service and Steam Pressure, measured by the average between the pressure transmitter B0LBA12CP001 and B0LBA12CP002 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve closes to an intermediate position.

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B1LBA12CT001) in the drain pot is below the saturation temperature plus A VALUE, and will close 15 seconds after an adequate steam superheating value (H) is achieved.
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close

##### B0LBW10 Pot Drain valve B0LBW10AA301

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when the Boiler 1 or 2 are in service and Steam Pressure, measured by the average between the pressure transmitter B0LBW10CP001 and B0LBW10CP002 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve closes to an intermediate position.

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B1LBW10CT003) in the drain pot is below the saturation temperature plus A VALUE, and will close 15 seconds after an adequate steam superheating value (H) is achieved.
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close

##### B0LBD10 Pot #1 Drain valve B0LBD10AA303

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when the ST is in service and Steam Pressure, measured by the pressure transmitter B0LBD10CP001 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve starts to operate based on temperature measurement.

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B0LBD10CT003) in the drain pot is below the saturation temperature plus A VALUE. This valve close if the above conditions are not complied with for more than a defined time (15 seconds).
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close.

##### B0LBD10 Pot #2 Drain valve B0LBD10AA304

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when the ST is in service and Steam Pressure, measured by the pressure transmitter B0LBD10CP001 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve closes to an intermediate position.

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B0LBD10CT004) in the drain pot is below the saturation temperature plus A VALUE, and will close 15 seconds after an adequate steam superheating value (H) is achieved.
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close.

##### B0LBD10 Pot #3 Drain valve B0LBD10AA305

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when the ST is in service and Steam Pressure, measured by the pressure transmitter B0LBD10CP001 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve closes to an intermediate position.

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B0LBD10CT005) in the drain pot is below the saturation temperature plus A VALUE, and will close 15 seconds after an adequate steam superheating value (H) is achieved.
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close.

##### B0LBD20 Pot #1 Drain valve B0LBD20AA303

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when the ST is in service and Steam Pressure, measured by the pressure transmitter B0LBD20CP001 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve starts to operate based on temperature measurement.

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B0LBD20CT003) in the drain pot is below the saturation temperature plus A VALUE. This valve close if the above conditions are not complied with for more than a defined time (15 seconds).
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close.

##### B0LBD20 Pot #2 Drain valve B0LBD20AA304

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when the ST is in service and Steam Pressure, measured by the pressure transmitter B0LBD20CP001 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve closes to an intermediate position.

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B0LBD20CT004) in the drain pot is below the saturation temperature plus A VALUE, and will close 15 seconds after an adequate steam superheating value (H) is achieved.
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close.

##### B0LBD20 Pot #3 Drain valve B0LBD20AA305

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when the ST is in service and Steam Pressure, measured by the pressure transmitter B0LBD20CP001 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve closes to an intermediate position.

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B0LBD20CT005) in the drain pot is below the saturation temperature plus A VALUE, and will close 15 seconds after an adequate steam superheating value (H) is achieved.
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close.

##### B0LBS10 Pot #1 Drain valve B0LBS10AA304

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when the ST is in service and Steam Pressure, measured by the average between the pressure transmitter B0LBS10CP001 and B0LBS10CP002 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve starts to operate based on level measurement.

In normal operation the valve will open and close as the following indications:

* + High or high-high level (B0LBS10CL301 and B0LBS10CL302) is detected in the drain pot. This valve close if the above conditions are not complied with for more than a defined time (15 seconds).
* Forced open

If the valve has not opened after some time, after the High level in the drain pot is exceeded, or if the High High level switched is achieved, the valve will force to open. The forced command shall disappear once the high level switch signal is deactivated after some time.

* Forced close

The valve is not forced to close.

##### B0LBS10 Pot #2 Drain valve B0LBS10AA305

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when the ST is in service and Steam Pressure, measured by the average between the pressure transmitter B0LBS10CP001 and B0LBS10CP002 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve starts to operate based on level measurement.

In normal operation the valve will open and close as the following indications:

* + High or high-high level (B0LBS10CL303 and B0LBS10CL304) is detected in the drain pot. This valve close if the above conditions are not complied with for more than a defined time (15 seconds).
* Forced open

If the valve has not opened after some time, after the High level in the drain pot is exceeded, or if the High High level switched is achieved, the valve will force to open. The forced command shall disappear once the high level switch signal is deactivated after some time.

* Forced close

The valve is not forced to close.

##### B0LBS10 Pot #3 Drain valve B0LBS10AA306

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when the ST is in service and Steam Pressure, measured by the average between the pressure transmitter B0LBS10CP001 and B0LBS10CP002 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve starts to operate based on level measurement.

In normal operation the valve will open and close as the following indications:

* + High or high-high level (B0LBS10CL305 and B0LBS10CL306) is detected in the drain pot. This valve close if the above conditions are not complied with for more than a defined time (15 seconds).
* Forced open

If the valve has not opened after some time, after the High level in the drain pot is exceeded, or if the High High level switched is achieved, the valve will force to open. The forced command shall disappear once the high level switch signal is deactivated after some time.

* Forced close

The valve is not forced to close.

##### B0LBS10 Pot #4 Drain valve B0LBS10AA307

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when the ST is in service and Steam Pressure, measured by the pressure transmitter B0LBS10CP003 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve starts to operate based on level measurement.

In normal operation the valve will open and close as the following indications:

* + High or high-high level (B0LBS10CL307 and B0LBS10CL308) is detected in the drain pot. This valve close if the above conditions are not complied with for more than a defined time (15 seconds).
* Forced open

If the valve has not opened after some time, after the High level in the drain pot is exceeded, or if the High High level switched is achieved, the valve will force to open. The forced command shall disappear once the high level switch signal is deactivated after some time.

* Forced close

The valve is not forced to close.

##### B0LBS20 Pot #1 Drain valve B0LBS20AA304

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when the ST is in service and Steam Pressure, measured by the pressure transmitter B0LBS20CP001 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve starts to operate based on level measurement.

In normal operation the valve will open and close as the following indications:

* + High or high-high level (B0LBS20CL301 and B0LBS20CL302) is detected in the drain pot. This valve close if the above conditions are not complied with for more than a defined time (15 seconds).
* Forced open

If the valve has not opened after some time, after the High level in the drain pot is exceeded, or if the High High level switched is achieved, the valve will force to open. The forced command shall disappear once the high level switch signal is deactivated after some time.

* Forced close

The valve is not forced to close.

##### B0LBS20 Pot #2 Drain valve B0LBS20AA305

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when the ST is in service and Steam Pressure, measured by the pressure transmitter B0LBS20CP001 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve starts to operate based on level measurement.

In normal operation the valve will open and close as the following indications:

* + High or high-high level (B0LBS20CL303 and B0LBS20CL304) is detected in the drain pot. This valve close if the above conditions are not complied with for more than a defined time (15 seconds).
* Forced open

If the valve has not opened after some time, after the High level in the drain pot is exceeded, or if the High High level switched is achieved, the valve will force to open. The forced command shall disappear once the high level switch signal is deactivated after some time.

* Forced close

The valve is not forced to close.

##### B0LBS20 Pot #3 Drain valve B0LBS20AA306

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when the ST is in service and Steam Pressure, measured by the pressure transmitter B0LBS20CP001 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve starts to operate based on level measurement.

In normal operation the valve will open and close as the following indications:

* + High or high-high level (B0LBS20CL305 and B0LBS20CL306) is detected in the drain pot. This valve close if the above conditions are not complied with for more than a defined time (15 seconds).
* Forced open

If the valve has not opened after some time, after the High level in the drain pot is exceeded, or if the High High level switched is achieved, the valve will force to open. The forced command shall disappear once the high level switch signal is deactivated after some time.

* Forced close

The valve is not forced to close.

### MP Steam/Auxiliary Steam

#### Analogue Control and Regulation

##### Main Steam to Auxiliary Steam Attemperation CV B0LBA30AA401

The function of this valve is to regulate the pressure of the HP steam line to auxiliary steam.

The process variable is the Main Steam to auxiliary steam header pressure, measured by the average between pressure transmitters B0LBG12CP0001 and B0LBG12CP0002.

The pressure measurement shall be compared to the setpoint, not adjustable by the operator. Control shall be performed by means of a reverse PI algorithm. If the difference between the measured pressure and the setpoint is positive, the valve will close; the opposite applies if the difference is negative, opening the valve.

* Forced open

The valve is not forced to open.

* Forced close

The valve will be forced to close in the following cases:

* If the discharge steam temperature, measured by the average between temperature transmitters B0LBG12CT001 and B0LBG12CT002 is higher than a certain value.

##### Main Steam to Auxiliary Steam Attemperation Water CV B0LAF33AA401

The primary function of this valve is to control the main steam to auxiliary steam header temperature.

The process variable is the Main Steam to Auxiliary Steam Attemperation CV discharge temperature, measured by the average between temperature transmitters B0LBG12CT0001 and B0LBG12CT0002.

The temperature measurement shall be compared to the setpoint, not adjustable by the operator. Control shall be performed by means of a direct PI algorithm. If the difference between the measured temperature and the setpoint and the is positive, the valve will open; the opposite applies if the difference is negative, closing the valve.

* Forced open

The valve is not forced to open.

* Forced closed:

The valve will be forced to close in the following cases:

* Main Steam to Auxiliary Steam Attemperation CV is closed

##### ST IV Extraction to Auxiliary Steam Conditioning CV B0LBD10AA401

The function of this valve is to regulate the pressure of ST extraction IV line to auxiliary steam.

The process variable is the ST IV extraction to auxiliary steam conditioning CV discharge pressure, measured by the average between pressure transmitters B0LBG11CP0001 and B0LBG11CP0002.

The pressure measurement shall be compared to the setpoint, not adjustable by the operator. Control shall be performed by means of a reverse PI algorithm. If the difference between the measured pressure and the setpoint is positive, the valve will close; the opposite applies if the difference is negative, opening the valve.

* Forced open

The valve is not forced to open.

* Forced close

The valve will be forced to close in the following cases:

* If the discharge steam temperature, measured by the average between the temperature transmitters B0LBG11CT001 and B0LBG11CT00B is higher than a certain value.

##### ST IV Extraction to Auxiliary Steam Conditioning water CV B0LAF34AA401

The primary function of this valve is to control the ST IV extraction to auxiliary steam Conditioning CV discharge temperature.

The process variable is the ST IV extraction Conditioning CV discharge temperature, measured by the average between temperature transmitters B0LBG11CT0001 and B0LBG11CT0002.

The temperature measurement shall be compared to the setpoint, not adjustable by the operator. Control shall be performed by means of a direct PI algorithm. If the difference between the measured temperature and the setpoint and the is positive, the valve will open; the opposite applies if the difference is negative, closing the valve.

* Forced open

The valve is not forced to open.

* Forced closed:

The valve will be forced to close in the following cases:

* ST IV Extraction to Auxiliary Steam Conditioning CV is closed

##### Main Steam to District Heating Header Attemperation CV B0LBA31AA401

The function of this valve is to regulate the pressure of the HP steam line to district heating.

The process variable is the Main Steam to district heating header pressure, measured by the average between pressure transmitters B0LBG40CP0001 and B0LBG40CP0002.

The pressure measurement shall be compared to the setpoint, not adjustable by the operator. Control shall be performed by means of a reverse PI algorithm. If the difference between the measured pressure and the setpoint is positive, the valve will close; the opposite applies if the difference is negative, opening the valve.

* Forced open

The valve is not forced to open.

* Forced close

The valve will be forced to close in the following cases:

* If the discharge steam temperature, measured by the average between temperature transmitters B0LBG40CT001 and B0LBG40CT002 is higher than a certain value.

##### Main Steam to District Heating Header Attemperation Water CV B0LAF32AA401

The primary function of this valve is to control the main steam to district heating header temperature.

The process variable is the Main Steam to District Heating Attemperation CV discharge temperature, measured by the average between temperature transmitters B0LBG40CT0001 and B0LBG40CT0002.

The temperature measurement shall be compared to the setpoint, not adjustable by the operator. Control shall be performed by means of a direct PI algorithm. If the difference between the measured temperature and the setpoint and the is positive, the valve will open; the opposite applies if the difference is negative, closing the valve.

* Forced open

The valve is not forced to open.

* Forced closed:

The valve will be forced to close in the following cases:

* Main Steam to District Heating Header Attemperation CV is closed

##### Auxiliary Steam to Deaerator CV B0LBG20AA401

The function of this valve is to regulate the pressure of the auxiliary steam to the deaerator.

The process variable is the DA and FWT pressure, measured by the average between pressure transmitters TBD.

The pressure measurement shall be compared to the setpoint, not adjustable by the operator. Control shall be performed by means of a reverse PI algorithm. If the difference between the measured pressure and the setpoint is positive, the valve will close; the opposite applies if the difference is negative, opening the valve.

* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close

##### Auxiliary Steam to Boiler 1 Air Preheaters CV B1LBG30AA401

The function of this valve is to regulate the flow of the auxiliary steam to the air preheaters.

The process variable is the flow, measured by the average between flow transmitters B1LBG30CF001 and B1LBG30CF002.

The flow measurement shall be compared to the setpoint, not adjustable by the operator. Control shall be performed by means of a reverse PI algorithm. If the difference between the measured flow and the setpoint is positive, the valve will close; the opposite applies if the difference is negative, opening the valve.

* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close

##### Auxiliary Steam to Boiler 2 Air Preheaters CV B2LBG31AA401

The function of this valve is to regulate the flow of the auxiliary steam to the air preheaters.

The process variable is the flow, measured by the average between flow transmitters B2LBG30CF001 and B2LBG30CF002.

The flow measurement shall be compared to the setpoint, not adjustable by the operator. Control shall be performed by means of a reverse PI algorithm. If the difference between the measured flow and the setpoint is positive, the valve will close; the opposite applies if the difference is negative, opening the valve.

* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close

#### Logic Control and Protections

##### B0LBA30 Pot #1 Drain valve B0LBA30AA303

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The e Drain Pot Valve fully opens when the Boiler 1 or 2 are in service and Steam Pressure, measured by the average between the pressure transmitter B1LBA10CP001 and B1LBA10CP002 or B2LBA10CP001 and B2LBA10CP002 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve closes to an intermediate position

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B0LBA30CT001) in the drain pot is below the saturation temperature plus A VALUE, and will close 15 seconds after an adequate steam superheating value (H) is achieved.
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close

##### B0LBA30 Pot #2 Drain valve B0LBA30AA304

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The e Drain Pot Valve fully opens when the Boiler 1 or 2 are in service and Steam Pressure, measured by the average between the pressure transmitter B1LBA10CP001 and B1LBA10CP002 or B2LBA10CP001 and B2LBA10CP002 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve closes to an intermediate position

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B0LBA30CT002) in the drain pot is below the saturation temperature plus A VALUE, and will close 15 seconds after an adequate steam superheating value (H) is achieved.
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close

##### B0LBA30 Pot #3 Drain valve B0LBA30AA305

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The e Drain Pot Valve fully opens when the Boiler 1 or 2 are in service and Steam Pressure, measured by the average between the pressure transmitter B1LBA10CP001 and B1LBA10CP002 or B2LBA10CP001 and B2LBA10CP002 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve closes to an intermediate position

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B0LBA30CT003) in the drain pot is below the saturation temperature plus A VALUE, and will close 15 seconds after an adequate steam superheating value (H) is achieved.
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close

##### B0LBA31 Pot #1 Drain valve B0LBA31AA302

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when the Boiler 1 or 2 are in service and Steam Pressure, measured by the average between the pressure transmitter B1LBA10CP001 and B1LBA10CP002 or B2LBA10CP001 and B2LBA10CP002 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve closes to an intermediate position.

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B0LBA31CT002) in the drain pot is below the saturation temperature plus A VALUE, and will close 15 seconds after an adequate steam superheating value (H) is achieved.
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close

##### B0LBD10 Pot #4 Drain valve B0LBA30AA306

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when the ST is in service and Steam Pressure, measured by the pressure transmitter B0LBD10CP002 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve closes to an intermediate position.

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B0LBD10CT006) in the drain pot is below the saturation temperature plus A VALUE, and will close 15 seconds after an adequate steam superheating value (H) is achieved.
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close

##### B0LBG10 Pot Drain valve B0LBG10AA301

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when the ST is in service and Steam Pressure, measured by the average between the pressure transmitter B0LBG10CP001 and B0LBG10CP002 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve closes to an intermediate position.

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B0LBG10CT003) in the drain pot is below the saturation temperature plus A VALUE, and will close 15 seconds after an adequate steam superheating value (H) is achieved.
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close

##### B0LBG20 Pot Drain valve B0LBG20AA302

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when Steam Pressure, measured by the average between the pressure transmitter B0LBG10CP001 and B0LBG10CP002 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve closes to an intermediate position.

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B0LBG20CT001) in the drain pot is below the saturation temperature plus A VALUE, and will close 15 seconds after an adequate steam superheating value (H) is achieved
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close

##### B0LBG30 Pot Drain valve B0LBG30AA301

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when Steam Pressure, measured by the average between the pressure transmitter B0LBG30CP001 and B0LBG30CP002 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve closes to an intermediate position.

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B0LBG30CT001) in the drain pot is below the saturation temperature plus A VALUE, and will close 15 seconds after an adequate steam superheating value (H) is achieved.
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close

##### B1LBG30 Pot #1 Drain valve B1LBG30AA302

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when Steam Pressure, measured by the average between the pressure transmitter B0LBG30CP001 and B0LBG30CP002 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve closes to an intermediate position.

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B1LBG30CT003) in the drain pot is below the saturation temperature plus A VALUE, and will close 15 seconds after an adequate steam superheating value (H) is achieved.
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close

##### B1LBG30 Pot #2 Drain valve B1LBG30AA303

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when Steam Pressure, measured by the average between the pressure transmitter B0LBG30CP001 and B0LBG30CP002 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve closes to an intermediate position.

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B1LBG30CT004) in the drain pot is below the saturation temperature plus A VALUE, and will close 15 seconds after an adequate steam superheating value (H) is achieved.
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close

##### B2LBG30 Pot #1 Drain valve B2LBG30AA302

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when Steam Pressure, measured by the average between the pressure transmitter B0LBG30CP001 and B0LBG30CP002 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve closes to an intermediate position.

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B2LBG30CT003) in the drain pot is below the saturation temperature plus A VALUE, and will close 15 seconds after an adequate steam superheating value (H) is achieved.
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close.

##### B2LBG30 Pot #2 Drain valve B2LBG30AA303

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when Steam Pressure, measured by the average between the pressure transmitter B0LBG30CP001 and B0LBG30CP002 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve closes to an intermediate position.

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B2LBG30CT004) in the drain pot is below the saturation temperature plus A VALUE, and will close 15 seconds after an adequate steam superheating value (H) is achieved.
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close.

##### B2LBG30 Pot #3 Drain valve B2LBG30AA304

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when Steam Pressure, measured by the average between the pressure transmitter B0LBG30CP001 and B0LBG30CP002 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve closes to an intermediate position.

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B2LBG30CT005) in the drain pot is below the saturation temperature plus A VALUE, and will close 15 seconds after an adequate steam superheating value (H) is achieved.
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close.

##### Auxiliary Steam to Deaerator CV bypass MOV B0LBG20AA301

The task of this valve is to ensure auxiliary steam flow to deaerator in case of Auxiliary Steam to Deaerator CV is out of service.

* Opening and closing conditions

The valve is operated manually.

* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close

##### Auxiliary Steam to Boiler 1 Air Preheaters CV bypass MOV B1LBG30AA301

The task of this valve is to ensure auxiliary steam flow to boiler 1 air preheaters in case of Auxiliary Steam to Boiler 1 Air Preheaters CV is out of service.

* Opening and closing conditions

The valve is operated manually.

* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close

##### Auxiliary Steam to Boiler 2 Air Preheaters CV bypass MOV B2LBG30AA301

The task of this valve is to ensure auxiliary steam flow to boiler 2 air preheaters in case of Auxiliary Steam to Boiler 2 Air Preheaters CV is out of service.

* Opening and closing conditions

The valve is operated manually.

* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close

##### Main Steam to Auxiliary Steam Attemperation Water Isolation Valve B0LAF33AA301

The task of this valve is to isolate the water supply to the Main Steam to Auxiliary Steam Attemperation Water CV.

* Opening and closing conditions

The valve is operated manually. It is not allowed to close if the control valve downstream is operating.

* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close

##### Main Steam to District Heating Header Attemperation Water Isolation Valve B0LAF32AA301

The task of this valve is to isolate the water supply to the Main Steam to Auxiliary Steam Attemperation Water CV.

* Opening and closing conditions

The valve is operated manually. It is not allowed to close if the control valve downstream is operating.

* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close

##### ST IV Extraction to Auxiliary Steam Conditioning Water Isolation Valve B0LAF34AA301

The task of this valve is to isolate the water supply to the Main Steam to Auxiliary Steam Attemperation Water CV.

* Opening and closing conditions

The valve is operated manually. It is not allowed to close if the control valve downstream is operating.

* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close

### Boilers Primary Air Heat Exchangers

#### Analogue Control and Regulation

##### Boiler 1 Primary Air Preheaters Temperature CV B1LBG31AA301

The function of this valve is to regulate the temperature of the steam supply to the boiler 1 primary air preheaters.

The process variable is the auxiliary steam temperature, measured by the temperature transmitters (TBD) by Hitachi.

The temperature measurement shall be compared to the setpoint, not adjustable by the operator. Control shall be performed by means of a reverse PI algorithm. If the difference between the measured temperature and the setpoint is positive, the valve will close; the opposite applies if the difference is negative, opening the valve.

* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close.

##### Boiler 2 Primary Air Preheaters Temperature CV B2LBG31AA301

The function of this valve is to regulate the temperature of the steam supply to the boiler 2 primary air preheaters.

The process variable is the auxiliary steam temperature, measured by the temperature transmitters (TBD) by Hitachi.

The temperature measurement shall be compared to the setpoint, not adjustable by the operator. Control shall be performed by means of a reverse PI algorithm. If the difference between the measured temperature and the setpoint is positive, the valve will close; the opposite applies if the difference is negative, opening the valve.

* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close.

#### Logic Control and Protections

There is no logic control and protections in this sheet.

### Boilers Secondary Air Heat Exchangers

#### Analogue Control and Regulation

##### Boiler 1 Secondary Air Preheaters Temperature CV B1LBG32AA301

The function of this valve is to regulate the temperature of the steam supply to the boiler 1 secondary air preheaters.

The process variable is the auxiliary steam temperature, measured by the temperature transmitters (TBD) by Hitachi.

The temperature measurement shall be compared to the setpoint, not adjustable by the operator. Control shall be performed by means of a reverse PI algorithm. If the difference between the measured temperature and the setpoint is positive, the valve will close; the opposite applies if the difference is negative, opening the valve.

* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close.

##### Boiler 2 Secondary Air Preheaters Temperature CV B2LBG32AA301

The function of this valve is to regulate the temperature of the steam supply to the boiler 2 secondary air preheaters.

The process variable is the auxiliary steam temperature, measured by the temperature transmitters (TBD) by Hitachi.

The temperature measurement shall be compared to the setpoint, not adjustable by the operator. Control shall be performed by means of a reverse PI algorithm. If the difference between the measured temperature and the setpoint is positive, the valve will close; the opposite applies if the difference is negative, opening the valve.

* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close.

#### Logic Control and Protections

There is no logic control and protections in this sheet.

### Boilers Sealing Air Heat Exchangers

#### Analogue Control and Regulation

There is no analogue control and regulation in this sheet.

#### Logic Control and Protections

##### Boiler 1 Sealing Air Preheater Auxiliary Steam Isolation Valve B1LBG33AA301

The task of this valve is to isolate the auxiliary steam supply to boiler 1 sealing air preheater.

* Opening and closing conditions

The valve is operated manually. It is not allowed to close if the control valve downstream is operating.

* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close

##### B1LBG33 Pot #1 Drain valve B1LBG33AA302

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when Steam Pressure, measured by the pressure transmitter B1LBG30CP001 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve closes to an intermediate position.

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B1LBG33CT002) in the drain pot is below the saturation temperature plus A VALUE, and will close 15 seconds after an adequate steam superheating value (H) is achieved.
* Forced open

The valve is not forced to open.

* Forced close

##### B1LBG33 Pot #2 Drain valve B1LBG33AA303

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when Steam Pressure, measured by the pressure transmitter B1LBG30CP001 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve closes to an intermediate position.

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B1LBG33CT003) in the drain pot is below the saturation temperature plus A VALUE, and will close 15 seconds after an adequate steam superheating value (H) is achieved.
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close.

##### Boiler 2 Sealing Air Preheater Auxiliary Steam Isolation Valve B2LBG33AA301

The task of this valve is to isolate the auxiliary steam supply to boiler 2 sealing air preheater.

* Opening and closing conditions

The valve is operated manually. It is not allowed to close if the control valve downstream is operating.

* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close

##### B2LBG33 Pot #1 Drain valve B2LBG33AA302

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when Steam Pressure, measured by the pressure transmitter B2LBG30CP001 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve closes to an intermediate position.

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B2LBG33CT002) in the drain pot is below the saturation temperature plus A VALUE, and will close 15 seconds after an adequate steam superheating value (H) is achieved.
* Forced open

The valve is not forced to open.

Forced close

##### B2LBG33 Pot #1 Drain valve B2LBG33AA302

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when Steam Pressure, measured by the pressure transmitter B2LBG30CP001 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve closes to an intermediate position.

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B2LBG33CT002) in the drain pot is below the saturation temperature plus A VALUE, and will close 15 seconds after an adequate steam superheating value (H) is achieved.
* Forced open

The valve is not forced to open.

Forced close

### Boiler 1 Bypass

#### Analogue Control and Regulation

##### Boiler 1 Main Steam Bypass CV B1MAN10AA401

The function of Boiler 1 Main Steam Bypass Control Valve is to regulate the pressure of the main steam line at a dynamic setpoint value.

The process variable is the Boiler 1 Main Steam Header Pressure, measured by the average between the pressure transmitter B1LBA10CP001 and B1LBA10CP002.

The pressure measurement shall be compared to the setpoint, not adjustable by the operator. Control shall be performed by means of a direct PI algorithm. If the difference between the measured pressure and the setpoint is positive, the valve will open; the opposite applies if the difference is negative, closing the valve.

The dynamic Set Point is elaborated as follows, depending on the different cases:

1. Boiler Start-up

During the early stages of the start-up, when the boiler is in service, with its isolation valve open, and the pressure in the main steam header measured pressure transmitters B1LBA10CP001 and B1LBA10CP002 is between a minimum pressure setpoint value and the ST floor pressure setpoint, a rate-controlled variable setpoint is used.

This rate-controlled variable setpoint will open the Main Steam Boiler 1 Bypass CV and will be limited by the pressure/temperature gradient of the boiler drum in order to protect it from thermal stress.

1. ST Start-up

Once the main steam header and the bypass piping are warmed-up and pressurized, and the ST floor pressure (Steam turbine admission condition) is reached, the rate-controlled variable setpoint is no longer required. It is established the Main Steam Boiler 1 Bypass pressure setpoint as the existing main steam line pressure plus a margin in order to start closing the bypass valve.

1. Normal Operation Mode

The Boiler 1 Bypass pressure setpoint is dynamic. During normal running operation it is continually above main steam pressure according to the Steam Turbine curve, keeping the Main Steam Boiler 1 Bypass CV closed.

1. Boiler Shutdown

The boiler load is reduced to decrease main steam generation while maintaining main steam temperature. When the shutdown control action is initiated, the Main Steam Boiler 1 Bypass pressure controller setpoint is immediately set to the boiler steam line pressure at the moment the steam turbine stops control. With the main steam bypass control maintaining the HP main steam pressure, the steam turbine control valves (MCVs) are ramped closed by means of the steam turbine speed/load control. As a result, all main steam is transferred to the Main Steam Boiler 1 Bypass system.

1. Shutdown of the ST

As soon as the ST goes out of SPC control, the Main Steam Boiler 1 Bypass setpoint is locked at the existing pressure of the moment, and the Main Steam Boiler 1 Bypass setpoint will be ramped decreasing until ST floor pressure.

* Forces Open

The valve is not forced to open.

* Forced Close:

The valve shall be tripped closed by solenoid action and forced to close in the following cases:

* If the discharge steam temperature, measured by the average between the temperature transmitter B1MAN10CT001 and B1MAN10CT002, is lower than a certain value.
* If the discharge steam temperature, measured by the average between the temperature transmitter B1MAN10CT001 and B1MAN10CT002, is higher than a certain value.
* All Feedwater Pumps are stopped.

##### Main Steam Boiler 1 Bypass Attemperation CV B1LAF31AA401

The primary function of the controller is to control the discharge temperature to obtain the required attemperation water flow.

The Main Steam Boiler 1 Bypass Attemperation water control valve utilizes two controllers in to improve stability. First controller is the bypass discharge temperature, measured by the temperature transmitter B1MAN10CT001 and B1MAN10CT002. The second controller is the maintaining a required enthalpy, using a cascade controller as described below.

**Temperature Controller**

The process variable to be used in the regulator is the bypass discharge temperature, measured by the average between temperature transmitters B1MAN10CT001 and B1MAN10CT002.

That temperature measurement is compared with the established set point. Control shall be performed by a PI algorithm.

If PV> SP the valve will open, increasing the flow in the line. Otherwise, the valve tends to close.

The controller is the main one if the attemperation header water flow, measured by flow transmitters B1LAF31CF001 and B1LAF31CF002 is lower than a certain value. A soon as this flow is higher than this value, the valve will start controlling enthalpy with two controllers in cascade as follows.

**Enthalpy (Cascade) controller**

The setpoint is the desired discharge steam temperature. The output of the outer temperature loop controller is summed (“trimmed”) with the calculated attemperation water demand and provides the reference to the inner flow-rate loop.

Outer Controller:

The process variable to be used in the regulator is the bypass discharge temperature, measured by the average between temperature transmitters B1MAN10CT001 and B1MAN10CT002.

That temperature measurement is compared with the established set point. Control shall be performed by a PI algorithm.

If PV> SP the valve will open, increasing the flow in the line. Otherwise, the valve tends to close.

The output of the Outer Controller is scaled to water flow engineering units and summed with the required attemperation water to provide the setpoint to the Inner Controller

Inner Controller:

The process variable to be used in the regulator is the attemperation water flow, measured by the flow transmitters B1LAF31CF001 and B1LAF31CF002.

That flow measurement is compared with a dynamic set point. Control shall be performed by a PI algorithm that shall order to close the valve if the difference (PV - SP) is positive, the opposite applies if the difference is negative.

The primary function of the Inner Controller is to provide feed-forward control to obtain the required attemperation water flow. This controller is independent of temperature feedback and therefore not susceptible to time lag associated with temperature measurement. This controller positions the attemperation Water Control (Spray) Valve. Water flow is the process variable and the trimmed calculated attemperation water flow demand summed with the output Outer Controller is the setpoint.

The required attemperation water flow is calculated performing an energy balance, as follows:

WATT = WSTEAM (hSTEAM - hTARGET) / (hTARGET - hATT)

Where:

WATT: calculated attemperation water flow

WSTEAM: inlet steam flow rate

hATT: attemperation water enthalpy, derived from measured temperature

hSTEAM: inlet steam enthalpy, derived from measured inlet pressure and temperature

* hTARGET: target steam enthalpy desired

In case of ST trip, the Main Steam Boiler 1 Bypass control valve will open and the HP spray water control valve will be in a minimum position adjusting the valve near to the required operating condition without controller action, so transients such as a steam turbine trip or a load rejection can be handled without reaching the bypass discharge header high temperature trip value

* Forced closed:

The valve shall be tripped closed by solenoid action and forced to close in the following cases:

* The discharge steam temperature, measured by the average between the temperature transmitter B1MAN10CT001 and B1MAN10CT002, is lower than a certain value.
* Boiler 1 Bypass CV is closed
* Forced Opened:
* The discharge steam temperature, measured by the average between the temperature transmitter B1MAN10CT001 and B1MAN10CT002, is higher than a certain value

#### Logic Control and Protections

##### Boiler 1 Bypass CV Attemperation Water Isolation Valve B1LAF31AA301

The task of this valve is to isolate the water supply to the Boiler 1 Bypass CV Attemperation Water CV.

* Opening and closing conditions

The valve is operated manually. It is not allowed to close if the control valve downstream is operating.

* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close

##### Boiler 1 Main Steam B1LBA20 #1 Pot Drain valve B1LBA20AA301

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when the Boiler 1 or 2 are in service and Steam Pressure, measured by the average between the pressure transmitter B1LBA10CP001 and B1LBA10CP002 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve closes to an intermediate position.

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B1LBA20CT001) in the drain pot is below the saturation temperature plus A VALUE, and will close 15 seconds after an adequate steam superheating value (H) is achieved.
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close.

##### Boiler 1 Main Steam B1MAN10 Pot Drain valve B1MAN10AA301

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when the Boiler 1 or 2 are in service and Steam Pressure, measured by the average between the pressure transmitter B1LBA10CP001 and B1LBA10CP002 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve closes to an intermediate position.

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B1MAN10CT003) in the drain pot is below the saturation temperature plus A VALUE, and will close 15 seconds after an adequate steam superheating value (H) is achieved.
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close.

##### Boiler 1 Main Steam B1LBA20 #2 Pot Drain valve B1LBA20AA302

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when the Boiler 1 or 2 are in service and Steam Pressure, measured by the average between the pressure transmitter B1LBA10CP001 and B1LBA10CP002 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve closes to an intermediate position.

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B1LBA20CT002) in the drain pot is below the saturation temperature plus A VALUE, and will close 15 seconds after an adequate steam superheating value (H) is achieved.
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close.

### Boiler 2 Bypass

#### Analogue Control and Regulation

##### Boiler 2 Main Steam Bypass CV B2MAN10AA401

The function of Boiler 2 Main Steam Bypass Control Valve is to regulate the pressure of the main steam line at a dynamic setpoint value.

The process variable is the Boiler 2 Main Steam Header Pressure, measured by the average between the pressure transmitter B2LBA10CP001 and B2LBA10CP002.

The pressure measurement shall be compared to the setpoint, not adjustable by the operator. Control shall be performed by means of a direct PI algorithm. If the difference between the measured pressure and the setpoint is positive, the valve will open; the opposite applies if the difference is negative, closing the valve.

The dynamic Set Point is elaborated as follows, depending on the different cases:

1. Boiler Start-up

During the early stages of the start-up, when the boiler is in service, with its isolation valve open, and the pressure in the main steam header measured pressure transmitters B2LBA10CP001 and B2LBA10CP002 is between a minimum pressure setpoint value and the ST floor pressure setpoint, a rate-controlled variable setpoint is used.

This rate-controlled variable setpoint will open the Main Steam Boiler 2 Bypass CV and will be limited by the pressure/temperature gradient of the boiler drum in order to protect it from thermal stress.

1. ST Start-up

Once the main steam header and the bypass piping are warmed-up and pressurized, and the ST floor pressure (Steam turbine admission condition) is reached, the rate-controlled variable setpoint is no longer required. It is established the Main Steam Boiler 2 Bypass pressure setpoint as the existing main steam line pressure plus a margin in order to start closing the bypass valve.

1. Normal Operation Mode

The Boiler 2 Bypass pressure setpoint is dynamic. During normal running operation it is continually above main steam pressure according to the Steam Turbine curve, keeping the Main Steam Boiler 2 Bypass CV closed.

1. Boiler Shutdown

The boiler load is reduced to decrease main steam generation while maintaining main steam temperature. When the shutdown control action is initiated, the Main Steam Boiler 2 Bypass pressure controller setpoint is immediately set to the boiler steam line pressure at the moment the steam turbine stops control. With the main steam bypass control maintaining the HP main steam pressure, the steam turbine control valves (MCVs) are ramped closed by means of the steam turbine speed/load control. As a result, all main steam is transferred to the Main Steam Boiler 2 Bypass system.

1. Shutdown of the ST

As soon as the ST goes out of SPC control, the Main Steam Boiler 2 Bypass setpoint is locked at the existing pressure of the moment, and the Main Steam Boiler 2 Bypass setpoint will be ramped decreasing until ST floor pressure.

* Forces Open

The valve is not forced to open.

* Forced Close:

The valve shall be tripped closed by solenoid action and forced to close in the following cases:

* If the discharge steam temperature, measured by the average between the temperature transmitter B2MAN10CT001 and B2MAN10CT002, is lower than a certain value.
* If the discharge steam temperature, measured by the average between the temperature transmitter B1MAN10CT001 and B1MAN10CT002, is higher than a certain value.
* All Feedwater Pumps are stopped.

##### Main Steam Boiler 2 Bypass Attemperation CV B2LAF31AA401

The primary function of the controller is to control the discharge temperature to obtain the required attemperation water flow.

The Main Steam Boiler 2 Bypass Attemperation water control valve utilizes two controllers in to improve stability. First controller is the bypass discharge temperature, measured by the temperature transmitter B2MAN10CT001 and B2MAN10CT002. The second controller is the maintaining a required enthalpy, using a cascade controller as described below.

**Temperature Controller**

The process variable to be used in the regulator is the bypass discharge temperature, measured by the average between temperature transmitters B2MAN10CT001 and B2MAN10CT002.

That temperature measurement is compared with the established set point. Control shall be performed by a PI algorithm.

If PV> SP the valve will open, increasing the flow in the line. Otherwise, the valve tends to close.

The controller is the main one if the attemperation header water flow, measured by flow transmitters B2LAF31CF001 and B2LAF31CF002 is lower than a certain value. A soon as this flow is higher than this value, the valve will start controlling enthalpy with two controllers in cascade as follows.

**Enthalpy (Cascade) controller**

The setpoint is the desired discharge steam temperature. The output of the outer temperature loop controller is summed (“trimmed”) with the calculated attemperation water demand and provides the reference to the inner flow-rate loop.

Outer Controller:

The process variable to be used in the regulator is the bypass discharge temperature, measured by the average between temperature transmitters B2MAN10CT001 and B2MAN10CT002.

That temperature measurement is compared with the established set point. Control shall be performed by a PI algorithm.

If PV> SP the valve will open, increasing the flow in the line. Otherwise, the valve tends to close.

The output of the Outer Controller is scaled to water flow engineering units and summed with the required attemperation water to provide the setpoint to the Inner Controller

Inner Controller:

The process variable to be used in the regulator is the attemperation water flow, measured by the flow transmitters B2LAF31CF001 and B2LAF31CF002.

That flow measurement is compared with a dynamic set point. Control shall be performed by a PI algorithm that shall order to close the valve if the difference (PV - SP) is positive, the opposite applies if the difference is negative.

The primary function of the Inner Controller is to provide feed-forward control to obtain the required attemperation water flow. This controller is independent of temperature feedback and therefore not susceptible to time lag associated with temperature measurement. This controller positions the attemperation Water Control (Spray) Valve. Water flow is the process variable and the trimmed calculated attemperation water flow demand summed with the output Outer Controller is the setpoint.

The required attemperation water flow is calculated performing an energy balance, as follows:

WATT = WSTEAM (hSTEAM - hTARGET) / (hTARGET - hATT)

Where:

WATT: calculated attemperation water flow

WSTEAM: inlet steam flow rate

hATT: attemperation water enthalpy, derived from measured temperature

hSTEAM: inlet steam enthalpy, derived from measured inlet pressure and temperature

* hTARGET: target steam enthalpy desired

In case of ST trip, the Main Steam Boiler 2 Bypass control valve will open and the HP spray water control valve will be in a minimum position adjusting the valve near to the required operating condition without controller action, so transients such as a steam turbine trip or a load rejection can be handled without reaching the bypass discharge header high temperature trip value

* Forced closed:

The valve shall be tripped closed by solenoid action and forced to close in the following cases:

* The discharge steam temperature, measured by the average between the temperature transmitter B2MAN10CT001 and B2MAN10CT002, is lower than a certain value.
* Boiler 2 Bypass CV is closed
* Forced Opened:
* The discharge steam temperature, measured by the average between the temperature transmitter B2MAN10CT001 and B2MAN10CT002, is higher than a certain value

#### Logic Control and Protections

##### Boiler 2 Bypass CV Attemperation Water Isolation Valve B2LAF31AA301

The task of this valve is to isolate the water supply to the Boiler 2 Bypass CV Attemperation Water CV.

* Opening and closing conditions

The valve is operated manually. It is not allowed to close if the control valve downstream is operating.

* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close

##### Boiler 2 Main Steam B2LBA20 #1 Pot Drain valve B2LBA20AA301

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when the Boiler 1 or 2 are in service and Steam Pressure, measured by the average between the pressure transmitter B2LBA10CP001 and B2LBA10CP002 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve closes to an intermediate position.

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B2LBA20CT001) in the drain pot is below the saturation temperature plus A VALUE, and will close 15 seconds after an adequate steam superheating value (H) is achieved.
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close.

##### Boiler 2 Main Steam B2MAN10 Pot Drain valve B2MAN10AA301

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when the Boiler 1 or 2 are in service and Steam Pressure, measured by the average between the pressure transmitter B2LBA10CP001 and B2LBA10CP002 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve closes to an intermediate position.

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B2MAN10CT003) in the drain pot is below the saturation temperature plus A VALUE, and will close 15 seconds after an adequate steam superheating value (H) is achieved.
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close.

##### Boiler 2 Main Steam B2LBA20 #2 Pot Drain valve B2LBA20AA302

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when the Boiler 1 or 2 are in service and Steam Pressure, measured by the average between the pressure transmitter B2LBA10CP001 and B2LBA10CP002 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve closes to an intermediate position.

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B2LBA20CT002) in the drain pot is below the saturation temperature plus A VALUE, and will close 15 seconds after an adequate steam superheating value (H) is achieved.
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close.

### Ejectors Attemperation

#### Analogue Control and Regulation

##### Main Steam Ejectors Attemperation CV B0LBA40AA401

The function of this valve is to regulate the pressure of the main steam to the ejectors.

The process variable is the Main Steam Ejectors Attemperation CV discharge pressure, measured by the average between pressure transmitters B0LBG50CP0001 and B0LBG50CP0002.

The pressure measurement shall be compared to the setpoint, not adjustable by the operator. Control shall be performed by means of a reverse PI algorithm. If the difference between the measured pressure and the setpoint is positive, the valve will close; the opposite applies if the difference is negative, opening the valve.

* Forced open

The valve is not forced to open.

* Forced close

The valve will be forced to close in the following cases:

If the discharge steam temperature, measured by the average between the temperature transmitters B0LBG50CT001 and B0LBG50CT002 is higher than a certain value.

##### Main Steam Ejectors Attemperation Water CV B0LAF35AA401

The primary function of this valve is to control the main steam to ejectors temperature.

The process variable is the Main Steam Ejectors Attemperation CV discharge temperature, measured by the average between temperature transmitters B0LBG50CT0001 and B0LBG50CT0002.

The temperature measurement shall be compared to the setpoint, not adjustable by the operator. Control shall be performed by means of a direct PI algorithm. If the difference between the measured temperature and the setpoint and the is positive, the valve will open; the opposite applies if the difference is negative, closing the valve.

* Forced open

The valve is not forced to open.

* Forced closed:

The valve will be forced to close in the following cases:

Main Steam Ejectors Attemperation CV is closed.

#### Logic Control and Protections

##### Main Steam Ejectors Attemperation Water Isolation Valve B0LAF35AA301

The task of this valve is to isolate the water supply to the Main Steam Ejectors Attemperation Water.

* Opening and closing conditions

The valve is operated manually. It is not allowed to close if the control valve downstream is operating.

* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close

##### Main Steam B0LBA40 #1 Pot Drain valve B0LBA40AA301

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when the Boiler 1 or 2 are in service and Steam Pressure, measured by the average between the pressure transmitter B1LBA10CP001 and B1LBA10CP002 or B2LBA10CP001 and B2LBA10CP002 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve closes to an intermediate position.

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B0LBA40CT001) in the drain pot is below the saturation temperature plus A VALUE, and will close 15 seconds after an adequate steam superheating value (H) is achieved.
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close.

##### Main Steam B0LBA40 #2 Pot Drain valve B0LBA40AA302

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when the Boiler 1 or 2 are in service and Steam Pressure, measured by the average between the pressure transmitter B1LBA10CP001 and B1LBA10CP002 or B2LBA10CP001 and B2LBA10CP002 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve closes to an intermediate position.

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B0LBA40CT002) in the drain pot is below the saturation temperature plus A VALUE, and will close 15 seconds after an adequate steam superheating value (H) is achieved.
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close.

##### Main Steam B0LBA40 #3 Pot Drain valve B0LBA40AA303

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when the Boiler 1 or 2 are in service and Steam Pressure, measured by the average between the pressure transmitter B1LBA10CP001 and B1LBA10CP002 or B2LBA10CP001 and B2LBA10CP002 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve closes to an intermediate position.

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B0LBA40CT003) in the drain pot is below the saturation temperature plus A VALUE, and will close 15 seconds after an adequate steam superheating value (H) is achieved.
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close.

##### Main Steam B0LBG50 Pot Drain valve B0LBG50AA301

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when Steam Pressure, measured by the average between the pressure transmitter B0LBG50CP001 and B0LBG50CP002 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve closes to an intermediate position.

In normal operation the valve will open and close as the following indications:

* + The valve will open when the temperature measured (B0LBG50CT001) in the drain pot is below the saturation temperature plus A VALUE, and will close 15 seconds after an adequate steam superheating value (H) is achieved.
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close.

### Steam/Flue Gas Heat Exchangers

#### Analogue Control and Regulation

##### Boiler 1 Drum Steam to Flue Gas Heat Exchangers Temperature CV B1HAD50AA401

The function of this valve is to regulate the temperature of the steam supply from the boiler 1 drum to the Boiler 1 flue gas heat exchangers

The process variable is the steam temperature, measured by the temperature transmitters (TBD) by Hitachi.

The temperature measurement shall be compared to the setpoint, not adjustable by the operator. Control shall be performed by means of a reverse PI algorithm. If the difference between the measured temperature and the setpoint is positive, the valve will close; the opposite applies if the difference is negative, opening the valve.

* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close.

##### Boiler 2 Drum Steam to Flue Gas Heat Exchangers Temperature CV B2HAD50AA401

The function of this valve is to regulate the temperature of the steam supply from the boiler 2 drum to the Boiler 2 flue gas heat exchangers

The process variable is the steam temperature, measured by the temperature transmitters (TBD) by Hitachi.

The temperature measurement shall be compared to the setpoint, not adjustable by the operator. Control shall be performed by means of a reverse PI algorithm. If the difference between the measured temperature and the setpoint is positive, the valve will close; the opposite applies if the difference is negative, opening the valve.

* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close.

#### Logic Control and Protections

##### Fuel Gas Treatment Heat Exchangers interconnection Motorized Operation Valve B0HAD50AA301

##### Boiler 1 Drum Steam to Flue Gas Heat Exchangers Steam Temperature CV Bypass MOV B1HAD50AA302

##### Boiler 1 Drum Steam to Flue Gas Heat Exchangers Isolation Valve B1HAD50AA301

The task of this valve is to isolate the steam supply from boiler 1 drum to boiler 1 flue gas heat exchangers.

* Opening and closing conditions

The valve is operated manually. It is not allowed to close if the control valve downstream is operating.

* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close.

##### B1HAD50 #1 Pot Drain valve B1HAD50AA303

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when the Steam Pressure, measured by the pressure transmitter B1HAD10CP004 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve starts to operate based on level measurement.

In normal operation the valve will open and close as the following indications:

* + High or high-high level (B1HAD50CL301 and B1HAD50CL302) is detected in the drain pot. This valve close if the above conditions are not complied with for more than a defined time (15 seconds).
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close.

##### B1HAD50 #2 Pot Drain valve B1HAD50AA304

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when the Steam Pressure, measured by the pressure transmitter B1HAD10CP004 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve starts to operate based on level measurement.

In normal operation the valve will open and close as the following indications:

* + High or high-high level (B1HAD50CL303 and B1HAD50CL304) is detected in the drain pot. This valve close if the above conditions are not complied with for more than a defined time (15 seconds).
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close.

##### B1HAD50 #3 Pot Drain valve B1HAD50AA305

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when the Steam Pressure, measured by the pressure transmitter B1HAD50CP001 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve starts to operate based on level measurement.

In normal operation the valve will open and close as the following indications:

* + High or high-high level (B1HAD50CL305 and B1HAD50CL306) is detected in the drain pot. This valve close if the above conditions are not complied with for more than a defined time (15 seconds).
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close.

##### Boiler 2 Drum Steam to Flue Gas Heat Exchangers Steam Temperature CV Bypass MOV B2HAD50AA302

##### Boiler 2 Drum Steam to Flue Gas Heat Exchangers Isolation Valve B2HAD50AA301

The task of this valve is to isolate the steam supply from boiler 2 drum to boiler 2 flue gas heat exchangers.

* Opening and closing conditions

The valve is operated manually. It is not allowed to close if the control valve downstream is operating.

* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close.

##### B2HAD50 #1 Pot Drain valve B2HAD50AA303

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when the Steam Pressure, measured by the pressure transmitter B2HAD10CP004 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve starts to operate based on level measurement.

In normal operation the valve will open and close as the following indications:

* + High or high-high level (B2HAD50CL301 and B2HAD50CL302) is detected in the drain pot. This valve close if the above conditions are not complied with for more than a defined time (15 seconds).
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close.

##### B2HAD50 #2 Pot Drain valve B2HAD50AA304

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when the Steam Pressure, measured by the pressure transmitter B2HAD10CP004 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve starts to operate based on level measurement.

In normal operation the valve will open and close as the following indications:

* + High or high-high level (B2HAD50CL303 and B2HAD50CL304) is detected in the drain pot. This valve close if the above conditions are not complied with for more than a defined time (15 seconds).
* Forced open

The valve is not forced to open.

* Forced close

The valve is not forced to close.

##### B2HAD50 #3 Pot Drain valve B2HAD50AA305

The task of this valve is to evacuate the condensate accumulated in the corresponding drain pot.

* Opening and closing conditions

The valve will open and close in AUTO during the start-up according to the following indications:

* + The Drain Pot Valve fully opens when the Steam Pressure, measured by the pressure transmitter B2HAD50CP001 exceeds a minimum pressure (L). After the drain valve has been open a minimum defined time (3 minutes), and once Steam pressure is greater than a defined pressure (H), the valve starts to operate based on level measurement.

In normal operation the valve will open and close as the following indications:

* + High or high-high level (B2HAD50CL305 and B2HAD50CL306) is detected in the drain pot. This valve close if the above conditions are not complied with for more than a defined time (15 seconds).
* Forced open

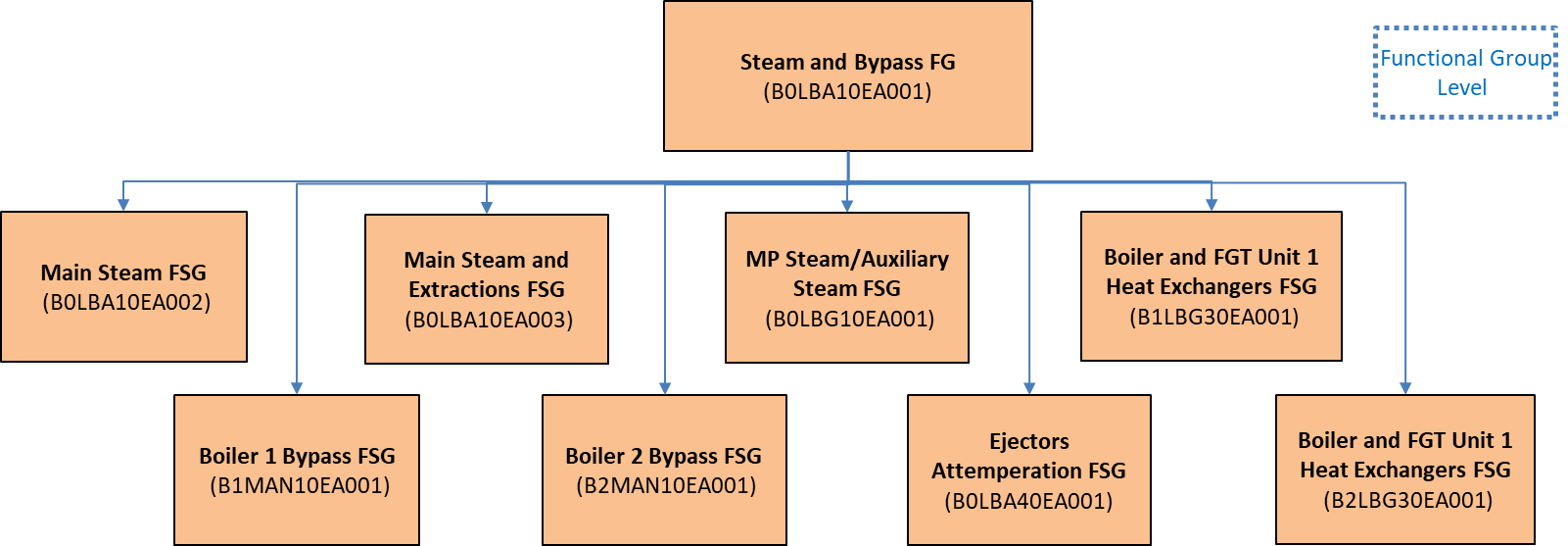
The valve is not forced to open.

* Forced close

The valve is not forced to close.

## System Automation

### Steam and Bypass Functional Group (B0LBA10EA001)

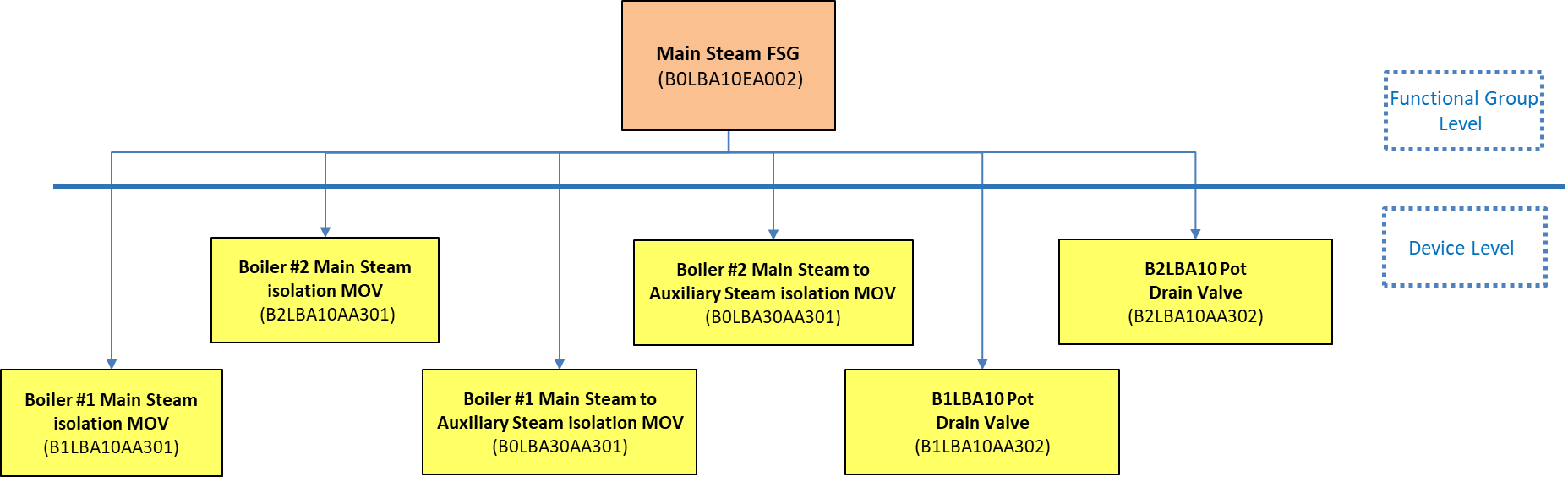


There will be a general Functional Group commanding all Functional Subgroups. When started, the main FG will send an ON command to all FSG

The main FG will have ON permissive when all FGS are available

The FG is always permitted to stop.

### Main Steam FSG (B0LBA10EA002)



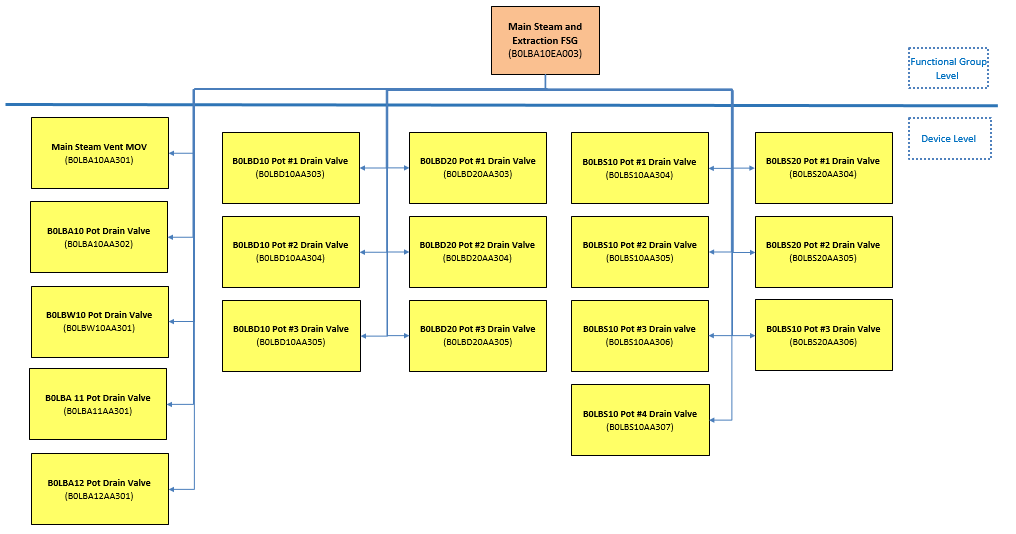
When the FSG is ON (both from the main FG or manually by the operator) the following actions are performed:

* Boiler #1 Main Steam isolation MOV B1LBA10AA301 is switched to AUTO
* Boiler #2 Main Steam isolation MOV B2LBA20AA301 is switched to AUTO
* Boiler #1 Main Steam to Auxiliary Steam Isolation MOV B0LBA30AA301 is switched to AUTO
* Boiler #2 Main Steam to Auxiliary Steam Isolation MOV B0LBA30AA301 is switched to AUTO
* B1LBA10 Pot Drain valve B1LBA10AA302 is switched to AUTO
* B2LBA10 Pot Drain valve B2LBA10AA302 is switched to AUTO

The FSG has ON permissive when all the previous devices are available

The FSG is always permitted to stop.

### Main Steam and Extractions FSG (B0LBA10EA003)



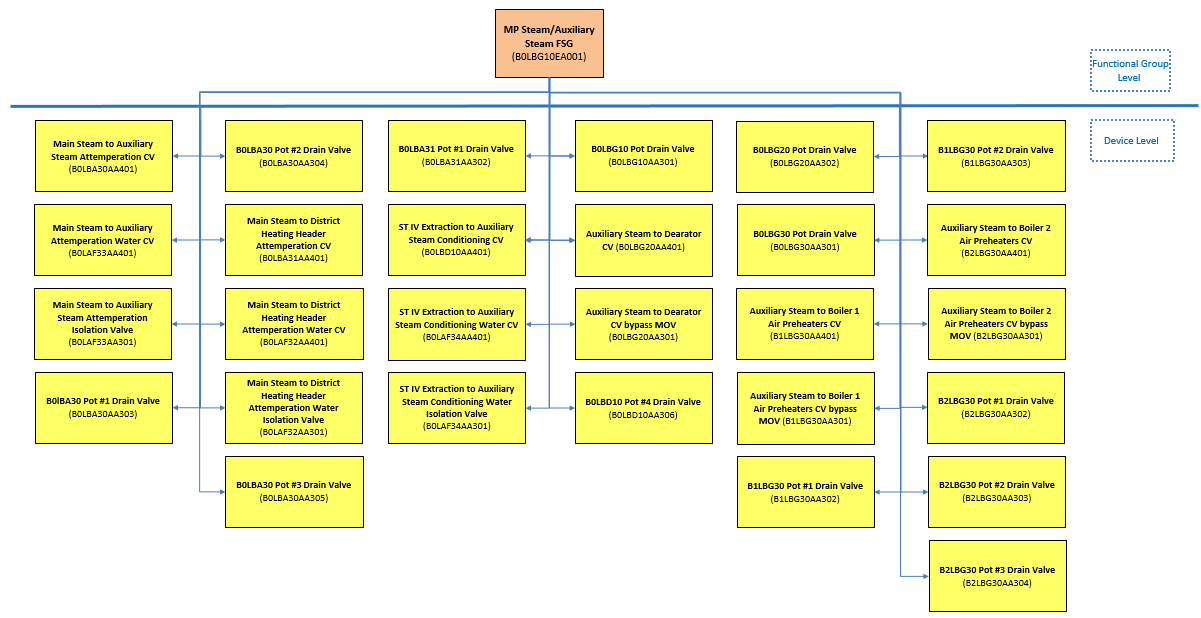
When the FSG is ON (both from the main FG or manually by the operator) the following actions are performed:

* Main Steam Vent MOV B0LBA10AA301 is switched to AUTO
* B0LBA10 Pot Drain valve B0LBA10AA302 is switched to AUTO
* B0LBW10 Pot Drain valve B0LBW10AA301 is switched to AUTO
* B0LBA11 Pot Drain valve B0LBA11AA301 is switched to AUTO
* B0LBA12 Pot Drain valve B0LBA12AA301 is switched to AUTO
* B0LBD10 Pot #1 Drain valve B0LBD10AA303 is switched to AUTO
* B0LBD10 Pot #2 Drain valve B0LBD10AA304 is switched to AUTO
* B0LBD10 Pot #2 Drain valve B0LBD10AA305 is switched to AUTO
* B0LBD20 Pot #1 Drain valve B0LBD20AA303 is switched to AUTO
* B0LBD20 Pot #2 Drain valve B0LBD20AA304 is switched to AUTO
* B0LBD20 Pot #3 Drain valve B0LBD20AA305 is switched to AUTO
* B0LBS10 Pot #1 Drain valve B0LBS10AA304 is switched to AUTO
* B0LBS10 Pot #2 Drain valve B0LBS10AA305 is switched to AUTO
* B0LBS10 Pot #3 Drain valve B0LBS10AA306 is switched to AUTO
* B0LBS10 Pot #4 Drain valve B0LBS10AA307 is switched to AUTO
* B0LBS20 Pot #1 Drain valve B0LBS20AA304 is switched to AUTO
* B0LBS20 Pot #2 Drain valve B0LBS20AA305 is switched to AUTO
* B0LBS20 Pot #3 Drain valve B0LBS20AA306 is switched to AUTO

The FSG has ON permissive when all the previous devices are available

The FSG is always permitted to stop.

### MP Steam/Auxiliary Steam FSG (B0LBG10EA001)



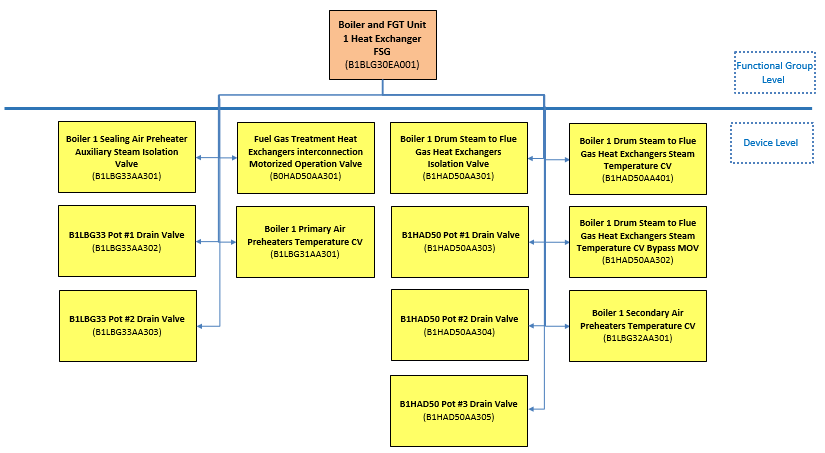
When the FSG is ON (both from the main FG or manually by the operator) the following actions are performed:

* Main Steam to Auxiliary Steam Attemperation CV B0LBA30AA401 is switched to AUTO
* Main Steam to Auxiliary Steam Attemperation Water CV B0LAF33AA401B is switched to AUTO
* Main Steam to Auxiliary Steam Attemperation Isolation valve B0LAF33AA301 is switched to AUTO
* B0LBA30 Pot #1 Drain valve B0LBA30AA303 is switched to AUTO
* B0LBA30 Pot #2 Drain valve B0LBA30AA304 is switched to AUTO
* B0LBA30 Pot #3 Drain valve B0LBA30AA305 is switched to AUTO
* Main Steam to District Heating Header Attemperation CV B0LBA31AA401 is switched to AUTO
* Main Steam to District Heating Header Attemperation Water CV B0LAF32AA401 is switched to AUTO
* Main Steam to District Heating Header Attemperation Water Isolation valve B0LAF32AA301 is switched to AUTO
* B0LBA31 Pot Drain valve B0LBA31AA302 is switched to AUTO
* ST IV Extraction to Auxiliary Steam Conditioning CV B0LBD10AA401 is switched to AUTO
* ST IV Extraction to Auxiliary Steam Conditioning Water CV B0LAF34AA401 is switched to AUTO
* ST IV Extraction to Auxiliary Steam Conditioning Water Isolation valve B0LAF34AA301 is switched to AUTO
* B0LBG10 Pot Drain valve B0LBG10AA301 is switched to AUTO
* Auxiliary Steam to Deaerator CV B0LBG20AA401 is switched to AUTO
* Auxiliary Steam to Deaerator CV bypass MOV B0LBG20AA301 is switched to AUTO
* B0LBD10 Pot #4 Drain valve B0LBD10AA306 is switched to AUTO
* B0LBG20 Pot Drain valve B0LBG20AA302 is switched to AUTO
* B0LBG30 Pot Drain valve B0LBG30AA301 is switched to AUTO
* Auxiliary Steam to Boiler 1 Air Preheaters CV B1LBG31AA401 is switched to AUTO
* Auxiliary Steam to Boiler 1 Air Preheaters CV bypass MOV B1LBG30AA301 is switched to AUTO
* B1LBG30 Pot #1 Drain valve B1LBG30AA302
* B1LBG30 Pot #2 Drain valve B1LBG30AA303
* Auxiliary Steam to Boiler 2 Air Preheaters CV B2LBG31AA401 is switched to AUTO
* Auxiliary Steam to Boiler 2 Air Preheaters CV bypass MOV B2LBG30AA301 is switched to AUTO
* B2LBG30 Pot #1 Drain valve B2LBG30AA302
* B2LBG30 Pot #2 Drain valve B2LBG30AA303
* B2LBG30 Pot #3 Drain valve B2LBG30AA304

The FSG has ON permissive when all the previous devices are available

The FSG is always permitted to stop.

### Boiler and FGT Unit 1 Heat Exchangers FSG (B1LBG30EA001)



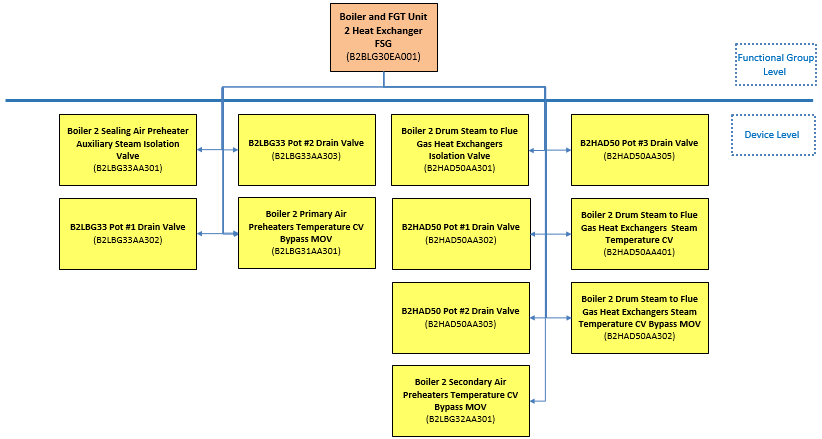
When the FSG is ON (both from the main FG or manually by the operator) the following actions are performed:

* Boiler 1 Sealing Air Preheater Auxiliary Steam Isolation valve B1LBG33AA301 is switched to AUTO
* B1LBG33 Pot #1 Drain valve B1LBG33AA302 is switched to AUTO
* B1LBG33 Pot #2 Drain valve B1LBG33AA303 is switched to AUTO
* Fuel Gas Treatment Heat Exchangers interconnection Motorized Operation Valve B0HAD50AA301
* Boiler 1 Primary Air Preheaters Temperature CV B1LBG31AA401 is switched to AUTO
* Boiler 1 Drum Steam to Flue Gas Heat Exchangers Isolation Valve B1HAD50AA301 is switched to AUTO
* B1HAD50 Pot #1 Drain valve B1HAD50AA303 is switched to AUTO
* B1HAD50 Pot #2 Drain valve B1HAD50AA304 is switched to AUTO
* B1HAD50 Pot #3 Drain valve B1HAD50AA305 is switched to AUTO
* Boiler 1 Drum Steam to Flue Gas Heat Exchangers Steam Temperature CV B1HAD50AA401 is switched to AUTO
* Boiler 1 Drum Steam to Flue Gas Heat Exchangers Steam Temperature CV Bypass MOV B1HAD50AA302 is switched to AUTO
* Boiler 1 Secondary Air Preheaters Temperature CV B1LBG32AA301 is switched to AUTO

The FSG has ON permissive when all the previous devices are available

The FSG is always permitted to stop.

### Boiler and FGT Unit 2 Heat Exchangers FSG (B2LBG30EA001)



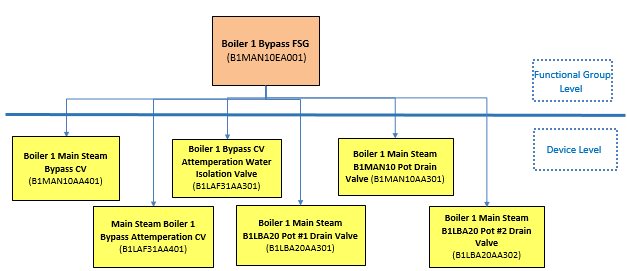
When the FSG is ON (both from the main FG or manually by the operator) the following actions are performed:

* Boiler 2 Sealing Air Preheater Auxiliary Steam Isolation valve B2LBG33AA301 is switched to AUTO
* B2LBG33 Pot #1 Drain valve B2LBG33AA302 is switched to AUTO
* B2LBG33 Pot #2 Drain valve B2LBG33AA303 is switched to AUTO
* Boiler 2 Primary Air Preheaters Temperature CV B2LBG31AA401 is switched to AUTO
* Boiler 2 Drum Steam to Flue Gas Heat Exchangers Isolation Valve B2HAD50AA301 is switched to AUTO
* B2HAD50 Pot #1 Drain valve B2HAD50AA303 is switched to AUTO
* B2HAD50 Pot #2 Drain valve B2HAD50AA304 is switched to AUTO
* B2HAD50 Pot #3 Drain valve B2HAD50AA305 is switched to AUTO
* Boiler 2 Drum Steam to Flue Gas Heat Exchangers Steam Temperature CV B2HAD50AA401 is switched to AUTO
* Boiler 2 Drum Steam to Flue Gas Heat Exchangers Steam Temperature CV Bypass MOV B2HAD50AA302 is switched to AUTO
* Boiler 2 Secondary Air Preheaters Temperature CV B2LBG32AA301 is switched to AUTO

The FSG has ON permissive when all the previous devices are available

The FSG is always permitted to stop.

### Boiler 1 Bypass FSG (B1MAN10EA001)



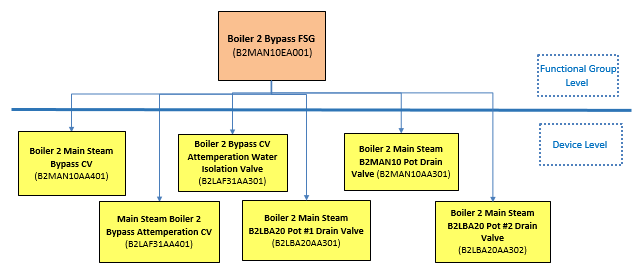
When the FSG is ON (both from the main FG or manually by the operator) the following actions are performed:

* Boiler 1 Main Steam Bypass CV B1MAN10AA401 is switched to AUTO
* Main Steam Boiler 1 Bypass Attemperation CV B1LAF31AA401 is switched to AUTO
* Boiler 1 Bypass CV Attemperation Water Isolation Valve B1LAF31AA301 is switched to AUTO
* Boiler 1 Main Steam B1LBA20 #1 Pot Drain valve B1LBA20AA301 is switched to AUTO
* Boiler 1 Main Steam B1LBA20 #2 Pot Drain valve B1LBA20AA302 is switched to AUTO
* Boiler 1 Main Steam B1MAN10 Pot Drain valve B1MAN10AA301 is switched to AUTO

The FSG has ON permissive when all the previous devices are available

The FSG is always permitted to stop

### Boiler 2 Bypass FSG (B2MAN10EA001)



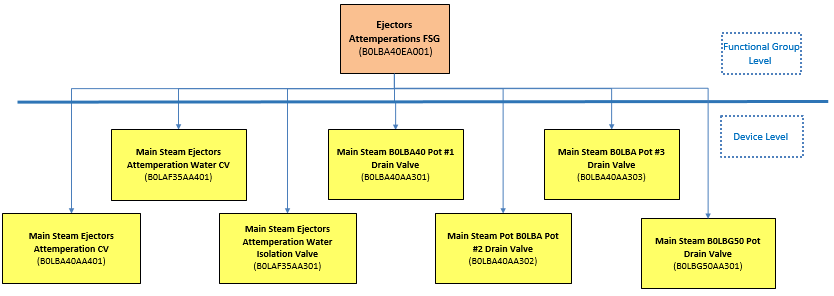
When the FSG is ON (both from the main FG or manually by the operator) the following actions are performed:

* Boiler 2 Main Steam Bypass CV B2MAN10AA401 is switched to AUTO
* Main Steam Boiler 2 Bypass Attemperation CV B2LAF31AA401 is switched to AUTO
* Boiler 2 Bypass CV Attemperation Water Isolation Valve B2LAF31AA301 is switched to AUTO
* Boiler 2 Main Steam B2LBA20 #1 Pot Drain valve B2LBA20AA301 is switched to AUTO
* Boiler 2 Main Steam B2LBA20 #2 Pot Drain valve B2LBA20AA302 is switched to AUTO
* Boiler 2 Main Steam B2MAN10 Pot Drain valve B2MAN10AA301 is switched to AUTO

The FSG has ON permissive when all the previous devices are available

The FSG is always permitted to stop

### Ejectors Attemperation FSG (B0LBA40EA001)



When the FSG is ON (both from the main FG or manually by the operator) the following actions are performed:

* Main Steam Ejectors Attemperation CV B0LBA40AA401 is switched to AUTO
* Main Steam Ejectors Attemperation Water CV B0LAF35AA401 is switched to AUTO
* Main Steam Ejectors Attemperation Water Isolation Valve B0LAF35AA301 is switched to AUTO
* Main Steam B0LBA40 Pot #1 Drain valve B0LBA40AA301 is switched to AUTO
* Main Steam B0LBA40 Pot #2 Drain valve B0LBA40AA302 is switched to AUTO
* Main Steam B0LBA40 Pot #3 Drain valve B0LBA40AA303 is switched to AUTO
* Main Steam B0LBG50 Pot Drain valve B0LBG50AA301 is switched to AUTO

The FSG has ON permissive when all the previous devices are available

The FSG is always permitted to stop