General Office

FINAL

# SYSTEM DESCRIPTION
(Index No. 2)

BLEED STEAM SYSTEM

(B&R DWG. NO. 2003, Rev. 17)

JERSEY CENTRAL POWER & LIGHT COMPANY

THREE MILE ISLAND NUCLEAR STATION

UNIT NO. 2

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FOR

BLEED STEAM SYSTEM



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# APPENDIX

# BLEED STEAM SYSTEM

## 1.0 INTRODUCTION

### 1.1 System Functions

The primary purpose of the bleed steam system is to provide steam from six extraction stages of the HP and LP turbines to their respective feedwater heaters. The steam enters the shellside of the feedwater heaters where it heats the feedwater flowing through the tubeside. The heating of the feedwater before entry into the steam generators serves the purpose of increasing the efficiency of the power plant cycle.

In addition, the bleed steam system provides heating steam to the first stage reheaters of the moisture separator-reheaters in the main and reheat steam system and also supplies steam to the auxiliary steam system.

The bleed steam system has an interface with the following systems. (Drawing numbers refer to Burns & Roe flow diagrams):
Main and Reheat Steam System (Dwg. No. 2002)
Auxiliary Steam System (Dwg. No. 2004)
Feedwater Heater Drains System (Dwg. No. 2009)
Instrument and Service Air System (Dwg. No. 2012)

### 1.2 Summary Description of the System (Refer to B&R Dwg. No. 2003, Rev. 13)

Bleed steam is extracted from the 3rd and 8th stages of the HP turbine and the 10th, 11th, 13th and 14th stages of both LP turbines. There are two feedwater heaters which receive bleed steam from each extraction stage and are identified

after the extraction stage from which they receive their heating steam. The feedwater heaters are arranged in two parallel trains to provide six stages of feedwater heating. The 14th stage feedwater heaters, which are the lowest pressure heaters, are located in the neck of each condenser. The 8th stage is the exhaust stage of the HP turbine.

Each external bleed steam line has a combination stop-check valve to prevent water induction or reverse flow of steam to the turbine. The 3rd stage bleed steam lines, however, have separate stop and check valves because of the high pressure and temperature condition. Each bleed steam line has a motor operated drain valve located between the turbine and the stop-check valve.

In addition to supplying steam to the 3rd stage feedwater heaters FW-J6A and 6B, the 3rd stage high pressure turbine extraction supplies heating steam to the first stage reheaters of the four moisture separator-reheaters. The reheaters reheat the HP turbine exhaust steam prior to admission to the two double flow low pressure turbines and the steam generator feed pump turbines. Excess bleed steam from the first stage reheaters flows to the 8th stage feedwater heaters through a connection to the heater drain tank vent lines. Refer to the Feedwater Heater Drains System Description, Index No. 7.

Excess main steam from the second stage reheaters flows to the 3rd stage feedwater heaters through a connection to the heater bleed steam supply line.

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The auxiliary steam system is supplied with steam from the 8th stage (HP turbine exhaust) extraction of the HP turbine. Refer to the Auxiliary Steam System Description, Index No. 3. The 3rd stage feedwater heaters FW-J-6A, 6B are considered high pressure heaters. All other feedwater heaters are considered low pressure heaters.

Motor operated valves are provided to divert a portion of the 10th stage extraction steam to each of the two condenser hotwells to deaerate the condensate at plant operating loads of 40% and below.

1.3 System Design Requirements

The bleed steam system is a conventional system. The equipment comprising the system, including piping and valves, is of commercial quality and the seismic design classification is Class II. The seismic Class II equipment is designed for Zone I loads.

The piping within the bleed steam system is designed, fabricated, inspected and erected in accordance with ANSI B31.1.0. Power Piping, while valves are in accordance with applicable ANSI pressure-temperature ratings.

The feedwater heater sizes are based on the maximum expected turbine rating (not guaranteed) which corresponds to the maximum primary system power rating of 2788 Mwt. The maximum calculated-not guaranteed turbine heat balance is included as Figure 1. Two identical parallel feedwater trains utilizing bleed steam from six turbine extraction points are provided

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to handle the above rating in the most economical manner. Feedwater heater shell design pressures are determined by adding 15 percent to the maximum expected turbine rating heat balance stage pressure, then using the next highest 25 psi value, except that no heater shell is designed for less than 50 psig. Shell side design temperatures are determined at the temperature corresponding to the design pressure on the turbine expansion line. Under emergency conditions of one heater train out of service, each remaining heater is capable of handling additional extraction steam resultant when the tubeside feedwater flow is increased temporarily by 50 percent. Tubeside design conditions are as discussed in the Feedwater and Condensate System Description, Index No. 4A. The mechanical design and construction of the feedwater heaters are in accordance with the requirements of the ASME Boiler and Pressure Vessel Code, Section VIII and are stamped with the applicable ASME Code symbol.

Sizing of the bleed steam lines was accomplished in order to comply with the pressure drop requirements of the maximum calculated - not guaranteed turbine heat balance.

Combination stop-check valves are located in the turbine external extraction lines to the low pressure feedwater heaters. Due to the higher pressure and temperature condition of the 3rd stage HP turbine extraction steam, separate check and stop valves are utilized in the 3rd stage bleed steam lines. The purpose of the check valves is to prevent water damage to the turbine if heater drains back up from the feedwater heaters, and to prevent overspeed of the turbine with a decrease in load or turbine trip, which can cause a

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reverse flow of steam from the feedwater heaters to the turbine.

## 2.0 DETAILED DESCRIPTION OF SYSTEM

### 2.1 Components

#### 2.1.1 Feedwater Heaters; FW-J-1A, 1B, 2A, 2B, 3A, 3B, 4A, 4B, 5A, 5B, 6A, 6B

The feedwater heaters are described in the Feedwater Heater Drains System Description Index No. 7 and the Feedwater and Condensate System Description, Index No. 4A.

#### 2.1.2 Moisture Separator - Reheaters; MO-T-1A, 1B, 2A, 2B

For a description of the moisture separator-reheaters, refer to the Feedwater Heater Drains System Description, Index No. 7 and the applicable Westinghouse manual (1.00).

#### 2.1.3 Major System Valves

3rd Stage Bleed Steam Stop Valves EX-V22A, 22B

An electric motor operated 18" gate valve with 400 lb. ANSI rating and design temperature of 500 F is provided to automatically shut off the 3rd stage bleed steam line when a turbine trip occurs or a high drain cooler level occurs in the 3rd stage feedwater heaters FW-J-6A, 6B, respectively. Power is supplied to the valve motor operators from the 480 volt motor control centers 2-41B, 2-31B, respectively. The stroke time of each valve motor operator is 1½ minutes. Pushbutton control, and open and closed indicating lights are provided on the Turbine Auxiliaries Monitoring Panel 17.

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3rd Stage Bleed Steam Check Valves EX-V23A, 23B

An air cylinder operated 18" check valve with 40 lb. ANSI rating and design temperature of 500F is provided in each 3rd stage bleed steam line to prevent a backflow of water or steam to the HP turbine from the 3rd stage feedwater heaters FW-J6A, 6B respectively, when a turbine trip or a high-high 3rd stage drain cooler level occurs. Pushbutton control, and open and closed indicating lights are provided on the Turbine Auxiliaries Monitoring Panel 17.

8th Stage Bleed Steam Stop Check Valves EX-V29A, 29B

An air cylinder and electric motor operated 18" stop-check valve with 300 lb. ANSI rating and design temperature of 440F is provided in each 8th stage bleed steam line to prevent a backflow of water or steam to the HP turbine from the 8th stage feedwater heaters FW-J-5A, 5B respectively, when a turbine trip or a high-high 8th stage level occurs. Pushbutton valve control and a set of open and closed indicating lights for each pneumatic and electric operator is provided on the Turbine Auxiliaries Monitoring Panel 17. Power is supplied to the electric motor operators from motor control centers 2-41B, 2-31B, respectively. Air is supplied to the air cylinders from the instrument and service air system.

10th Stage Bleed Steam Stop-Check Valves EX-V1A, 1B

An air cylinder and electric motor operated 16" stop-check valve with 300 lb. ANSI rating and design temperature of 340F is provided in each 10th stage bleed steam line to prevent a

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backflow of water or steam to the LP turbines from the 10th stage feedwater heaters FW-J-4A, 4B, respectively, when a turbine trip or a high-high 10th stage drain cooler level occurs. Pushbutton valve control, and a set of open and closed indicating lights for each pneumatic and electric operator is provided on the Turbine Auxiliaries Monitoring Panel 17. Power is supplied to the electric motor operators from motor control centers 2-41B, 2-31B, respectively. Air is supplied to the air cylinders from the instrument and service air system.

11th Stage Bleed Steam Stop-Check Valves EX-V6A, 6B

An air cylinder and electric motor operated 24" stop-check valve with 150 lb. ANSI rating and design temperature of 320F is provided in each 11th stage bleed steam line to prevent a backflow of water or steam to the LP turbines from the 11th stage feedwater heaters FW-J-3A, 3B, respectively, when a turbine trip or a high-high 11th stage drain cooler level occurs. Pushbutton valve control, and a set of open and closed indicating lights for each pneumatic and electric operator is provided on the Turbine Auxiliaries Monitoring Panel 17. Power is supplied to the electric motor operators from motor control centers 2-41B, 2-31B, respectively. Air is supplied to the air cylinders from the instrument and service air system.

13th Stage Bleed Steam Stop-Check Valves EX-V11A, 16A and EX-V11B, 16B

Two air cylinder and electric motor operated 24" stop-check valves with 150 lb. ANSI rating and design temperature of 260F are provided in each 13th stage bleed steam line to prevent

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a backflow of water or steam to the LP turbines from the 13th stage feedwater heaters FW-J-2A, 2B, respectively, when a turbine trip or a high-high 13th stage drain cooler level occurs. Panel 17 pushbutton control is provided to open or close each pair of valves. A separate set of open and closed indicating lights is provided on the Turbine Auxiliaries Monitoring Panel 17 for each pneumatic and electric operator. Power is supplied to the electric motor operators for the "A" and"B" valves from the 480 volt motor control centers 2-41B and 2-31B, respectively. Air is supplied to the air cylinders from the instrument and service air system.

An interlock is provided between the pair of stop-check valves EX-11A and 16A and the pair of auxiliary steam supply valves AS-V6C, 6D for the 13th stage feedwater heater FW-J-2B as well as between the pair of stop-check valves EX-V11B, 16B and the auxiliary steam supply AS-V6A, 6B for the 13th stage feedwater heater FW-J-2A. The interlock prevents the pair of bleed steam stop-check valves and the corresponding pair of auxiliary steam supply valves to a 13th stage feedwater heater from being open at the same time.

Deaerating Steam Supply Valves EX-V71A, 71B

Two electric motor operated 8" gate valves with 150 lb. ANSI rating and design temperature of 340 F are provided to supply 10th stage bleed steam to the condenser hotwells at plant loads below 40% to deaerate the condensate. The valves are operated from control switches with position indicating lights on Turbine Control Panel 5. The valve motor operators are powered from the 480 volt motor control centers 3-41B, 2-31B, respectively. The stroke time of each valve is 40 seconds.



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Turbine Bleed Steam Drain Valves EX-V35A, 35B, 36A, 36B, 37A, 37B, 38A, 38B, 47A, 47B, 48A, 48B

A 2" electric motor operated globe valve is provided in each external bleed steam line to drain the line to the condenser. The LP turbine bleed steam line drain valves EX-V35A, 35B, 36A, 36B, 37A, 37B, 38A and 38B have a 150 lb ANSI rating and design temperature of 440 F. The HP turbine bleed steam line drain valves EX-V47A, 47B, 48A and 48B have a 300 lb. ANSI rating and design temperature of 500 F. The "A" valves and "B" valves are powered from the 480 volt motor control centers 2-41B and 2-31B, respectively. A single pushbutton control switch (EX-FHS-3242) and a single set of indicating lights are provided on the Turbine Auxiliaries Monitoring Panel 17 for all the drain valves.

## 2.2 Instruments, Controls, Alarms and Protective Devices

### 2.2.1 Instruments

All heaters have pressure and temperature indication in the Control Room as listed in Table 1.

### 2.2.2 Bleed Steam Stop-Check Valve Control

The bleed steam stop-check valves (separate stop and check valves in the 3rd stage bleed steam line) are automatically or remote manually controlled through the I and C Logic System. Refer to B&R Instrumentation and Control Schematic drawing No. 3090, Sheets 64, 64A, 65 and 65A.

When a high-high level occurs in a feedwater heater drain cooler, the stop check valve is automatically closed in the bleed steam line to the feedwater heater. When a turbine

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trip occurs, the stop-check valves in all the bleed steam lines are automatically closed. Each valve may be individually closed by pushbutton control from Panel 17.

When the valve is being closed, the air cylinder is first vented and the spring in the air cylinder pushes the check valve disc to the closed position. When the check valve closed limit switch is actuated, the electric motor operator is automatically energized which turns a stem down to the disc to seat the disc and hold it closed.

When the valve is being opened, the electric motor operator is energized first. When the stem is fully withdrawn from the valve disc, the electric motor operator open limit switch is actuated. Air pressure is then automatically applied to the air cylinder which forces the piston in the air cylinder to its top position with the closing spring compressed. The valve disc is free to swing open or closed as with any ordinary check valve.

The 3rd stage bleed steam check valve operates in the same manner as the other bleed steam check valves except that instead of the motor operator having a stem to seat the check valve disc, a separate motor operated shutoff gate valve is used.

After a stop-check valve is automatically closed because of heater drain cooler high-high level, it can only be opened by manually resetting a relay using a Panel 17 pushbutton after the level has been restored to normal. After a turbine trip, all the stop-check valves are automatically opened when the turbine trip is reset.

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### 2.2.3 Turbine Bleed Steam Drain Valve Control

The turbine bleed steam drain valves are automatically or remote manually controlled through the I and C Logic System. Refer to B&R Instrumentation and Control Schematic drawing No. 3090, sheets 64, 64A, 65 and 65A.

When a high-high level occurs in a feedwater heater drain cooler, the drain valve in the bleed steam line to the feedwater heater is automatically opened. When a turbine trip occurs, the drain valves in all the bleed steam lines are automatically opened. A single pushbutton control switch EX-FHS-3242 is provided on the Turbine Auxiliaries Monitoring Panel 17 to close the drain valves.

### 2.2.4 Safety Valves

Four 6" x 8" pressure relief valves EX-R1A, 1B, 2A, 2B are provided on the four bleed steam lines to the 13th stage feedwater heaters FW-J-2A, 2B. Auxiliary steam is supplied to the 13th stage feedwater heaters through a connection with the bleed steam lines to heat the feedwater during startup. The valves are set to open at 50 psig to protect the heaters and bleed steam piping from overpressure in the event the pressure control valves in the auxiliary steam system fail.

### 2.2.5 Alarms and Computer Inputs

Alarms and Computer inputs are listed in Table 2.

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## 3.0 PRINCIPAL MODES OF OPERATION

### 3.1 Startup

The bleed steam line stop-check valves are closed and the turbine bleed steam drain valves are open as a result of the last turbine trip during plant shutdown. After actuating the turbine trip reset, the bleed steam stop-check valves are automatically opened. The 13th stage bleed steam stop-check valves EX-V11A, 11B, 16A and 16B are closed from Panel 17 so that the auxiliary steam supply valves AS-V6A, 6B, 6C and 6D may be opened in order to heat the feedwater. The turbine bleed steam drain valves are left open. The deaerating steam supply valves which supply 10th stage bleed steam to the condenser hotwell are opened. As steam is admitted to the turbine and turbine load is increased, bleed steam flow from the turbine is increased. After the bleed steam lines are warmed up, the bleed steam line drain valves are closed.

When plant load is increased to the point where the bleed steam can heat the feedwater to the required temperature, the auxiliary steam to the 13th stage feedwater heaters is shut off and the 13th stage bleed steam stop-check valves are opened. At approximately 40% plant load, the deaerating steam supply valves are closed.

### 3.2 Normal Operation

Above 40% plant load, the bleed steam from each turbine bleed stage flows through the stop-check valves to the respective feedwater heater. The 3rd stage bleed steam supply also provides heating steam to the first stage reheater of the moisture separator-reheaters and the 8th stage bleed steam

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supply can provide steam to the auxiliary steam system.

3.3 Shutdown

As turbine load is decreased, the bleed steam flow from the turbine decreases in proportion to turbine load. At about 40% plant load, the deaerating steam supply valves are opened to supply deaerating steam to the condenser hotwells.

When turbine load is decreased to 0% and the turbine is tripped, the bleed steam stop-check valves are automatically closed and the turbine bleed steam drain valves are automatically opened.

3.4 Special or Infrequent Operation

3.4.1 Bleed Steam Stop-Check Valve Closed

If a high-high feedwater heater level occurs, the bleed steam stop-check valve will automatically close. If the level returns to normal, the valve can be opened manually by depressing the Panel 17 reset pushbutton. If the level is not restored to normal, the reason for the high-high level must be found and the problem corrected.

3.4.2 Feedwater Heater Train Out of Service

If a high pressure feedwater heater or low pressure feedwater heater train needs to be taken out of service, the bleed steam stop-check valves to the feedwater heaters being taken out of service are individually closed.

3.5 Emergency

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The two emergency conditions which affect the bleed steam system are a feedwater heater high-high level or a turbine trip. When

either of these events occur, the bleed steam stop-check valves and drain valves function automatically.

## 4.0 HAZARDS AND PRECAUTIONS

The bleed steam stop-check valves play an important part in preventing water induction to the turbine and also overspeed of the turbine when it is tripped. Their function is automatically controlled during plant operation. They are to be periodically tested by using the hand operated air testing valve at each stop-check valve.

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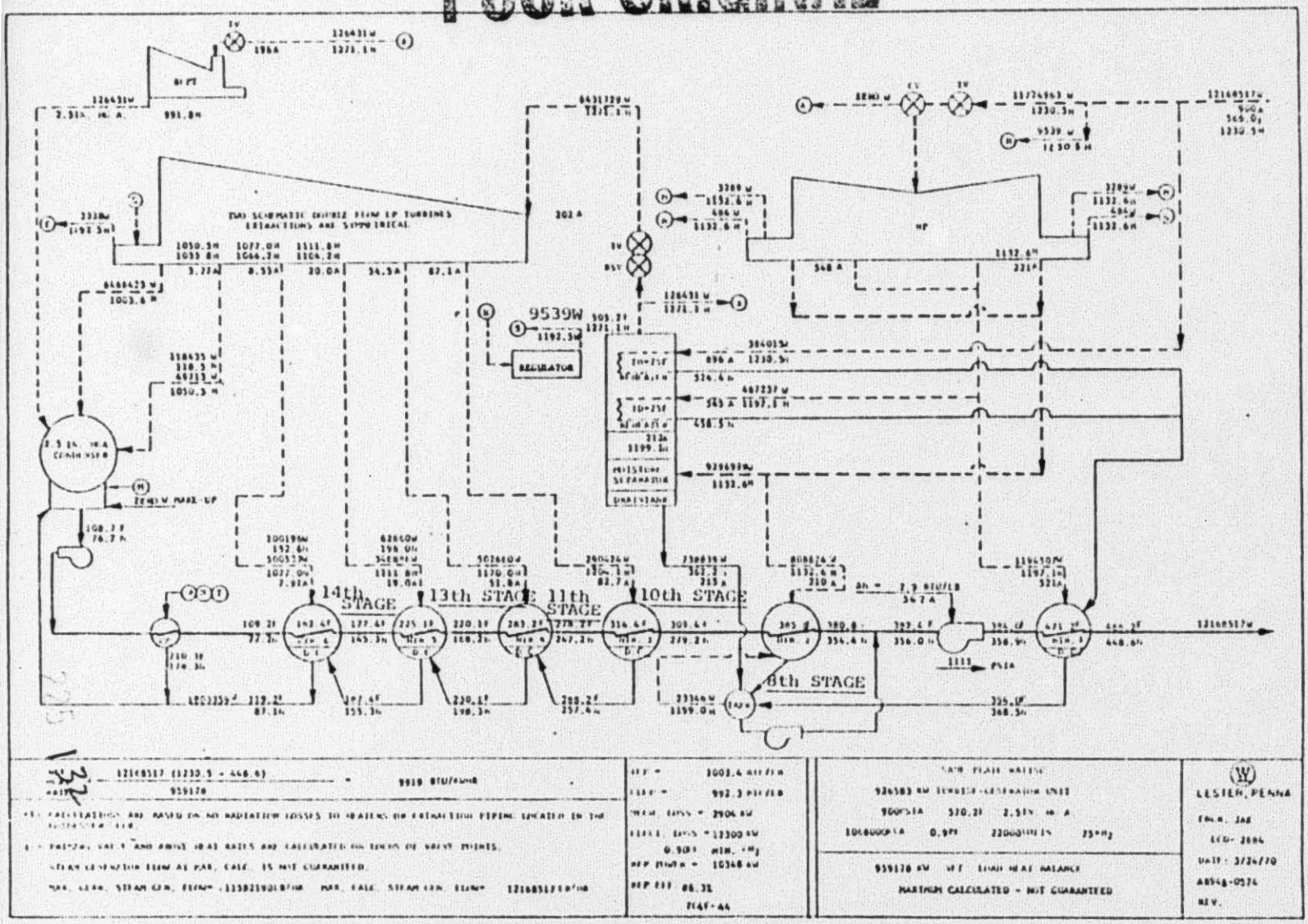


Figure 1

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Table 1

INSTRUMENTATION AND CONTROLS

| IDENTIFICATION | DESCRIPTION | FUNCTION | LOCATION | TYPE | INPUT RANGE | OUTPUT RANGE | SETPOINT |
|---|---|---|---|---|---|---|---|
| EX-PT-115, 116 | Pressure transmitter | Measure 14th stage feedwater heater FW-J-1A, 1B shell side pressure and transmit indication to pressure indicator EX-PI-115, 116 and the computer | Local | Vacuum Compound | 0-30" Hg | 10-50 MA | N/A |
| EX-PI-115, 116 | Pressure Indicator | Indicates 14th stage feedwater heater FW-J-1A, 1B shell side pressure | Turbine Auxiliarios Monitoring panel 17 | MA Vertical | 10-50 MA | 0-30"Hg | N/A |
| EX-PT-117, 118/ 119, 120 | Pressure transmitter | Measures 13th stage bleed steam pressure from HP turbine A/B and transmit indication to pressure indicator EX-PI-117, 118/119, 120 and the computer | Rack 412, 110 | Vacuum Compound | 30"Hg-. psig | 10-50 MA | N/A |
| EX-PI-117, 118/ 119, 120 | Pressure Indicator | Indicates 13th stage bleed steam pressure from HP turbine B/A | Turbine Auxiliaries Monitoring Panel 17 | MA Vertical | 10-50 MA | 30"Hg-15 psig | N/A |
| EX-PT-121, 122 | Pressure transmitter | Measures 11th stage bleed steam pressure from HP turbine A,B and transmits indication to pressure indicators EX-PI-121, 122 and the computer | Rack 412, 110 | Vacuum Compound | 30"Hg-60 psig | 10-50 MA | N/A |
| EX-PI-121, 122 | Pressure Indicator | Indicate 11th stage bleed steam pressure from HP turbine A, B | Turbine Auxiliaries Monitoring Panel 17 | MA Vertical | 10-50 MA | 30"Hg-60 psig | N/A |
| EX-PT-123, 124 | Pressure transmitter | Measure 10th stage bleed steam pressure from HP turbine A, B and transmit indication to pressure indicator EX-PI-123, 124 and the computer | Rack 412, 110 | Vacuum Compound | 30" Hg-150 psig | 10-50 MA | N/A |
| EX-PI-123, 124 | Pressure Indicator | Indicate 10th stage bleed steam pressure from HP turbine A, B | Turbine Auxiliarios Monitoring panel 17 | MA Vertical | 10-50 MA | 30"Hg-150 psig | N/A |
| EX-PT-125, 126 | Pressure transmitter | Measure 8th stage bleed steam pressure from the HP turbine and transmit indication to pressure indicator EX-PI-125, 126 and computer | Rack 412 | Gage | 0-300 psig | 10-50 MA | N/A |
| EX-PI-125, 126 | Pressure Indicator | Indicate 8th stage bleed steam pressure from the HP turbine | Turbine Auxiliaries Monitoring panel 17 | MA Vertical | 10-50 MA | 0-300 psig | N/A |

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Table 1 (Continued)

| IDENTIFICATION | DESCRIPTION | FUNCTION | LOCATION | TYPE | INPUT RANGE | OUTPUT RANGE | SETPOINT |
|---|---|---|---|---|---|---|---|
| EX-PT-127,128 | Pressure transmitter | Measure 3rd stage bleed steam pressure from the HP turbine and transmit indication to pressure indicator EX-PI-127,128 and computer. | Rack 412 | Gage | 0-600 psig | 10-50 MA | N/A |
| EX-PI-127,128 | Pressure Indicator | Indicate 3rd stage bleed steam pressure from the HP turbine | Turbine Auxiliaries Monitoring panel 17 | MA Vertical | 10-50 MA | 0-600 psig | N/A |
| EX-TE-129, 130 | Temperature element | Measure 14th stage feedwater heater FW-J-1A, 1B shell side temperature for temperature transmitter EX-TT-129, 130 | Piping | Dual | 50-250F | 103.95-147.15 OHM | N/A |
| EX-TT-129, 130 | Temperature transmitter | Transmit an indication of 14th stage feedwater heater FW-J-1A, 1B shell side temperature to temperature indicator EX-TI-129, 130 and computer | Cable room | R/I Converter | 103.95-147.15 OHM | 10-50 MA | N/A |
| EX-TI-129, 130 | Temperature Indicator | Indicate 14th stage feedwater heater FW-J-1A, 1B shell side temperature | Turbine Auxiliaries Monitoring panel 17 | MA Vertical | 10-50 MA | 50-250F | N/A |
| EX-TE-131, 132/133, 134 | Temperature element | Measure 13th stage bleed steam temperature from LP turbine A/B for temperature transmitter EX-TT-131, 132/133, 134 | piping | Dual RTD | 50-300F | 103.95-157.73 OHM | N/A |
| EX-TT-131, 132/133, 134 | Temperature transmitter | Transmit indication of 13th stage bleed steam temperature from LP turbine A/B to temperature indicator EX-TI-131, 132/133, 134 and computer | Cable room | R/I Converter | 103.95-157.73 OHM | 10-50 MA | N/A |
| EX-TI-131,132/133, 134 | Temperature Indicator | Indicate 13th stage bleed steam temperature from LP turbine A/B | Turbine Auxiliaries Monitoring panel 17 | MA Vertical | 10-50 MA | 50-300F | N/A |
| EX-TE-135, 136 | Temperature element | Measure 11th stage bleed steam temperature from LP turbine A/B for temperature transmitter EX-TT-135, 136 | piping | Dual RTD | 50-350F | 114.89-168.27 | N/A |
| EX-TT-135,136 | Temperature transmitter | Transmit indication of 11th stage bleed steam temperature from LP turbine A,B to temperature indicator EX-TI-135, 136 and computer | Cable room | R/I Converter | 114.09-168.27 OHM | 10-50MA | N/A |

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Table 1 (Continued)

| IDENTIFICATION | DESCRIPTION | FUNCTION | LOCATION | TYPE | INPUT RANGE | OUTPUT RANGE | SETPOINT |
|---|---|---|---|---|---|---|---|
| EX-TI-135, 136 | Temperature indicator | Indicate 11th stage bleed steam temperature from LP turbine A,B | Turbine Auxiliaries Monitoring Panel 17 | MA Vertical | 10-50 MA | 100-350F | N/A |
| EX-TE-137, 138 | Temperature element | Measure 10th stage bleed steam temperature from LP turbine A,B for temperature transmitter EX-TT-137,138 | piping | Dual | 100-400F | 114.89 178.60 OHM | N/A |
| EX-TT-137, 138 | Temperature transmitter | Transmit indication of 10th stage bleed steam temperature from LP turbine A,B to temperature indicator EX-TI-137, 138 and computer | Cable room | R/I Converter | 114.89-178.60 OHM | 10-50 MA | N/A |
| EX-TI-137, 138 | Temperature indicator | Indicate 10th stage bleed steam temperature from LP turbine A,B | Turbine Auxiliaries Monitoring Panel 17 | MA Vertical | 10-50 MA | 100-400F | |
| EX-TE-139, 140 | Temperature element | Measure 8th stage bleed steam temperature from the HP turbine for temperature transmitter EX-TT-139, 140 | piping | Dual RTD | 150-500F | 125.74-199.11 OHM | N/A |
| EX-TT-139, 140 | Temperature transmitter | Transmits indication of 8th stage bleed steam temperature from the HP turbine to temperature indicator EX-TI-139,140 and computer | Cable room | R/I Converter | 125.74-199.11 OHM | 10-50 MA | N/A |
| EX-TI-139, 140 | Temperature indicator | Indicates 8th stage bleed steam temperature from the HP turbine | Turbine Auxiliaries Monitoring Panel 17 | MA Vertical | 10-50 MA | 150-500F | N/A |
| EX-TE-141, 142 | Temperature element | Measures 3rd stage bleed steam temperature from the HP turbine for temperature transmitter EX-TT-141, 142 | piping | Dual RTD | 200-600F | 136.49 219.26 OHM | N/A |
| EX-TT-141,142 | Temperature transmitter | Transmits indication of 3rd stage bleed steam temperature from the HP turbine to temperature indicator EX-TI-141, 142 and computer | Cable room | R/I Converter | 136.49 219.26 OHM | 10-50 MA | N/A |
| EX-TI-141, 142 | Temperature indicator | Indicates 3rd stage bleed steam temperature from the HP turbine | Turbine Auxiliaries Monitoring Panel 17 | MA Vertical | 10-50 MA | 200-600F | N/A |

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TABLE 1 (Continued)

| Identification | Description | Function | Location | Type | Input Range | Output Range | Setpoint |
|---|---|---|---|---|---|---|---|
| EX-HIS-157 | Hand Switch | Provides shut and open permissive operation of bleed steam stop check valves EX-V22A and 23A | Panel 17 | CH E-30 Push button | N/A | N/A | N/A |
| EX-HIS-158 | Hand Switch | Provides shut and open permissive operation of bleed steam stop check valves EX-V22B and 23B | Panel 17 | CH E-30 Push button | N/A | N/A | N/A |
| EX-HIS-159 | Hand Switch | Provides shut and open permissive operation of bleed steam stop check valves EX-V 29A | Panel 17 | CH E-30 Pushbutton | N/A | N/A | N/A |
| EX-HIS-160 | Hand Switch | Provides shut and open permissive operation of bleed steam stop check valves EX-V29B | Panel 17 | CH E-30 Push button | N/A | N/A | N/A |
| EX-HIS-161 | Hand Switch | Provides shut and open permissive operation of bleed steam stop check valves EX-V1A | Panel 17 | CH E-30 Push button | N/A | N/A | N/A |
| EX-HIS-162 | Hand Switch | Provides shut and open permissive operation of bleed steam stop check valves EX-V1B | Panel 17 | CH E-30 Push button | N/A | N/A | N/A |
| EX-HIS-163 | Hand Switch | Provides shut and open permissive operation of bleed steam stop check valves EX-V6A | Panel 17 | CH E-30 Push button | N/A | N/A | N/A |
| EX-HIS-164 | Hand Switch | Provides shut and open permissive operation of bleed steam stop check valves EX-V6B | Panel 17 | CH E-30 Pushbutton | N/A | N/A | N/A |
| EX-HIS-165 | Hand Switch | Provides shut and open permissive operation of bleed steam stop check valve EX-V11A and 16A | Panel 17 | CH E-30 Push button | N/A | N/A | N/A |
| EX-HIS-166 | Hand Switch | Provides shut and open permissive operation of bleed steam stop check valves EX-V11B and 16B | Panel 17 | CH E-30 Pushbutton | N/A | N/A | N/A |
| EX-HIS-1772, 1773 | Hand Switch | Provides remote manual open/closed operation of deaerating steam supply valves EX-V71A, 71B | Turbine control Panel 5 | CH E-30 Pushbutton | N/A | N/A | N/A |
| EX-HIS-3242 | Hand Switch | Provides remote manual operation of all turbine bleed steam drain valves simultaneously | Turbine Auxiliaries Monitoring Panel 17 | CH E-30 Pushbutton | N/A | N/A | N/A |

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TABLE 1 (Continued)

| Identification | Description | Function | Location | Type | Input Range | Output Range | Setpoint |
|---|---|---|---|---|---|---|---|
| EX-EL-157-1/ 158-1 | Indicating Lights | Provides open and closed indication for EX-V22A/22B | Panel 17 | Red/Green GE-ET 16 | N/A | Open, Closed | N/A |
| EX-EL-157-2/ 158-2 | Indicating Lights | Provides open and closed indication for EX-V23A/EX-V23B | Panel 17 | Red/Green GE-ET 16 | N/A | Open, Closed | N/A |
| EX-ES-157-1/ 158-1 | Position Switch | Provides signal to EX-EL-157-1 /EX-EL-158-1 | EX-V22A/22B | Gear, SPST | N/A | Open, Closed | N/A |
| EX-ES-157-2/ 158-2 | Position Switch | Provides signal to Common Alarm Panel 17, EX-EA-4609 | EX-V22A/22B | Gear, SPST | N/A | Closed | N/A |
| EX-ES-157-3/ 158-3 | Position Switch | Provides signal used for interlock of pneumatic and electric systems | EX-V22A/22B | Gear, SPST | N/A | Closed | N/A |
| EX-ES-157-4/ 158-4 | Position Switch | Provides signal to EX-EL-157-2/ EX-EL-158-2 | EX-V23A/23B | D-2400, DPDT | N/A | Open, Closed | N/A |
| EX-ES-157-5/ 158-5 | Position Switch | Provides signal used for interlock of pneumatic and electric systems | EX-V23A/23B | D-2400, DPDT | N/A | Closed | N/A |
| EX-EL-159-1/ 160-1 | Indicating Lights | Provides open and closed indication for EX-V29A/29B motor | Panel 17 | Red/Green GE-ET 16 | N/A | Open, Closed | N/A |
| EX-EL-159-2/ 160-2 | Indicating Lights | Provides open and closed indication for EX-V29A/29B pneumatic piston | Panel 17 | Red/Green GE-ET 16 | N/A | Open, Closed | N/A |
| EX-ES-159-1/ 160-1 | Position Switch | Provides signal to EX-EL-159-1/ EX-EL-160-1 | EX-V29A/29B | Gear, SPST | N/A | Open, Closed | N/A |
| EX-ES-159-2/ 160-2 | Position Switch | Provides signal to Common Alarm Panel 17, EX-EA-4609 | EX-V29A/29B | Gear, SPST | N/A | Closed | N/A |
| EX-ES-159-3/ 160-3 | Position Switch | Provides signal used for interlocking pneumatic and electric systems | EX-V29A/29B | Gear, SPST | N/A | Closed | N/A |
| EX-ES-159-4/ 160-4 | Position Switch | Provides signal to EX-EL-159-2/ EX-EL-160-2 | EX-V29A/29B | D-2400, DPDT | N/A | Open, Closed | N/A |
| EX-ES-159-5/ 160-5 | Position Switch | Provides signal used for interlock of pneumatic and electric systems | EX-V29A/29B | D-2400, DPDT | N/A | Closed | N/A |
| EX-EL-161-1/ 162-1 | Indicating Lights | Provides open and closed indication for EX-V1A/1B motor | Panel 17 | Red/Green GE-ET-16 | N/A | Open, Closed | N/A |
| EX-EL-161-2/ 162-2 | Indicating Lights | Provides open and closed indication for EX-V1A/1B pneumatic piston | Panel 17 | Red/Green GE-ET 16 | N/A | Open, Closed | N/A |





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TABLE 1 (Continued)

| Identification | Description | Function | Location | Type | Input Range | Output Range | Setpoint |
|---|---|---|---|---|---|---|---|
| EX-HS-161-1/ 162-1 | Position Switch | Provides signal to EX-HL-161-1/ EX-HL-162-1 | EX-V1A/1B | Gear, SPDT | N/A | Open, Closed | N/A |
| EX-HS-161-2/ 162-2 | Position Switch | Provides signal to Common Alarm Panel 17, EX-HA-4609 | EX-V1A/1B | Gear, SPST | N/A | Closed | N/A |
| EX-HS-161-3/ 162-3 | Position Switch | Provides signal used for interlocking pneumatic and electric systems | EX-V1A/1B | Gear, SPST | N/A | Closed | N/A |
| EX-HS-161-4/ 162-4 | Position Switch | Provides signal to EX-HL-161-2/ EX-HL-162-2 | EX-V1A/1B | D-2400, DPDT | N/A | Open, Closed | N/A |
| EX-HS-161-5/ 162-5 | Position Switch | Provides signal used for interlock of pneumatic and electric systems | EX-V1A/1B | D-2400, DPDT | N/A | Closed | N/A |
| EX-HL-163-1/ 164-1 | Indicating Lights | Provides open and closed indication for EX-V6A/6B motor | Panel 17 | Red/Green GE-ET 16 | N/A | Open, Closed | N/A |
| EX-HL-163-2/ 164-2 | Indicating Lights | Provides open and closed indication for EX-V6A/6B pneumatic piston | Panel 17 | Red/Green GE-ET 16 | N/A | Open, Closed | N/A |
| EX-HS-163-1/ 164-1 | Position Switch | Provides signal to EX-HL-163-1/ EX-HL-164-1 | EX-V6A/6B | Gear, SPST | N/A | Open, Closed | N/A |
| EX-HS-163-2/ 164-2 | Position Switch | Provides signal to Common Alarm Panel 17, EX-HA-4609 | EX-V6A/6B | Gear, SPST | N/A | Closed | N/A |
| EX-HS-163-3/ 164-3 | Position Switch | Provides signal used for interlocking pneumatic and electric systems | EX-V6A/6B | Gear, SPST | N/A | Closed | N/A |
| EX-HS-163-4/ 164-4 | Position Switch | Provides signal to EX-HL-163-2/ EX-HL-164-2 | EX-V6A/6B | D-2400, DPDT | N/A | Open, Closed | N/A |
| EX-HS-163-5/ 164-5 | Position Switch | Provides signal used for interlocking pneumatic and electric systems | EX-V6A/6B | D-2400, DPDT | N/A | Closed | N/A |
| EX-HL-165-1/ 166-1 | Indicating Lights | Provides open and closed indication for EX-V11A/11B motor | Panel 17 | Red/Green GE-ET 16 | N/A | Open, Closed | N/A |
| EX-HL-165-2/ 166-2 | Indicating Lights | Provides open and closed indication for EX-V11A/11B pneumatic piston | Panel 17 | Red/Green GE-ET 16 | N/A | Open, Closed | N/A |
| EX-HS-165-3/ 166-3 | Indicating Lights | Provides open and closed indication for EX-V16A/16B motor. | Panel 17 | Red/Green GE-ET 16 | N/A | Open, Closed | N/A |
| EX-HS-165-4/ 166-4 | Indicating Lights | Provides open and closed indication for EX-V16A/16B pneumatic piston | Panel 17 | Red/Green GE-ET 16 | N/A | Open, Closed | N/A |

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TABLE 1 (Continued)

| Identification | Description | Function | Location | Type | Input Range | Output Range | Setpoint |
|---|---|---|---|---|---|---|---|
| EX-FS-165-1/ 166-1 | Position Switch | Provides signal to EX-RL-165-1/166-1 | EX-V11A/11B | Gear, SPST | N/A | Open, Closed | N/A |
| EX-FS-165-2/ 166-2 | Position Switch | Provides signal to Common Alarm Panel 17, EX-RA-4609 | EX-V11A/11B | Gear, SPST | N/A | Closed | N/A |
| EX-FS-165-3/ 166-3 | Position Switch | Provides signal used for interlocking pneumatic and electric systems | EX-V11A/11B | Gear, SPST | N/A | Closed | N/A |
| EX-FS-165-4/ 166-4 | Position Switch | Provides signal to EX-RL-165-2/ EX-RL-166-2 | EX-V11A/11B | D-2400, DPDT | N/A | Open, Closed | N/A |
| EX-FS-165-5/ 166-5 | Position Switch | Provides signal used for interlocking pneumatic and electric systems | EX-V11A/11B | D-2400, DPDT | N/A | Closed | N/A |
| EX-FS-165-6/ 166-6 | Position Switch | Provides signal to EX-RL-165-3/ EX-RL-166-3 | EX-V16A/16B | Gear, SPST | N/A | Open, Closed | N/A |
| EX-FS-165-7/ 166-7 | Position Switch | Provides signal to Common Alarm Panel 17, EX-RA-4609 | EX-V16A/16B | Gear, SPST | N/A | Closed | N/A |
| EX-FS-165-8/ 166-8 | Position Switch | Provides signal used for interlocking pneumatic and electric systems | EX-V16A/16B | Gear, SPST | N/A | Closed | N/A |
| EX-FS-165-9/ 166-9 | Position Switch | Provides signal to EX-RL-165-4/ EX-RL-166-4 | EX-V16A/16B | D-2400, DPDT | N/A | Open, Closed | N/A |
| EX-FS-165-10/ 166-10 | Position Switch | Provides signal used for interlocking pneumatic and electric systems | EX-V16A/16B | D-2400, DPDT | N/A | Closed | N/A |

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Table 2

PANEL MOUNTED ANNUNCIATORS AND COMPUTER INPUTS

PANEL MOUNTED ANNUNCIATORS:

| IDENTIFICATION | MEASURED VARIABLE, UNITS | ALARM SETPOINTS HIGH | ALARM SETPOINTS LOW | SOURCE | VARIABLE RANGE | PANEL NAME AND NUMBER |
|---|---|---|---|---|---|---|
| EX-HA-6609 | Any feedwater heater bleed steam stop-check valve closed | N/A | N/A | All closed position limit switches of stop-check valve motor operators. | N/A | Turbine Auxiliaries Monitoring Panel 17 |

COMPUTER INPUTS:

| | | | | | | |
|---|---|---|---|---|---|---|
| 0120, 0121 | 14th stage feedwater heater HW-J-1A, 1B shell pressure, "Hg | N/A | N/A | Pressure transmitter EX-PT-115,116 | 0-30"Hg | |
| 0122, 0123, 0124, 0125 | 13th stage bleed steam pressure from LP turbine A/B - psia | N/A | N/A | Pressure transmitter EX-PT-117,118,119,120 | 30"Hg-15 psig | |
| 0126, 0127 | 11th stage bleed steam pressure from LP turbine A,B - psia | N/A | N/A | Pressure transmitter EX-PT-121,122 | 30"Hg-60 psig | |
| 0128, 0129 | 10th stage bleed steam pressure from LP turbine A,B-psia | N/A | N/A | Pressure transmitter EX-PT-123, 124 | 30"Hg-150 psig | |
| 0130, 0131 | 8th stage bleed steam pressure from HP turbine, psia | N/A | N/A | Pressure transmitter EX-PT-125, 126 | 0-300 psig | |
| 0132, 0133 | 3rd stage bleed steam pressure from HP turbine, psia | N/A | N/A | Pressure transmitter EX-PT-127, 128 | 0-600 psig | |
| 0900, 0901 | 14th stage feedwater heater HW-J-1A, 1B shell side temperature, °F | N/A | N/A | Temperature transmitter EX-TT-129, 130 | 50-250F | |
| 0902, 0903, 0904, 0905 | 13th stage bleed steam temperature from LP turbine A/B °F | N/A | N/A | Temperature transmitter EX-TT-131,132,133,134 | 50-300F | |
| 0906, 0907 | 11th stage bleed steam temperature from LP turbine A,B - °F | N/A | N/A | Temperature transmitter EX-TT-135, 136 | 100-350F | |
| 0908, 0909 | 10th stage bleed steam temperature from LP turbine A,B - °F | N/A | N/A | Temperature transmitter EX-TT-137, 138 | 100-400F | |
| 0910, 0911, | 8th stage bleed steam temperature from the HP turbine - °F | N/A | N/A | Temperature transmitter EX-TT-139, 140 | 150-500F | |
| 0912, 0913 | 3rd stage bleed steam temperature from the HP turbine - °F | N/A | N/A | Temperature transmitter EX-TT-141, 142 | 200-600F | |

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