Enclosure to RNP-RA/14-0036

RNP-I/INST-1150, Turbine Low Hydraulic Pressure Trip Setpoint and Uncertainty Calculation

SYSTEM# 5015 (EHC) / 1080 (RPS)

CALC. SUB-TYPE ID

PRIORITY CODE 0

QUALITY CLASS D

NUCLEAR GENERATION GROUP

RNP-I/INST-1150

(Calculation #)

Turbine Low Hydraulic Pressure Trip Setpoint and Uncertainty Calculation

(Title including structures, systems, components)

☐ BNP UNIT ____

☐ CR3 ☐ HNP ☒ RNP ☐ NCP ☐ ALL

APPROVAL ☐ Electronically Approved

REV	PREPARED BY	REVIEWED BY	SUPERVISOR
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Owner's Review By C B Patel Date 2/19/14

Chandrakant B. Patel

Table of Contents

REVISION SUMMARY

REVISION	DESCRIPTION OF CHANGE
0	Original Issue
1	Changed Reference 4.7.4 Title to "ASO Turbine Trip Setpoint Change". Corrected Mercoid Pressure Switch model number from DAW-7021-153-13S to DAW-7023-153-13S.

1 OBJECTIVE

The objective of this calculation is to determine the uncertainties and setpoints for the Turbine Stop Emergency Trip Fluid Pressure; RPS inputs:

- PS-63AST-1
- PS-63AST-2
- PS-63AST-3

This calculation is performed to provide the setpoint basis for the above listed devices, which are part of the Robinson Nuclear Plant Limiting Safety System Setting (LSSS) setpoints (Reference 4.7.2).

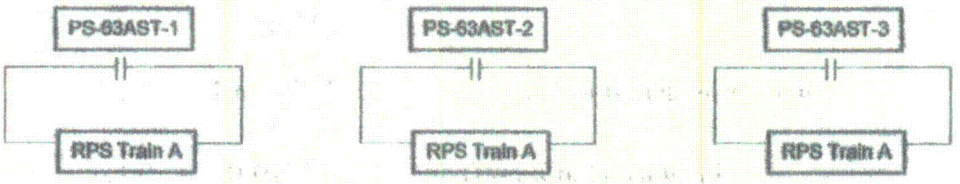
The three pressure switches are Mercoid DAW-7023-153-13S Snap Action type pressure switches.

2 FUNCTIONAL DESCRIPTION

The components listed above are multi-contact pressure switches locally mounted to the Turbine EHC fluid system. The switches monitor the Turbine Stop Emergency Trip Fluid Pressure (Auto Stop Trip header) and provide contact "change of state" input signals to the Reactor Protection System (RPS) logic to initiate a reactor trip on Low EH Fluid Oil Pressure when two of three pressure switches indicate pressure is ≤ 800 psig. There are a total of three pressure switches each with contact inputs to RPS trip logic A and RPS trip logic B. Two of three switches below the setpoint is indicative of a turbine trip and causes a reactor trip, if reactor power is above 40%. The Low EH Fluid Pressure reactor trip is an anticipatory trip that anticipates the loss of heat removal capabilities of the secondary system following a turbine trip.

PassPort Equipment Data Base lists the switches as Quality Class "D", Non Safety Related, Non-Seismic devices. FSAR Sections 15.0.9 and 15.2.2 and DBD-R87038-SD06 Section 1.3 document that the direct reactor trip on turbine trip function of the turbine auto stop trip pressure switches is not credited in the accident analysis for any core protection function. This trip function acts to minimize the pressure/temperature transient on the reactor. Therefore, the uncertainties calculated in the following sections are determined for normal conditions because the switches are not credited to operate under accident conditions, are not expected to be exposed to adverse environmental conditions before or during the time they are needed to function, and because the purpose of the switches is to actuate a reactor trip in response to a turbine trip event, not as a result of an accident such as a LOCA or MSLB.

3 LOOP DIAGRAM



Note: This simplified diagram is typical for the B loop, substituting "B" for "A" in all places. See B-190628 SHT 711.

4 REFERENCES

4.1 DRAWINGS

4.1.1 B-190628 sheet 711, Control Wiring Diagram, Turbine Emergency Trip, Rev. 24

4.1.2 5379-02753, Reactor Trip Signals, Rev. 11

4.1.3 5379-03695, Turbine Trip Signals, Rev. 19

4.1.4 5379-03249, Reactor Protection System, Sheet 11, Rev. 14

4.1.5 5379-05738, Instructions – Turbine Controls Setting, Sheet 1, Rev. 8

4.1.6 5379-05738, Instructions – Turbine Controls Setting, Sheet 2, Rev. 9

4.1.7 5379-01030, Wiring, Terminal Equipment Terminal Boxes "A" and "B", Rev. 7

4.2 CALCULATIONS

None

4.3 REGULATORY DOCUMENTS

4.3.1 NUREG-1431 Volume 1, Standard Technical Specifications - Westinghouse Plants, Rev. 4

4.3.2 ANSI/ISA-67.04.01-2006, Setpoints for Nuclear Safety-Related Instrumentation, Reaffirmed 2011

4.3.3 ISA-RP67.04.02-2000, Methodologies for the Determination of Setpoints for Nuclear Safety-Related Instrumentation, 2000

4.4 TECHNICAL MANUALS

4.4.1 729-063-40, Westinghouse Vendor Manual – Operation and Control Volume I, II, & III, Rev. 53

4.5 CALIBRATION AND MAINTENANCE PROCEDURES

4.5.1 PIC-301, Pressure Switches and Vacuum Switches, Rev. 9

4.5.2 MMM-006, Calibration Program, Rev. 33

4.5.3 MMM-006 Appendix B-1, Calibration Data Sheets, Rev. 46 (pending revision)

4.6 PROCEDURES

4.6.1 EGR-NGGC-0153, Engineering Instrument Setpoints, Rev. 12

4.7 OTHER REFERENCES

4.7.1 Updated Final Safety Analysis Report, Section 15, Rev.15

4.7.2 RNP Technical Specifications, Table 3.3.1-1 Reactor Protection System Instrumentation, Amendment No. 222

4.7.3 DBD/R87038/SD06, Reactor Safeguards & Protection System, Rev. 11 (pending revision)

4.7.4 EC87736, ASO Turbine Trip Setpoint Change

4.7.5 EC87740, Front Standard and Turbine Auxiliary System Modifications

4.7.6 Technical Specification Task Force (TSTF) 493, Clarify Application of Setpoint Methodology for LSSS Function, Rev. 4

5 INPUTS AND ASSUMPTIONS

5.1 The uncertainties are determined for normal conditions, since this equipment is Quality Class D, non-seismic, and performs its function based on a turbine trip, not a LOCA or MSLB accident.

5.2 The Standard Westinghouse Technical Specification (Ref. 4.3.1) lists the nominal trip setpoint for Turbine Trip on Low EH Fluid Oil Pressure as 800 psig. This is the basis for using a nominal trip point of 800 psig in this calculation. See Section 6.17 for further detail.

5.3 The Standard Westinghouse Technical Specification (Ref. 4.3.1) lists the allowable value for Turbine Trip on Low EH Fluid Oil Pressure as greater than or equal to 750 psig. See Section 6.18 for further detail.

5.4 An analytical limit is a limit of a measured or calculated variable established by the safety analysis to ensure that a safety limit is not exceeded. Since the Low EH Fluid Oil Pressure is not an established setpoint used in the safety analyses, the allowable value is used as the analytical limit for the purposes of this calculation.

5.5 Since only one device (the pressure switch) contributes to the total loop uncertainty, no group or loop analysis is performed.

5.6 The MMV of the AST header pressure switch is assumed to be a Dwyer Mercoid DAW-7023-153-13S.

6 CALCULATION OF UNCERTAINTY CONTRIBUTORS / SETPOINTS

6.1 ACCIDENT EFFECTS (AE)

Since the pressure switch devices are Non-Safety Related, Q Class-D, and are not credited to function properly during or after a design basis accident as described in section 15.2.2 of the UFSAR, accident effects are not applicable.

AE = N/A

6.2 SEISMIC EFFECT (SE)

Since the pressure switch devices are Non-Safety Related, Q Class-D, and are not credited to function properly during or after a seismic event as described in section 15.2.2 of the UFSAR, seismic effects are not applicable.

SE = N/A

6.3 INSULATION RESISTANCE ERROR (IR)

Since the pressure switch devices are Non-Safety Related, Q Class-D, and are not credited to function properly during or after a design basis accident as described in section 15.2.2 of the UFSAR, the effects of insulation resistance are not applicable.

IR = N/A

6.4 PROCESS MEASUREMENT ERROR (PME)

The pressure switches are mounted to the EH fluid system emergency trip header and are the Primary Elements in the loop. No process effects are considered in this calculation because the switches simply monitor the high pressure of the system. The pressure is normally maintained at 2000 psig and the nominal trip point is at 800 psig. Head effects and density effects are negligible compared to these system pressures and are not evaluated further.

PME = N/A

6.5 PRIMARY ELEMENT ERROR (PE)

The primary element in this case is a pressure sensing device. No instrument uncertainties apply to the mechanical primary element of such a device.

PE = N/A

6.6 REFERENCE ACCURACY (RA)

Per EGR-NGGC-0153 Section 9.4.1, for some devices no reference accuracy is provided by the vendor. Instead, the vendor may only provide a value for repeatability. If the vendor states that this is the only applicable term for the device, then it can be used as the reference accuracy. This is the case with the Mercoid pressure switches. The repeatability specification from the vendor (Attachment – 1) is used as the reference accuracy for these pressure switches.

The vendor provides a repeatability value of ± 1% of full operating range. The range for the switch is: 300 – 2500 psig. Thus, 1.0% X 2200 psig = 22 psig

RA = ± 22 psig

6.7 CALIBRATION TOLERANCE (CAL)

Per EGR-NGGC-0153, Section 9.5.1, the calibration error is typically equal to the reference accuracy for a device/loop, plus any additional tolerance deemed necessary to aid in the calibration of the device/loop. Therefore, the calibration tolerance is set equal to the reference accuracy of ± 1% of full operating range.

Thus, 1.0% X 2200 psig = 22 psig.

CAL = ± 22 psig

6.8 DRIFT (DR)

Per EGR-NGGC-0153, Section 9.4.2, typical values which may be assumed for drift are ± 1% of full operating range for 18 months nominal maintenance for a sensor when no drift value can be obtained from the vendor. Therefore a drift of ± 1% of full operating range will be used. Thus, 1.0% X 2200 psig = 22 psig.

DR = ± 22 psig

6.9 M&TE Error (MTE)

Per the MMM-006 Appendix B-1, a Condec UPC 5000 Portable Pneumatic Pressure Calibration Console or device with equivalent accuracy is used to calibrate this type pressure switch at the given setpoint and range. The Condec is rated at an overall accuracy of ± 0.05% full scale; however, the I&C Maintenance Shop calibrates the Condec to ± 0.1% of full scale. The UPC devices that I&C Maintenance Shop use have a 0-2000 psig span. Thus, 0.1% X 2000 psig = 2 psig

M&TE = ± 2 psig

6.10 Temperature Effect (TE)

During the intervals between calibrations, the pressure switches are subject to various temperatures due to operation of the EHC system and changes in ambient (outdoor) temperature. The temperature in the location of the pressure switches is within the rated outdoor functional temperature of the pressure switches. Per Dwyer technical group, fluid temperature is not a variable when determining device uncertainties if the fluid temperature is within the rated temperature span of the device. This is the case for the interface between the EH fluid and the pressure switches.

The Mercoid switches do not have a defined temperature effect. Per EGR-NGGC-0153, Section 9.4.3, a typical value of TE for components located outside containment at RNP is ± 0.5% of full operating range when no temperature effect value can be obtained from the vendor. Thus, 0.5% X 2200psig = ± 11 psig.

TE = ± 11 psig

6.11 Static Pressure Effect (SPE)

Per EGR-NGGC-0153 Section 9.4.4, static pressure effect is only applicable to differential pressure transmitters in high static pressure service. This effect does not apply to the pressure switches. Therefore,

SPE = N/A

6.12 Power Supply Effect (PSE)

Power supply effects are not applicable to these pressure switches because their contacts simply provide an open or short circuit that is sensed by the solid state protection system.

PSE = N/A

6.13 Readability (RE)

Readability error is only relevant when reading the calibration device for pressure switch calibration. Therefore, readability of the pressure switch is not applicable.

RE = N/A

6.14 Total Device Uncertainty (TDU)

Per EGR-NGGC-0153, Sections 9.5.1.2 and 9.6.2.2, Total Device Uncertainty is computed using the following equation:

$$TDU = \sqrt{(CAL + MTE)^2 + DR^2 + RA^2 + TE^2}$$

$$TDU = \sqrt{(1.0 + 0.1)^2 + 1.0^2 + 1.0^2 + 0.5^2}$$

TDU = ± 1.86% Span

Thus,

TDU = ± 1.86% X 2200 psig = ± 41 psig

6.15 As-Found Tolerance (AFT)

Per EGR-NGGC-0153, Section 9.7.4, the As-Found Tolerance (AFT) is computed using the following equation:

$$AFT = \sqrt{CAL^2 + DR^2 + MTE^2}$$

$$AFT = \sqrt{1^2 + 1^2 + 0.1^2}$$

AFT = ±1.42 % Span

Thus,

AFT = ± 1.42% X 2200 psig = ± 31 psig

6.16 As-Left Tolerance (ALT)

Per EGR-NGGC-0153, Section 9.7.4, the As-Left Tolerance (ALT) can be taken as the reference accuracy.

ALT = RA

ALT = ± 1.0% Span

Thus,

ALT = ± 1.0% X 2200 psig = ± 22 psig

6.17 Setpoint Determination (SP)

The Standard Westinghouse Technical Specification (Ref. 4.3.1) lists the nominal trip setpoint for Turbine Trip on Low EH Fluid Oil Pressure as 800 psig. According to RNP drawing 5379-05738, Instructions -- Turbine Control Settings, the High Pressure Fluid System (also known as the EHC Fluid System) operates between 1950-2050 psig. The high pressure fluid "Low Pressure Alarm" pressure switch closes on decreasing pressure at 1400 psig and alarms the operator in the control room that the EH pressure is decreasing. The "Main Pump Auto Start" pressure switch closes on decreasing pressure at 1350 psig and starts the backup EH fluid pump to maintain pressure in the high pressure header to prevent a turbine trip. The existing operating conditions confirm that the Standard Westinghouse setpoint value is relevant to RNP, is appropriate for use at RNP, and no adverse effect to the current alarms and backup mechanisms will be present.

Therefore, based on current RNP operating conditions and alignment with the Standard Westinghouse Technical Specification, it is appropriate to set the AST header pressure setpoint to 800 psig. The nominal trip setpoint of 800 psig is used to derive the associated technical specification allowable value described in Section 6.18.

SP = 800 psig

6.18 Allowable Value (AV)

The allowable value for the Turbine Trip on Low EH Fluid Oil Pressure as specified in reference 4.3.1 is greater than or equal to 750 psig. However, if the Allowable Value specified in the Standard Westinghouse Technical Specification (Ref. 4.3.1) is used, unnecessary margin is present. In accordance with EGR-NGGC-0153 Section 9.10 (Technical Specification Task Force-493 Implementation), no additional margin should be

applied.

Therefore, per EGR-NGGC-0153 Section 9.8.2, the Allowable Value (AV) is computed using the following equation:

AV = SP - AFT

AV = 800psig – 31psig

AV ≥ 769 psig

6.19 *Reset Setpoint (RS)*

The reset setpoint should be set to a value high enough to prevent spurious chattering of the pressure switch contacts. Based on known operating conditions and the minimum pressure switch deadband of 390 psig, the reset setpoint will be set to 1200 psig. This allows ample margin between the trip setpoint of 800 psig and reset setpoint of 1200 psig to ensure chattering does not occur and provide false trip indication. When pressure is established in the AST header to 1200 psig, the pressure switch contacts will open.

7 DISCUSSION OF RESULTS

The AST header pressure switches are physically located on the ETS Trip Block Assembly and utilize a tap located on the ETS Trip Block Assembly to measure high pressure Electro-Hydraulic fluid in the AST header. The AST header is the pressure in the line between the turbine valves and the ETS Trip Block Assembly. The pressure in the AST header is pressurized to equilibrium with the EH Supply pressure. According to 5379-05738, Instructions – Turbine Control Settings, the High Pressure Fluid System (also known as the EH Fluid System) operates between 1950-2050 psig. The high pressure fluid "Low Pressure Alarm" pressure switch closes on decreasing pressure at 1400 psig and alarms the operator in the control room that the EH pressure is decreasing. The "Main Pump Auto Start" pressure switch closes on decreasing pressure at 1350 psig and starts the backup EH fluid pump to maintain pressure in the high pressure header to prevent a turbine trip.

According to EGR-NGGC-0153, setpoints for alarms should have sufficient margin from a system trip point, or safety limit, to allow an operator time to take corrective action. An alarm, coincident with an equipment trip setpoint, may serve no useful function. However, when attempting to achieve this margin, alarm and plant trip points should not be set so close to normal plant operation limits that they cause nuisance alarms and spurious trips. To allow for EH fluid pressure recovery before a turbine trip, the new AST header pressure setpoint will be set to 800 psig. This will allow for an Operator to take action to recover the EH fluid pressure in response to the Low Pressure Alarm and Main Pump Auto Start action. If fluid pressure is not recovered by the time the pressure drops below 800 psig, the new AST header pressure switch contacts will close and consequently send a signal to the Reactor Protection System.

Error Contributor	Value
RA	±1.0% Span
CAL	±1.0% Span
DR	±1.0% Span
MTE	±0.1% Span
TE	±0.5% Span
As Left Tolerance (ALT)	±1.0% Span
As Found Tolerance (AFT)	±1.42% Span
Total Device Uncertainty (non-accident)	±1.86% Span

Device Uncertainty Summary

8 DOCUMENT IMPACTS

8.1 Impact on Technical Specifications

Technical Specification Table 3.3.1-1 Reactor Protection System Instrumentation will need to be updated to reflect the new Turbine Trip on Low EH Fluid Oil Pressure Nominal Setpoint and Allowable Value from 45 psig and 40.87 psig to 800 psig and 769 psig, respectively.

8.2 Impact on FSAR

The associated setpoint does not impact any sections of the UFSAR. This was determined by a review of the UFSAR requirements.

8.3 Impact on Plant Procedures

MMM-006 Appendix B-1 is impacted because the ASO pressure switch setpoint and calibration data sheets will be updated to reflect the new AST header pressure switches and their associated setpoint of 800 psig, tolerance of ±22 psig, and their reset setpoint of 1200 psig.

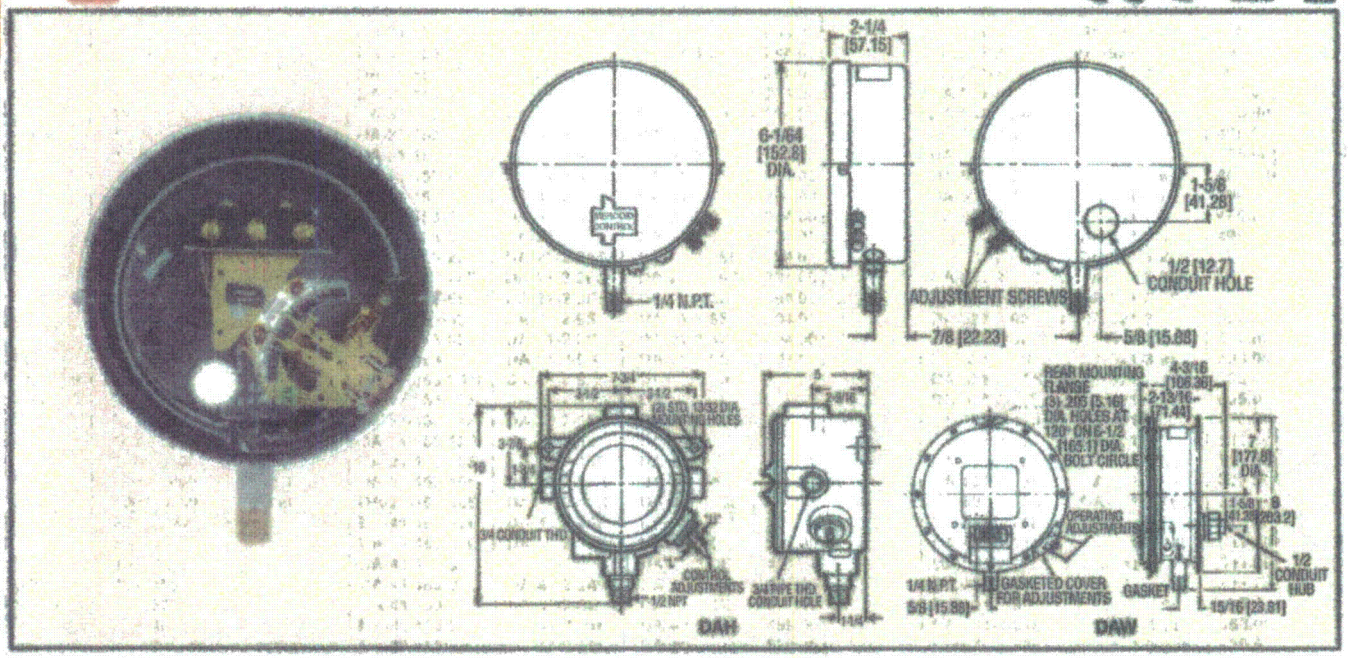
9 ATTACHMENT 1 – Dwyer/Mercoid Snap Action Cutsheet

Mercoid®

Series DA/DS

Bourdon Tube Pressure Switches

Pressure Ranges to 6000 psi (551.6 bar)



Customers tell us that this is the best pressure switch made. The Mercoid D Series is one of the world's broadest lines of pressure switches.

The D Series has extremely high sensitivity and great repeatability. The DA Models are equipped with two external adjustments, one for setting high pressure operating point, the other for setting low pressure operating point. Deadband, the difference between high and low setpoints, is adjustable over the full-scale. The DS Models are equipped with a single external adjustment for setting operating point only. For mercury-free switches, choose between the snap action switch or hermetically sealed snap action switch. Hermetically sealed mercury switch also available.

FEATURES

- Visible calibrated dial
- On/off indication (except hermetically sealed snap switch models)
- Adjustable or fixed deadband
- SPDT snap-action, hermetically sealed snap action or hermetically sealed mercury switch
- External switch setpoint adjustments
- Minimum deadband is obtainable at any point in the range
- Pressure ranges of full vacuum to 6000 psig
- UL listed, CSA approved, many models FM approved
- General purpose, weatherproof or explosion-proof enclosures

OPTIONS

Weatherproof Enclosure, Series DAW –
Add "W" to model number after DA or DS and change 1 to 3.
Example: DAW-33-153-7 ..... add $126.00

Explosion-Proof Enclosure, Series DAH – Suitable for Class I, Groups C and D; NEMA 7; Class II, Groups E, F, G; Class III NEMA 9 and 9A, Division 1. Add "H" to model number after DA or DS
Example: DAH-31-153-7 ..... add 599.00

FM Approved: For general purpose and explosion-proof models see agency approvals. Add "F" to model number after DA, DS, DAH or DSH ..... add 54.00
Examples: DAF-31-153-7 or DAHF-31-153-7

Other Options (Consult Factory): DPDT switches or other switch types, fixed deadband mercury switch units for low deadband applications, manual reset operation, two-stage operation, acetal bushed movement for applications with high amounts of vibration and/or pulsation, fungus proofing, siphon, diaphragm seals, mounting flange and remote connection.

SPECIFICATIONS

Wetted Materials: Brass, 403 SS, or 316 SS.
Temperature Limit: 180°F (82°C).
Pressure Limit: Maximum pressure of the operating range.
Enclosure Rating: General purpose, weatherproof or explosion-proof.
Repeatability: ±1% of full operating range, ±1.5% on DS-7300 models.
Switch Type: SPST mercury switch, SPDT mercury switch, SPDT snap switch, or SPDT hermetically sealed snap switch. Other circuit types available.
Electrical Rating: See model charts.
Electrical Connections: Screw terminal.
Conduit Connection: General purpose: 1/2" hole for conduit hub; Weatherproof: 1/2" conduit hub; Explosion-proof: 3/4" female NPT.
Process Connection: General purpose and weatherproof: 1/4" male NPT, 1/2" male NPT on ranges 15S and 16S; Explosion-proof: 1/2" male NPT and 1/4" female NPT.
Mounting Orientation: Vertical.
Set Point Adjustment: Thumbscrew.
Weight: General purpose: 4 lb (1.8 kg); Weatherproof: 6 lb (2.7 kg); Explosion-proof: 8 lb (3.5 kg).
Deadband: See model chart.
Agency Approvals: CE, CSA, FM, UL (mercury switch units are not CE approved) (Consult factory for FM approved models).

D Series Pressure Switch with Mercury Switch and General Purpose Enclosure

Bourdon Tube Material	Adjustable Operating Range (psig)	Adjustable Deadband: Minimum Deadband (psig)	SPDT 4A @ 120 V 2A @ 240 V AC/DC	SPST Open on Increase 10A @ 120 V 5A @ 240 V AC/DC	SPST Close on Increase 10A @ 120 V 5A @ 240 V AC/DC	Price ($)	Adjustable Deadband: Minimum Deadband (psig)	SPST Open on Increase 5A @ 120 VAC 2A @ 240 VDC 2.5A @ 120 VDC 1A @ 240 VDC	SPST Close on Increase 6A @ 120 VAC 2A @ 240 VDC 2.5A @ 120 VDC 1A @ 240 VDC	Price ($)
Brass	0-30" Hg Vac	2" Hg	DA-31-153-2	DA-31-2-2	DA-31-3-2	$294.00	1" Hg	DA-531-2-2	DA-531-3-2	$465.00
	10" Hg Vac - 12	1	DA-31-153-3	DA-31-2-3	DA-31-3-3	294.00	0.5	DA-531-2-3	DA-531-3-3	465.00
	25" Hg Vac - 50	3.5	DA-31-153-27	DA-31-2-27	DA-31-3-27	294.00	2	DA-531-2-27	DA-531-3-27	465.00
	1/8 – 15	1	DA-31-153-1	DA-31-2-1	DA-31-3-1	294.00	0.5	DA-531-2-1	DA-531-3-1	465.00
	1/8 – 20	1	DA-31-153-3A	DA-31-2-3A	DA-31-3-3A	294.00	0.5	DA-531-2-3A	DA-531-3-3A	465.00
	1 – 35	1.75	DA-31-153-4	DA-31-2-4	DA-31-3-4	294.00	0.75	DA-531-2-4	DA-531-3-4	465.00
	2 – 60	3	DA-31-153-5	DA-31-2-5	DA-31-3-5	294.00	1	DA-531-2-5	DA-531-3-5	465.00
	5 – 100	3.75	DA-31-153-6	DA-31-2-6	DA-31-3-6	294.00	2	DA-531-2-6	DA-531-3-6	465.00
	5 – 150	6	DA-31-153-7	DA-31-2-7	DA-31-3-7	294.00	3	DA-531-2-7	DA-531-3-7	465.00
	10 – 200	8	DA-31-153-8	DA-31-2-8	DA-31-3-8	324.00	3.5	DA-531-2-8	DA-531-3-8	496.00
	10 – 300	12	DA-31-153-9	DA-31-2-9	DA-31-3-9	324.00	6	DA-531-2-9	DA-531-3-9	496.00
403 Stainless Steel	30" Hg Vac – 60	6	DA-21-153-2SS	DA-21-2-2SS	DA-21-3-2SS	394.00	3	DA-521-2-2SS	DA-521-3-2SS	577.00
	30" Hg Vac – 75	8	DA-21-153-2SS	DA-21-2-2SS	DA-21-3-2SS	394.00	4	DA-521-2-2SS	DA-521-3-2SS	577.00
	2 – 60	4	DA-21-153-5S	DA-21-2-5S	DA-21-3-5S	394.00	2.5	DA-521-2-5S	DA-521-3-5S	577.00
	5 – 100	6	DA-21-153-6S	DA-21-2-6S	DA-21-3-6S	394.00	3	DA-521-2-6S	DA-521-3-6S	577.00
	10 – 200	8	DA-21-153-8S	DA-21-2-8S	DA-21-3-8S	394.00	4	DA-521-2-8S	DA-521-3-8S	577.00
	10 – 300	14	DA-21-153-9S	DA-21-2-9S	DA-21-3-9S	421.00	7	DA-521-2-9S	DA-521-3-9S	608.00
	40 – 350	14	DA-21-153-9AS	DA-21-2-9AS	DA-21-3-9AS	443.00	7	DA-521-2-9AS	DA-521-3-9AS	635.00
	25 – 600	25	DA-21-153-10S	DA-21-2-10S	DA-21-3-10S	443.00	15	DA-521-2-10S	DA-521-3-10S	635.00
	50 – 1000	60	DA-21-153-11S	DA-21-2-11S	DA-21-3-11S	556.00	40	DA-521-2-11S	DA-521-3-11S	776.00
	100 – 1500	90	DA-21-153-12S	DA-21-2-12S	DA-21-3-12S	597.00	60	DA-521-2-12S	DA-521-3-12S	811.00
	300 – 2500	150	DA-21-153-13S	DA-21-2-13S	DA-21-3-13S	597.00	100	DA-521-2-13S	DA-521-3-13S	811.00
	500 – 5000	450	DA-21-153-15S	DA-21-2-15S	DA-21-3-15S	603.00	200	DA-521-2-15S	DA-521-3-15S	823.00
	800 – 8000	750	DA-21-153-16S	DA-21-2-16S	DA-21-3-16S	603.00	400	DA-521-2-16S	DA-521-3-16S	823.00
316 Stainless Steel	30" Hg Vac – 75	7	DA-41-153-2SE	DA-41-2-2SE	DA-41-3-2SE	421.00	3.5	DA-541-2-2SE	DA-541-3-2SE	611.00
	5 – 75	3	DA-41-153-23E	DA-41-2-23E	DA-41-3-23E	421.00	2	DA-541-2-23E	DA-541-3-23E	611.00
	10 –100	7	DA-41-153-6E	DA-41-2-6E	DA-41-3-6E	421.00	3.5	DA-541-2-6E	DA-541-3-6E	611.00
	10 – 150	8	DA-41-153-24E	DA-41-2-24E	DA-41-3-24E	421.00	3	DA-541-2-24E	DA-541-3-24E	611.00
	10 – 300	18	DA-41-153-9E	DA-41-2-9E	DA-41-3-9E	437.00	5	DA-541-2-9E	DA-541-3-9E	628.00
	30 – 400	30	DA-41-153-21E	DA-41-2-21E	DA-41-3-21E	459.00	15	DA-541-2-21E	DA-541-3-21E	658.00
	75 – 600	75	DA-41-153-22E	DA-41-2-22E	DA-41-3-22E	620.00	35	DA-541-2-22E	DA-541-3-22E	730.00
	100 – 1000	100	DA-41-153-11E	DA-41-2-11E	DA-41-3-11E	597.00	45	DA-541-2-11E	DA-541-3-11E	811.00
	200 - 2500	210	DA-41-153-13E	DA-41-2-13E	DA-41-3-13E	597.00	110	DA-541-2-13E	DA-541-3-13E	811.00

D Series Pressure Switch with Snap Action Switch and General Purpose Enclosure

Bourdon Tube Material	Adjustable Operating Range (psig)	Adjustable Deadband SPDT: 10A @ 120/240 VAC: Minimum Deadband (psig)	Model	Price ($)	Fixed Deadband SPDT: 15A @ 120/240 AC: Fixed Deadband (psig)	Model	Price ($)	Hermetically Sealed, Fixed Deadband SPDT: 5A @ 120/240 VAC, 5A res. @ 30 VDC: Fixed Deadband (psig)	Model	Price ($)
Brass	0-30" Hg Vac	13.5" Hg	DA-7031-153-2	$276.00	3" Hg	DS-7231-153-2	$276.00	5" Hg	DS-7331-153-2	$411.00
	10" Hg Vac - 12	6	DA-7031-153-3	276.00	1.5	DS-7231-153-3	276.00	3	DS-7331-153-3	411.00
	25" Hg Vac - 50	12	DA-7031-153-27	276.00	2.5	DS-7231-153-27	276.00	3.75	DS-7331-153-27	411.00
	1/8 – 15	6	DA-7031-153-1	276.00	1.5	DS-7231-153-1	276.00	3	DS-7331-153-1	411.00
	1/8 – 20	6	DA-7031-153-3A	276.00	1.5	DS-7231-153-3A	276.00	3	DS-7331-153-3A	411.00
	1 – 35	7.5	DA-7031-153-4	276.00	1.5	DS-7231-153-4	276.00	3	DS-7331-153-4	411.00
	2 – 60	9	DA-7031-153-5	276.00	2	DS-7231-153-5	276.00	3	DS-7331-153-5	411.00
	5 – 100	13.5	DA-7031-153-6	276.00	2.5	DS-7231-153-6	276.00	3.75	DS-7331-153-6	411.00
	5 – 150	24	DA-7031-153-7	276.00	3	DS-7231-153-7	276.00	5.25	DS-7331-153-7	411.00
	10 – 200	24	DA-7031-153-8	306.00	4	DS-7231-153-8	306.00	6.75	DS-7331-153-8	440.00
	10 – 300	37.5	DA-7031-153-9	306.00	5	DS-7231-153-9	306.00	9	DS-7331-153-9	440.00
403 Stainless Steel	30" Hg Vac – 60	18	DA-7021-153-2SS	372.00	3.5	DS-7221-153-2SS	372.00	5.25	DS-7321-153-2SS	507.00
	30" Hg Vac – 75	22.5	DA-7021-153-2SS	372.00	3.5	DS-7221-153-2SS	372.00	5.25	DS-7321-153-2SS	507.00
	2 – 60	13.5	DA-7021-153-5S	372.00	3	DS-7221-153-5S	372.00	4.5	DS-7321-153-5S	507.00
	5 – 100	19.5	DA-7021-153-6S	372.00	3.5	DS-7221-153-6S	372.00	5.25	DS-7321-153-6S	507.00
	10 – 200	22.5	DA-7021-153-8S	372.00	4	DS-7221-153-8S	372.00	7.125	DS-7321-153-8S	507.00
	10 – 300	28.5	DA-7021-153-9S	424.00	6	DS-7221-153-9S	424.00	10.5	DS-7321-153-9S	559.00
	40 – 350	30	DA-7021-153-9AS	424.00	6	DS-7221-153-9AS	424.00	10.5	DS-7321-153-9AS	559.00
	25 – 600	67.5	DA-7021-153-10S	424.00	10	DS-7221-153-10S	424.00	18	DS-7321-153-10S	559.00
	50 – 1000	142.5	DA-7021-153-11S	534.00	20	DS-7221-153-11S	534.00	33	DS-7321-153-11S	669.00
	100 – 1500	195	DA-7021-153-12S	566.00	30	DS-7221-153-12S	566.00	52.5	DS-7321-153-12S	701.00
	300 – 2500	390	DA-7021-153-13S	566.00	60	DS-7221-153-13S	566.00	90	DS-7321-153-13S	701.00
	500 – 5000	1350	DA-7021-153-15S	577.00	200	DS-7221-153-15S	577.00	300	DS-7321-153-15S	712.00
	800 – 8000	2250	DA-7021-153-16S	577.00	500	DS-7221-153-16S	577.00			
316 Stainless Steel	30" Hg Vac – 75	15	DA-7041-153-2SE	401.00	3.5	DS-7241-153-2SE	401.00	5.25	DS-7341-153-2SE	536.00
	5 – 75	12	DA-7041-153-23E	401.00	4	DS-7241-153-23E	401.00	6	DS-7341-153-23E	536.00
	10 –100	15	DA-7041-153-6E	401.00	3.5	DS-7241-153-6E	401.00	5.25	DS-7341-153-6E	536.00
	10 – 150	16.5	DA-7041-153-24E	401.00	4	DS-7241-153-24E	401.00	6.75	DS-7341-153-24E	536.00
	10 – 300	42	DA-7041-153-9E	401.00	8	DS-7241-153-9E	401.00	12	DS-7341-153-9E	536.00
	30 – 400	78	DA-7041-153-21E	442.00	10	DS-7241-153-21E	442.00	18	DS-7341-153-21E	577.00
	75 – 600	180	DA-7041-153-22E	498.00	25	DS-7241-153-22E	498.00	37.5	DS-7341-153-22E	633.00
	100 – 1000	285	DA-7041-153-11E	665.00	35	DS-7241-153-11E	665.00	52.5	DS-7341-153-11E	700.00
	200 - 2500	600	DA-7041-153-13E	665.00	75	DS-7241-153-13E	665.00	112.5	DS-7341-153-13E	700.00

10 Attachment 2 – Dwyer Instrument Input Email

Graham, Shawn P

From: Widmoyer, Brianne [bwidmoyer@dwyermail.com]
Sent: Friday, October 11, 2013 3:46 PM
To: Graham, Shawn P
Subject: RE: Dwyer DA specs

Shawn,

We do not have specs on drift or temperature effect. My apologies.

Best regards,
Brianne

From: Graham, Shawn P [mailto:shawn.p.graham@urs.com]
Sent: Friday, October 11, 2013 2:10 PM
To: Widmoyer, Brianne
Subject: RE: Dwyer DA specs

Great thank you. Did they say anything about drift or temperature effect?

Thank you,

Shawn P. Graham, EIT
Instrumentation & Controls

URS Energy & Construction, Inc.
3023 HSBC Way, Mail Room 400
Fort Mill, SC 29715
E: shawn.p.graham@urs.com
O: (803) 578-7137

From: Widmoyer, Brianne [mailto:bwidmoyer@dwyermail.com]
Sent: Friday, October 11, 2013 1:36 PM
To: Graham, Shawn P
Subject: Dwyer DA specs

Hi Shawn,

I spoke with the factory and the only accuracy spec we have is the repeatability of 1%.

Best regards,

Brianne Widmoyer
Sales Engineer
Dwyer Instruments

11 Attachment 3 – Document Indexing Table

Document Type	ID Number	Function	Relationship to Calc	Action
DRAW	B-190628 SH00711	IN/OUT	Instrument Arrangement and Location (Design Input)	DS ADD
DRAW	5379-02753	IN	Reactor Trip Signals (Design Input)	DS ADD
DRAW	5379-03695	IN	Turbine Trip Signals	DS ADD
DRAW	5379-03249	IN	Reactor Protection System (Design Input)	DS ADD
DRAW	5379-05738	IN/OUT	Instructions – Turbine Controls Setting (Design Input)	DS ADD
DRAW	5379-01030	IN/OUT	Wiring, Terminal Equipment Terminal Boxes "A" and "B" (Design Input)	DS ADD
POM	EGR-NGGC-0153	IN	Engineering Instrument Setpoints (Methodology Design Input)	DS ADD
POM	MMM-006	IN	Calibration Program(Design Input)	DS ADD
POM	MMM-006 APPENDIX B-1	IN/OUT	Appendix B-1 Calibration Data Sheets (Design Input, Calc changed tolerances)	DS ADD
POM	PIC-301	IN	Process Instrument Calibration Procedure (Design Input, but Calc Confirms Cal Methods)	DS ADD
VTMA	729-063-40	IN/OUT	Westinghouse Vendor Manual (Design Input)	DS ADD

Document Type	ID Number	Function	Relationship to Calc	Action
LICN	Final Safety Analysis Report	IN	Section 15.2.2 (Design Input to show pressure switches are not required to provide input during accident)	DS ADD
LICN	Operating License DPR-23	IN/OUT	Table 3.3.1-1 Reactor Protection System Instrumentation (Design Input, Setpoint and Allowable Value are documented in this table)	DS ADD
EDB Tag	PS-63AST-1	N/A	Document Cross Reference	CM ADD
EDB Tag	PS-63AST-2	N/A	Document Cross Reference	CM ADD
EDB Tag	PS-63AST-3	N/A	Document Cross Reference	CM ADD

12 EGR-NGGC-0003 Owner's Review

ATTACHMENT 2
Sheet 1 of 1

Record of Lead Review

Document RNP-I/INST-1150 **Revision** 1

The signature below of the Lead Reviewer records that:

- the review indicated below has been performed by the Lead Reviewer;
- appropriate reviews were performed and errors/deficiencies (for all reviews performed) have been resolved and these records are included in the design package;
- the review was performed in accordance with EGR-NGGC-0003.

☐ **Design Verification Review** ☐ **Engineering Review** ☒ **Owner's Review**

- ☐ Design Review
- ☐ Alternate Calculation
- ☐ Qualification Testing

☐ **Special Engineering Review** _____

☐ YES ☐ N/A **Other Records are attached.**

Ebin Patel	C Patel	Maj Proj	2/19/14
Lead Reviewer	**(print/sign)**	**Discipline**	**Date**

Item No.	Deficiency	Resolution

FORM EGR-NGGC-0003-2-10
This form is a QA Record when completed and included with a completed design package. Owner's Reviews may be processed as stand alone QA records when Owner's Review is completed.