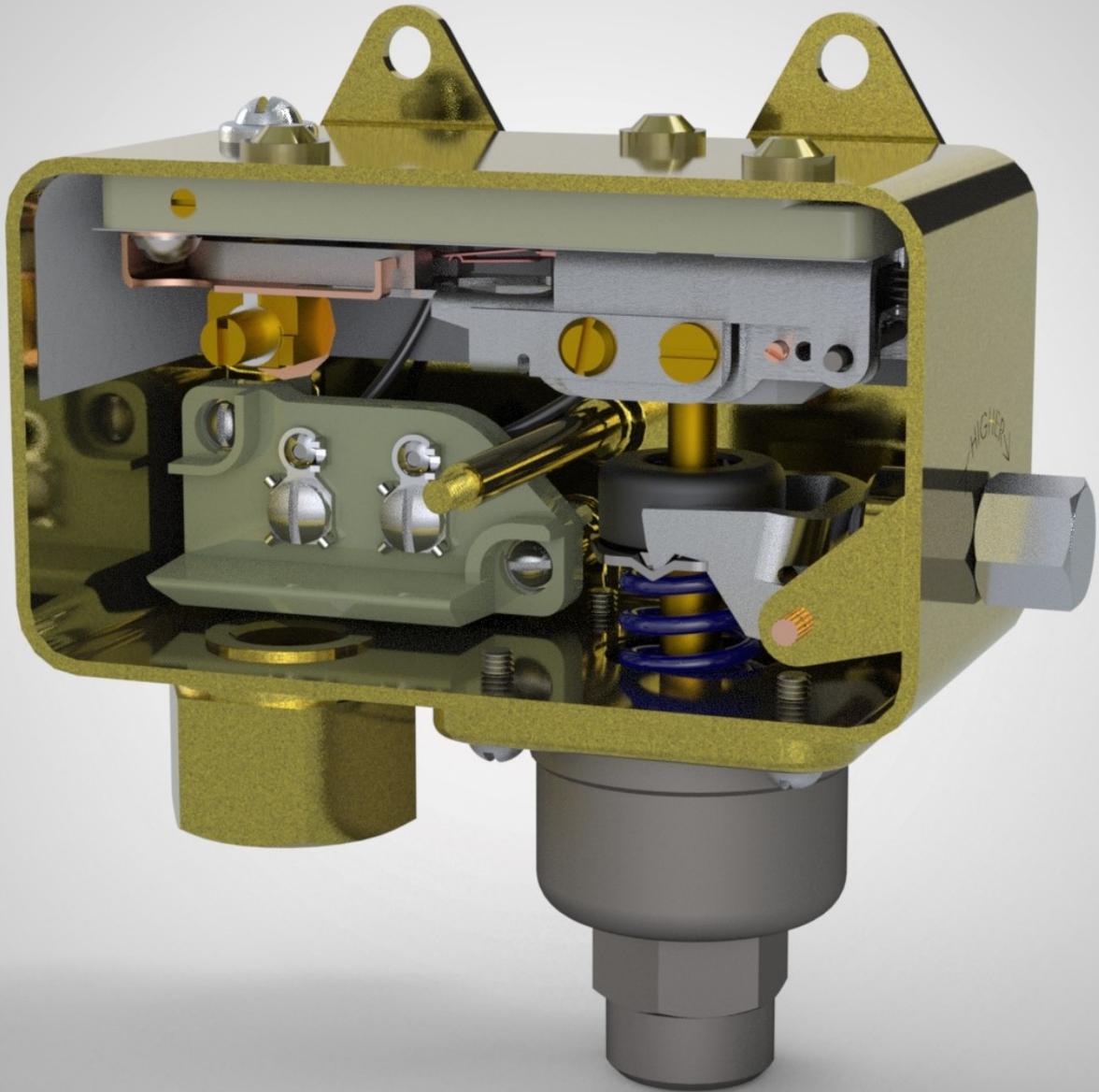


DETROIT SWITCH, INC.



222 MIL SPEC

**PRESSURE OR TEMPERATURE
ACTUATED CONTROL SWITCHES**

Detroit Switch, Inc.

222 MIL Spec Control Switches

The **222-10**, **222-15**, **222-20**, **222-25** and **222-32** Series Temperature and Pressure Control Switch models are designed to conform to:

- MIL-DTL-901E For Shock Tests, High Impact, Shipboard Machinery, Equipment, and Systems Requirements
- MIL-DTL-2036E For Watertight Enclosures for Electric and Electronic Equipment, Naval Shipboard (Exception: Models 222-20 and 222-25 have a splash proof enclosure with a safety vent hole.)
- MIL-R-16743F for Refrigeration and Air Conditioning
- MIL-STD-167-1 for type 1 Vibration
- MIL-S-16032 (222-32 or 222-20) for Alarm Systems

Models **222-10** and **222-20** conform to MIL-DTL-2212K (Contactors and Controllers, Electric Motor A.C. or D.C., and Associated Switching Devices) for non-vital applications (≤ 20 millisecond contact bounce). Models **222-15** and **222-25** conform to MIL-DTL-2212K for vital applications (≤ 10 milliseconds of contact bounce).

Construction

Steel or brass case: plated or powder coated; high shock resistant; dust-proof; watertight; for magnetic or non-magnetic use.

Shock Vibration Resistance

Permanent switch magnet and heat dissipating beryllium-copper contact spring prevent floating switch action. Design provides for a positive make or break, eliminates zero contact pressure and reduces electrical arc when no less than the listed switch differential settings are used.

Electrical Rating

Electrical Rating in AMPS

SPST - SPDT* - DUAL SPST* - DUAL CONTACT DPST*

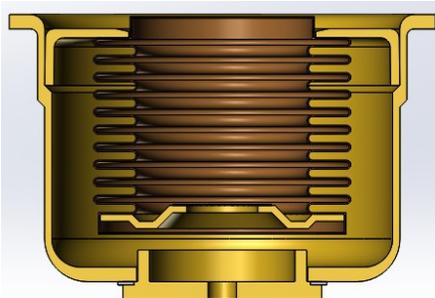
VOLTAGE	INDUCTIVE		LOCKED ROTOR	
	A.C.	D.C.	A.C.	D.C.
115	16	9.6	96	96
230	8	4.8	48	48
440	4	2.5	24	25
550**	3.2	2	19.2	20

NOTE: Primary (upper) contacts are capable of direct motor control up to 1 HP.

*Secondary (lower) contacts have the same A.C. ratings. Lower Contacts D.C. rating is 1 AMP at 115 VDC. Derate for higher D.C. voltages.

**Must be specified when ordering for proper dielectric test.

POWER ELEMENTS



Seamless phosphor bronze bellows construction in all models provides a long life and accurate repeatability at set point. Optional metals available.

Contact Design

Silver cadmium oxide contacts are used for maximum life. Gold plated contacts optional.

Dependability

These controls have proved reliable over many years of service under rigorous conditions - on nuclear propulsion, stationary, mobile, marine and railroad installations. They meet the military specifications shown in this brochure.

The max ambient temperature is 185°F (85°C). The standard max media temperature for pressure controls is 300°F (149°C).

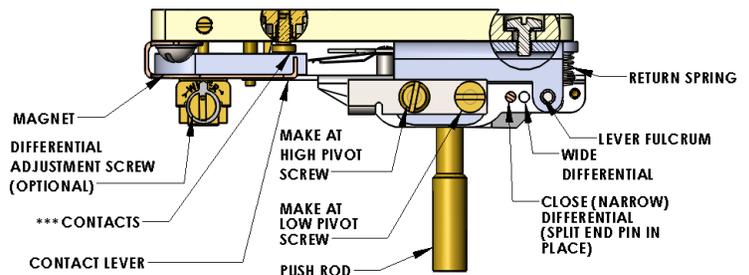
Circuitry

SINGLE POLE, SINGLE THROW (SPST) 2 WIRE. NORMALLY OPEN OR NORMALLY CLOSED. STANDARD.	
SINGLE POLE, DOUBLE THROW (SPDT) 3 WIRE. ONE COMMON WIRE.**	
DUAL CONTACT, SINGLE POLE, SINGLE THROW (DC. SPST) 3 WIRE. NORMALLY OPEN OR NORMALLY CLOSED. ONE COMMON WIRE.	
DOUBLE POLE, SINGLE THROW (DPST) 4 WIRE. TWO CIRCUIT - BOTH NORMALLY OPEN OR BOTH NORMALLY CLOSED (2 N.O. OR 2 N.C.)	
DOUBLE POLE, SINGLE THROW (DPST) 4 WIRE. TWO CIRCUIT - ONE NORMALLY OPEN AND ONE NORMALLY CLOSED (1 N.O. AND 1 N.C.)**	

**NOTE: Manual Reset Circuit Option May Shock Open. Field adjustable differential optional on SPST only. Minimum differential is approximately 1-1/2 times the SPST minimum differential.

Drawing of Typical SPST Switch

See TS-2074 for detail of other switching arrangements.



*** Note: Upper contact on switches other than SPST.

Detroit Switch, Inc.

222 MIL Spec Control Switches

222-10 Pressure Switches

For further information: See Form 1871— Drawing TS-1421

STANDARD FEATURES

(1.) Screwdriver range adjustment. (2.) 7/16-20 UNF-2B; Pressure connection.^e

MODEL	STANDARD RANGES ^c VAC. IN INCHES MERCURY PRESSURE IN P.S.I.G.	DIFFERENTIAL (PSIG)- SPST ^a		MAX. PRESS. (PSIG)	BELLOWS DIAMETER (INCHES)
		CLOSE (NARROW) PIN POSITION MIN. - MAX.	WIDE PIN POSITION MIN. - MAX.		
NC-1	0.1 TO 4.5 PSIG	0.3 - 0.5	---	15	4 - 3/8
NC-2 ^f	3" VAC TO 3 PSIG	0.3 - 0.5	---	15	4 - 3/8
NC-3 ^f	30" VAC TO 10" VAC	0.5 - 1.0	0.6 - 2.0	20	3
NC-4	0.1 TO 8 PSIG	0.5 - 1.0	0.6 - 2.0	20	3
NC-5 ^f	6" VAC TO 8 PSIG	0.5 - 1.0	0.6 - 2.0	20	3
NA-1 ^f	30" VAC TO 20 PSIG	3 - 9	4 - 14	80	1 - 3/8
NA-4 ^f	30" VAC TO 60 PSIG	5 - 12	8 - 20	160	1 - 1/8
NB-1	3 TO 50 PSIG	2 - 6	4 - 14	80	1 - 3/8
NB-3 ^f	20" VAC TO 80 PSIG	9 - 15	14 - 30	216	3/4
NB-4	5 TO 75 PSIG	4 - 12	7 - 20	160	1 - 1/8
NB-6	10 TO 180 PSIG	9 - 15	14 - 30	216	3/4
NB-7	60 TO 350 PSIG	15 - 30	24 - 60	400	9/16
NB-12	60 TO 900 PSIG	---	50 - 90	900	15/32
NB-15	30 TO 80 PSIG TYPICAL	ON APPLICATION		4000	N/A
NB-16	100 TO 1800 PSIG	70 - 180	150 - 390	2360	1/4

Note: Approx. 50% Wider Differential for SPDT and DPST 1 NO & 1 NC; Wider Differentials Available.

222-10 Temperature Switches

For further information: See Form 1871—Drawing TS-1420

STANDARD FEATURES

(1.) Screwdriver range adjustment. (2.) 10 ft. tubing standard on remote switches.

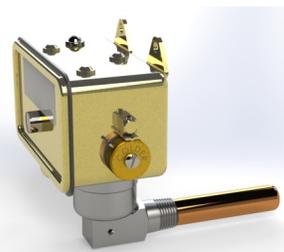
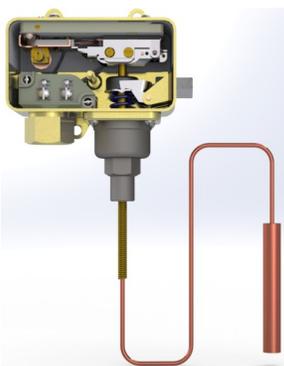
STANDARD RANGES ^c (°F)	MAXIMUM TEMPERATURE (°F)	APPROX. MINIMUM DIFFERENTIAL (°F) - SPST ^{a,b}	
		LOW END OF RANGE	HIGH END OF RANGE
-30 TO +22	--	5	2
-10 TO +60	g	6	2
25 TO 90	120	5	2
70 TO 140	167	5	2
90 TO 165	195	6	3
140 TO 215	245	4	2
185 TO 250	276	5	2
220 TO 290 ^d	317	5	2
255 TO 330 ^d	355	5	2
280 TO 360 ^d	385	5	2
300 TO 400 ^d	437	5	2
375 TO 480 ^d	500	5	2
400 TO 580 ^d	625	ON APPLICATION	

Note: Approx. 50% Wider Differential for SPDT and DPST 1 NO & 1 NC; Wider Differentials Available.
Other ranges available on application.



222-10 temperature switches with standard (1-3/8" dia.) bellows will have differential characteristics at the high end of the range similar to those of a B-1 pressure switch (1°F = 1 PSI).

222-32 temperature switch differentials with standard (3/4" dia.) bellows compare with a B-6 pressure switch with some exceptions per MIL-S-16032.



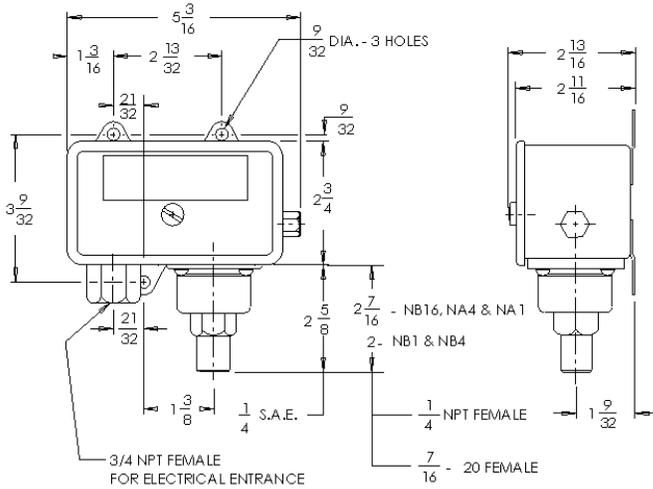
- a) A differential is the difference between the opening and closing (make/break) points of the switch contacts. Differentials are approximately 50% wider for SP-DT and DP-ST 1 NO & 1 NC circuitry. For capillary tubing over 10 ft. in length, the minimum differential is 1-1/2 times that shown. Differential capabilities of non-standard bellows will be provided on application.
- b) The differentials shown in the temperature table are for narrow differential pin position. Differentials will be approximately 2 times that shown for the wide pin position.
- c) Other ranges are available on application.
- d) These ranges are for models NL or NN only (remote sensing).
- e) 1/4" NPT female, 1/4" SAE and other pressure connections and wetted materials are available on application.
- f) Not a standard bellows range. Use the range with the same bellows diameter for repeatability calculations.
- g) Maximum temperature for a cross ambient style bulb given on application.

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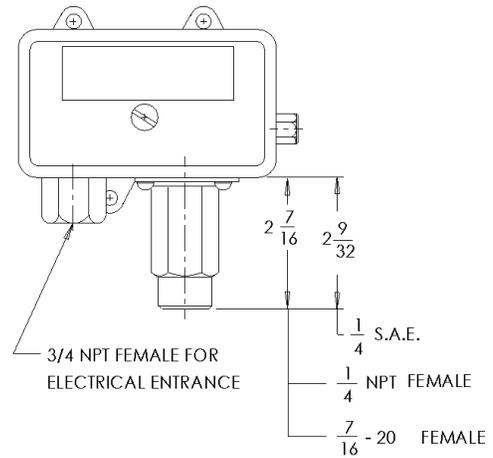
222 MIL Spec Control Switches

Pressure Switch Dimensions

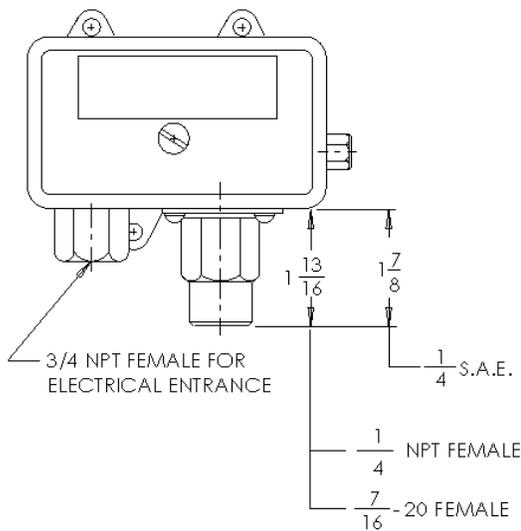
Note: All dimensions are for roughing in typical controls and are approximate



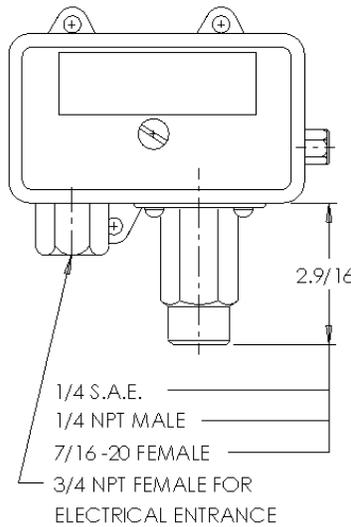
MODELS NA1, NA4, NB1, NB4 & NB16



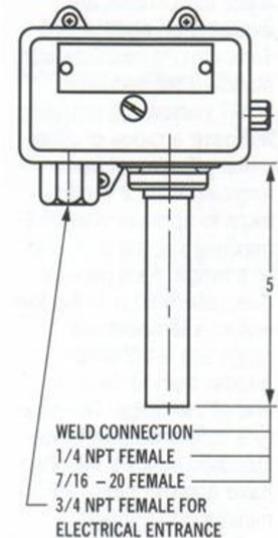
MODEL NB3



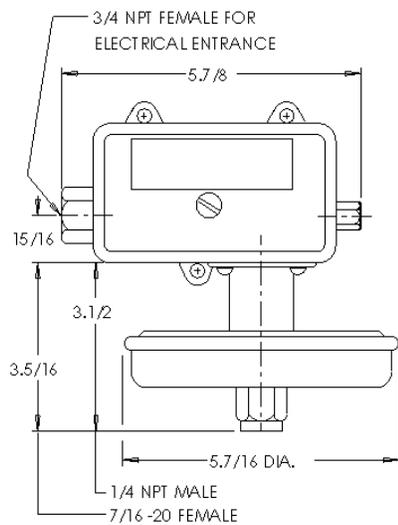
MODEL NB6



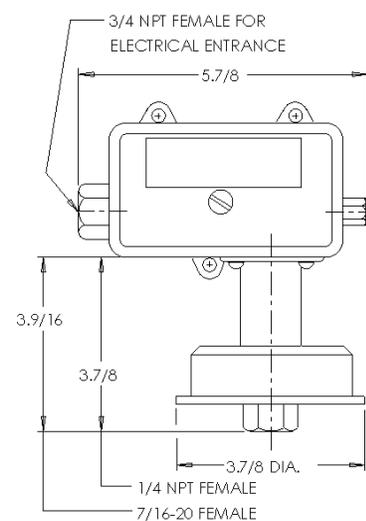
MODELS NB7 & NB12



MODEL NB15



MODELS NC1 & NC2



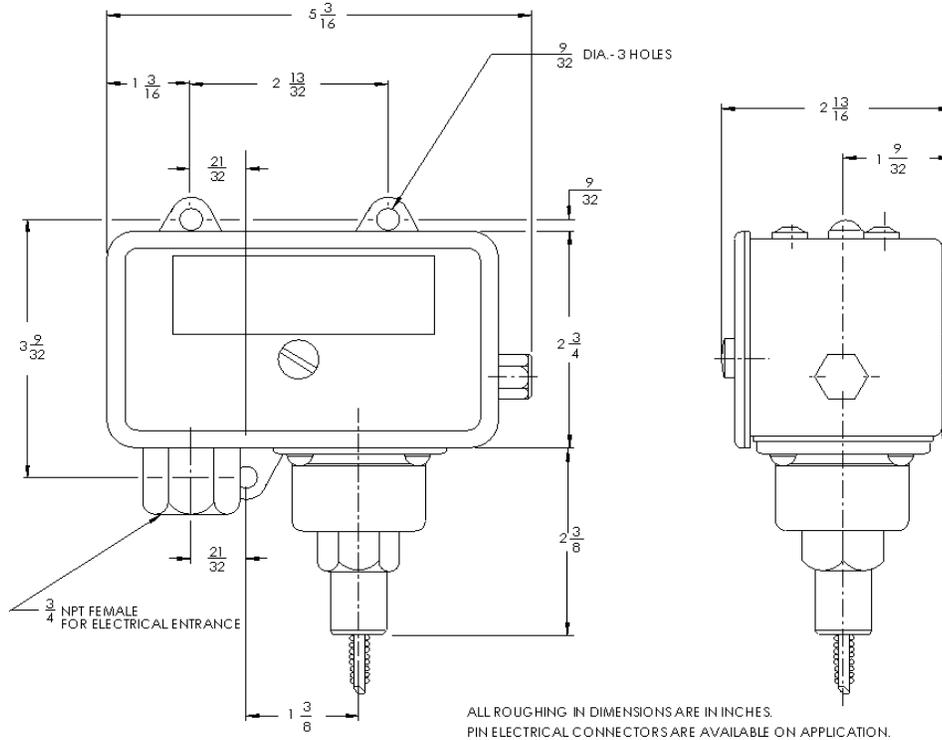
MODELS NC3, NC4, & NC5

Detroit Switch, Inc.

222 MIL Spec Control Switches

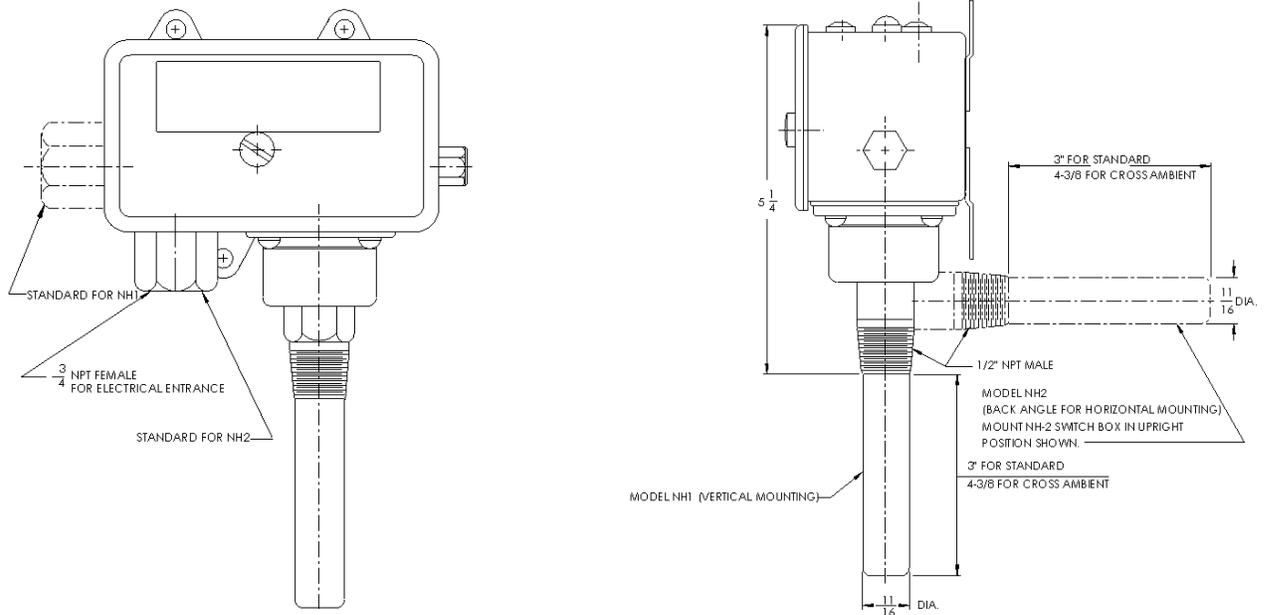
Temperature Switch Dimensions

Note: All dimensions are for roughing in typical controls and are approximate



ALL ROUGHING IN DIMENSIONS ARE IN INCHES.
PIN ELECTRICAL CONNECTORS ARE AVAILABLE ON APPLICATION.

ROUGH IN DIMENSIONS FOR MODELS NL & NN



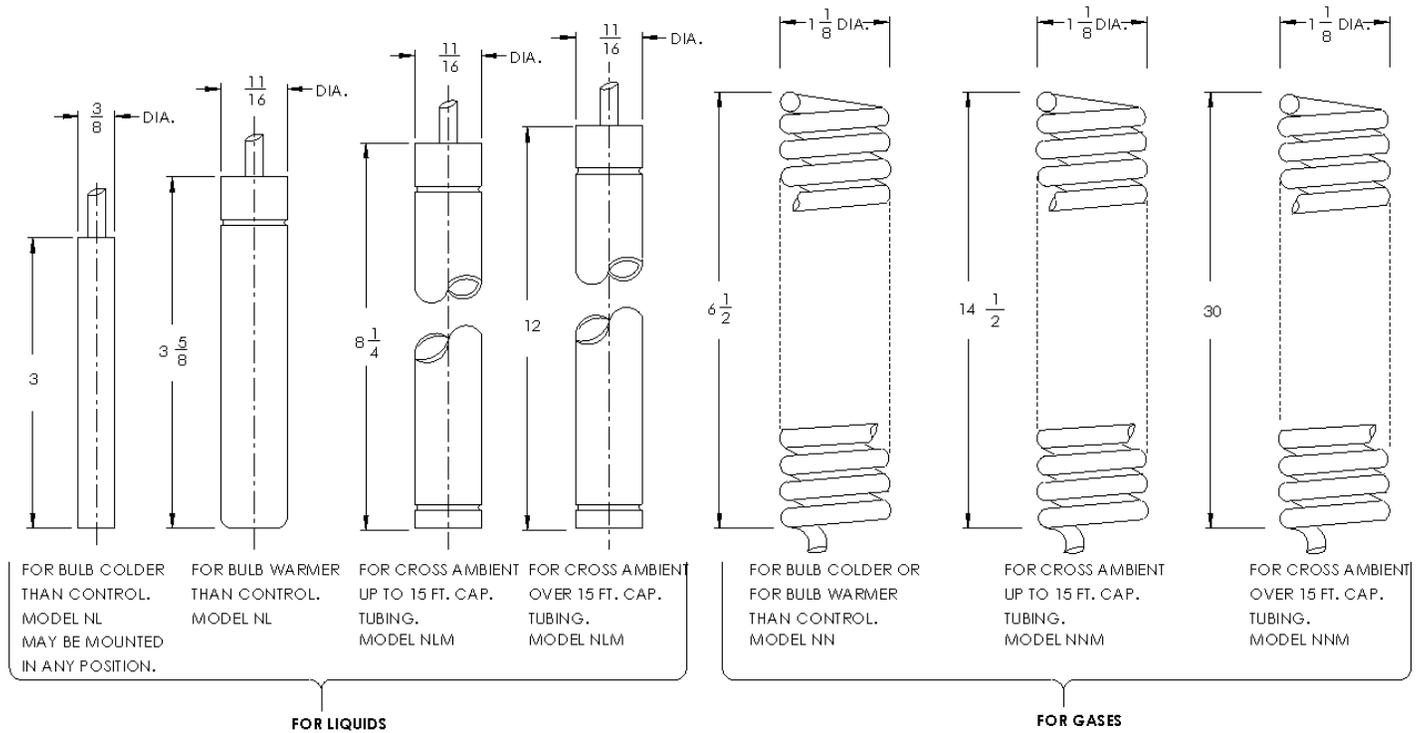
DIRECT MOUNTING

Special bulbs are available for non-standard mounting positions and non-standard differentials.

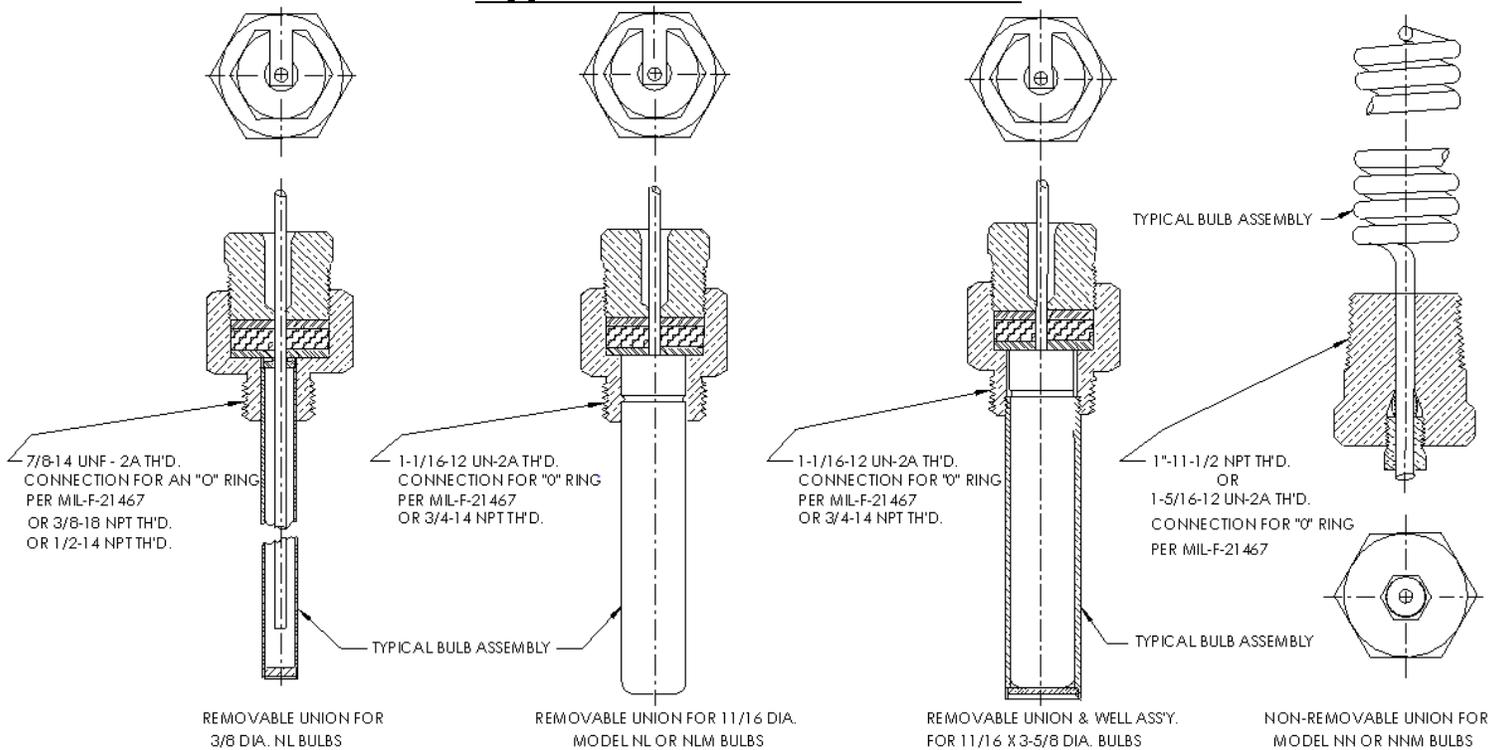
Detroit Switch, Inc.

222 MIL Spec Control Switches

Standard Remote Temperature Bulbs in Correct Mounting Positions



Typical Unions and Wells



Detroit Switch, Inc.

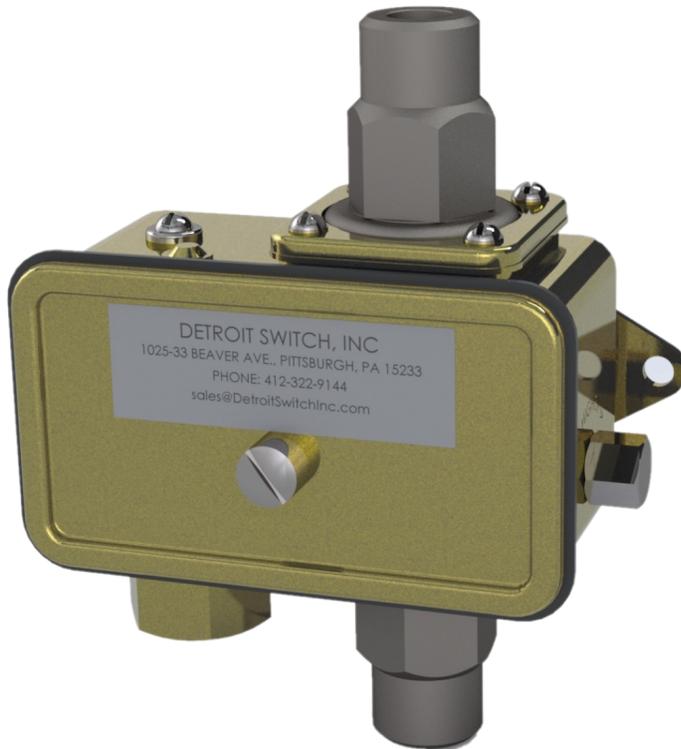
222 MIL Spec Control Switches

222-10 Pressure Difference Switches

For further information: See Form 19-08—Drawing TS-1544

MODEL	STANDARD ^b ADJUSTMENT RANGE OF PRESSURE DIFFERENCE	MAKE / BREAK ^a DIFFERENTIAL - SPST		MAX. PRESSURE (PSIG)	BELLOWS DIAMETER (INCHES)
		MINIMUM	MAXIMUM		
NB18	0.3 TO 3.0 PSID	0.3 PSIG	0.5 PSIG	15	4 - 3/8
NB19	4 TO 35 PSID	3 PSIG	9 PSIG	80	1 - 3/8
NB20	7 TO 70 PSID	4 PSIG	12 PSIG	160	1 - 1/8
NB21	16 TO 160 PSID	14 PSIG	30 PSIG	216	3/4
NB22	25 TO 250 PSID	29 PSIG	50 PSIG	400	9/16
NB23	8" TO 55" WATER	3" WATER	8" WATER	60	N/A
NB24	80 TO 800 PSID	50 PSIG	90 PSIG	900	0.13
NB25	0.3 TO 3.0 PSID	0.5 PSIG	1.0 PSIG	20	3
NB30	1 TO 7 PSID	0.5 PSIG	1.0 PSIG	20	3
NB31	1 TO 40 PSID	4 PSIG	12 PSIG	160	1 - 1/8
NB32	1 TO 20 PSID	3 PSIG	9 PSIG	80	1 - 3/8
NB33	10 TO 100 PSID	14 PSIG	30 PSIG	216	3/4
NB34	7 to 130 PSID	4 PSIG	12 PSIG	c	1 - 1/8
ABSOLUTE PRESSURE (VAC. IN INCHES MERCURY, PRESSURE IN PSIG) ^d					
NB26	30" TO 2"	5"	26"	80	1 - 3/8
NB27	30" TO 2"	8"	26"	160	1 - 1/8
NB28	30" TO 2"	0.7"	4.0"	20	3
NB29	30" TO 20 PSIG	5"	26"	80	1 - 3/8

- a) A differential is the difference between the opening and closing (make/break) points of the switch contacts. The differentials shown in the table are for narrow differential pin position. Differentials will be approximately 2 times that shown for the wide pin position. Differentials are approximately 50% wider for SPDT and DPST 1 N.O. & 1 N.C. circuitry. Differential capabilities of non-standard bellows will be provided on application.
- b) Other ranges are available on application.
- c) 284 max. pressure (PSIG) only if 160 max. difference pressure (PSID) is not exceeded.
- d) Absolute pressure controls and ambient pressure compensated switches are designed with equal sized bellows opposing each other. The upper bellows is evacuated and sealed thus acting as an additional range spring force in the switch. Therefore, ranges are different than our standard ranges. Switch dimensions are similar to that of the pressure control of the same bellows size. Ambient pressure compensation also applies to temperature switches since they are designed to operate off a saturated vapor pressure curve. Roughing in dimensions may differ on the upper power element when evacuated and sealed.

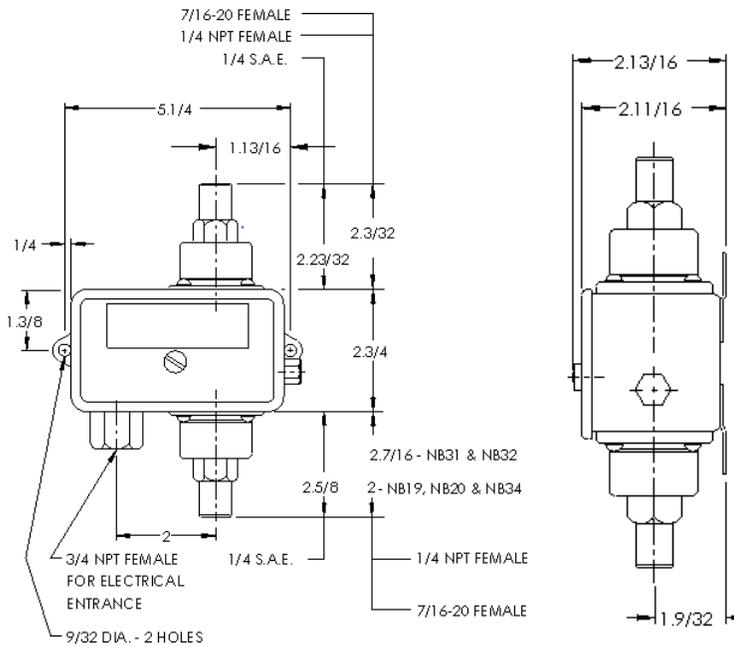


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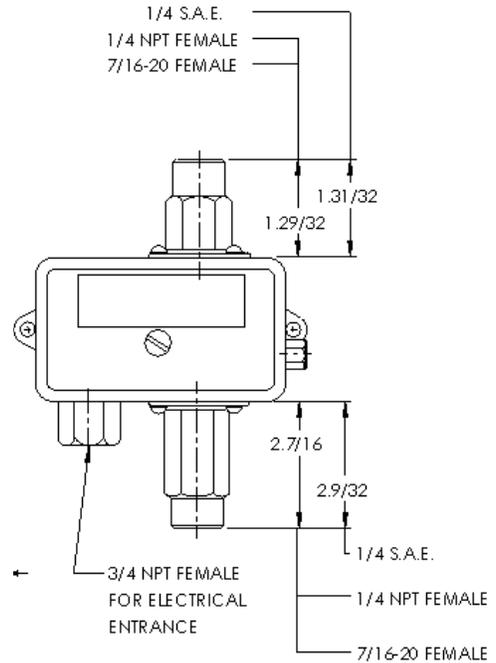
222 MIL Spec Control Switches

Pressure Difference Switch Dimensions

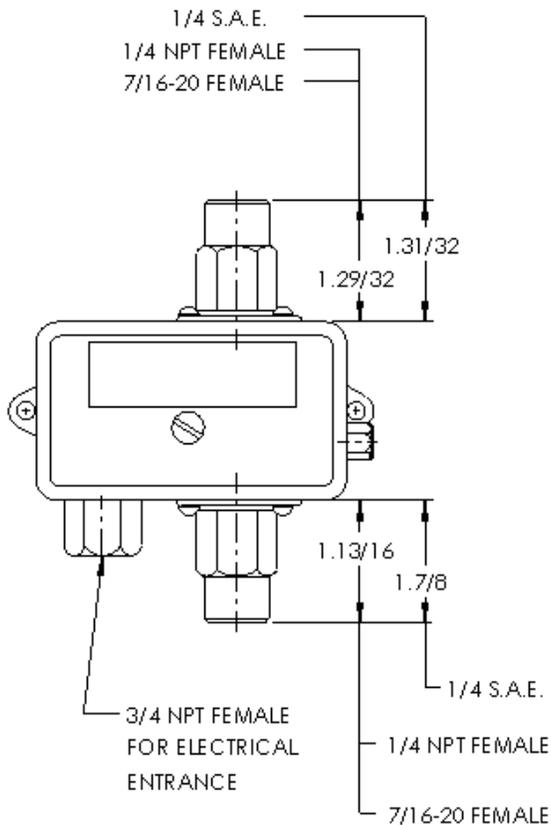
Note: All dimensions are for roughing in typical controls and are approximate



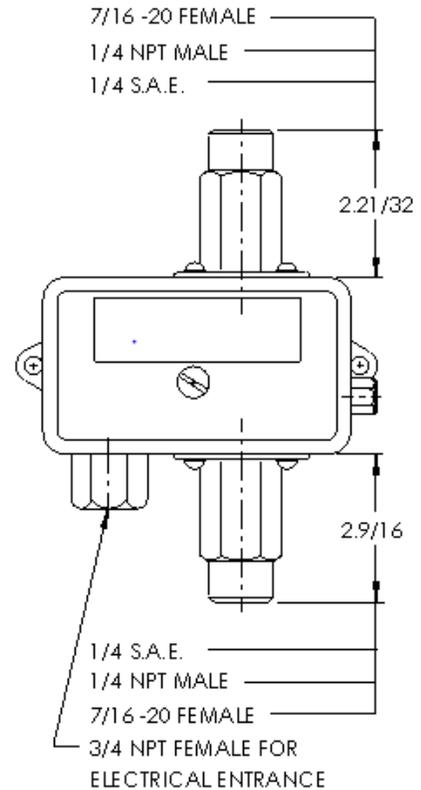
MODELS NB19, NB20, NB26, NB27, NB29, NB31, NB32 & NB34



MODEL NB33



MODEL NB21



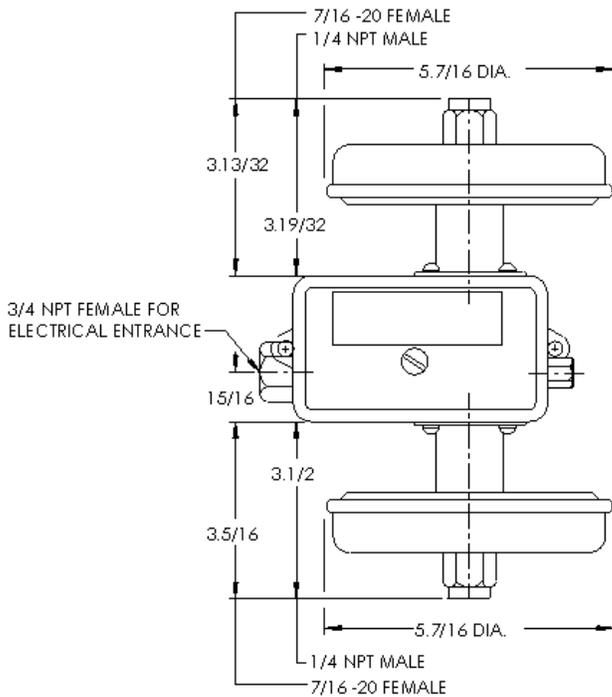
MODEL NB22 & NB24

Detroit Switch, Inc.

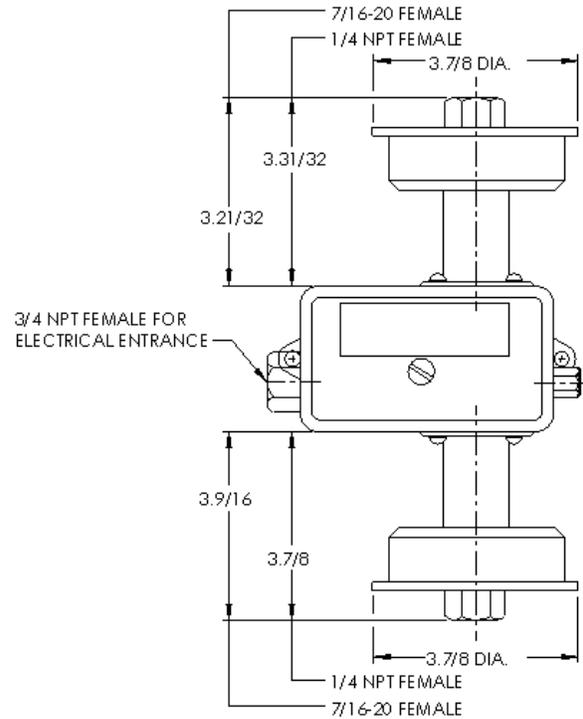
222 MIL Spec Control Switches

Pressure Difference Switch Dimensions

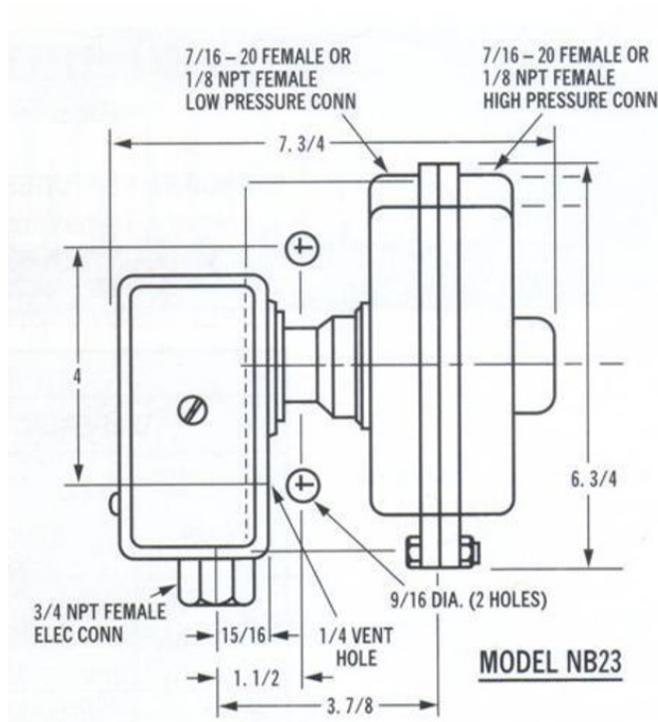
Note: All dimensions are for roughing in typical controls and are approximate



MODEL NB18



MODELS NB25, NB28 & NB30



MODEL NB23

Detroit Switch, Inc.

222 MIL Spec Control Switches

SERIES 222-20 AND 222-25 HIGH PRESSURE SWITCHES

For further information: See Form 1870—Drawing TS-1903-1

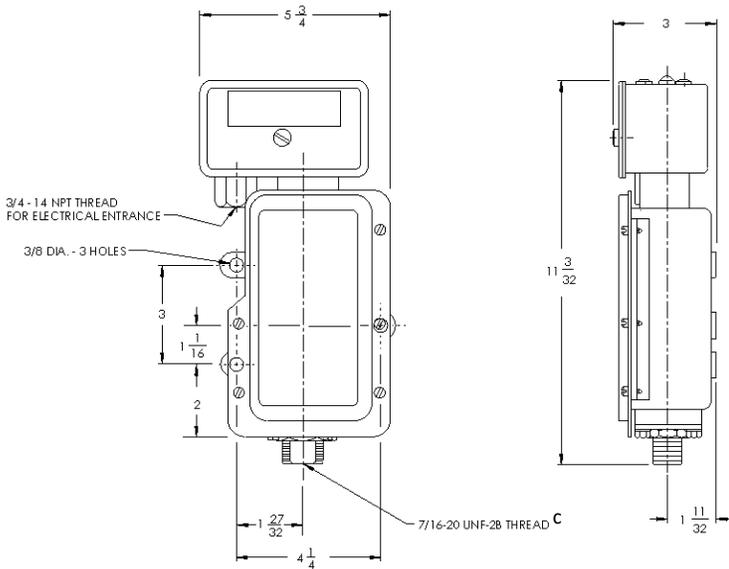
STANDARD FEATURES:

- 1) Internal 1 –1/4 hex nut range adjustment.
- 2) SPST circuitry is standard on model NB14. SPDT is standard on model NB13. SPST circuitry is not available on model NB13.

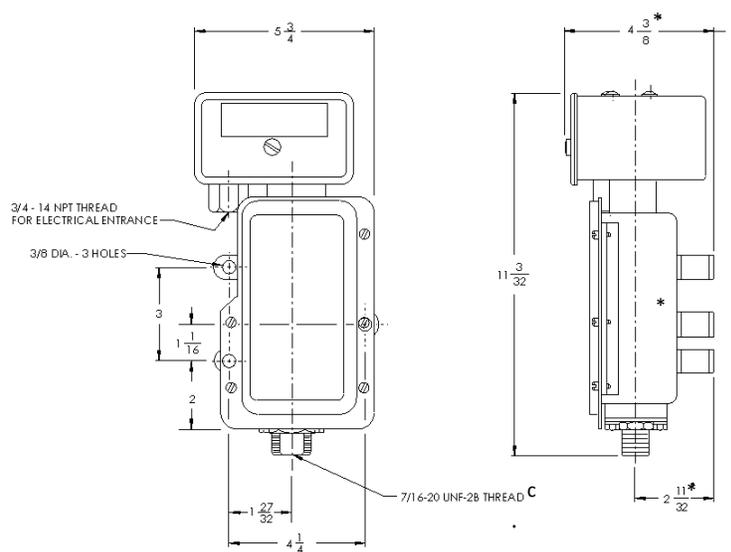
PRESSURE RANGES						
DIFFERENTIALS LISTED ARE FOR STANDARD CIRCUITRY ^a						
MODEL	RANGE (PSIG)	DIFFERENTIAL (PSIG) ^b				MAXIMUM PRESSURE (PSIG)
		MINIMUM		MAXIMUM		
		LOW END	HIGH END	LOW END	HIGH END	
B13	500 - 5000	75	100	220	240	5600
B14	250 - 3000	40	60	80	90	5600

- a) A differential is the difference between the opening and closing (make/break) points of the switch contacts.
- b) Wider differentials are available on application.
- c) 1/4" NPT female and other pressure connections and wetted materials are available on application.
- d) Specials may change power element size.
- e) Pin electrical connectors are available on application.

Note: All dimensions are for roughing in typical controls and are approximate



Series 222-20



*May be wider for other circuitry

Series 222-25

For vital applications (≤ 10 milliseconds of contact bounce).

Detroit Switch, Inc.

222 MIL Spec Control Switches

22100 Heating and Cooling Thermostat

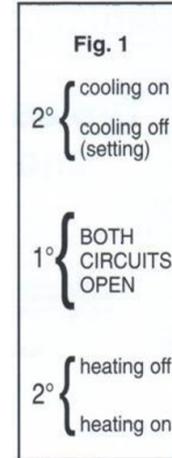
For further information: See Form 1872—Drawing TS-1617

Conforms to:

- MIL-DTL-901E for Shock Tests, High Impact, Shipboard Machinery, Equipment, and Systems Requirements
- MIL-DTL 2036E for Watertight Enclosures for Electric and Electronic Equipment, Naval Shipboard
- MIL-R-16743F for Refrigeration and Air Conditioning
- MIL-STD-167-1 for type 1 Vibration

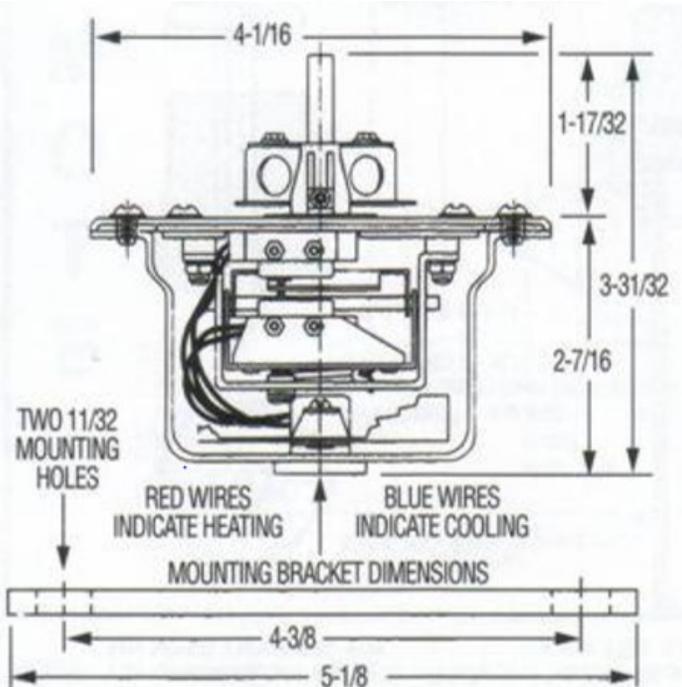
SPECIFICATIONS		
RANGE	SWITCHES	DIFFERENTIAL
40° TO 90 ° F	SPST Output (2)	2° Max.

ELECTRICAL RATING IN AMPERES		
Inductive Current		
VOLTAGE	AC	DC
115	3.8	0.2



Model 22100 has a 1° F spread in which the heating and cooling switches are both open (see Fig 1). The two switches are so interlocked that they cannot both close at the same time. The thermostat can be used as either a heating or cooling unit by wiring one switch only.

The set point shown on the dial is the temperature at which the cooling thermostat opens. The setting may be changed by loosening the lock screw, with the Allen wrench furnished, and rotating the dial and knob.



Note: All dimensions are for roughing in typical controls and are approximate

Detroit Switch, Inc.

222 MIL Spec Control Switches

SERIES 222-15

For vital applications (≤ 10 milliseconds of contact bounce)

Unless otherwise specified, all information from 222-10 series control switches applies (ranges, differentials, circuitry, etc.). 222-15 series control switches conform to the requirements of MIL-DTL-2212K and have virtually no contact bounce. This is achieved through an electronic module that produces a slight time delay in the opening of the contacts. Many configurations are available. The standard switch has an approximate one second delay on the opening of the contacts. For special applications, this delay can be modified. A delay on the closing of the contacts is also available.

The standard 222-15 series control switches for AC current applications are supplied with a voltage capability of 80 VAC through 480 VAC. The standard 222-15 series control switches for DC current applications are supplied with a voltage capability of 80 VDC through 240 VDC. Multiple circuit modules allow different voltages to be used on different circuits. Switch contact load maximums vary between switch configurations. 222-10 series electrical loads will be maintained as minimums on standard hardware.

There are advantages in specifying switches for the actual application voltages when they are known. The standard switch has a longer time delay on 440 VAC than on 110 VAC. With the actual voltage specified, the time delay can be minimized and the module control voltage can be set for minimum maintenance and maximum reliability.

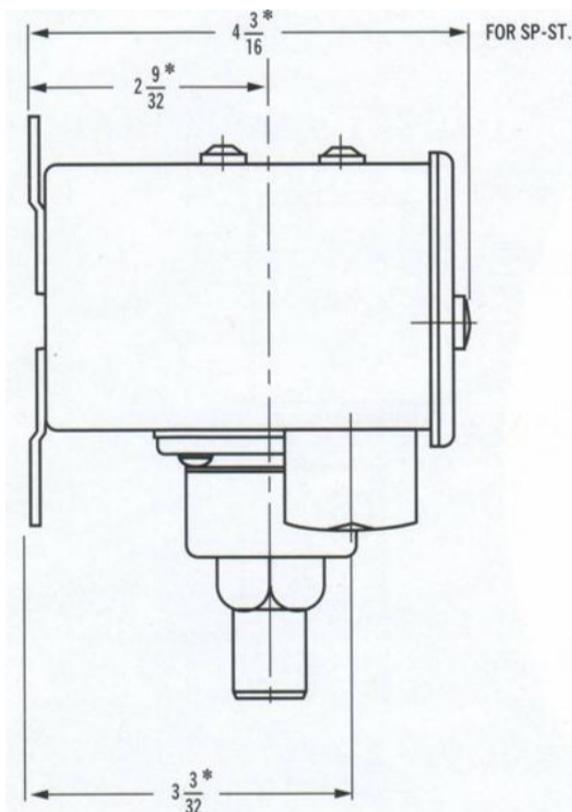
The standard 222-15 series switches are supplied with a protection capability from module failure. A "Slow Blow Fuse" should be selected by the user to replace the factory supplied fuse, sized at 50% to 75% of the electrical load of the application, to achieve this protection. With a module failure, the primary circuit will continue to operate using the electro-mechanical contacts without the benefits of the module. If the fuse blows, circuits other than the primary will cease operation. Some configurations do not have a primary circuit that will continue to operate with module failure (electro-mechanical backup circuit) in the open failure mode. A test can be run to check proper module performance.

The 222-15 control switch requires dedicated (non-interrupted) power. The enclosure does not require grounding. Without a dedicated power source there will be a delay from the application of power until the contact bounce protection (time delay) of the switch is fully operational.

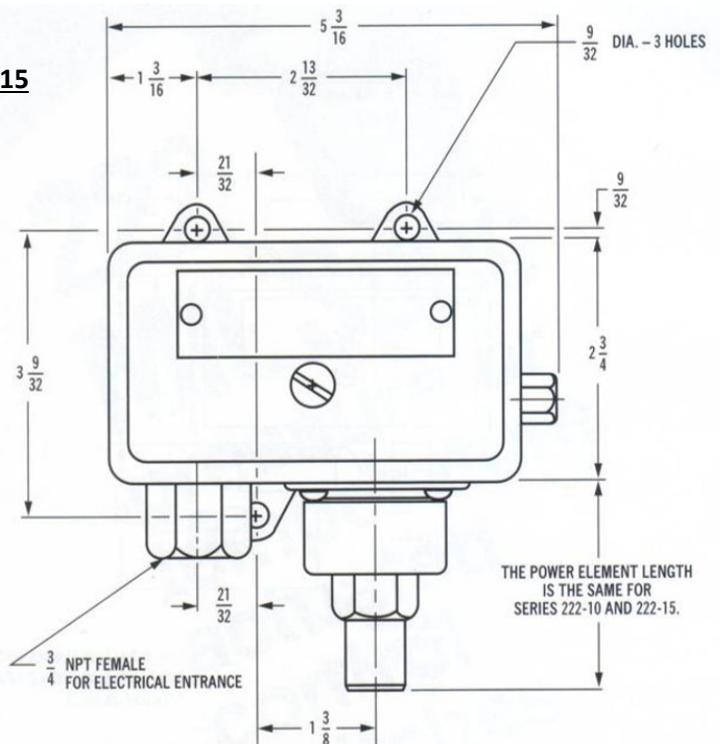
The 222-15 series electronic module for contact bounce elimination is available as a separately packaged unit. It may be used with the 222-10 series control switch or other control hardware provided parallel contacts for input are available.

The 222-15 series has an electronic module(s) and assorted wiring added behind the operating mechanisms of the switch. The operating mechanisms are the same ones use in the 222- 10 series. Fusing is placed adjacent to the cover.

Technical data sheets describe specific circuitry and electronic module options for application considerations. The technical data sheets also cover testing, mounting, maintenance and calibration. Specific capabilities and characteristics of each unit number are available from the manufacturer.



SERIES 222-15



*Dimensions may be wider for other circuitry.

Note: All dimensions are for roughing in typical controls and are approximate

Detroit Switch, Inc.

222 MIL Spec Control Switches

222-32 SERIES PRESSURE AND TEMPERATURE SWITCHES

FOR MIL-S-16032 ALARM SYSTEMS

222-32 series switch is intended for use on vessels having an annunciator panel (Spec. MIL-A-17196) with a supervisory circuit continuously indicating whether ships wiring between the panel and alarm switch is in working order. To provide for this feature a Navy-approved resistor is connected across the terminal screws. This resistor is easily removed when the switch is used on panels without this supervisory circuit. They are available in non-magnetic (brass—less than 2.0 magnetic permeability) models when specified. 222-10 switch differentials may not apply to 222-32 switches. Dimensions shown below are typical.

Note: All dimensions are for roughing in typical controls and are approximate

