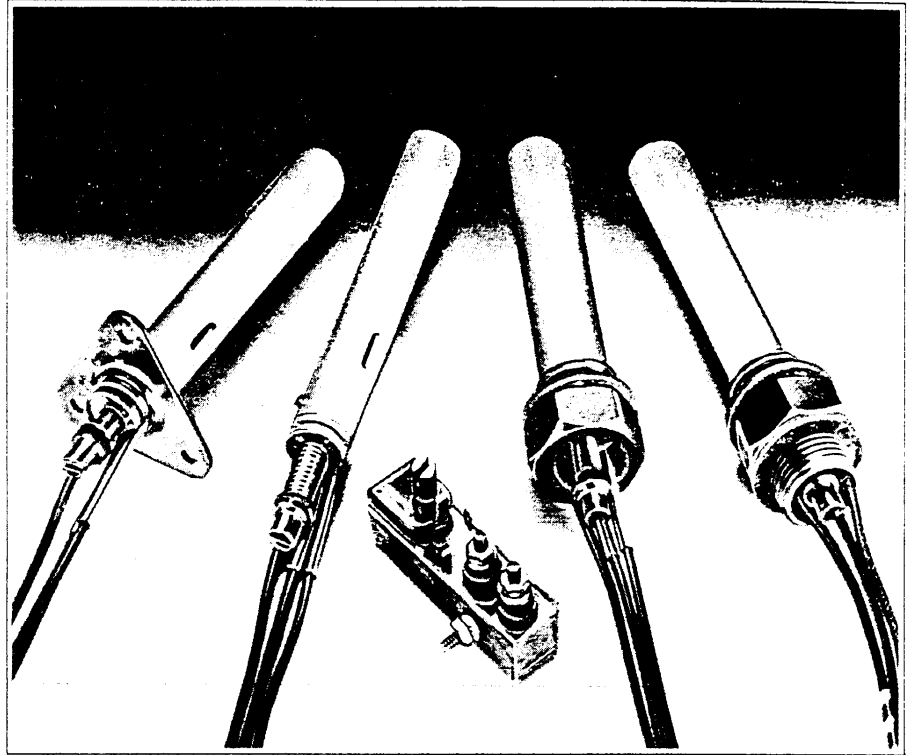


PED

PED Limited

150-383
TO
150-387

Thermostats Series 75



INTRODUCTION

Operating Principles

The principle upon which the operation of all PED thermostats is based, is the expansion or contraction with temperature of a brass or stainless steel case. The instantaneous reaction of the case is made to make or break a pair of totally enclosed contacts at a pre-set temperature point. The advantage of this method of operation is that all our thermostats are adjustable over a very wide temperature range: approximately 300°C. Also, the differential (defined as the temperature difference between cut-in and cut-out of the thermostat on rise or fall of temperature) is considerably better than that obtainable from other types of thermostat, such as the snap-action type. Low load switching differentials of less than 1°C are achieved.

Construction

The cartridge thermostat is a precision instrument for the detection of set temperature. It consists of two contacts mounted on, but insulated from, two special nickel-steel members of low-expansion coefficient. This assembly is mounted under tension in a seamless drawn brass tube, or a stainless steel tube for the high temperature range. The surface mounted thermostat is based on the same principles and comprises an inner assembly mounted in a rectangular shell.

The temperature changes that cause the shell to expand or contract subject the steel contact supports to changes of tension, so causing the contacts to make or break. There are important advantages inherent in this rugged form of construction:

- Resistance to vibration
- Short reaction times
- Simple and full adjustability over-range
- Small switching differential
- Wide operating range
- Accurate control in any position
- Good load carrying capacity
- Ease of installation

Selecting a Thermostat

The four principal factors that influence selection are as follows:

- Physical dimension and methods of mounting. Full dimensional details are shown under the relevant specifications.
- Medium to be controlled—this may be air, liquid or a platen but whatever the application, a thermostat can be used in temperature control or indicator circuits.
- Contact action—a cartridge thermostat can be selected with contacts to either make or break on rise of temperature.
- Operating Temperature—a brass cartridge thermostat is used on the low/medium temperature range and the stainless steel type in the

Applications

The matching of a thermostat to any particular temperature control problem is a simple operation, made easier by consideration of the following basic principles.

Cyclic temperature behaviour of the process may be influenced by:

- location and characteristics of the heat source
- location of the thermostat
- heat characteristics of the controlled medium, and the shape of its container.

Thus primary considerations are the relative locations of the heat source and thermostat. Also, by locating the thermostat in a place where it will heat or cool rapidly, its anticipation characteristics can be used to advantage because the thermostat can operate before reaching set-point and thereby reduce the total variation of the system.

As an example, we may consider the effect of the relative positions of a thermostat and heater in a water tank. With the thermostat at the top of the tank and the heater at the bottom, the switching action will take place at a temperature several degrees below the temperature in the immediate vicinity of the heater. This temperature difference will be reduced if the water is agitated or the heaters more widely distributed. If the thermostat is placed closer to the heater, the control will be improved because due to convection, the cold water on the bottom will be the last to heat and the thermostat will be the last to

small at this point. If the thermostat is directly over the heater, anticipation effects may be obtained.

This example may be applied just as appropriately to an oven, wax tank, vulcanizer, or other installation. The basic factors of location of the component parts of the system, and characteristics of the medium to be controlled, must all be carefully considered and then balanced.

The essential factor to remember is that the thermostat can react only to the temperature changes to which the shell is subjected.

Current Ratings

For all thermostats, non inductive ratings are as follows:-

- 5A at 240V AC
- 10A at 110V AC
- 2A at 30V DC
- 0.25A at 110V DC

Although the thermostat is a robust switching device its first function is in sensing the temperature to be controlled and if the contacts are subjected to unnecessarily arduous duties performance may be impaired.

Electrical Characteristics

DC applications

When direct current is to be switched a capacitor must be connected in parallel with the switch contacts.

Voltage rating of the selected capacitor should, for safety, be twice the applied voltage. If necessary with DC inductive loads a rectifier diode connected in reverse polarity across the load can be fitted.

Typical capacitor values are:-

- 2A resistive load at 30V DC...0.4 μ F
- 0.25A resistive load at 110V DC...0.01 μ F in series with 50 ohm resistor

Further details available from our Applications Engineering Department.

AC applications

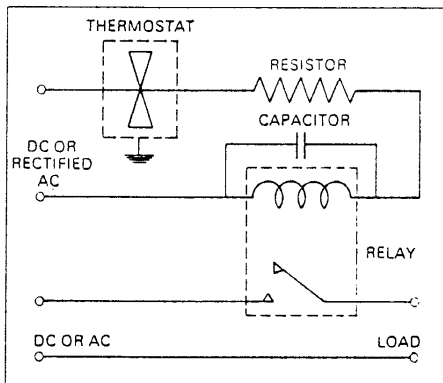
In most cases, where a 110V AC supply is used, a capacitor is not necessary, but we recommend for 240V AC supplies that a 0.1 μ F capacitor be used in parallel with the switch. The following capacitance values are recommended for the conditions stated:

- 110V AC resistive loads...no capacitor
- 240V AC resistive loads...0.1 μ F
- 110—240V AC operating relays, contactors...0.001 to 0.01 μ F
- 15—25V AC operating relays...0.02 μ F
- 110—240V AC operating motors...use a relay

Slave Switching

A relay is a useful component in a thermostat control circuit but due to

thermostat contact action the relay may in some applications not at first energise positively and contact chatter may result. This effect can be minimised by the fitting of a small value capacitor with an associated series resistor, as shown in the circuit diagram. A slugged relay may be used to advantage in these circumstances. The recommended resistor value is 50 ohms.



If it is required to use a contactor in conjunction with a PED thermostat, we again recommend the connection of a small value capacitor, 0.001 to 0.01 μ F across the switch terminals. In cases where the holding current may be high, please contact our Application Department for advice on the value of capacitor to be used.

Handling and Installation

Although the thermostat is robust and sturdy, it must be remembered that it is the outside shell which is the operating element, and distortion of the shell may affect the operation of the whole system.

For the same reason the thermostat must be installed so that free expansion of the shell is allowed and the maximum area is exposed to the medium to be controlled.

It should also be remembered that because the outer shell is the active control element, it is equally sensitive to radiant heat and direct contact heat (since, in its operation it does not rely upon conduction to the inside mechanism).

Note:

This range of thermostats is not hermetically sealed and care should be taken to prevent the ingress of media which could produce contact contamination.

The standard thermostats are not suitable for use in applications where there is a risk of explosion. For further information on such applications please contact our engineering department.

The use of solder and similar substances on the shell will not only lower the efficiency of the instrument,

Setting Instructions

Normally surface thermostats will be set to +40°C approximately and the cartridge thermostats to +22°C approximately.

For further adjustment the following procedures should be adopted.

1. Loosen the thread locking clamp screw.
2. Turn the temperature control screw to the approximate temperature setting.
 - (i) For surface types, one complete turn in a clockwise direction will raise the operating temperature by 100°C (200°F).
 - (ii) For cartridge types one complete turn in an anti-clockwise direction will raise the operating temperature by 40°C (72°F).
3. Tighten the thread locking clamp screw to secure high torque, but not enough to jam the temperature control screw.
4. Install the thermostat and check setting under working conditions.
5. Make final adjustment by forcibly rotating the temperature control screw.

Excess Temperature Cartridge Thermostats

These thermostats must not be subjected to temperatures of more than 55°C (110°F) in excess of the set-point otherwise permanent damage to the unit may result.

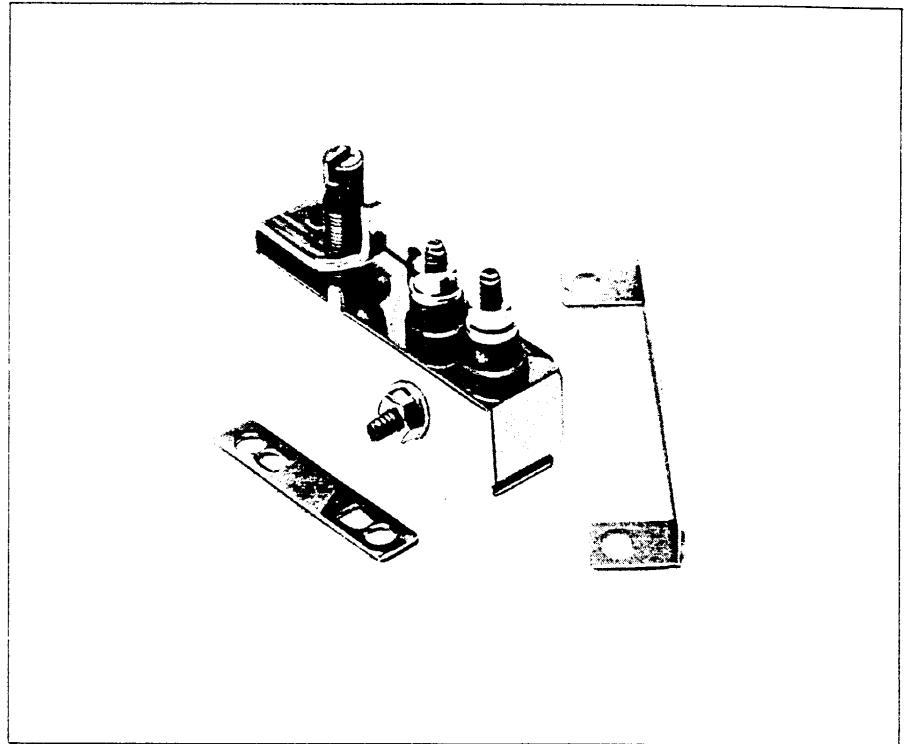
Surface Mounting Thermostats

These thermostats must not be subjected to temperature in excess of 350°C (662°F) or less than -10°C (14°F).

Thermostats

Surface Mounting

- High sensitivity
- High switching capacity
- Adjustable over full operating range
- Stainless steel construction
- Easy installation
- Short reaction time
- Optional method of mounting



Mechanical Specification

Temperature range
40°C to 300°C

Excess Temperature
These thermostats must not be subjected to temperature in excess of 350°C (662°C) or less than -10°C (14°F).

Switching differential
±0.5°C approx. on light non-inductive loads.
±2°C approx. switching 4A at 240V AC

Mounting
The thermostat is fixed in position on the surface being monitored using the clamp or bracket provided.

Important
It is essential for correct operation to only tighten bracket fixing screws sufficient to allow the thermostat case to expand and contract. (See page 4).

Terminations
Connections to the thermostat contacts and earthing points are made by the 6-32 UNC studs shown in drawing. (See page 4).

Electrical Specification
Contact Rating (non inductive)
5A at 240V AC
10A at 110V AC
2A at 30V DC
0.25A at 110V DC

Contact Operation
Open on rise of temperature

Suppression

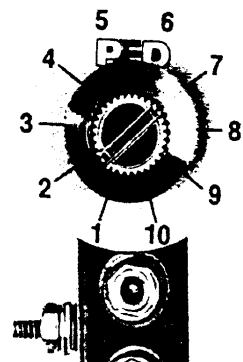
Options

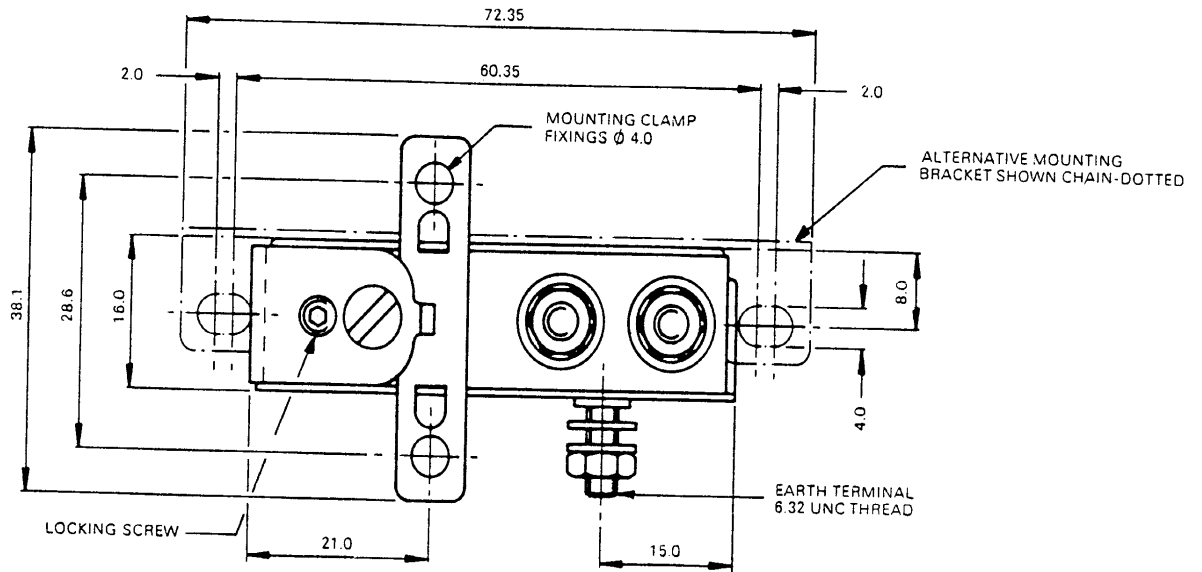
Temperature Setting

Thermostats are normally supplied to switch at +40°C approximately. If requested thermostats can be set at the factory within the temperature range +40°C to 300°C. The normal method of setting is by fixing to a heat conducting platen. Due to the differing conditions in which the thermostat may be required to operate, we prefer to regard this adjustment as an aid to the application, so that only a small correction is necessary to bring the operating point to the desired temperature when finally installed in a customer's equipment. The adjusting screws are clamped after setting. (See page 2).

Knob and Dial

A knob and dial can be supplied for surface mounting thermostats. The dial is marked 0-10 and is normally supplied so that the knob travel is limited to approximately 350°.





NOTE
BRACKET FIXING SCREWS SHOULD ONLY BE LIGHTLY TIGHTENED
TO ALLOW THERMOSTAT CASE TO EXPAND AND CONTRACT.

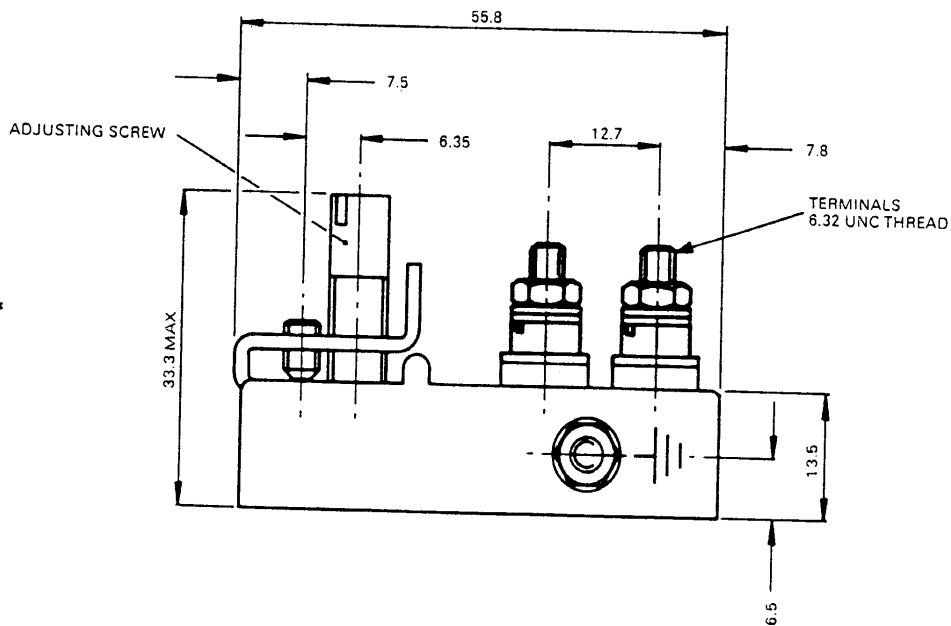


Table 1.

Thermostat Description	Temperature Range	Contact Action Below Set-point	Ordering Code
Surface Mounting Stainless Steel Body with Mounting Clamp and Bracket	+40°C to +300°C	Normally closed	75 100

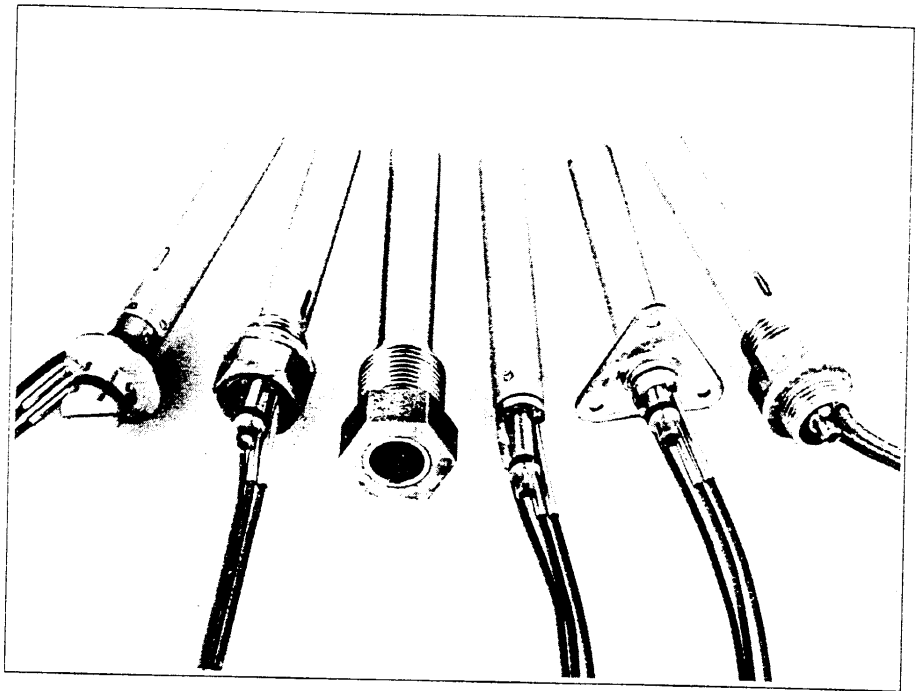
Table 2. Accessories

Description	Ordering Code
Knob and Dial Assembly for Surface Mounted Thermostats	75 004 160 011

Thermostats

Cartridge Type

- High sensitivity
- High switching capacity
- Adjustable over full operating range
- Choice of mountings
- Easy installation
- Choice of sizes
- Short reaction time
- Availability of options



Mechanical Specification

Temperature range
Brass shell -70°C to $+200^{\circ}\text{C}$
Stainless steel shell $+40^{\circ}\text{C}$ to $+300^{\circ}\text{C}$

Excess Temperature
These thermostats must not be subjected to temperatures of more than 55°C (110°F) in excess of the set-point otherwise permanent damage to the unit may result.

Differential
The temperature difference between 'cut-in' and 'cut-out' of the thermostat on rise or fall in temperature is approximately 0.1°C for small loads
For heavy loads, where close control is required, a slave relay should be interposed, as the operating differential is affected directly by the magnitude of the load. It is, typically, 4°C for 3A load with capacitor suppression.

Terminations
Connections are by three P.T.F.E. glass sleeved leads of standard 200mm length including earth, or 1.25M if specified.

Electrical Specification

Contact Rating (non inductive)
5A at 240V AC
10A at 110V AC
2A at 30V DC
0.25A at 110V DC

Contact Operation
Depending on type, open or close on rise of temperature.

Suppression
See notes on Page 2.

Options

Temperature Setting

Thermostats are normally supplied to switch at $+22^{\circ}\text{C}$ approximately. Thermostats can be temperature set at the factory to a customers requirements within the following ranges:

Brass shell: -20°C to $+200^{\circ}\text{C}$.
Stainless Steel shell: $+40^{\circ}\text{C}$ to $+300^{\circ}\text{C}$.

Due to the varying heat loss in various applications between the heat source and thermostat, it is to be expected that a slight adjustment will be required after installation although the unit will have been accurately set at the factory. The adjusting screw should be reclamped after adjustment. (See page 2).

Knobs

A knob with a graduated scale can be supplied for fitting to the straight and flanged pattern thermostats.

Thermowell

A thermowell (shown on page 8) should be used if the shell of the thermostat can be exposed to a pressure higher than 30 lbs/in² (2 kg/m²) or if in contact with a corrosive material.

Extended Leads

Continuous leads of various lengths can be supplied to special order. Thermostats can also be supplied without earth leads for low voltage applications or when the user provides adequate safe earthing arrangements.

Straight Pattern Types

The standard straight pattern unit is designed for insertion into a reamed hole drilled directly into the container of the medium to be controlled. To prevent the cartridge from rotating when the adjusting sleeve is turned, the hole should have a slot into which the pin projecting from the cartridge shell can be located. This pin is also used for location purposes when the cartridge is inserted into a thermowell. The diameter of the mounting hole should be $16.1\text{mm} \pm 0.05$.

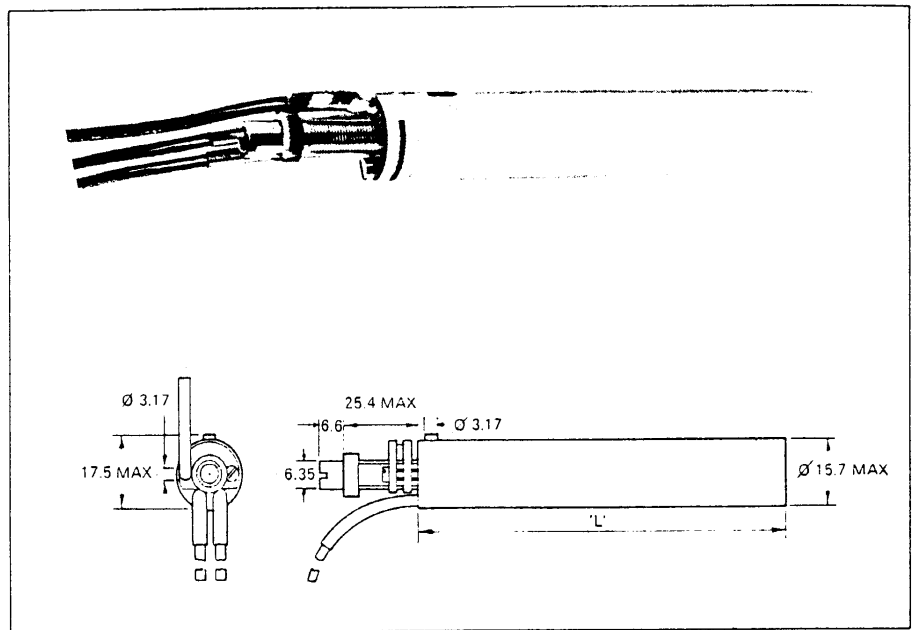


Table 3.

Thermostat Description *	Shell Length 'L' mm	Temperature Range	Contact Action Below Set-Point	Ordering Code
Straight Pattern Brass Shell	79.4	-70°C to +200°C	Normally Closed	75 200 111 611
Straight Pattern Brass Shell	93.7	-70°C to +200°C	Normally Closed	75 200 121 612
Straight Pattern Brass Shell	93.7	-70°C to +200°C	Normally Open	75 200 121 512
Straight Pattern Stainless Steel Shell	79.4	+40°C to +300°C	Normally Closed	75 200 211 621
Straight Pattern Stainless Steel Shell	93.7	+40°C to +300°C	Normally Closed	75 200 221 622
Straight Pattern Stainless Steel Shell	93.7	+40°C to +300°C	Normally Open	75 200 221 522

*Fitted with 200mm lead length.

Flanged Pattern Types

The flanged pattern has three holes to facilitate mounting against any flat surface. This method of mounting permits the temperature sensitive shell of the unit to be inserted fully into the medium, while the lead wires and adjusting sleeve remain accessible.

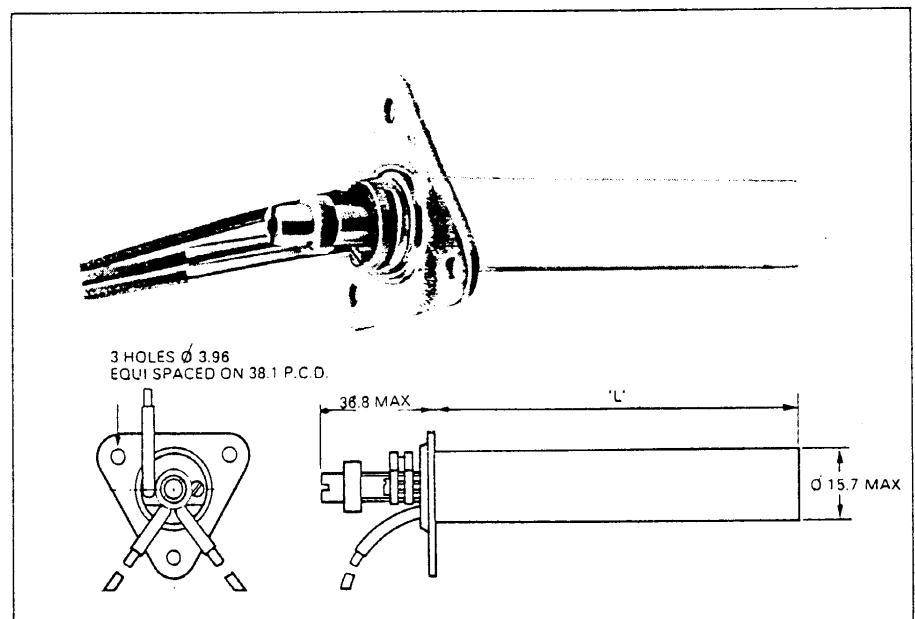


Table 4.

Thermostat Description *	Shell Length 'L' mm	Temperature Range	Contact Action Below Set-Point	Ordering Code
Flanged Pattern Brass Shell	76.2	-70°C to +200°C	Normally Closed	75 200 113 611
Flanged Pattern Brass Shell	90.5	-70°C to +200°C	Normally Closed	75 200 123 612
Flanged Pattern Brass Shell	90.5	-70°C to +200°C	Normally Open	75 200 123 512
Flanged Pattern Stainless Steel Shell	76.2	+40°C to +300°C	Normally Closed	75 200 213 621
Flanged Pattern Stainless Steel Shell	90.5	+40°C to +300°C	Normally Closed	75 200 223 622
Flanged Pattern Stainless Steel Shell	90.5	+40°C to +300°C	Normally Open	75 200 223 522

*Fitted with 200mm lead length.

Hexagon-Head Pattern Types

These units are supplied with a 1/2 inch B.S.P. thread. This allows the cartridge to be inserted directly into the medium either through a tapped hole in the container casing or, if the casing is thin, into a suitable boss. As with the flange pattern types, the adjusting screw and lead wires remain accessible.

Tighten to a torque of approximately 20 ft lbs.

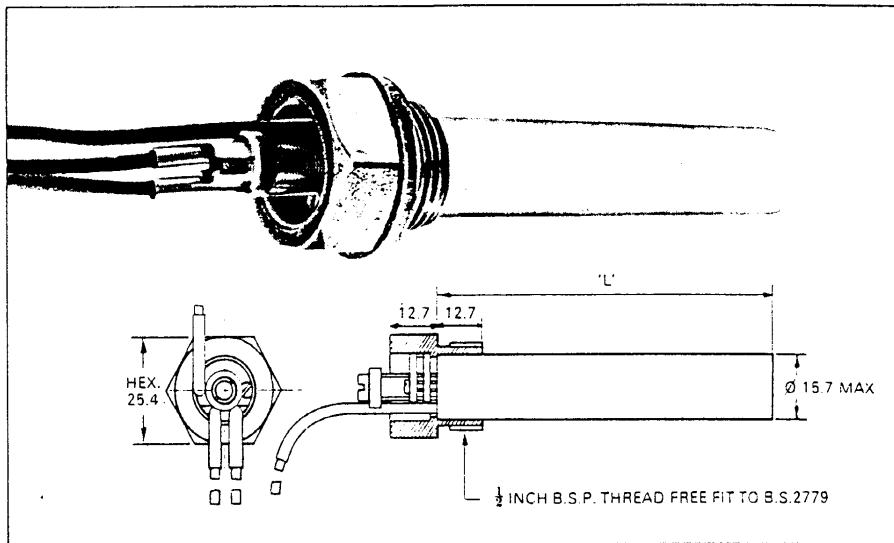


Table 5.

Thermostat Description *	Shell Length 'L' mm	Temperature Range	Contact Action Below Set-Point	Ordering Code
Hex-Head Pattern Brass Shell	79.4	-70°C to +200°C	Normally Closed	75 200 112 611
Hex-Head Pattern Brass Shell	93.7	-70°C to +200°C	Normally Closed	75 200 122 612
Hex-Head Pattern Brass Shell	93.7	-70°C to +200°C	Normally Open	75 200 122 512
Hex-Head Pattern Stainless Steel Shell	79.4	+40°C to +300°C	Normally Closed	75 200 212 621
Hex-Head Pattern Stainless Steel Shell	93.7	+40°C to +300°C	Normally Closed	75 200 222 622
Hex-Head Pattern Stainless Steel Shell	93.7	+40°C to +300°C	Normally Open	75 200 222 522

*Fitted with 200mm lead length.

Coupling-Head Pattern Types

The coupling-head feature is primarily intended for temperature control of closed gas or liquid systems. The pipe thread is 1/2 inch B.S.P. and can be screwed directly into a tapped hole or boss in the container wall. The protruding thread is offered with 1/2 inch B.S.P. or M20 for connection to electrical conduit. Tighten to a torque of approximately 20 ft lbs.

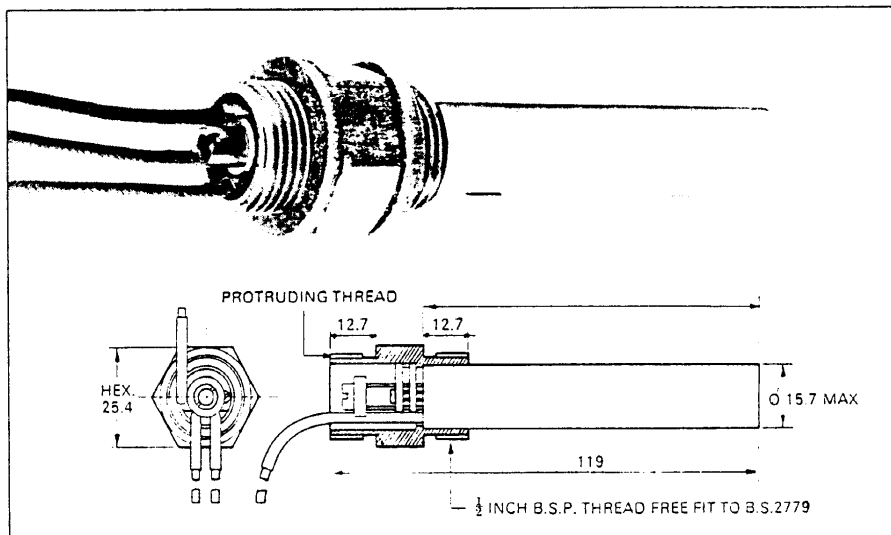


Table 6.

Thermostat Description *	Protruding Thread	Shell Length	Temperature Range	Contact Action Below Set-Point	Ordering Code
Coupling-Head Pattern Brass Shell	1/2" BSP	93.7	-70°C to +200°C	Normally Closed	75 200 124 612
Coupling-Head Pattern Brass Shell	1/2" BSP	93.7	-70°C to +200°C	Normally Open	75 200 124 512
Coupling-Head Pattern Brass Shell	M 20	93.7	-70°C to +200°C	Normally Closed	75 200 125 612
Coupling-Head Pattern Brass Shell	M 20	93.7	-70°C to +200°C	Normally Open	75 200 125 512
Coupling-Head Pattern Stainless Steel Shell	1/2" BSP	93.7	+40°C to +300°C	Normally Closed	75 200 224 622
Coupling-Head Pattern Stainless Steel Shell	1/2" BSP	93.7	+40°C to +300°C	Normally Open	75 200 224 522

*Fitted with 200mm lead length.

Accessories

Thermowell

for use with Straight Pattern Thermostats

Manufactured of stainless steel. Thermowells provide a protective shield for cartridge thermostats in applications wherein pressure may exceed 30lb/in² (2kg/cm²) or in which brass shelled thermostats may come into contact with corrosive fluids or where a risk of unwanted electrolytic action may exist.

Further advantages are: protection from external damage and elimination of the need to drain the container before withdrawing the thermostat.

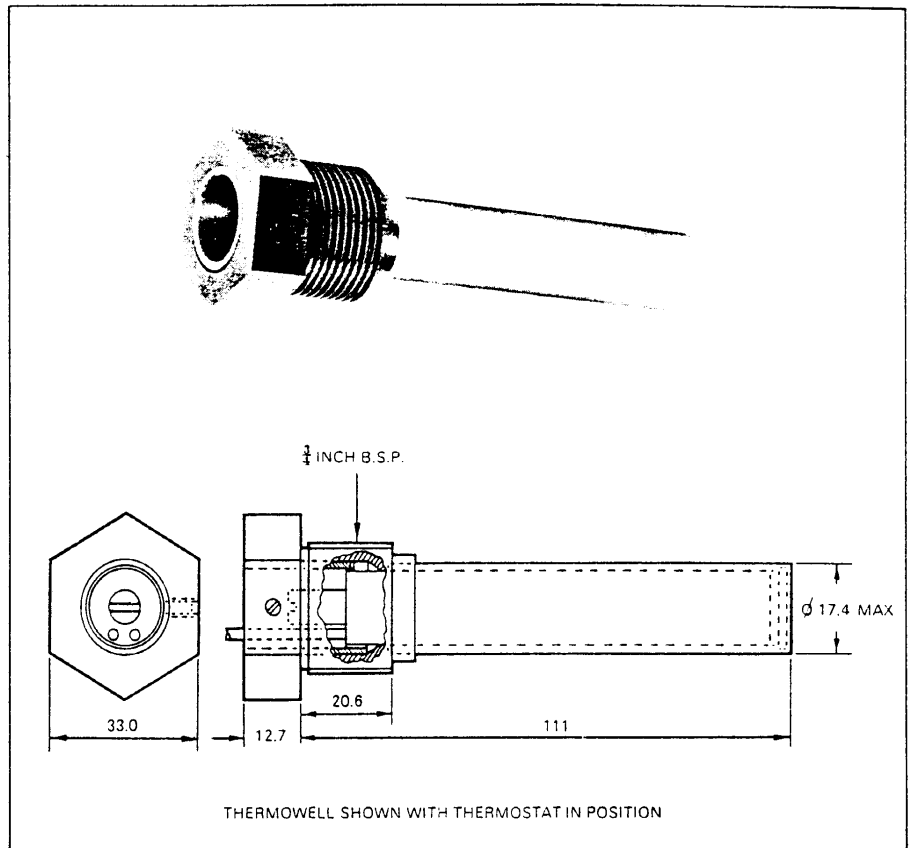


Table 7.

Description	Ordering Code
Thermowell Stainless Steel Protective Shield	75 300 * * * * *
Knob and Dial for Straight and Flanged Cartridge Thermostat	75 004 160 010

Ordering Information

See Tables and Description.

All dimensions in Millimetres.

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Health & Safety at Work etc., Act 1974

Some of our products are capable of being operated by and capable of switching high voltages and/or currents. Care must therefore be exercised in the use of such products.

PED

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