

## COMPACT TEMP. SWITCHES SERIES TCS & TCA

**WEATHERPROOF AND INTRINSICALLY SAFE: SERIES TCS; FLAMEPROOF: SERIES TCA**

| Stem type B                        |                     | Stem type C, Q, R  |   |
|------------------------------------|---------------------|--|---|
|                                    |                     |  |   |
| WEIGHT 1kg                         | dimensions unit: mm | WEIGHT 1kg   | dimension unit: mm                      |
| Y = 125 mm                         |                     | Stem type C: K = 2m ; Y max.=350mm<br>Stem type Q: K = 4m ; Y max.=900mm | Stem type R:<br>K = 10m ; Y max.=1800mm |
| For surface mounting use screws M5 |                     |  |   |

**NOTE: dimensions and weights are not binding unless released on certified drawings.**

### CAUTION

- Before installing, using or carrying out maintenance on the instrument it is necessary to **read** and **understand** the indications given in the attached Instruction Manual.
- The instrument must only be installed and maintained by **qualified personnel** in relation to working with instruments for hazardous areas.

**• INSTALLATION IS TO BE CARRIED OUT ONLY AFTER CHECKING THAT INSTRUMENT CHARACTERISTICS ARE CONSISTENT WITH PROCESS AND PLANT REQUIREMENTS.**

- The functional **features** of the instrument and its degree of protection are shown on the identification plate fixed to the case.

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### RELATED DOCUMENT

To authenticated document with certificate  
 N° IECEx PRE 16.0072X  
 N° IECEx PRE 16.0074X

**SAFETY INSTRUCTIONS FOR USE IN HAZARDOUS ATMOSPHERES..**

**RECOMMENDATIONS FOR PRESSURE SWITCH SAFE USE.**

All data, statements and recommendations supplied with this manual are based on information believed by us to be reliable. As the conditions of effective use are beyond our control, our products are sold under the condition that the user himself evaluates such conditions before following our recommendations for the purpose or use foreseen by him.

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### 1 - GENERAL NOTES

#### 1.1 FOREWORD

The wrong choice of a series or a model, as well as the incorrect installation, lead to malfunction and reduce instrument life. Failure to abide by the indications given in this manual can cause damage to the instrument, the environment and persons.

#### 1.2 ALLOWED OVERRANGE

Temperature exceeding the working range can be occasionally **allowed only for testing proposal** up to the proof temperature. **Continuous** temperature exceeding the (adjustable) "RANGE" (see fig 1) can be applied to the instrument, provided they are clearly stated in the instrument features (see fig.1, "MAX T."). The current and voltage values stated in the technical specifications and data plate must **not** be exceeded: transitory overranges can have a destructive effect on the switch.

#### 1.3 TEMPERATURE



The temperature of the instrument is influenced by the environmental and process temperature. Special attention must be taken to avoid the exceeding of the limits specified in table 1 and 2.

For the instrument model TC\*\*B\* (stem for direct mounting) the following table is applicable

Table 1 – Temperature conditions

| Temp. Classification | Ambient temperature range (Tamb) | Max working temperature (T max.)  | Max electrical rating (resistive load)              |
|----------------------|----------------------------------|---|---|
| T6                   | -60 ... +60 °C                   | Shall not exceed the maximum temperature specified on the nameplate (see fig.1 item 5). | See nameplate of the instrument (electrical rating) |
| T5                   |                                  |   |   |
| T4                   |                                  |   |   |
| T3                   |                                  |   |   |
| T2                   |                                  |   |   |
| T1                   | -60 ... +85 °C                   |   |   |

For the instrument models TC\*\*C\*, TC\*\*Q\*, TC\*\*R\* (stem for remote mounting) and TC\*\*S\* (helical bulb for ambient temperature) the following table is applicable

Table 2 – Temperature conditions

| Temperature Classification | Ambient temperature range (Tamb) | Max electrical rating (resistive load)              |
|----------------------------|----------------------------------|---|
| T6                         | -60 ... +60 °C                   | See nameplate of the instrument (electrical rating) |
| T5                         |                                  |   |
| T4                         |                                  |   |
| T3                         |                                  |   |
| T2                         |                                  |   |
| T1                         | -60 ... +85 °C                   |   |

### 2 - OPERATING PRINCIPLE

The operating principle is based on a pressure measuring element, connected via a capillary tube to a bulb. This system is partially filled with a volatile liquid, the residual free volume being filled by its saturated vapour. In this system a pressure is generated which is a non-linear function of bulb temperature; this pressure acts on a stainless steel diaphragm which applies a force to a stiff disc; this force is directly proportional to the temperature value to which the bulb is submitted and is contrasted by a compression spring charged by a suitable bush. When the force balance point is exceeded, the stiff disc shifts and, by means of a rigid rod, **activates one or two simultaneous release electric microswitches**. The microswitches are of the rapid release type with automatic rearm. When the temperature moves away from the set values, returning towards the normal values, the switch is rearmed.

### 3 - MODEL CODE

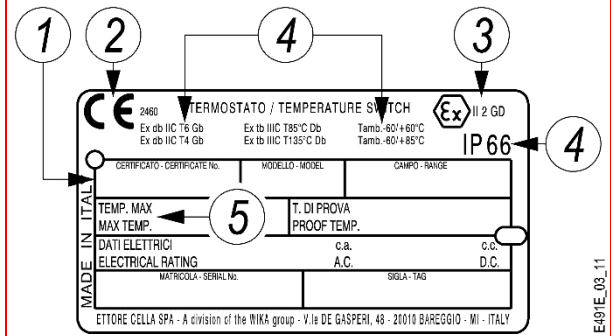
See Annex 1

### 4 - IDENTIFICATION PLATE AND MARKINGS



The instrument is fitted with a metal plate bearing all its functional characteristics and in case of flameproof or intrinsic safety execution also the markings prescribed by standard IEC/EN 60079-0. Fig.1 shows the plate mounted on flameproof instruments.

Fig. 1 - Flameproof instruments plate



- 1 Notified body that issued the type certificate and number of said certificate.
- 2 CE marking and identification number of the notified body responsible for production surveillance.
- 3 Apparatus classification according to ATEX 2014/34/EU directive.
- 4 Type of protection and ambient temperature limits of operation.
- 5 Max working temperature

The following table gives the relationship between hazardous areas, ATEX Categories and Equipment Protection Level (EPL) listed on the flameproof instrument nameplate.

| Hazardous area    |         | Categories according to 2014/34/EU Directive (ATEX) | EPL          |
|-------------------|---------|---|--------------|
| Gas, vapours, fog | Zone 0  | 1G  | Ga           |
| Gas, vapours, fog | Zone 1  | 2G or 1G  | Gb or Ga     |
| Gas, vapours, fog | Zone 2  | 3G, 2G or 1G  | Gc, Gb or Ga |
| Dust              | Zone 20 | 1D  | Da           |
| Dust              | Zone 21 | 2D or 1D  | Db or Dc     |
| Dust              | Zone 22 | 3D, 2D or 1D  | Dc, Db or Da |

### 5 - SET POINT REGULATION

The charge of the compression spring can be regulated by means of the bush (for adjustment) in such a way that the switch is released when the temperature reaches (increasing or decreasing) the desired value (set point). The instrument is usually supplied with the switches set at 0°C or at the lowest setting range value if this is higher than 0°C (**factory calibration**). The instrument is supplied with an adhesive label showing the set point calibration value. With **factory calibration** the values are not indicated on the label as these are temporary and will be modified with the final values. Prior to installation the instrument must **be calibrated** and the final calibration values written on the adhesive label.

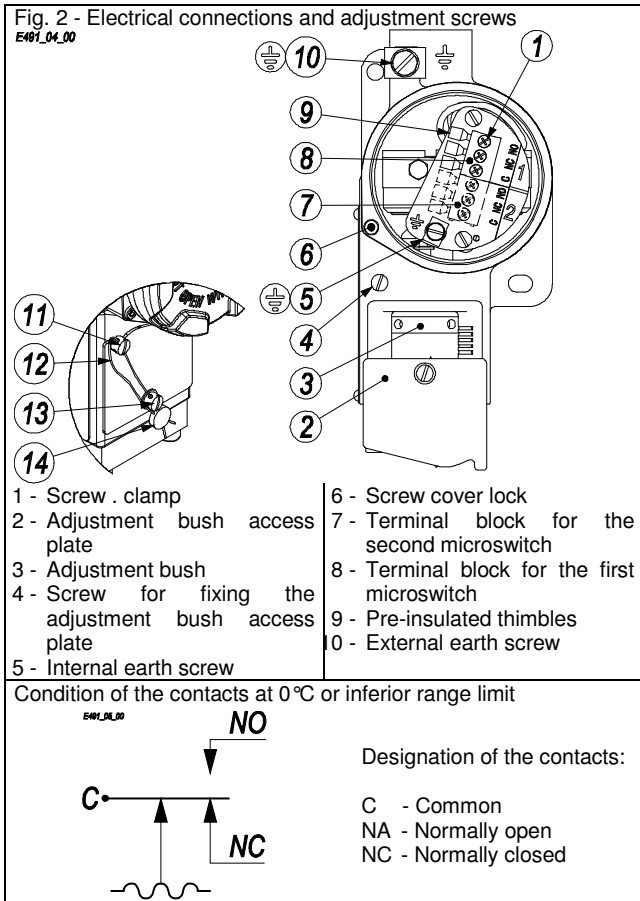
If the instrument has been ordered with a **specific calibration**, it is a good rule to check the calibration values marked on the relevant adhesive label, prior to installation.



The position of the adjustment bush is given in figure 2

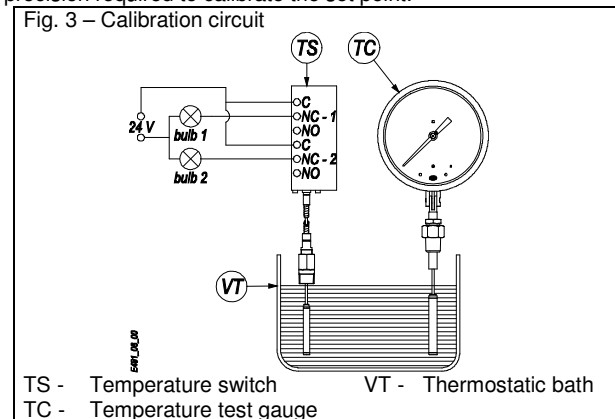
The effect of rotation of the adjustment bush is described on the adhesive label.

Rotate the screw by inserting a 3.0 mm dia. rod into the holes of adjustment screw (Fig.2).



## 6 - SET POINT CALIBRATION

In order to proceed with the calibration and the periodical functional verification of the instrument a suitable **calibration circuit** (fig. 3) and an adequate heat source is required. The test instrument should have a measurement range approximately equal to or slightly wider than the temperature switch range and should have an accuracy consistent with the precision required to calibrate the set point.



### 6.1 PRELIMINARY OPERATIONS

**WARNING: TCA model instrument, flameproof.**  
Before open the cover check the absence of explosive atmosphere and check that the instrument is **not energized**.

With reference to Fig. 2 tighten the cover locking screw (6) using an 2,5 mm allen key then unscrew the cover

### 6.2 CALIBRATION CIRCUIT AND OPERATIONS

Prepare the control circuit as indicated in Fig. 3. The warning lamps should be connected to the contact in the NO or NC position according to the required contact action.

If the instrument is equipped with two microswitches, take into account that they actuate simultaneously within rated tolerances.

The warning lamps can either be connected by means of a thimble with a maximum diameter of 2.5 mm to be inserted in the appropriate holes situated beside the terminal screw (see Fig. 2).

#### Connection of C and NO terminals

- If the circuit is open at the working temperature, the switch **closes** the circuit as the temperature **increases** when the desired value is reached.
- If the circuit is closed at the working temperature, the switch **opens** the circuit as the temperature **decreases** when the desired value is reached.

#### Connection of C and NC terminals

- If the circuit is closed at the working temperature, the switch **opens** the circuit as the temperature **increases** when the desired value is reached.
- If the circuit is open at the working temperature, the switch **closes** the circuit as the temperature **decreases** when the desired value is reached.

The temperature switch must be mounted in the normal installation position, i.e. with the stem or the capillary outlet downwards.

Avoid forcing the microswitch by hand or with tools. This could affect the instrument functioning. With reference to Fig.2, free the access to the adjustment bush by loosening the screw (4) which holds the closure plate (2).

Increase the temperature in the circuit up to the desired microswitch set point value.

Turn the adjustment screw by inserting a 3.0 mm dia. rod into the holes of adjustment screw until the relative lamp turns on (or turns off); then turn it in the opposite direction until the lamp turns off (or on). Slowly turn the bush again until the lamp turns on (or off).

### 6.3 SET POINT VERIFICATION

Generate the normal working temperature ( $T_w$ ) and wait the stabilisation of the temperature. Modify, slowly the temperature up to the set value ( $T_i$ ) and record the set point value. Write the set point value on the adhesive label.

**Note:** the repeatability should be checked verifying for three times the set point ( $T_i$ ) starting always from the same temperature value ( $T_w$ ). The temperature cycle should be slowly to give the possibility to record the set point with accuracy

### 6.4 FINAL OPERATIONS

Disconnect the instrument from the control circuit. With reference to Fig. 2 close the access to the adjustment bush by rotating the closure plate (2) and tighten the relative screw (4). Tighten the cover into the enclosure and lock it unscrewing the locking screw (6) using an 2,5 mm allen key. Mount on the cable entry the protection caps supplied with the instrument.

**CAUTION:** the protection cap should only be definitively removed **during** the connection steps (see § 8).

## 7 - INSTRUMENT PLUMBING

The plumbing, aimed as a guarantee against possible tampering of the calibrations, can be carried out using a flexible steel wire (12) inserted into the holes in the screws (11 and 13) provided for this purpose (see Fig. 2).

## 8 - MOUNTING AND CONNECTIONS

### 8.1 MOUNTING

**Surface** mount the instrument by means of the holes provided, or **pipe** mount using the appropriate bracket or mount directly on process **in a vertical position** (with the stem or capillary outlet pointing downwards) (Fig.5,7,12 and Fig.13). In case of surface or panel or rack mounting the instruments can be mounted side by side (see Fig.14).

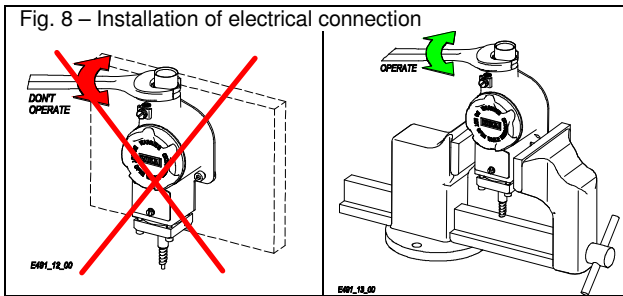
**Warning:** Instruments with aluminum enclosure. The instrument must be protected against accidental impacts of the housing.

The chosen position must be such that vibrations, the possibility of shocks or temperature changes are within tolerable limits. The above also applies to direct mounting instrument (code B into the model code).

**CAUTION:** Positions other than vertical are allowed provided environmental conditions do not cause condensation to form or water to enter the instrument through the adjustment bush access plate (see Fig. 2).







With the instrument into the final position provided that the electric line is not energized, remove the cover and make the electrical connection to the terminal block (see Fig. 2).

If the ambient temperature exceeds 60 °C is recommended to use cables suitable for operating temperatures of at least 105 °C.

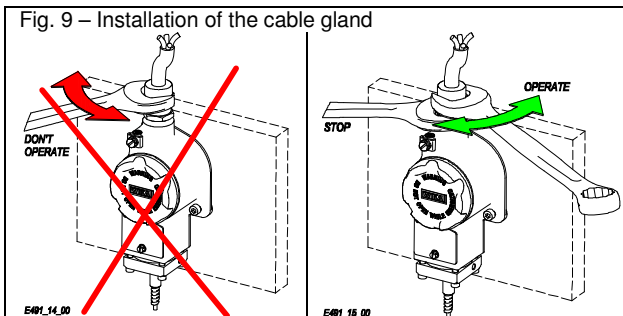
Flexible cables with a maximum section of 1,5 mm<sup>2</sup> (16AWG) are recommended using the pre-insulated crimp ring terminal.

**Warning:** The instrument may be equipped with micro switches SPDT or DPDT. Where two microswitches are fitted (DPDT), the two switches must be part of intrinsically safe circuits. The entry parameters relevant for intrinsic safety are listed on the nameplate of the instrument.

Ensure that no deposits or wire ends remain inside the case.

When inserting cables into the enclosure pay attention not to force the microswitch with cable or tools, otherwise instrument calibration or even its operation could be compromised. The microswitch has been factory mounted and positioned in order to obtain the best performances. Any tampering made on site without following instructions authorised by the WIKA may result in **instrument malfunction**.

The tightening of the cable gland or the swivel adapter must be performed as shown in Fig. 9.



Tightening the cover as the wiring of the instrument is finish checking the position of the cover O-ring. With reference to Fig. 2 unscrewing the locking screw (6) using an 2,5 mm allen key up to lock the cover

## 8.7 EARTHING CONNECTIONS

The instrument is supplied with with two protective grounding connection, one inside and one outside the enclosure. The external connection provide effective connection of a conductor with a cross-sectional area of at least 4 mm<sup>2</sup>(see Fig.2), the internal one up to 2.5 mm<sup>2</sup>.

## 9 - SAFETY INTEGRITY LEVEL (SIL) INSTALLATION REQUIREMENTS

The temperature switch has been evaluated as Type A safety related hardware. It has an hardware fault tolerance of 0 if it is used in one out one configuration (1oo1). The installation has to be designed to allow a proof test to detect dangerous undetected fault using, as example, the following procedure:

- Take appropriate action to avoid a false trip
- Force the switch to reach a define max or min threshold value and verify that output goes into the safe state.
- Force the switch to reach a define normal threshold value and verify that output goes into the normal state.
- Repeat the check two times evaluating average set point value and repeatability.
- Restore the loop to full operation
- Restore normal operation

The installation requirements, the useful life and the failure of the switch is discussed in the Failure Modes, Effects and Diagnostic Analysis Report.

## 10 - PUTTING INTO OPERATION

The instrument comes into operations as soon as the electrical line is energized (see fig.12, 13).

## 11 - VISUAL INSPECTION

Periodically check the external condition of the enclosure.

In case of flameproof or intrinsic safety instruments, inspections of the electrical installation are to be carried out also according to customer procedures and at least in accordance with Standard EN-60079-17.

The flameproof and the intrinsic safety instruments installed in explosive atmospheres for the combustibile dust presence, must be periodically cleaned up externally in order to avoid dust accumulating..

## 12 - FUNCTIONAL VERIFICATION

This will be carried out according to the Customer's control procedures and as minimum yearly. The instruments can be verified on the plant if installed as illustrated in Fig. 13.

To avoid any risk it is **recommended** check the set point on site **without** open the cover and without dismount the cable gland and without unplugging the power cable.

Flameproof and intrinsic safety instruments can be check on-site only if apparatus suitable for explosive atmosphere are used.

If this is not the case it is necessary remove the instrument from the plant, and carry out the verification in a testing room.

If the verification of the set point is performed unplugging the power cable from the terminal block it is recommended de-energize the instrument to avoid any electrical hazard.

### WARNING: TCA model Instrument, flameproof.

Before open the cover or the cable gland check the absence of explosive atmosphere and check that the instrument is **not energized**.

Verification consists in **check the calibration value** and possibly regulating the adjustment bush (see §6).

## 13 - STOPPING AND DISMOUNTING

Before proceeding with these operations **ensure** that the plant or machines have been put into the **conditions** foreseen to allow these operations.

### With reference to figures 4, 12 and 13

Remove the power supply (signal) from the electrical line. Loosen and remove the seal press being careful not to bend the capillary and protective sheath (Fig.4).

**Warning:** Do not touch the bulb and the parts in contact with the thermowell if hot.

Loosen and remove the fitting (3) then extract the bulb (5) from the thermowell (4) holding it by the capillary tube (1), without bending it.

### WARNING: Instrument model TCA, flameproof.

Before open the cover or the cable gland check the absence of explosive atmosphere and check that the instrument is de energized.

Unscrew the swivel adapter (8) (electrical cable tubing).

Remove the instrument cover and disconnect the electrical cables from the terminal block and earth screws. Remove the screws fixing the case to the panel (or pipe) and remove the instrument, taking care to slide the electrical conductors out from the case. Mount instrument cover. Insulate and protect cables around, if any. Temporarily plug the thermowell.

In case of flameproof or intrinsic safety instruments it is recommended to follow - at least - the standard EN-60079-17 for the withdrawal from service of electrical apparatus.

## 14 - DISPOSAL

The instruments are mainly made of stainless steel and aluminium and therefore, once the electrical parts have been dismantled and the parts being exposed to fluids that could be harmful to people or the environment have been properly dealt with, they can be scrapped.



### 15 - TROUBLESHOOTING



**IMPORTANT NOTE:** operations involving replacement of essential components must be carried out at our workshop, especially for instruments with flameproof certificate; this is to guarantee the user the total and correct restoration of the product original characteristics.



| MALFUNCTION     | PROBABLE CAUSE  | REMEDY   |
|-----------------|---|--|
| Set point shift | <ul style="list-style-type: none"> <li>Deposits on thermowell or bulb.</li> <li>Filling fluid leakage.</li> </ul>   | <ul style="list-style-type: none"> <li>Check and clean surfaces.</li> <li>Replace the instrument.</li> </ul>   |
| Slow response   | <ul style="list-style-type: none"> <li>Deposits on thermowell or bulb.</li> </ul>   | <ul style="list-style-type: none"> <li>Check and clean surfaces.</li> </ul>  |
| No actuation    | <ul style="list-style-type: none"> <li>Loosened electrical joints.</li> <li>Interrupted or short-circuited electrical line.</li> <li>Microswitch contacts damaged.</li> <li>Filling fluid leakage.</li> </ul> | <ul style="list-style-type: none"> <li>Check all electrical joints.</li> <li>Check the conditions of the electrical line.</li> <li>Replace the instrument.</li> <li>Replace the instrument.</li> </ul> |
| Undue actuation | <ul style="list-style-type: none"> <li>Accidental shocks.</li> <li>Interrupted or short-circuited electrical line.</li> </ul>   | <ul style="list-style-type: none"> <li>Modify the mounting.</li> <li>Check the conditions of the electrical line.</li> </ul>   |

Fig. 10 – Vertical 2" pipe

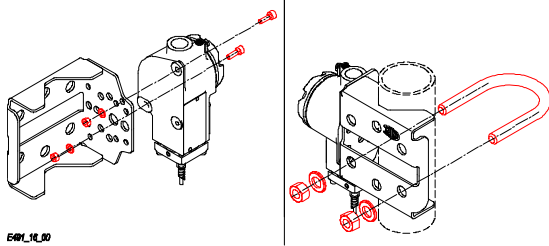
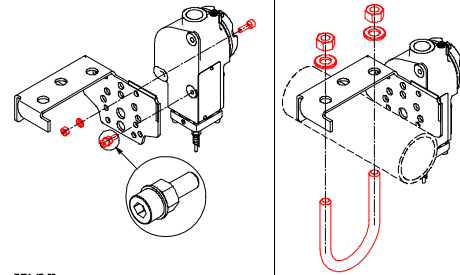


Fig. 11 – Horizontal 2" pipe



**Note:** To install the instrument on the 2" pipe use the mounting brackets accessories supplied with the instrument. To mount the instrument on the brackets use the M5 screws supplied as per Fig. 10 or 11.

Fig. 12 – Direct mounting -

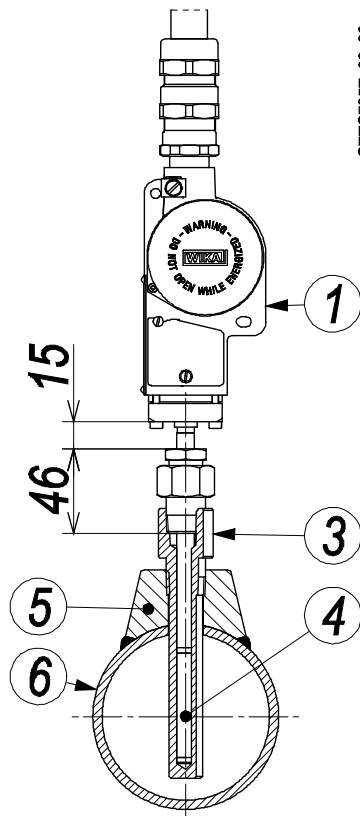


Fig. 13 - Surface mounting -

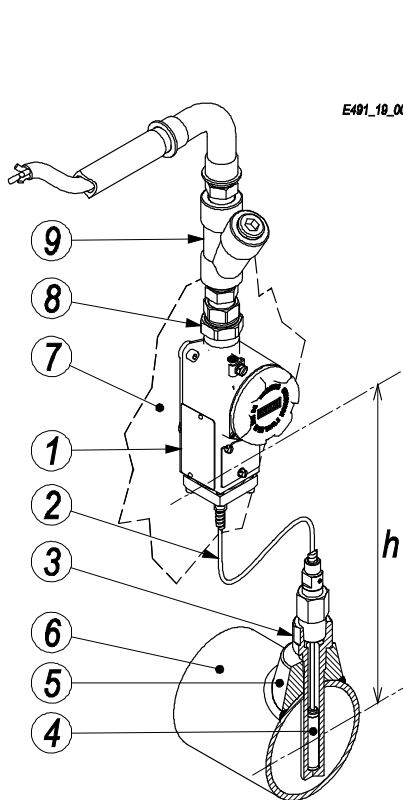
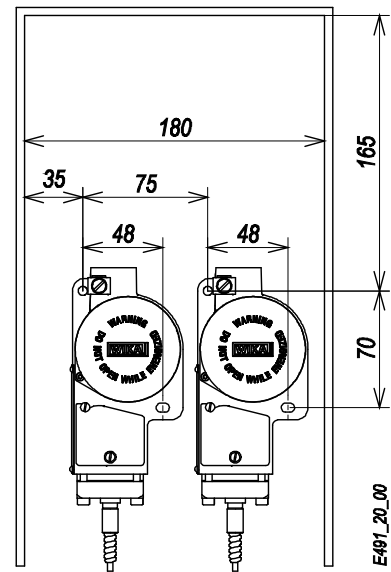


Fig. 14 – Rack / Wall mounting



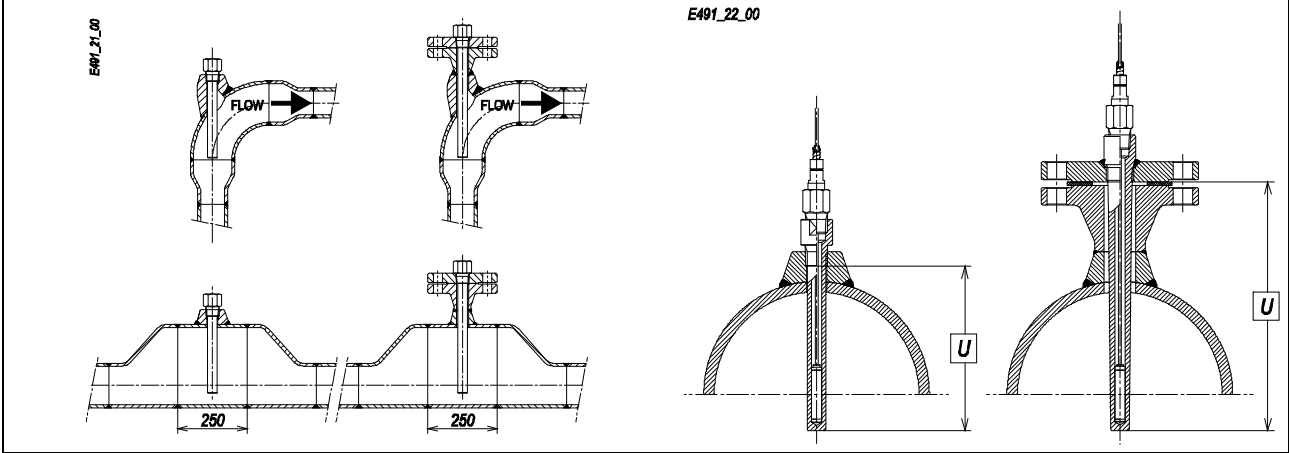
**LEGENDA**

- 1 - Temperature switch
- 2 - Capillary
- 3 - Thermowell

- 4 - Bulb
- 5 - Branch Connection Fittings
- 6 - Process piping

- 7 - Rack/Panel /Wall
- 8 - Swivel adapter or cable gland
- 9 - Conduit seal

Fig. 15 - Thermowell: examples of installation



### Annex 1 – Model Code

|          |                           |                                     |        |                       |                       |  |   |
|----------|---------------------------|-------------------------------------|--------|-----------------------|-----------------------|--|---|
| <b>1</b> | <b>MODEL CODE</b>         | TC                                  |        |                       |                       |  | For further information see datasheet   |
| 1.1      | Ignition protection mode  | S<br>A                              |        |                       |                       |  | Weather proof<br>Ex d   |
| 1.2      | Enclosure code (Material) |                                     | 2<br>4 |                       |                       |  | Aluminium<br>316 s.s.   |
| 1.3      | Sensor code               |                                     |        | B<br>C<br>Q<br>R<br>S |                       |  | Direct mounting<br>Remote mounting with 2m capillary<br>Remote mounting with 5m capillary<br>Remote mounting with 10m capillary<br>Helical bulb |
| 1.4      | Electric Contacts         |                                     |        |                       | A<br>B<br>C<br>G<br>H |  | Silver SPDT<br>Silver SPDT + argon sealed<br>Gold SPDT + argon sealed<br>Silver DPDT<br>Silver sealed DPDT                                      |
| <b>2</b> | <b>Options</b>            | Example: Intrinsic Safety execution |        |                       |                       |  |   |