

TERMOKUPL & RTD

enelean

We Measure



WHAT IS THERMOCOUPLE?

Temperature is one of the most important parameters to be measured in the industrial field. Temperature, which is one of the most fundamental issues in physics, is an important variable that should be measured because it is a parameter that affects physical properties. Temperature measurement can be done by many methods. Among all of these methods, thermocouples are the most preferred sensors in the industrial field. Measurements can be made from -200 °C to 2320 °C with thermocouples.

Thermocouple which is formed by welding the ends of two different alloys, is a simple temperature measuring element. Welding point is named as hot spot, and other two open ends are named as cold spot. A temperature difference occurs between the hot spot and the cold spot. A weak voltage in the order of mV is produced at the cold point ends in proportion to the temperature difference.

The temperature distribution between the hot point and the cold point of the thermocouple is proportional to the generated voltage. As long as the hot spot stays the same, different temperatures will occur when the cold spot temperature changes. Therefore, in order to provide standardization in the values in the mV tables, the mV values for the temperature are obtained by keeping the cold point at 0 Centigrade degree. For example, the mV value corresponding to 100°C is the mV value measured at the end point when the hot point of the thermocouple is at 100°C and the cold point is at 0°C.

Thermocouples are used in special protective sheaths due to impacts that may occur during process use and physical and chemical corrosive reasons, and the element wires used are isolated from each other with the help of insulators, since they are of different poles.

When choosing the insulator, it is necessary to consider the ambient conditions and temperature limits. The most important factors that can affect the service life of thermocouples are the selection of the right element wire and protective sheath.

DIN 43710 and IEC 60584 standard thermocouple element wire types, which are mostly used in temperature ranges from -200°C to 2320°C.

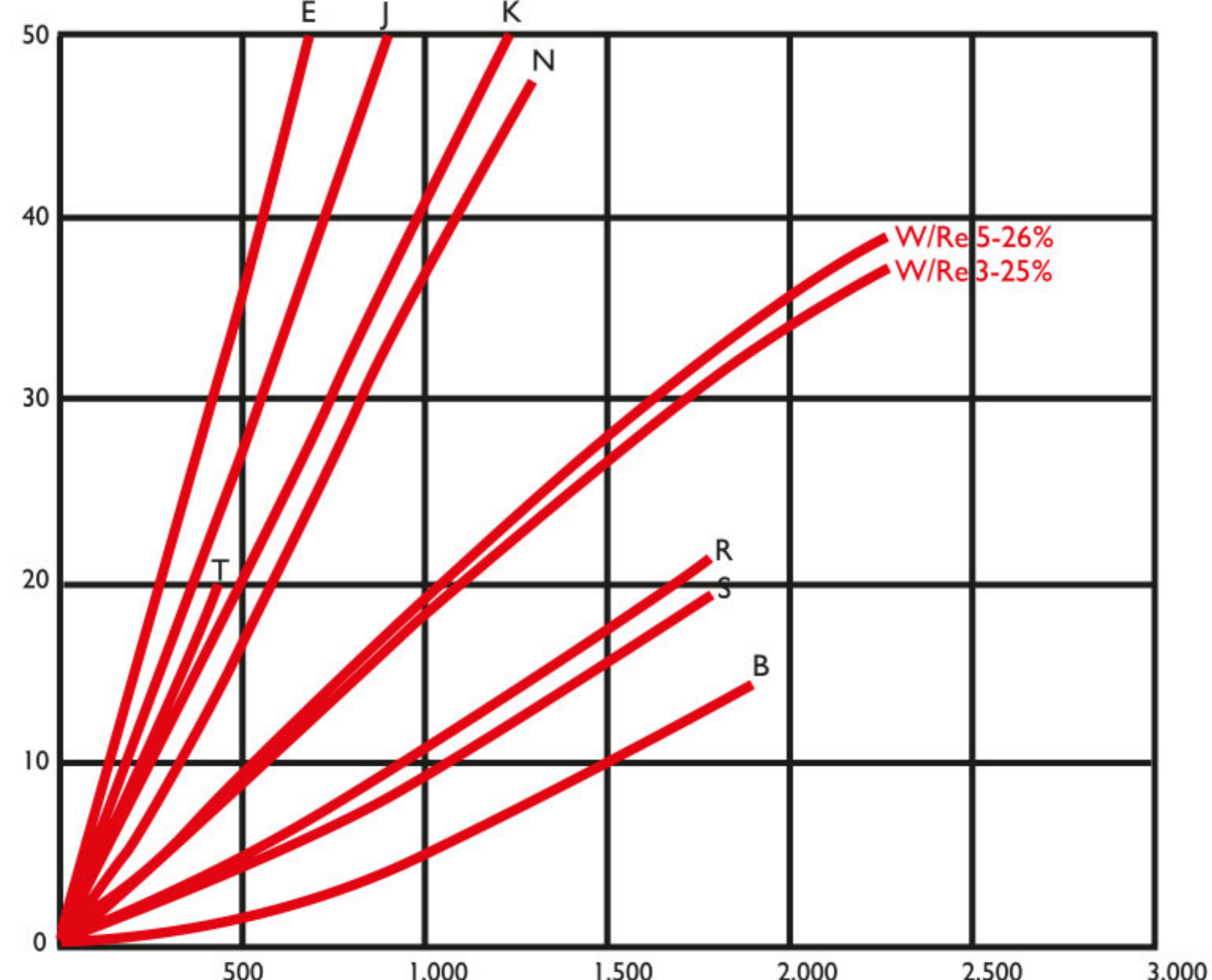
Cu-Const (CuNi)	Copper-Constantan
Fe-Const (CuNi)	Iron-Constantan
Cr-Al	Chromium-Aluminum
NiCr-Ni	NickelChromium-Nickel
Nikrosil-Nisil	NickelChromiumSilicon-NickelSilicon magnesium
Pt%10Rh-Pt	PlatinumRhodium-Platinum (%10)
Pt%13Rh-Pt	PlatinumRhodium -Platinum (%13)
Pt%18Rh-Pt	PlatinumRhodium -Platinum (%18)
Tn-Tn%26Re	Tennessee-Tennessee %26 Rhenium

Temperature limits and standard codes

DIN 43710	IEC 60584	Temp. Range
Cu-Const	T	-200 300 ° C
Fe-Const	J	-200 800 ° C
Cr-Al	K	-200 ... 1200 ° C
NiCr-Ni	K	-200 ... 1200 ° C
Cr-Const	E	-200 ... 1200 ° C
Nikrosil-Nisil	N	0 ... 1200° C
Pt%10Rh-Pt	S	0 ... 1500 ° C
Pt%13Rh-Pt	R	0 ... 1600° C
Pt%18Rh-Pt	B	0 ... 1800 ° C
Tn-Tn%26Re	W	0 ... 2000° C

When the temperature - mV curves of the element wires are examined, it is seen that they are not linear, there are regions where each is more suitable than the other in terms of temperature measurement. For example, when the mV curve of Fe-Const, which can measure 0-800 °C temperature, and NiCr-Ni element wires, which can measure up to 0-1200 °C, are compared, Fe-Const between 300 and 600 °C is more linear than NiCr-Ni. For this reason, it is preferred to work with Fe-Const in this temperature range

Thermocouple temperature – mV curves



In the thermocouple element wires, the first leg is (+), the other leg is (-). Thermocouple should be connected to the device by considering (+) and (-) ends.

World-class thermocouple ends are coded with certain color codes. In DIN standards positive (+) legs are red, and negative (-) legs vary according to the type of thermocouples.

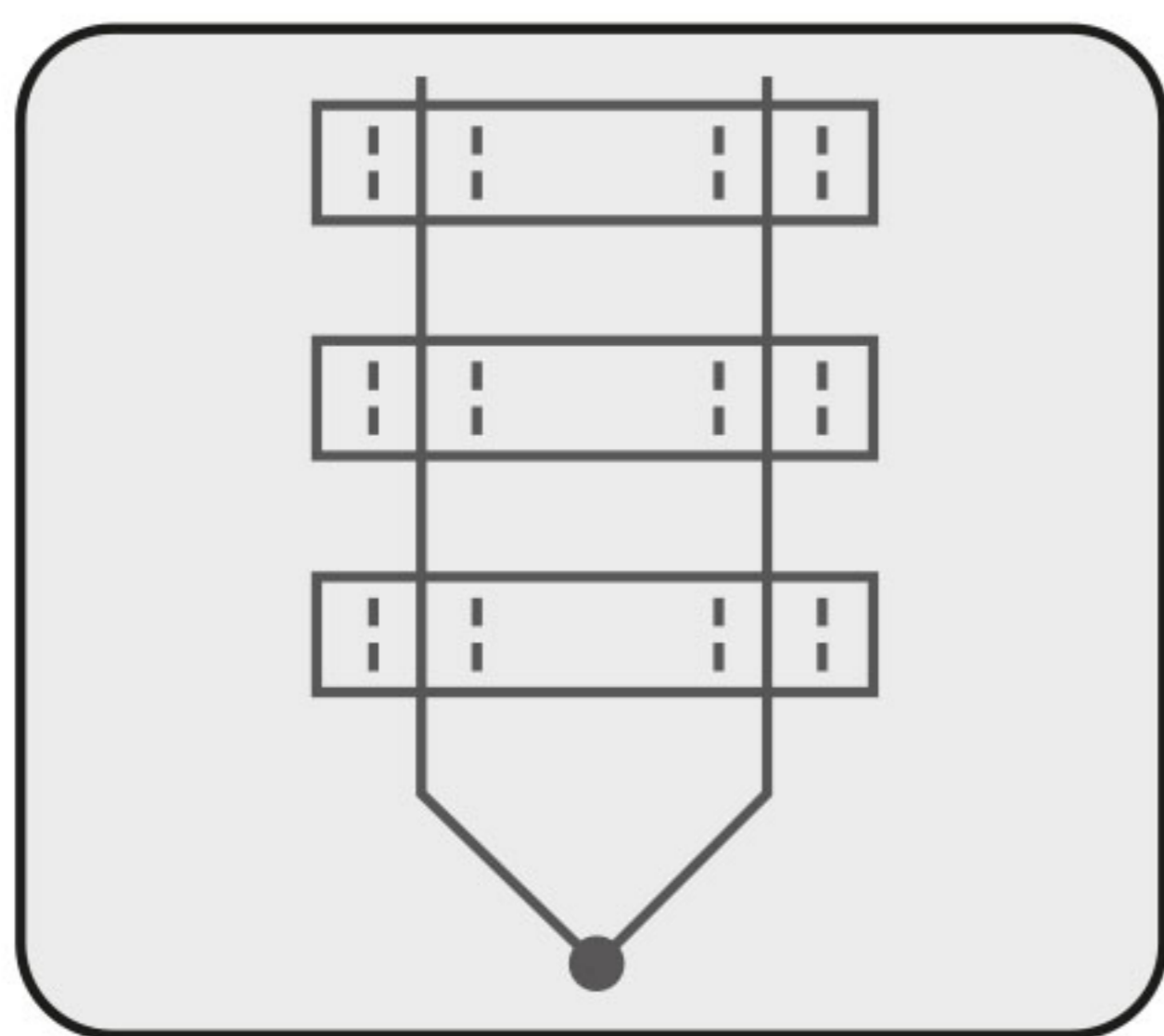
In IEC standards negative (-) legs are white, positive legs (+) vary according to the type of thermocouple.

Thermocouple color codes

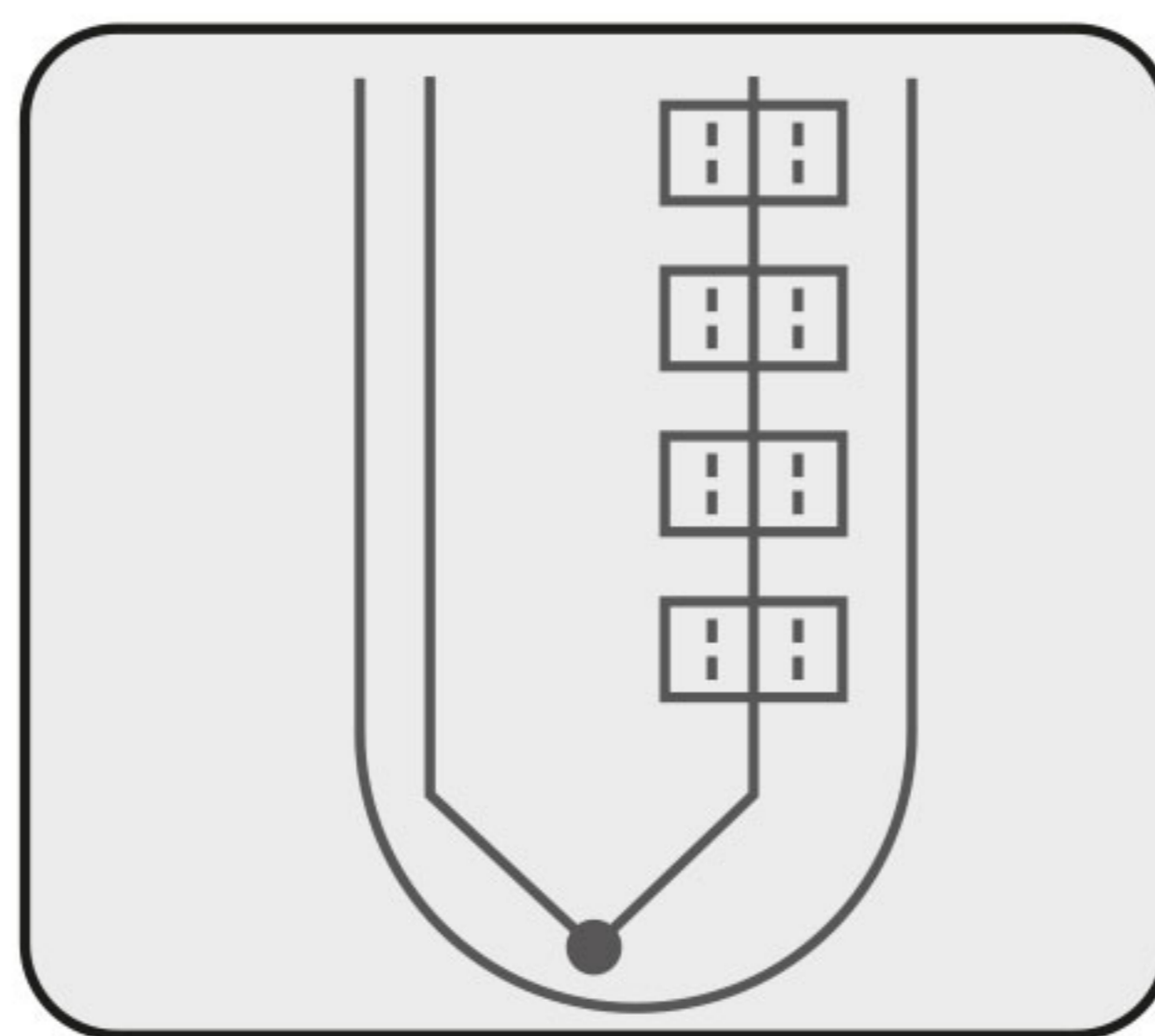
+	COLOR		-	COLOR	
	DIN 43710	IEC60584		DIN 43710	IEC60584
Cu	● Red	● Brown	Const	● Brown	○ White
Fe	● Red	● Black	Const	● Blue	○ White
NiCr	● Red	● Green	Ni	● Green	○ White
PtRh	● Red	● Orange	Pt	○ White	○ White

INSULATION OF ELEMENT WIRES

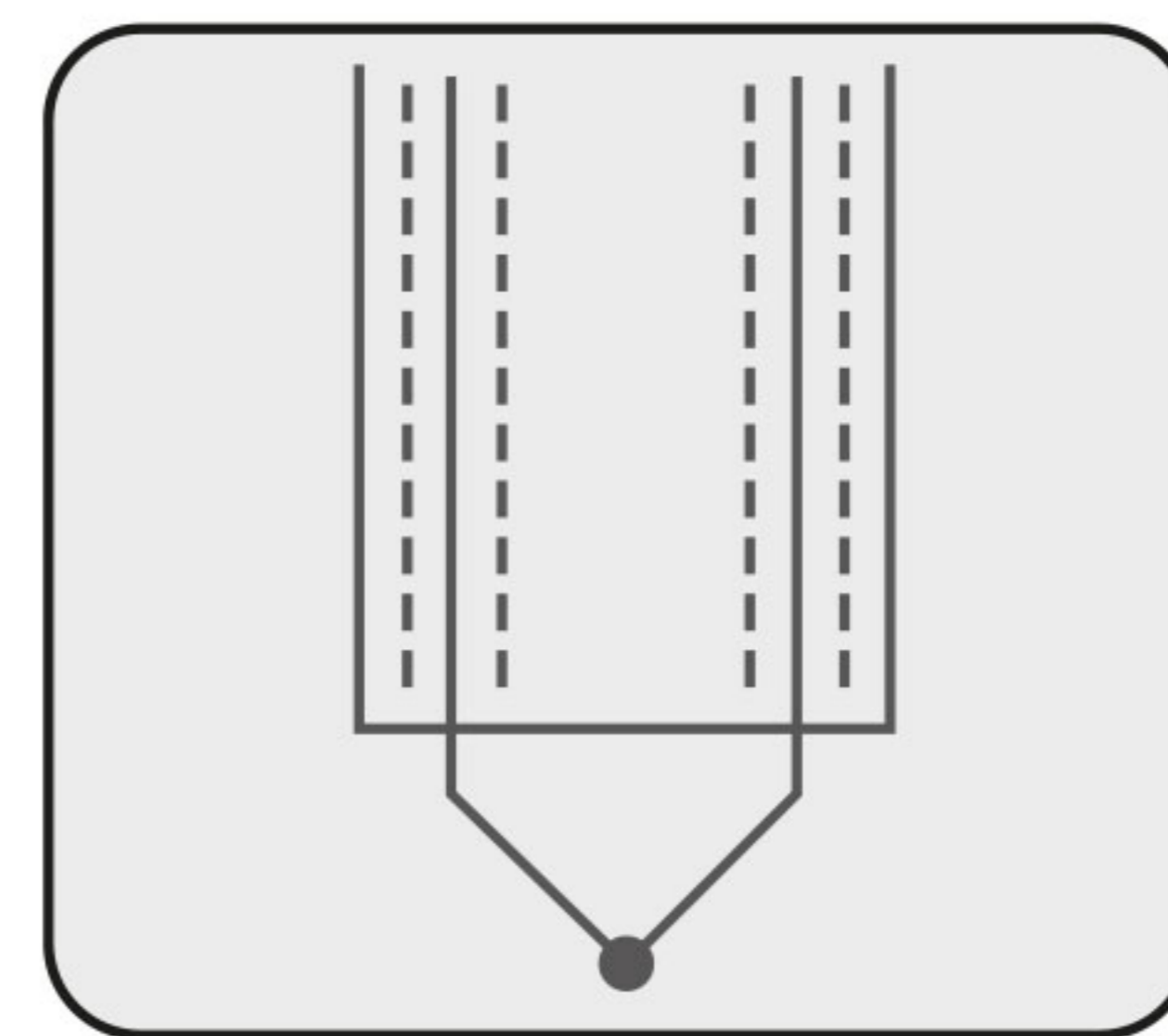
The (+) and (-) legs are isolated from each other in all thermocouples, whether or not they are placed in a protective tube after the tip is welded. Ceramic insulators are used for the insulation process. Insulators are selected according to temperature limits and ambient conditions. In general, special porcelain insulators called KER 610 in the DIN standard are widely used. It is used in pure alumina insulators known as KER 799 at temperatures above 1400-1500°C or under special ambient conditions. At temperatures below 1200°C, element wires such as Cu-Const, Fe-Const, NiCr-Ni are generally insulated with non-one-piece insulators, and PtRh-Pt thermocouples are insulated with one-piece insulators.



Double hole single insulator
Both legs isolated.



Single hole insulator,
Single leg is in insulated
ceramic sheath.



Solid single insulator for
fine-wire thermocouples
(PtRh-Pt)

ELEMENT WIRE ASSEMBLY

After the ends of the wires are welded and the insulator is passed, the protective sheath is mounted. Protective covers of various shapes, including grounded, ungrounded, open-ended type, are selected according to the situation of the application and the assembly process is carried out.

Grounded Assembly



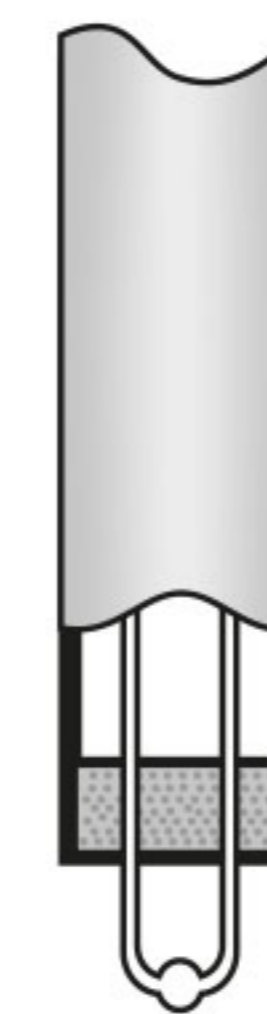
It is a suitable mounting type for taking precise measurements or sensing rapid temperature changes. They may not be preferred in applications where there may be electrical noise problems.

Ungrounded Assembly



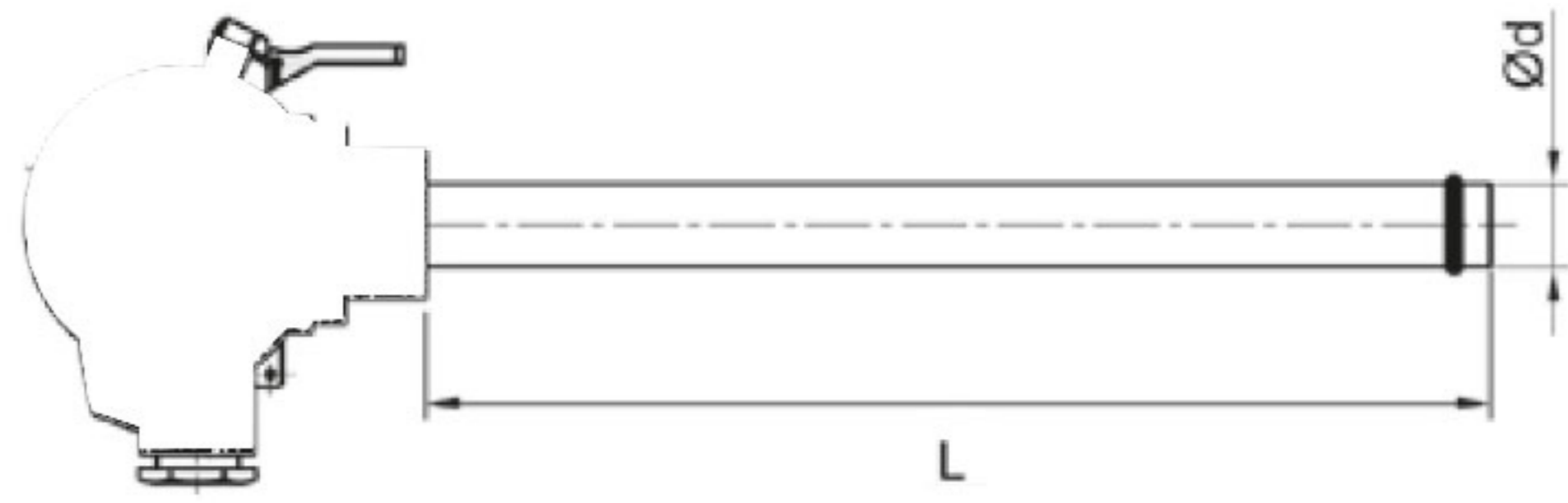
It is the most common mounting method chosen in thermocouples. There is not short circuit between the outer shield and the element wire.

Open-ends Assembly



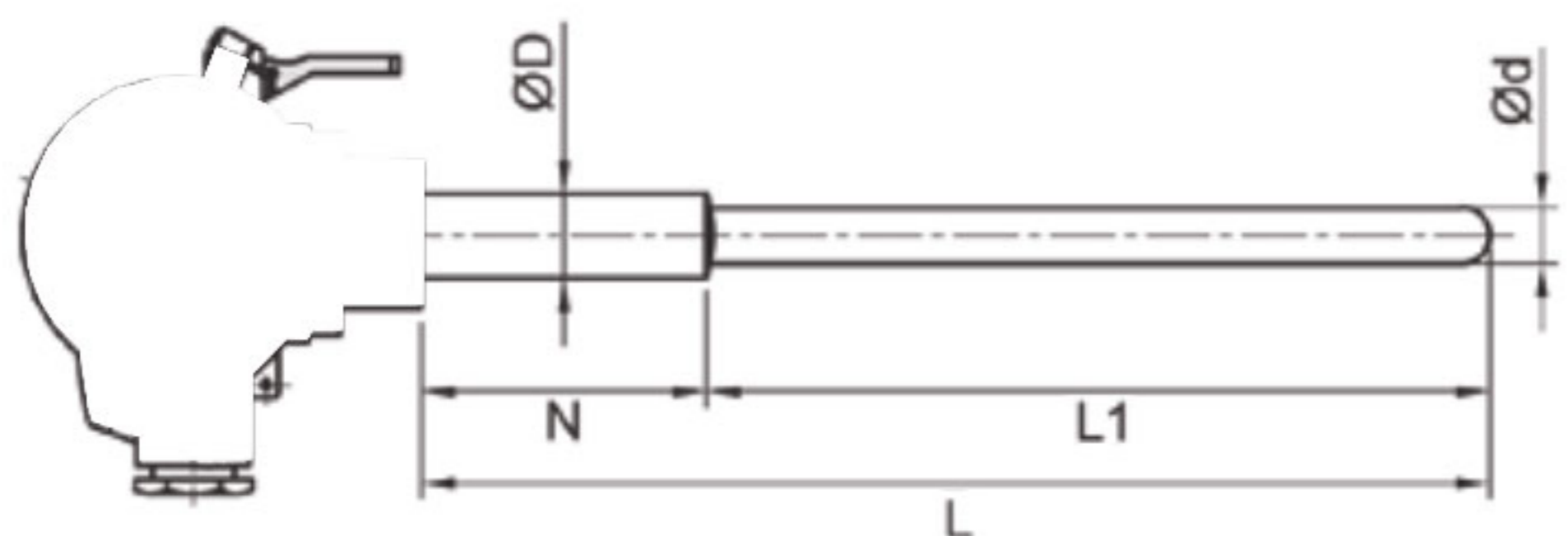
It can be selected in order to make more precise measurements in cases where there is no danger of abrasion and mechanical impact. The source end is open to the environment.

TC-10



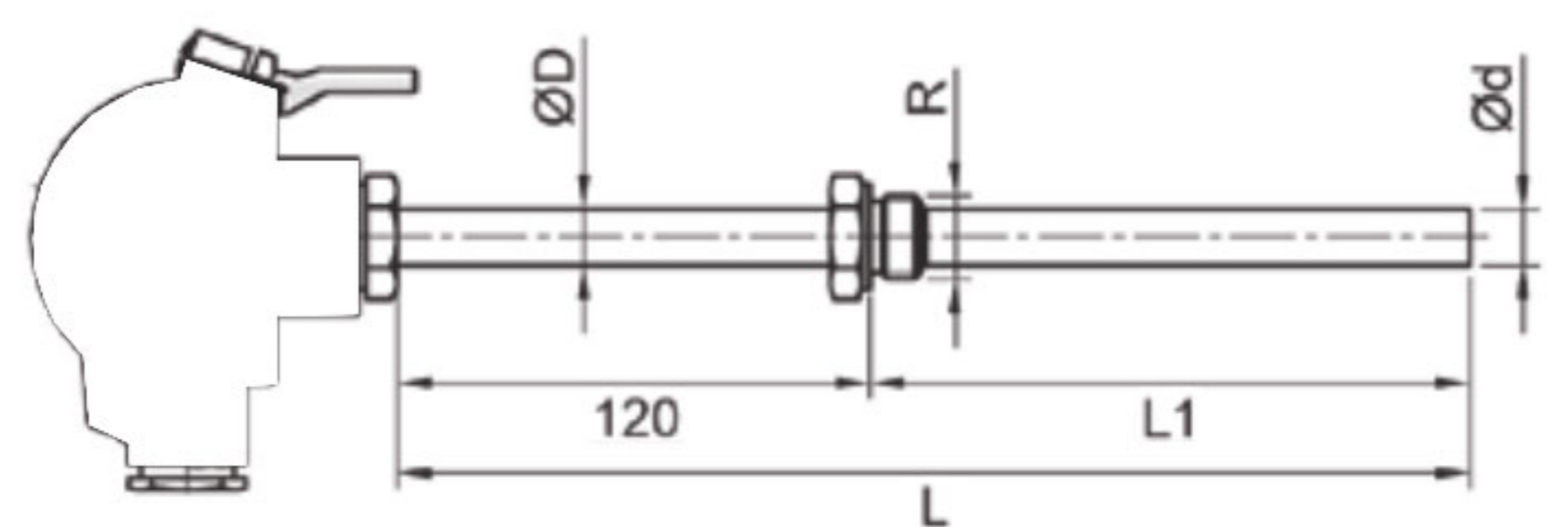
A, B or C type head can be given according to the diameters of the metal protective pipes. Standard types are unregistered. It can be ordered together with L1 and L dimensions, if a flange or a union under the head is desired. In stepped diameters, the small diameter is denoted by the letter d and the larger diameter by the letter D.

TC-20



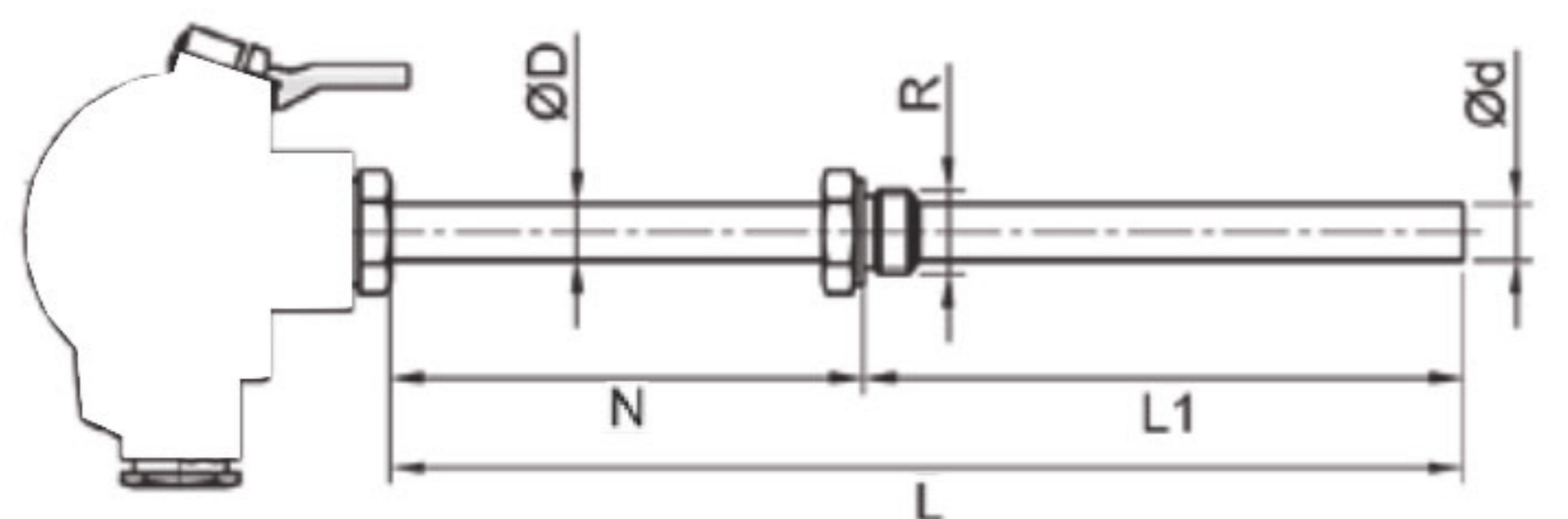
KER 530, KER 610, KER 799 ceramic protectors used at high temperatures are connected to the head with a metal holder pipe. It is mounted with the help of flange when necessary. L length starts just below the head as seen in the picture.

TC-30



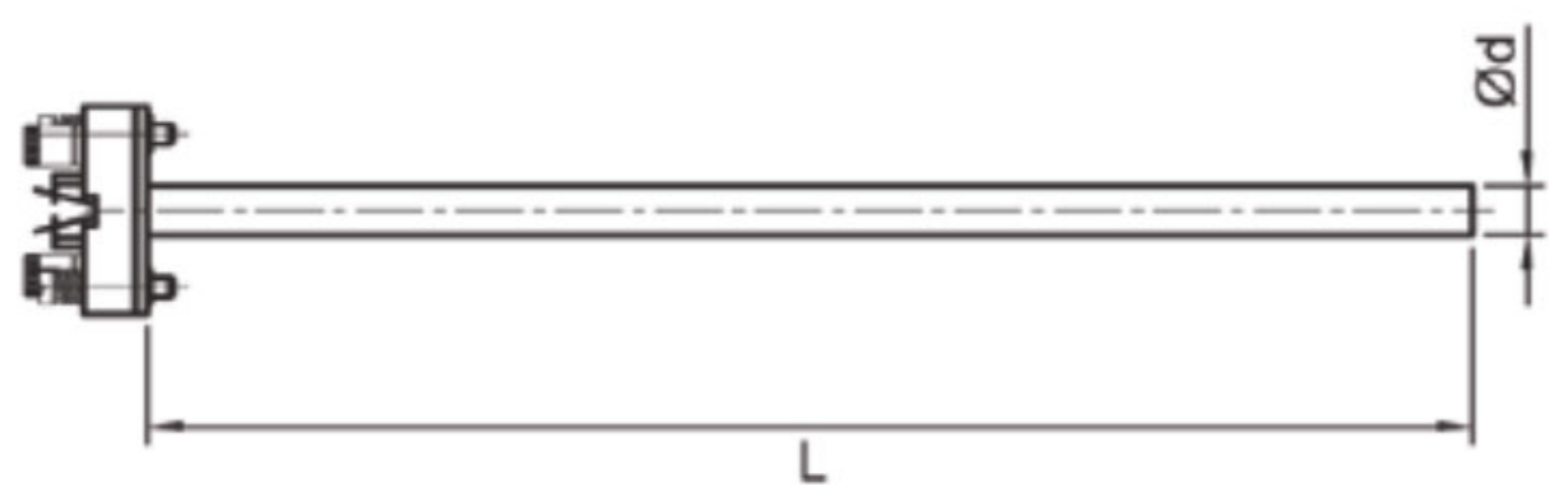
It is a standard inset, metal shielded, record connection assembly. The standard distance between the head and the record is 120 mm. It can be selected for applications where the head needs to stay away from the record port.

TC-40



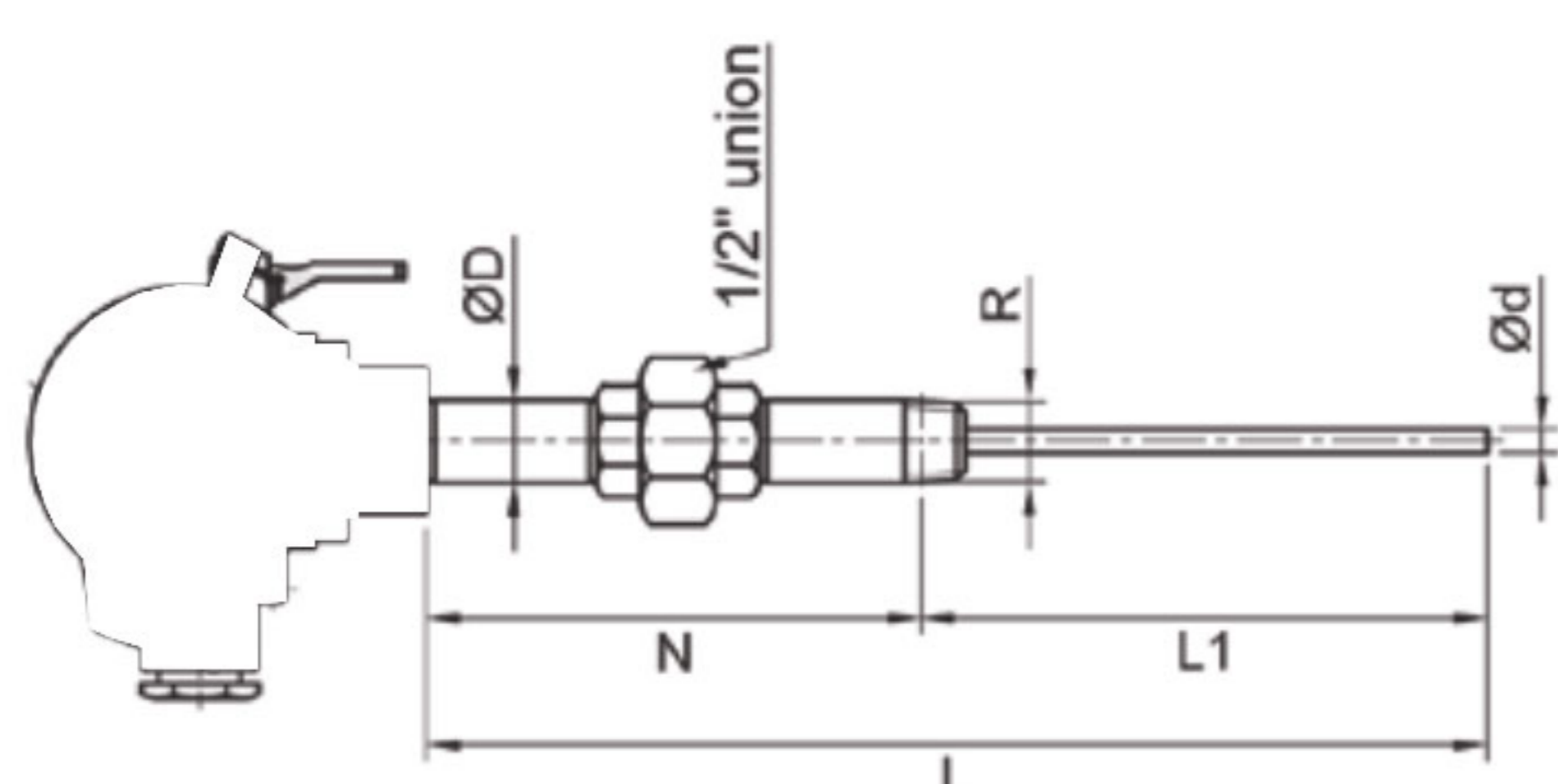
Unlike Tc03, the distance between the head and the record is arbitrarily determined. It is inset mounting. TC04 type is selected, the record is ordered at the desired distance from the head.

TC-50



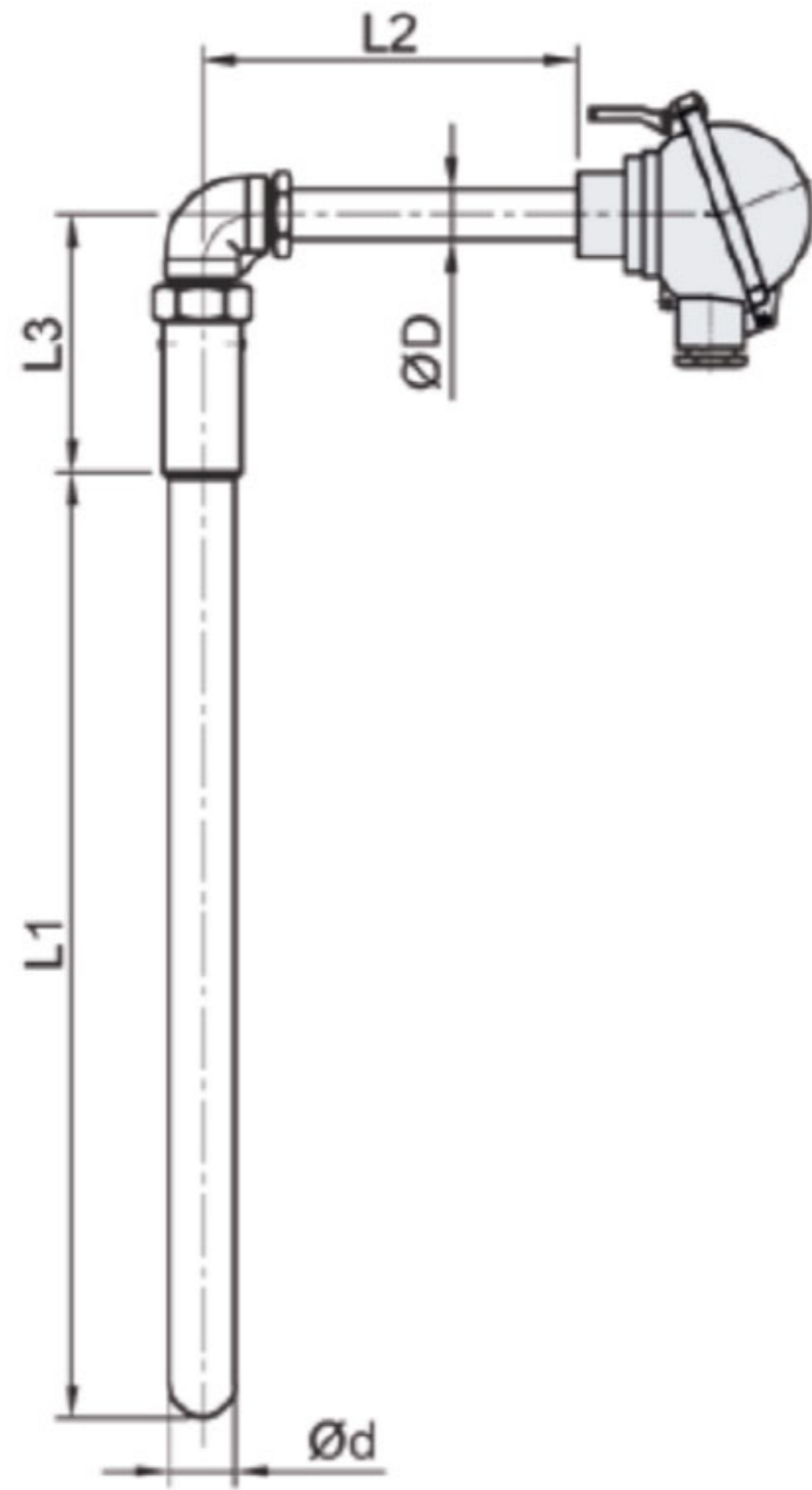
It is a standard type used in thermocouples with metal shielding tube, mounted inside the outer shield tube..

TC-300



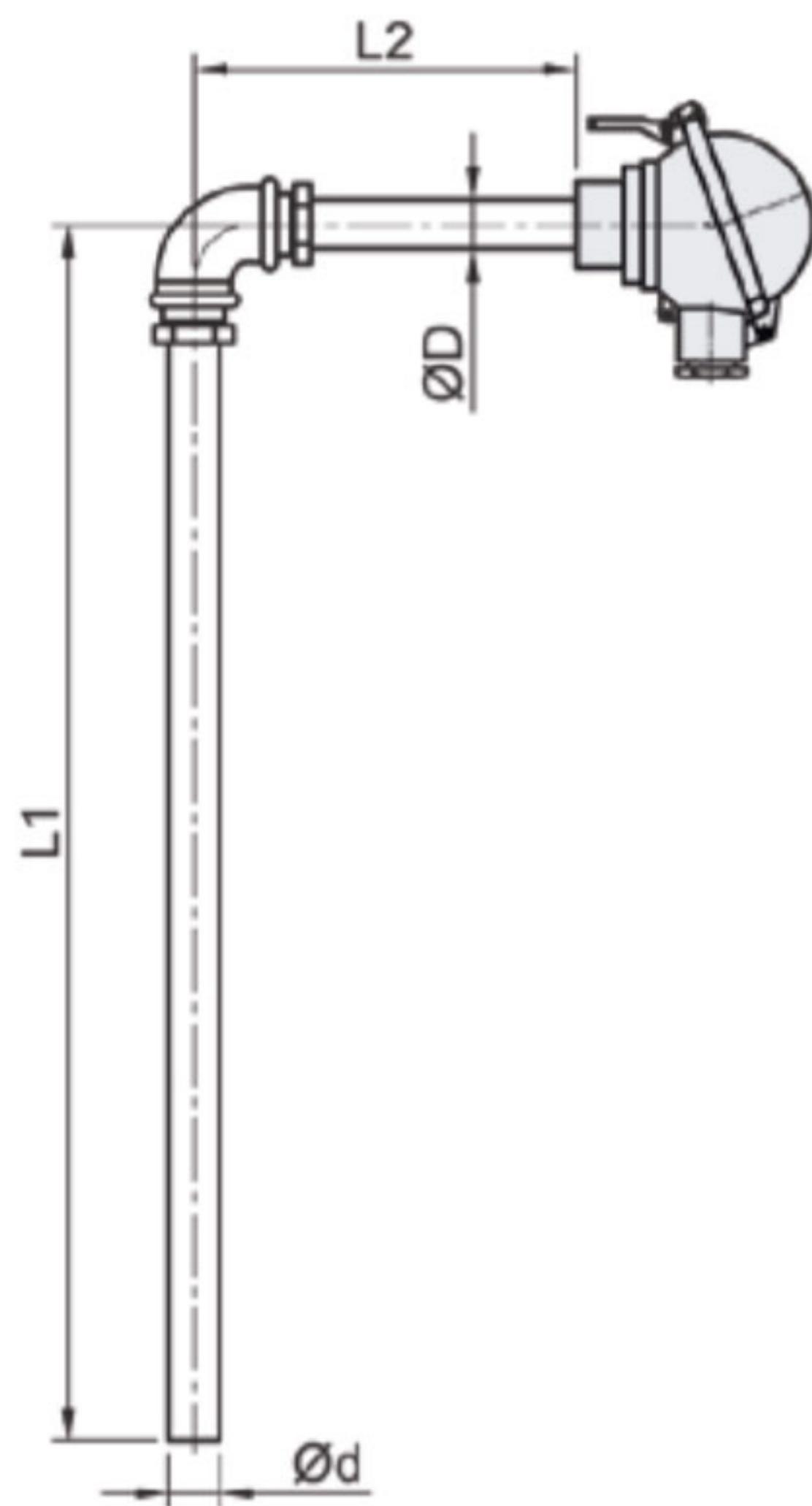
It is generally used in T/C's assemblies and connections to thermowell. It consists of a record and two Nipples. Head and well connection is made as ½ NPT.

TC-60



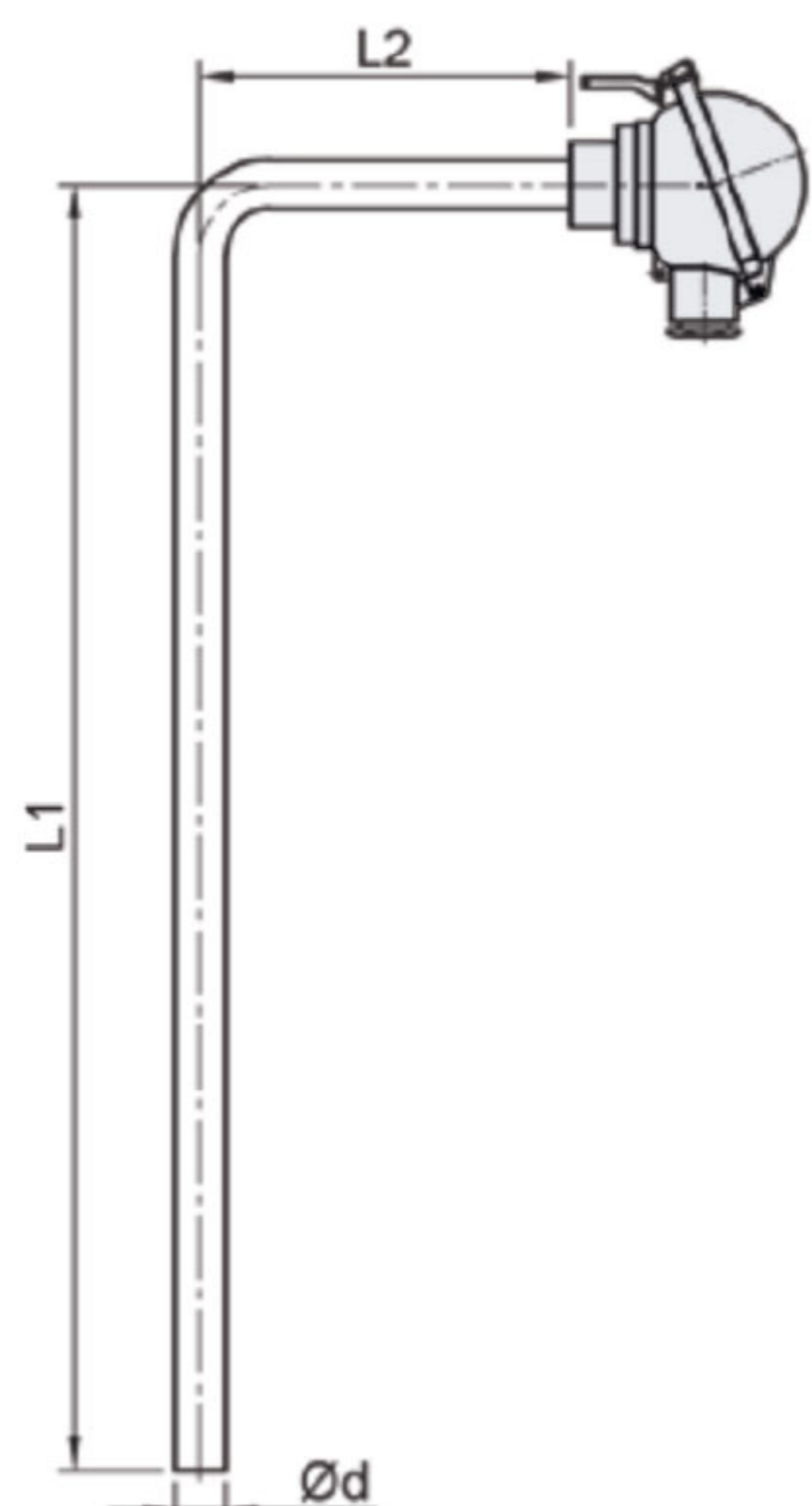
With this type of assembly, the thick and fleshy protective sheath is connected to the L2 neck with a solid connector. It is useful to keep this connection point above the surface of the metal curve. Otherwise, corrosive gases or high temperature may damage the thermocouple at this point.

TC-70



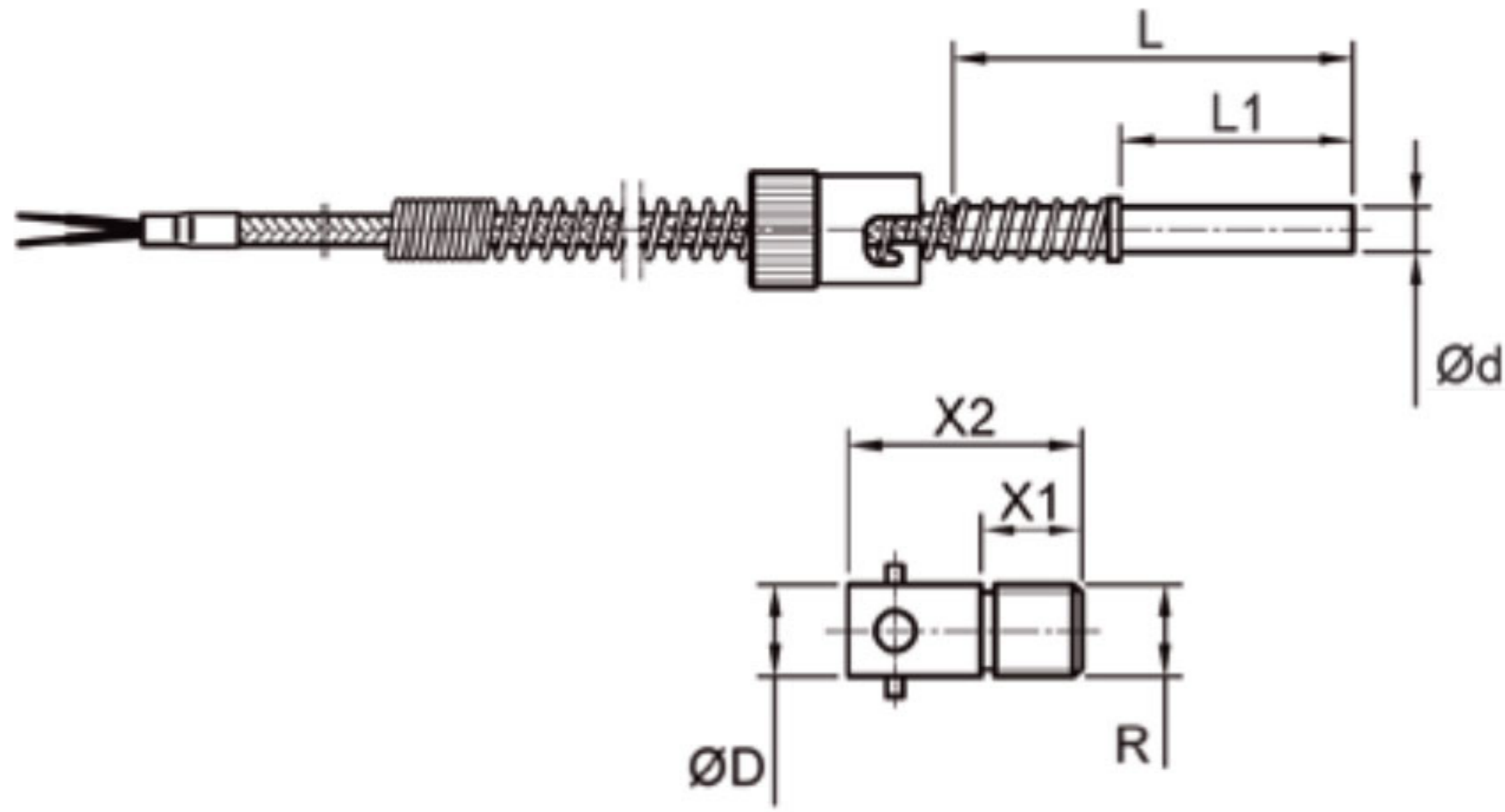
In order to extend the life of the thermocouple, especially in salt baths and metal melt applications, a second gas-tight protective ceramic sheath is added to the L1 immersion length. In this way, the gases leaking into the metal pipe are prevented from affecting and corroding the element wire.

TC-70-B



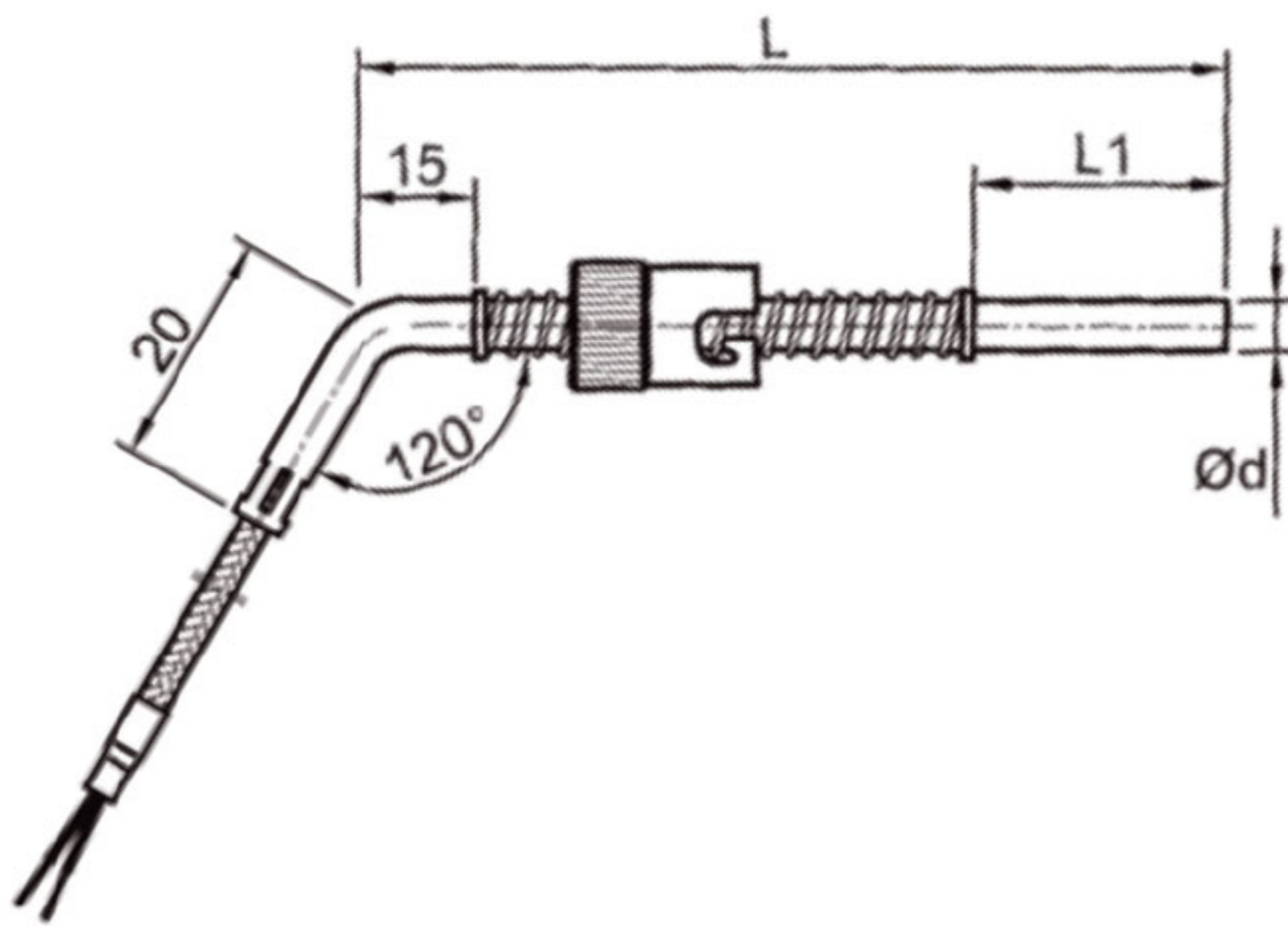
In TC07 type assembly, the plunge length given with size L1 can be machined from solid material. Since the wall thickness can be selected higher, its life will be longer

BT-10



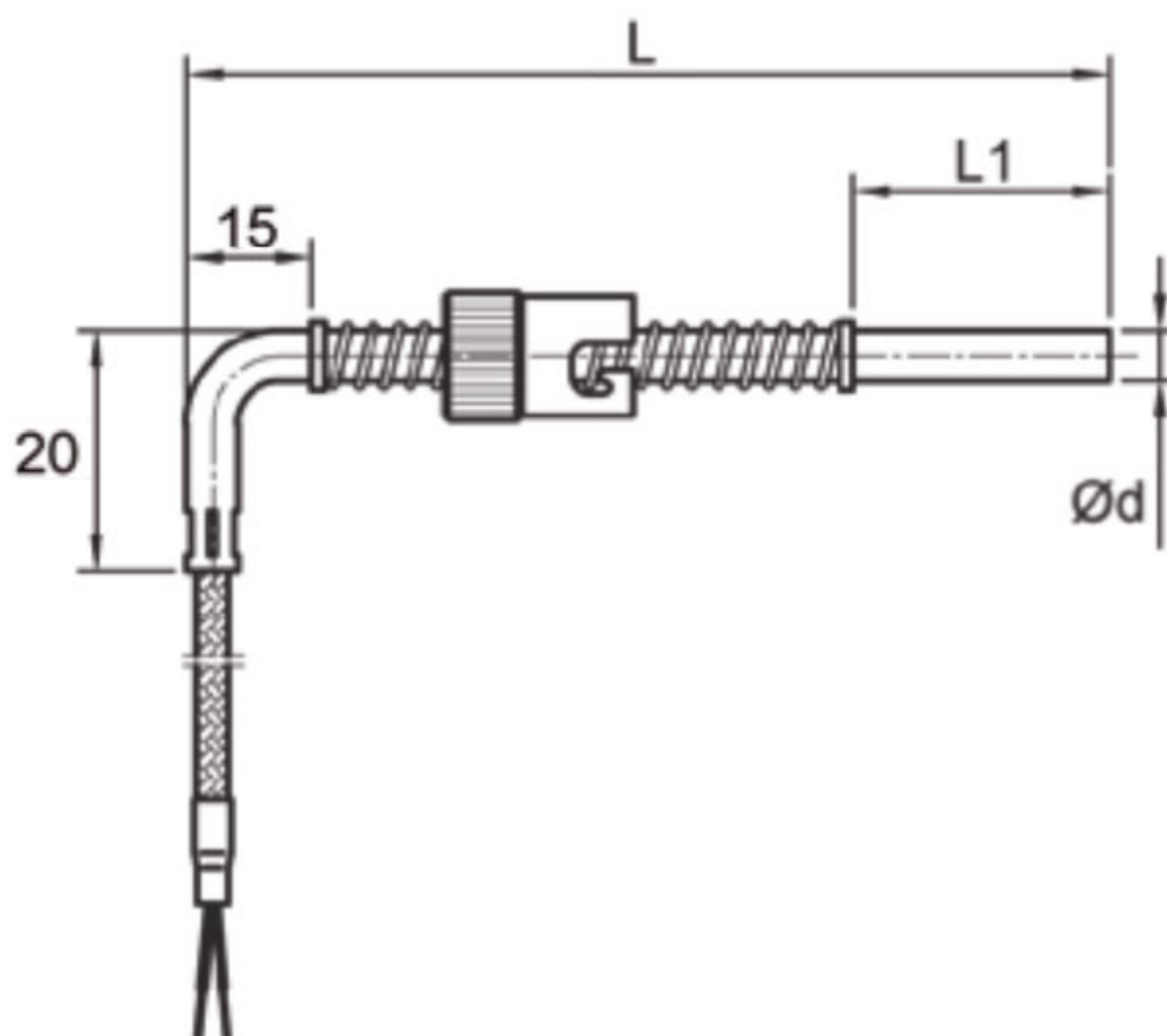
Standard type: L length 30 mm, diameter 6 mm. The end part is fixed with the help of a spring compressed record. The cable should not be overloaded. Compression union is standard female M12x1.5. Different caps and lengths can be produced by order. Standard types are grounded.

BT-20



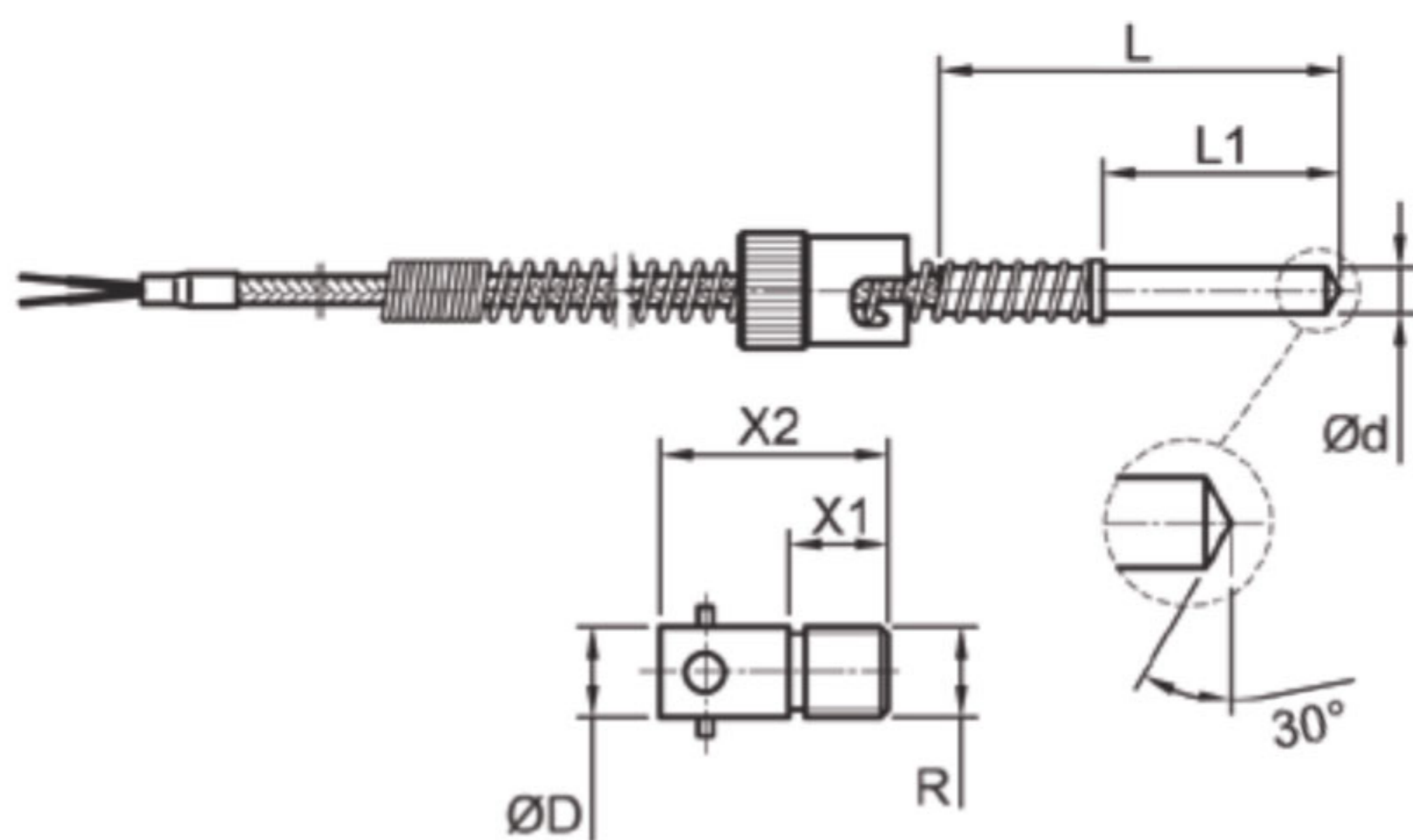
It is manufactured with an angle of 120° . In special cases, this type of angled bayonet is used. Due to its miniature nature, the bending element should not be loaded. Standard types are grounded.

BT-30

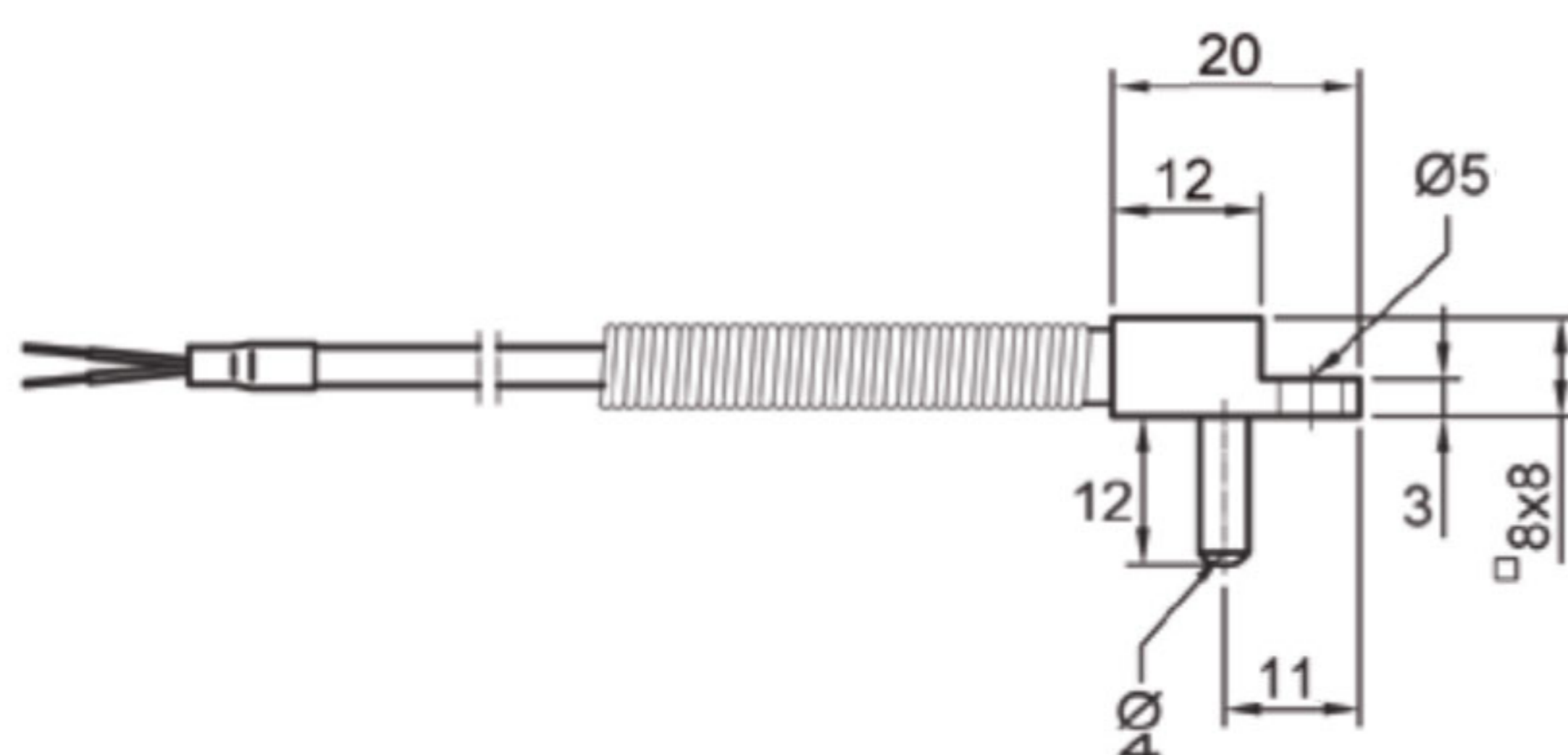


It is manufactured as 90° angled, vertical mounting type, provided that all features of BT01 type are the same. Standard types are grounded.

BT-40

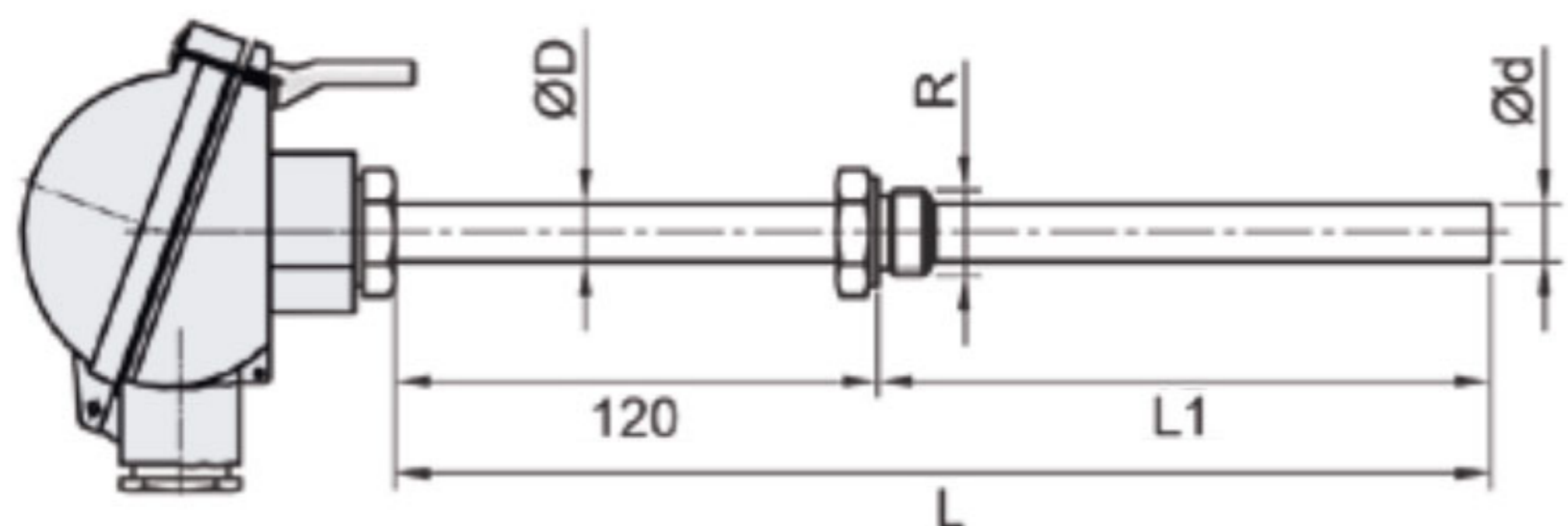


BT-50



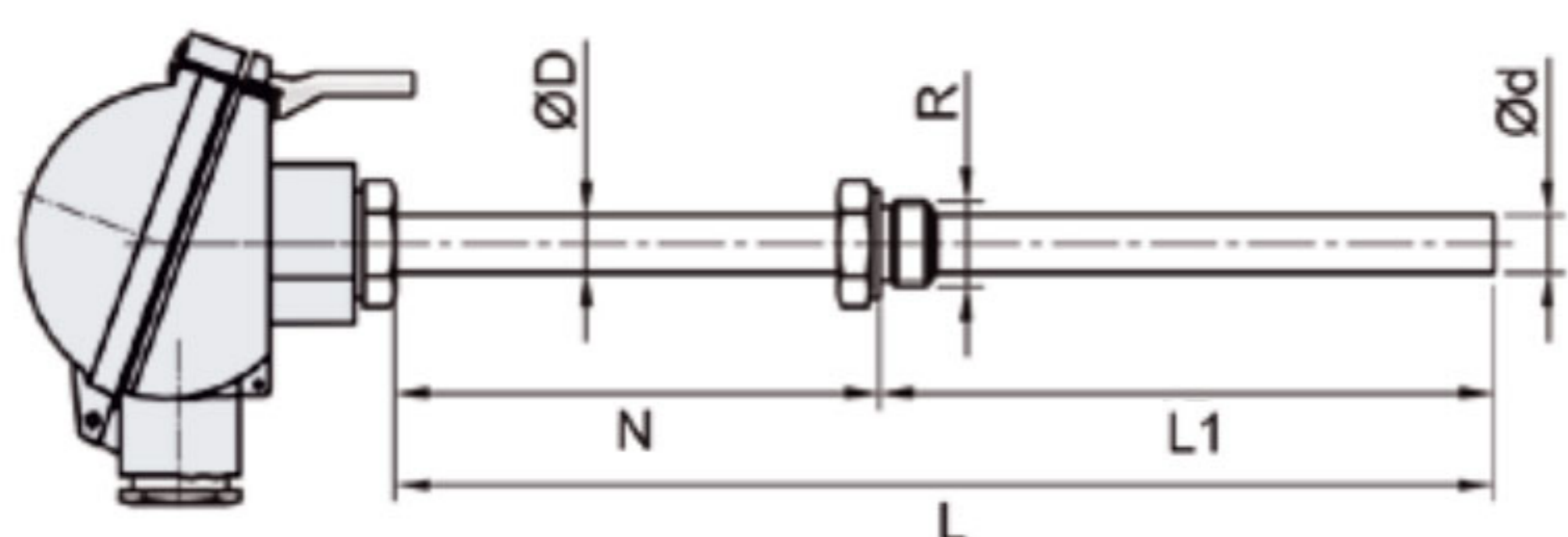
Thermocouple is fixed by screw. Cable length and type must be specified in the order. Standard types are grounded.

TC-30



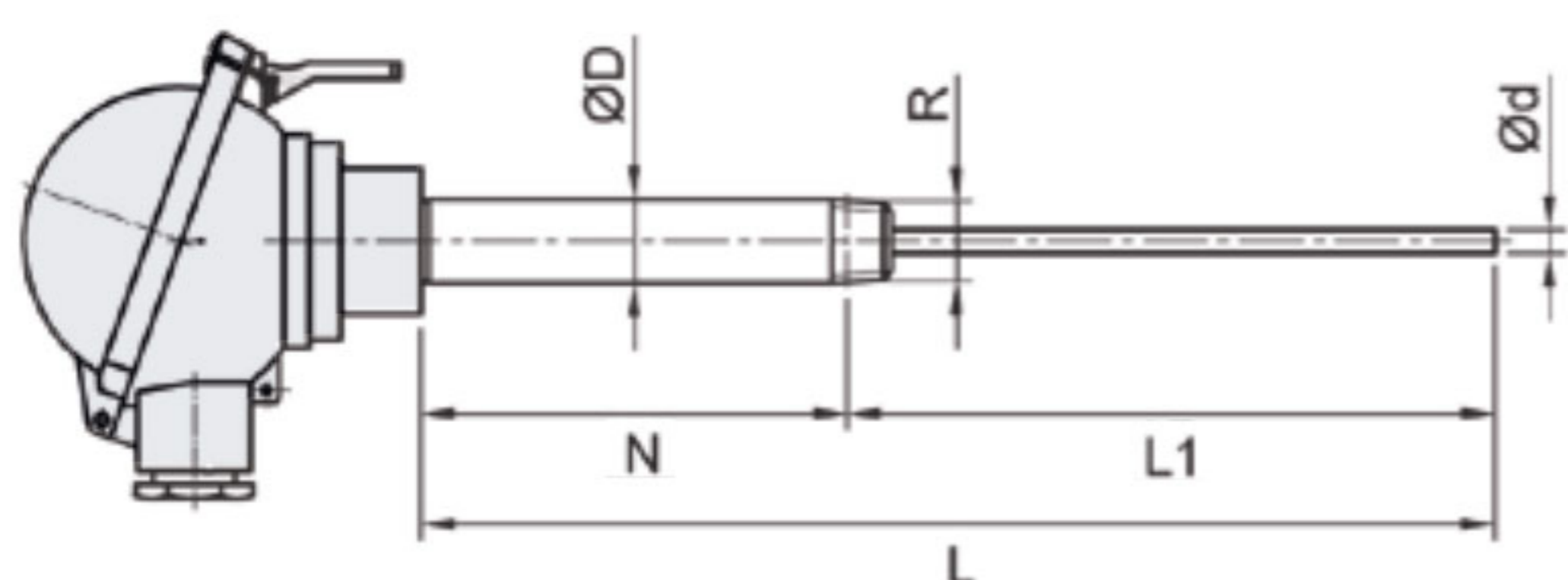
Standard inset type, metal shielding, mounting with union connection. Standard 120 mm between head and record. Suitable for applications where the head must stay away from the record connection.

TC-40

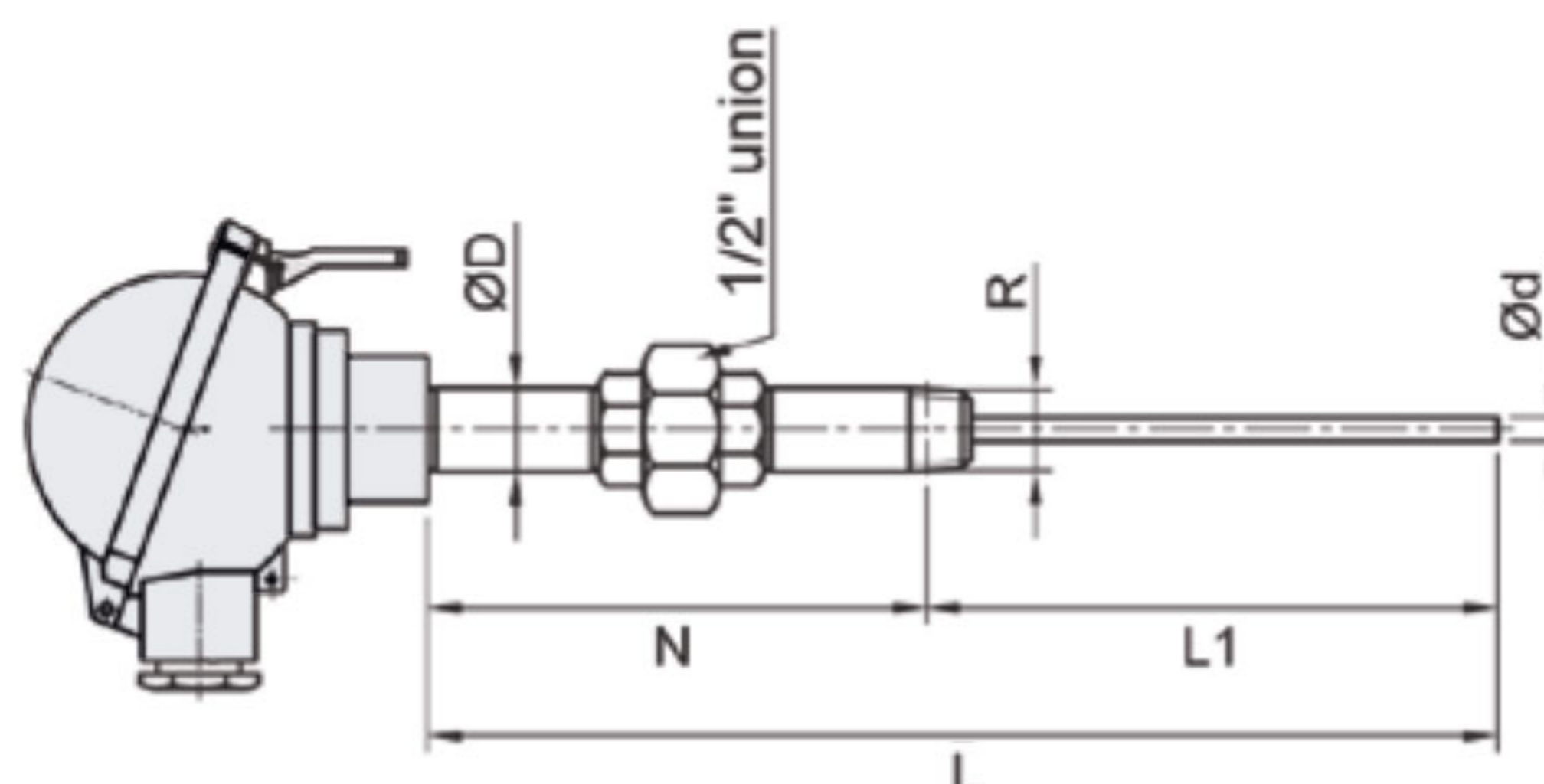


The distance between the head and the record can be adjusted. It is a built-in assembly. The record is conveniently set on the L size.

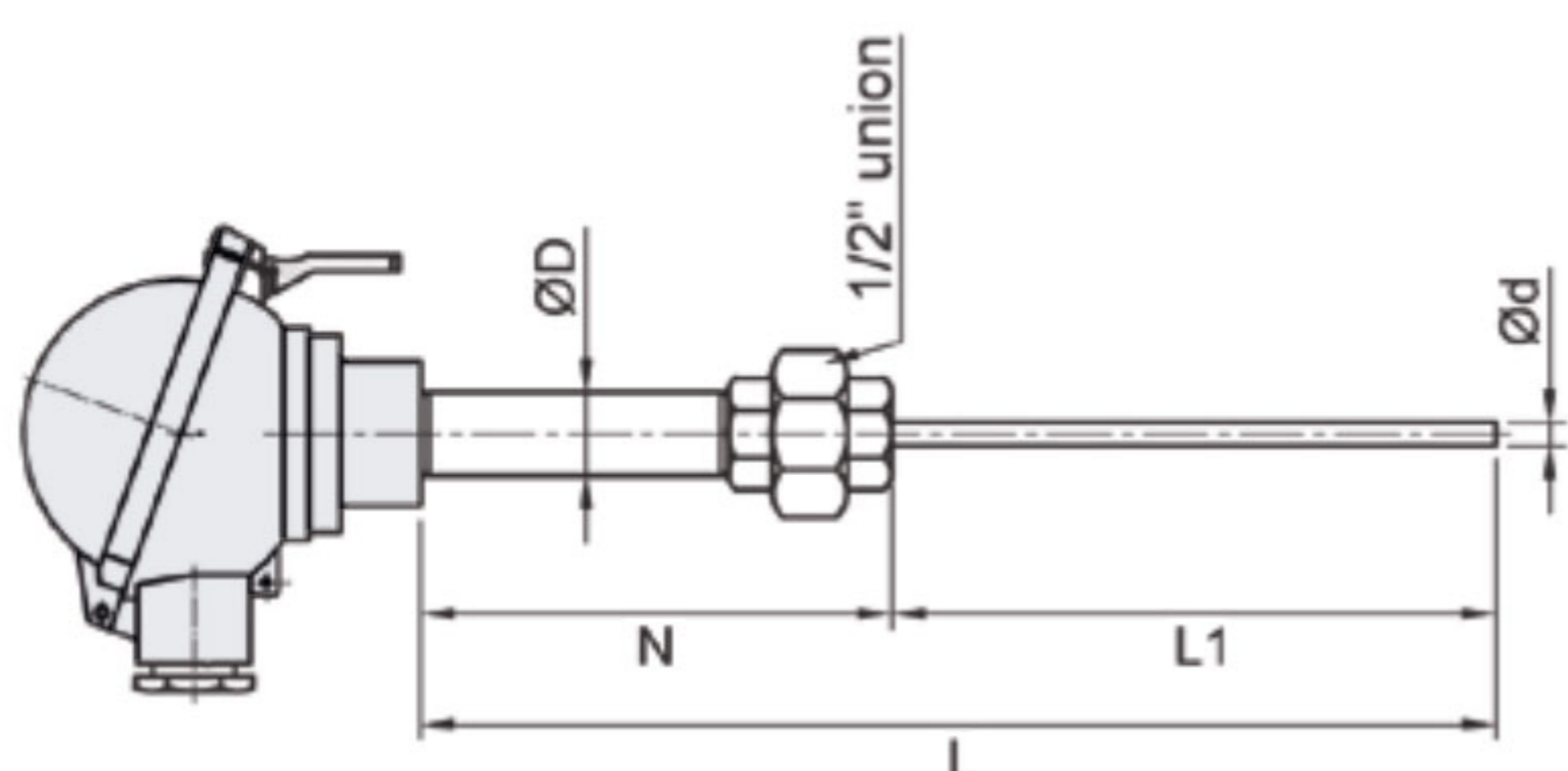
TC-300



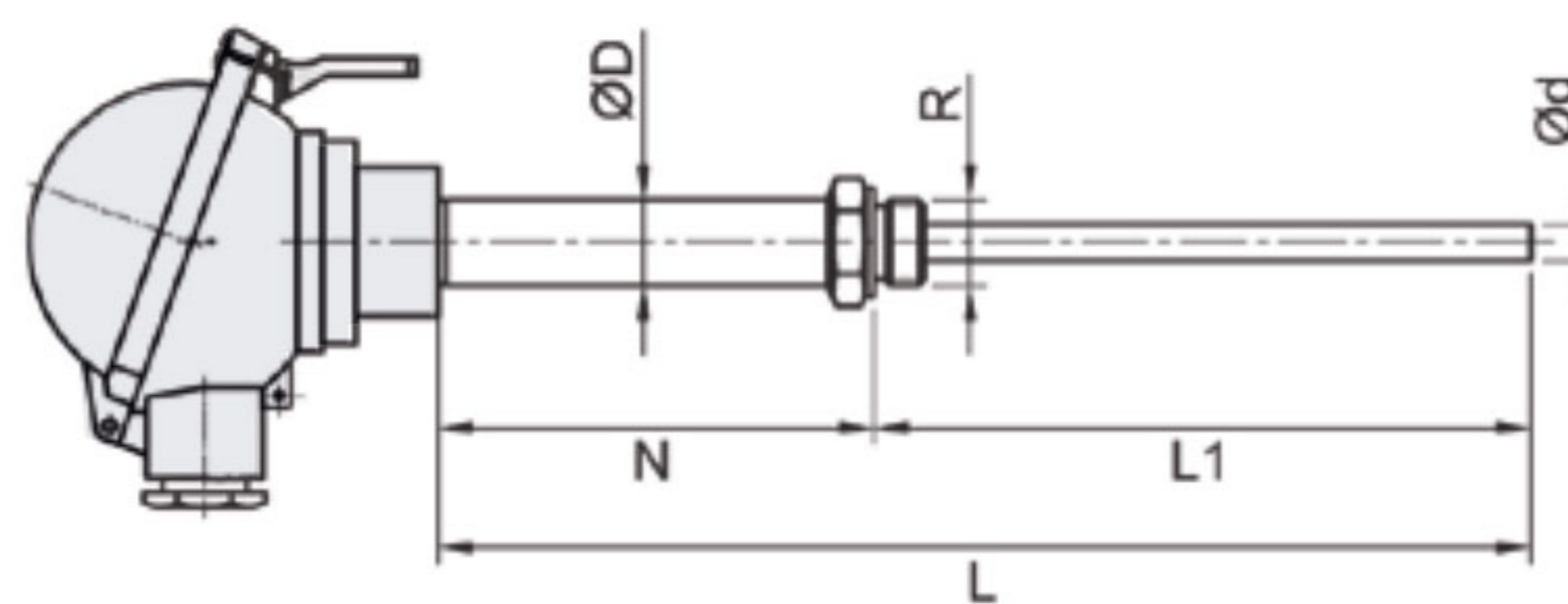
TC-300-N Nipple



TC-300-NUN Nipple-Record-Nipple



TC-300-NU Nipple-Record



TC-300-R Straight-Record

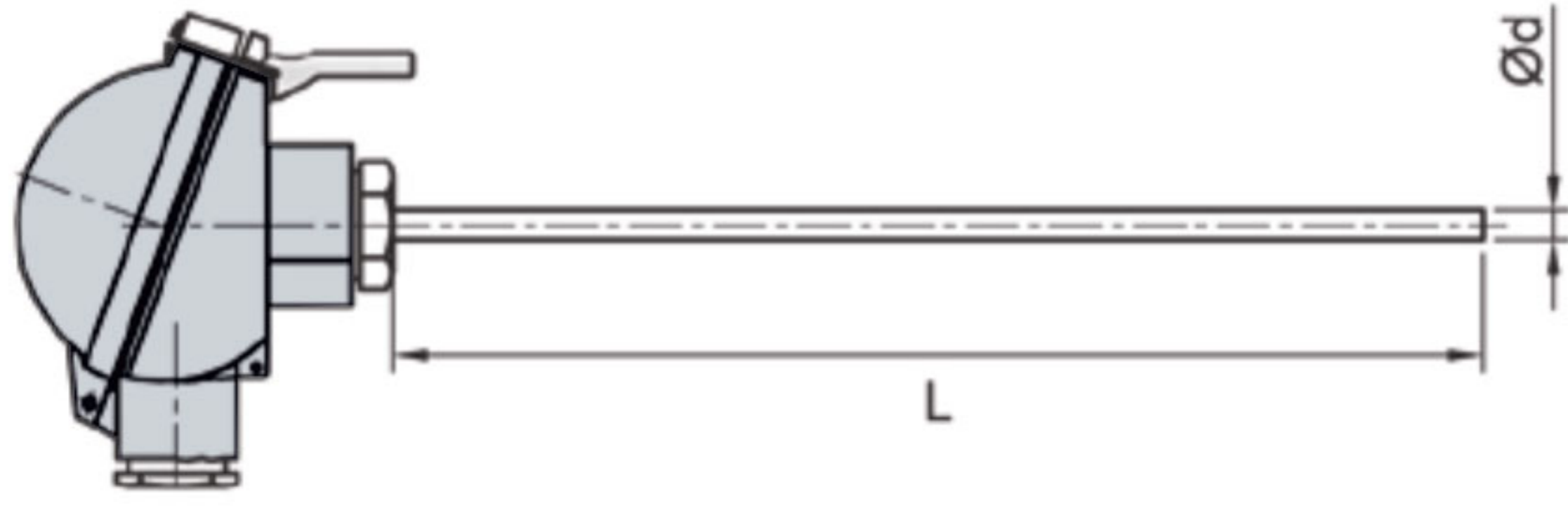
In general, one of the Nipple (N), Nipple-Record (NU), Nipple-Record-Nipple (NUN) connections can be applied in thermowell assemblies of T/Cs. Head and well connection is made with ½ NPT.

TC-50



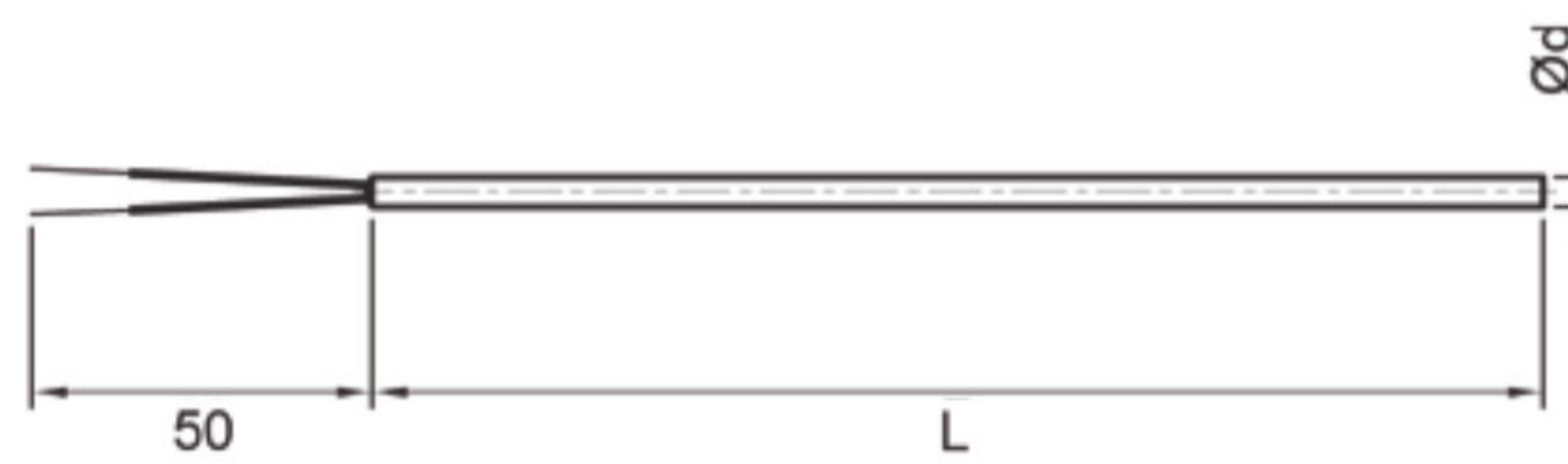
Standard type installed inside the outer protective tube, used in thermocouples with metal shielding tube.

MI-10



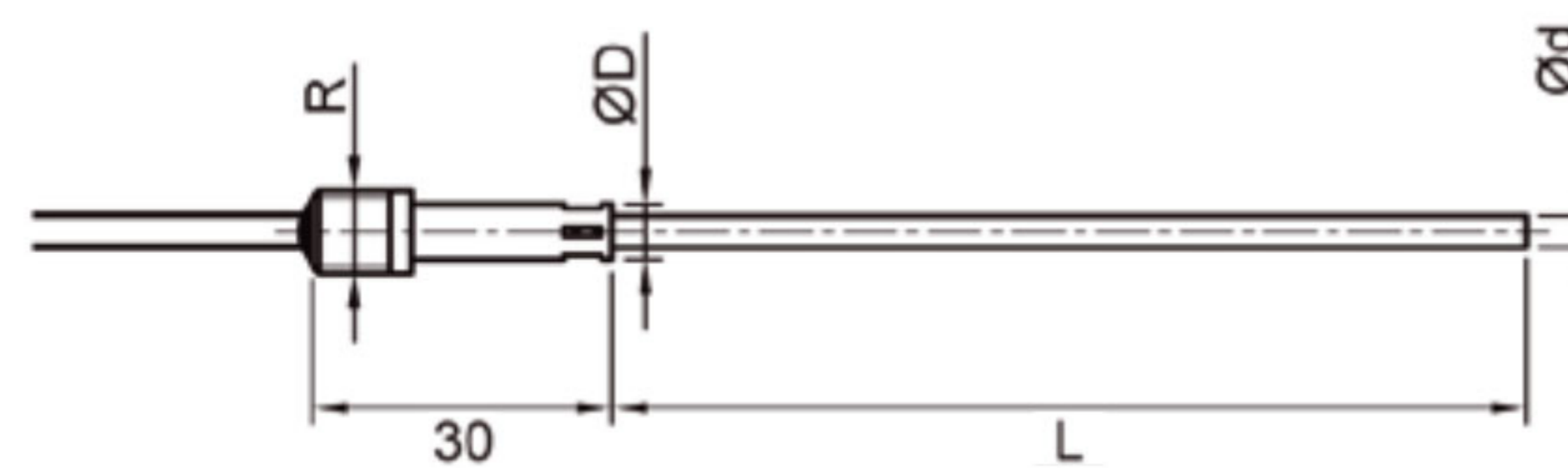
B type is produced with small head. It is a standard type without record. When a record is requested, the record standard must be specified.

MI-20



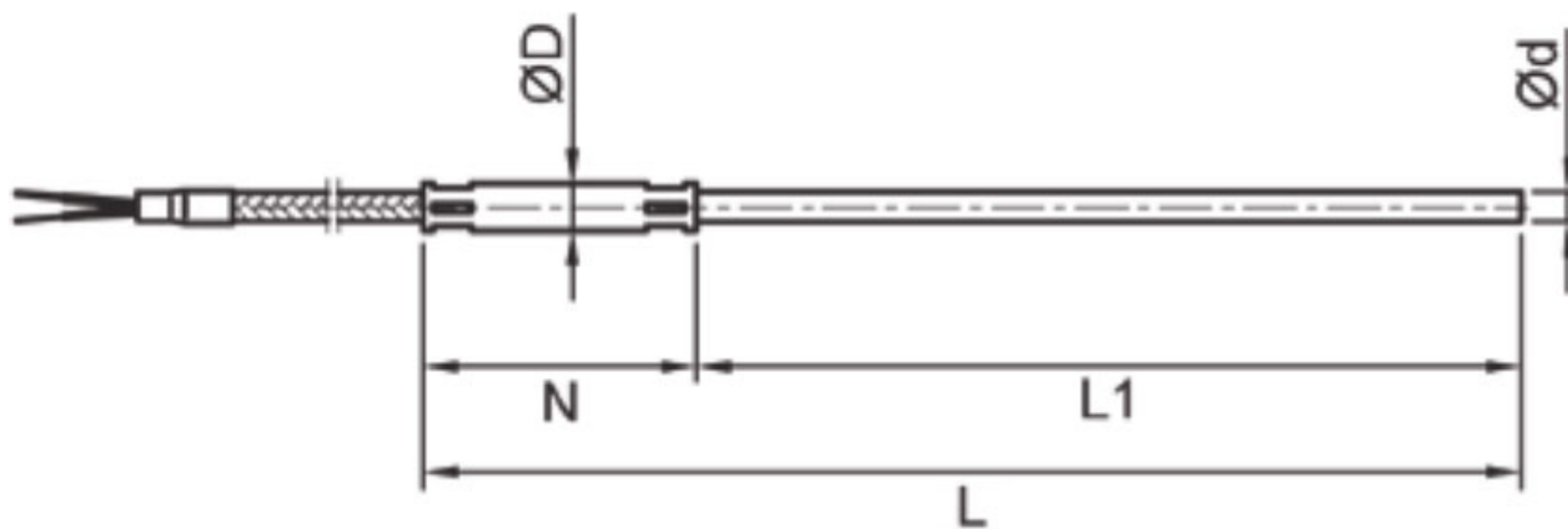
It is a simple type. It can be used for different purposes. L length is cut, the end is welded, the other end is left open as (+)(-).

MI-30



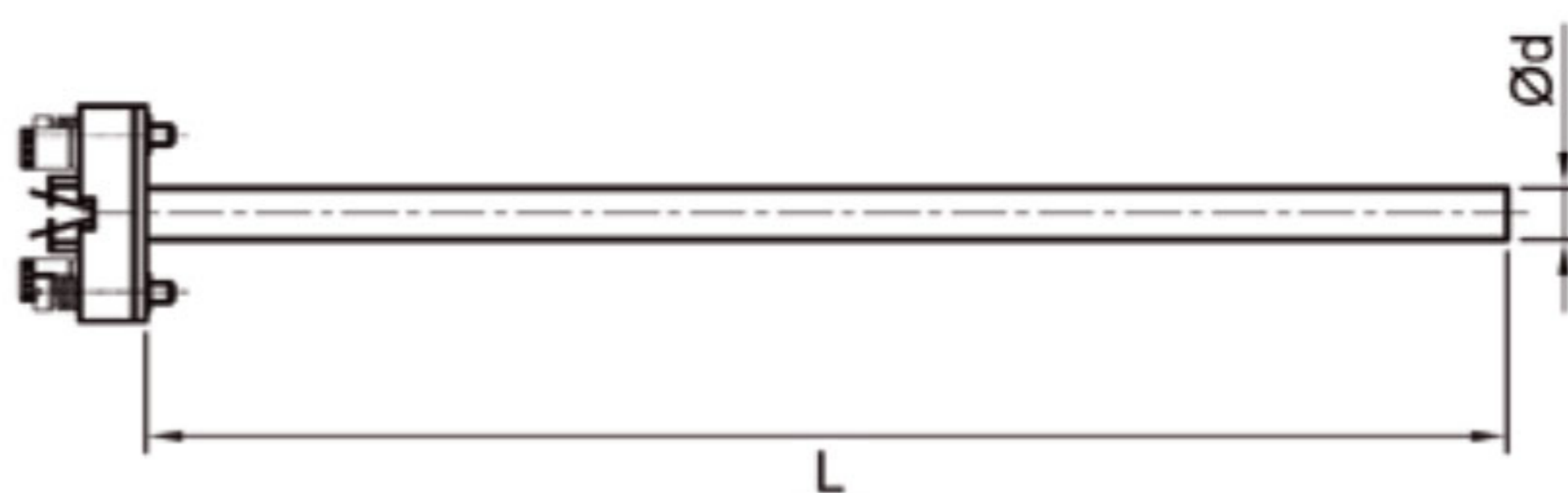
One end is welded and the other end is gradually terminated with an M10 x 1 threaded piece.

MI-40



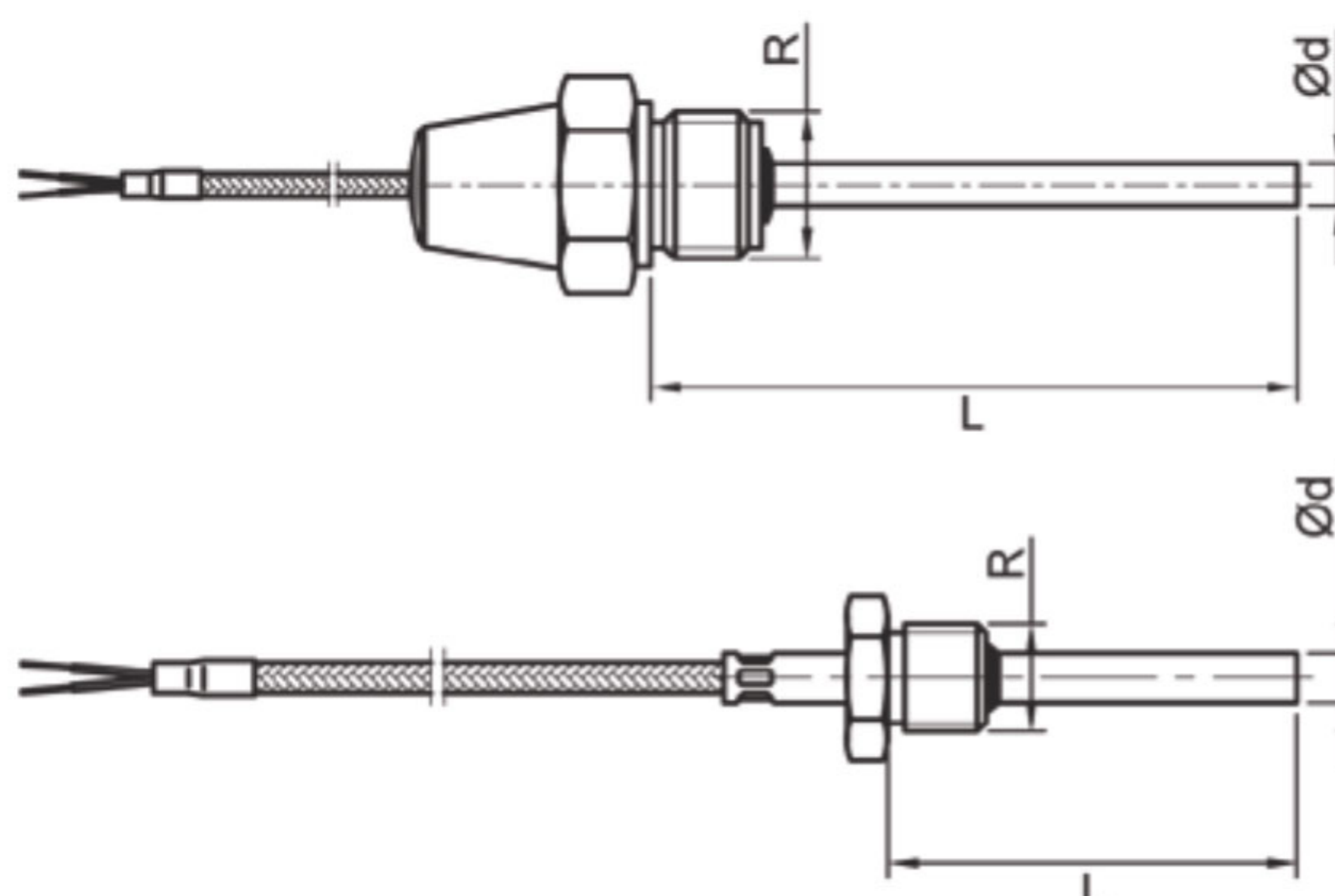
Element wire ends are reinforced, insulated and fixed in the ring, and the ends are free.

MI-50



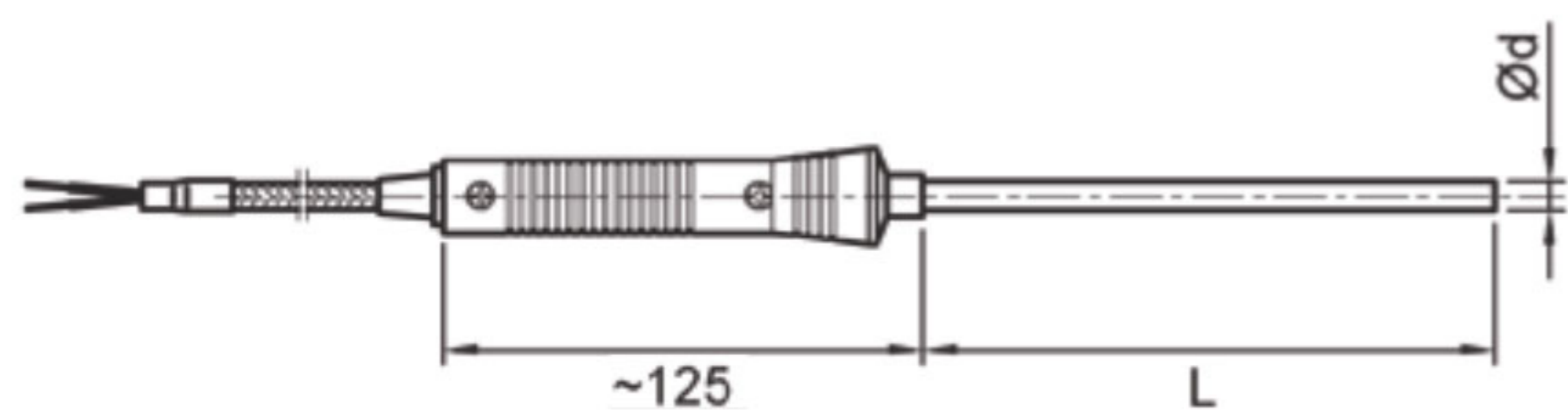
Mineral insulated inset.

MI-60



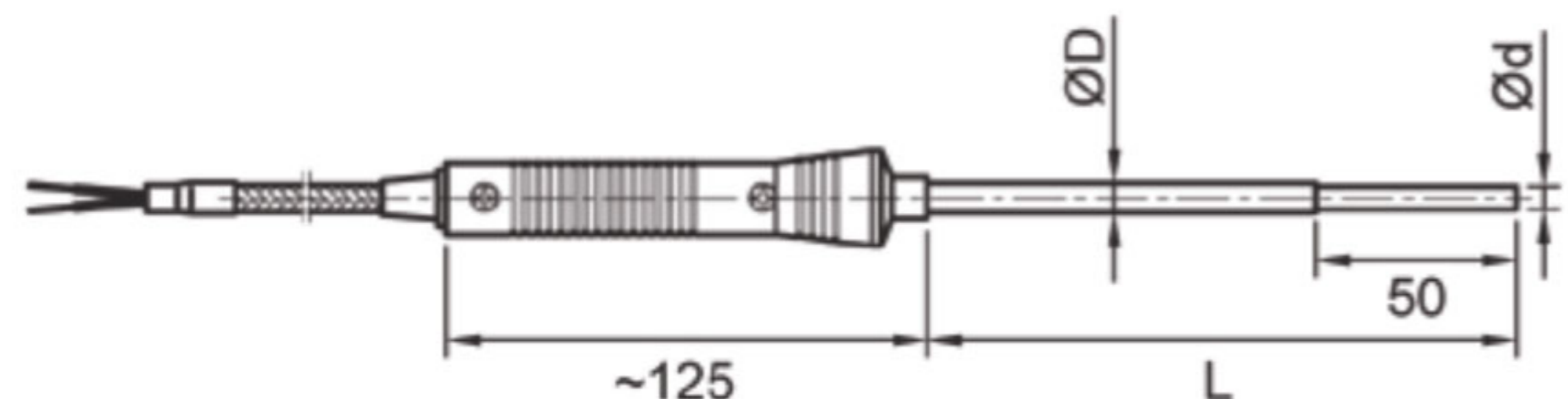
It is a simple type mineral insulated thermocouple mounted with a fixed cable with a connector. Since it is a fixed cable, the cable length must be specified in the order. Recorded head temperature should not exceed 100°C. Standard record is G½ finger.

MI-70



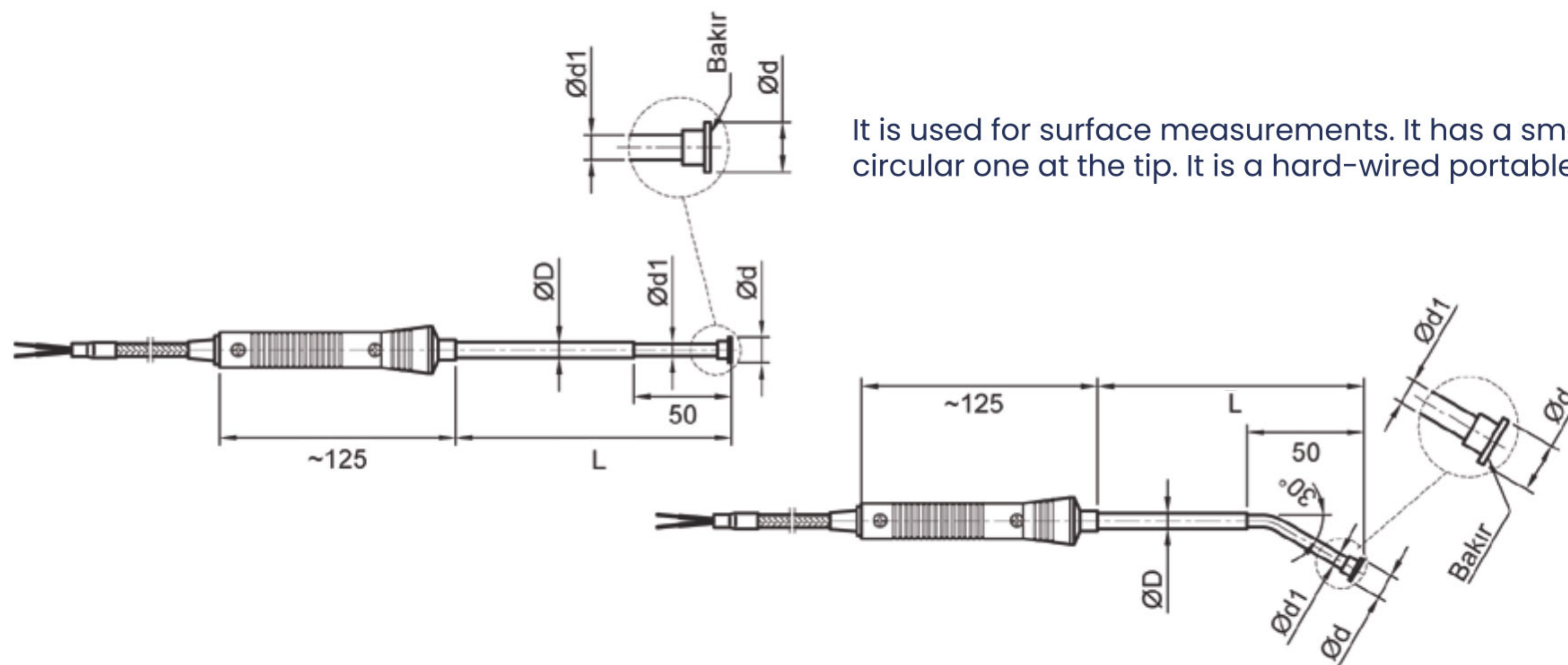
It is a hand-held type for portable purposes, it has a wide variety of uses. T/C length of MI07 type mineral insulated thermocouple mounted with hard cable can be in desired length.

MI-70-1



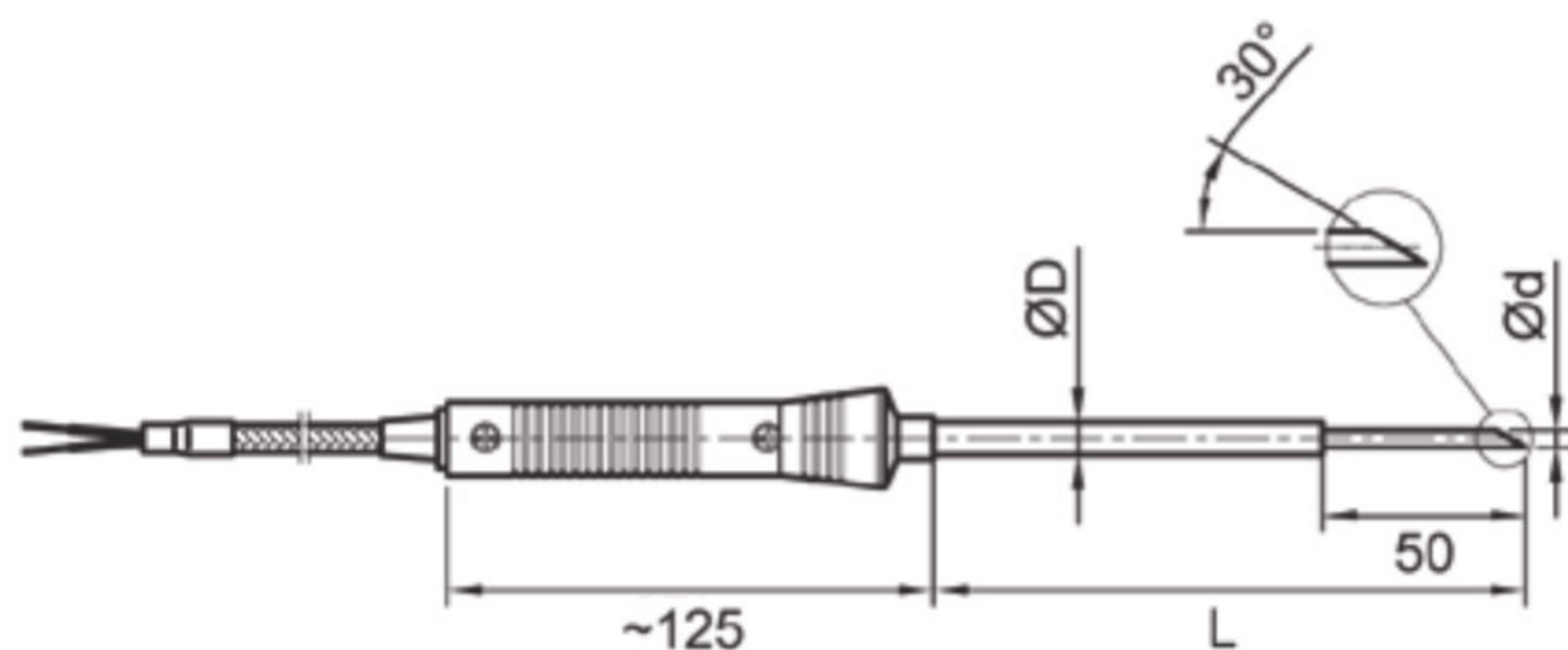
In order to make more precise measurements, the level is reduced at the tip. Temperature changes can be detected more quickly and precisely. Portable type, hand held.

MI-70-Y / MI-70-YA



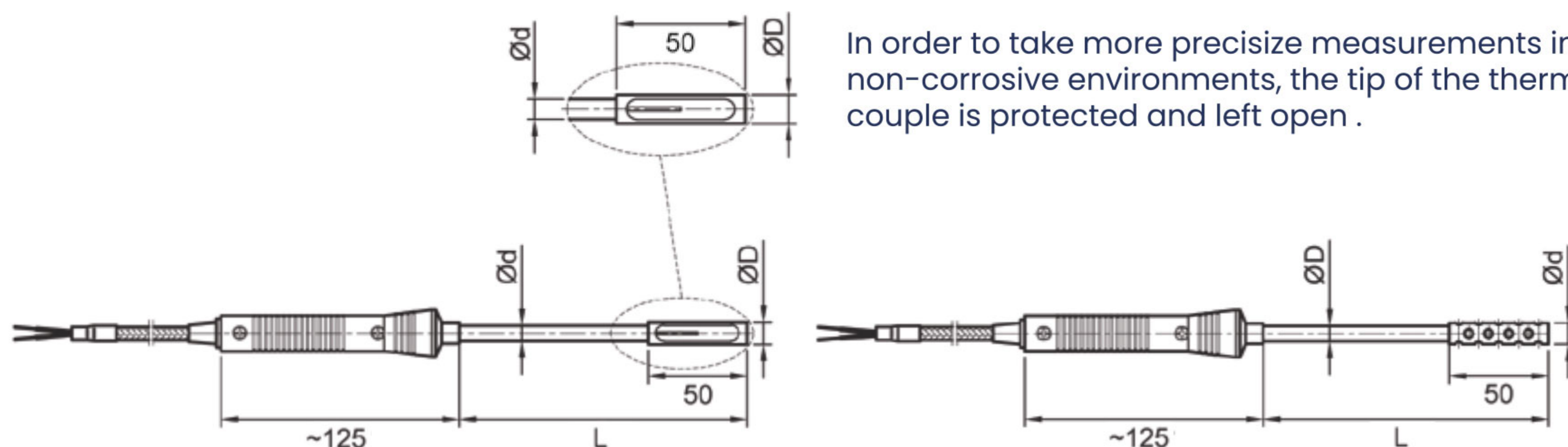
It is used for surface measurements. It has a small circular one at the tip. It is a hard-wired portable type.

MI-70-I



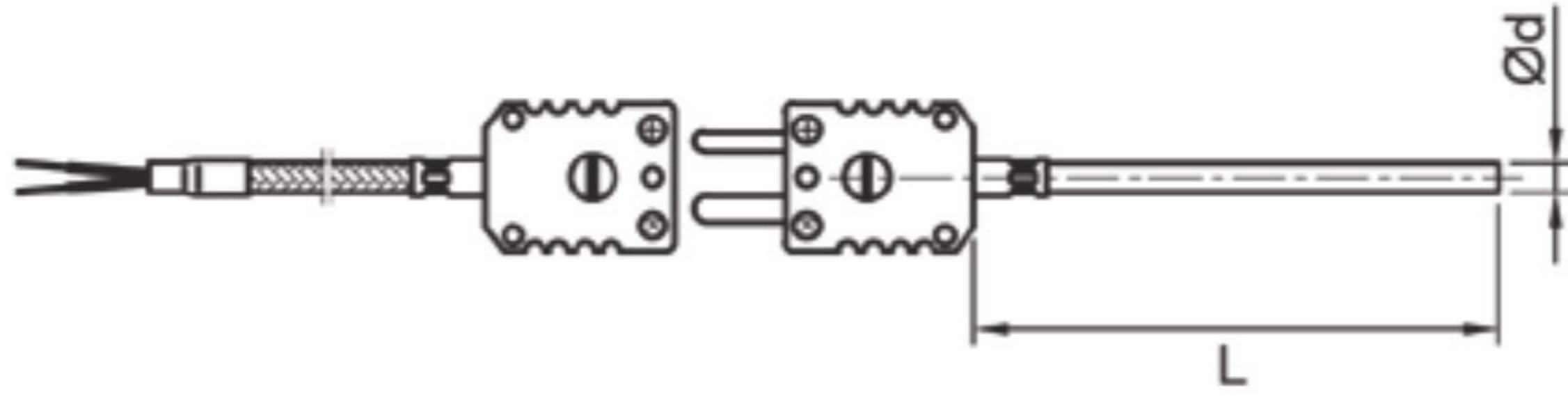
Thanks to the needle tip, soft objects can be entered and pierced. The tip is gradually lowered.

MI-70-H / MI-70-HD



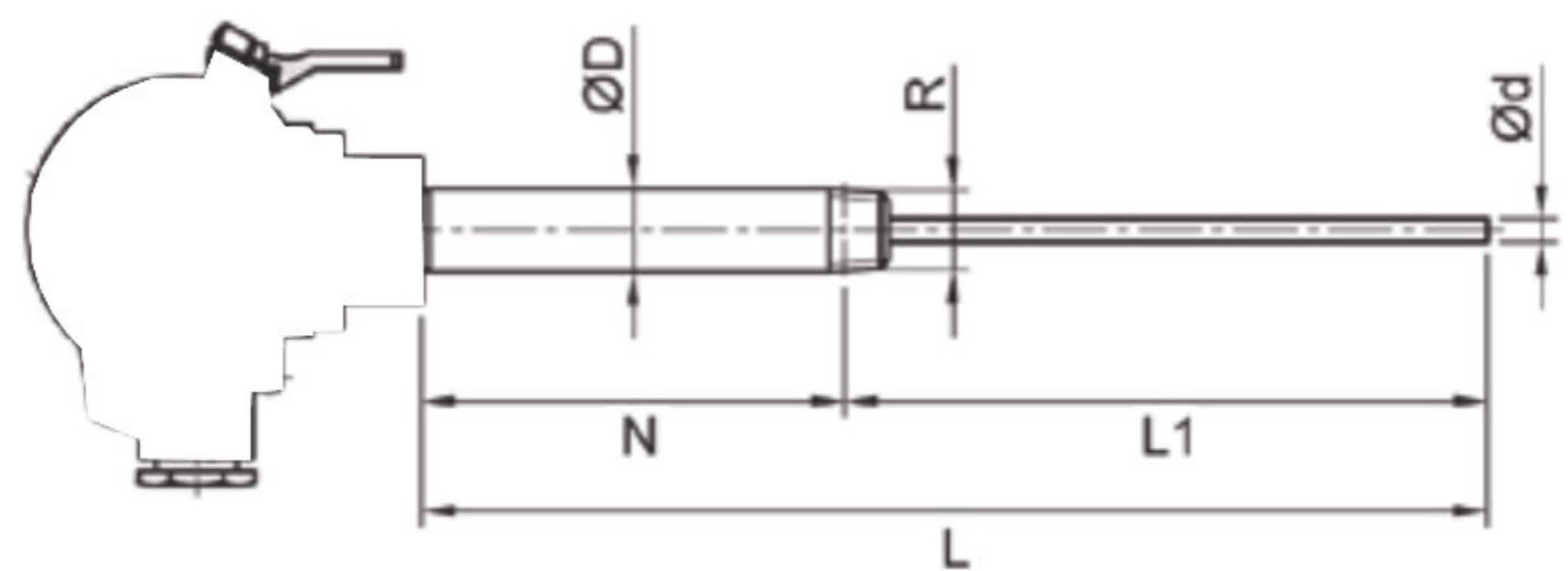
In order to take more precise measurements in non-corrosive environments, the tip of the thermocouple is protected and left open.

MI-80



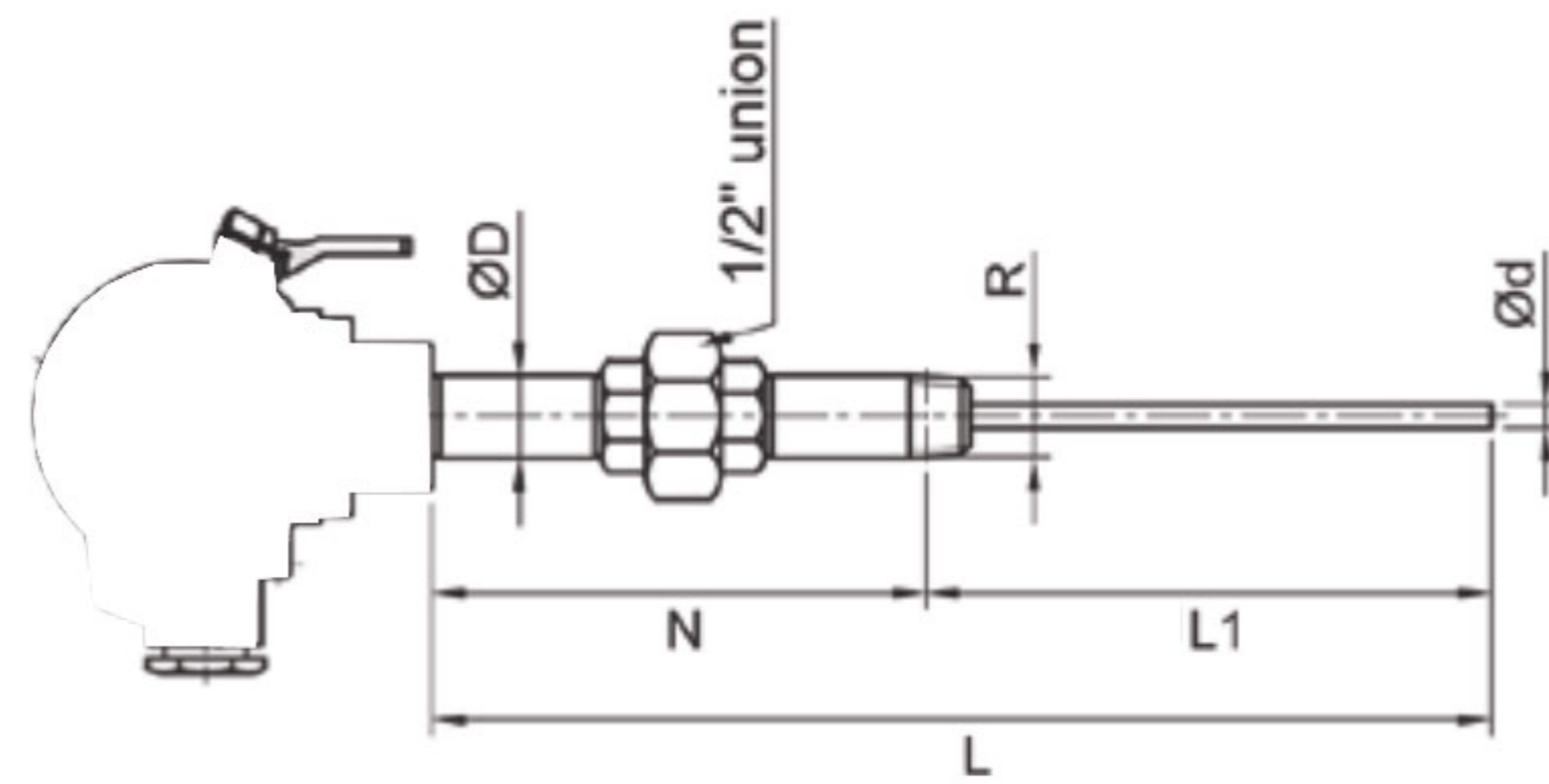
A special plug is attached to the cable terminal of the mineral insulated thermocouple. The male and female ends of the plug (+) (-) are protected to be inserted in one direction.

MI-300-N Nipple

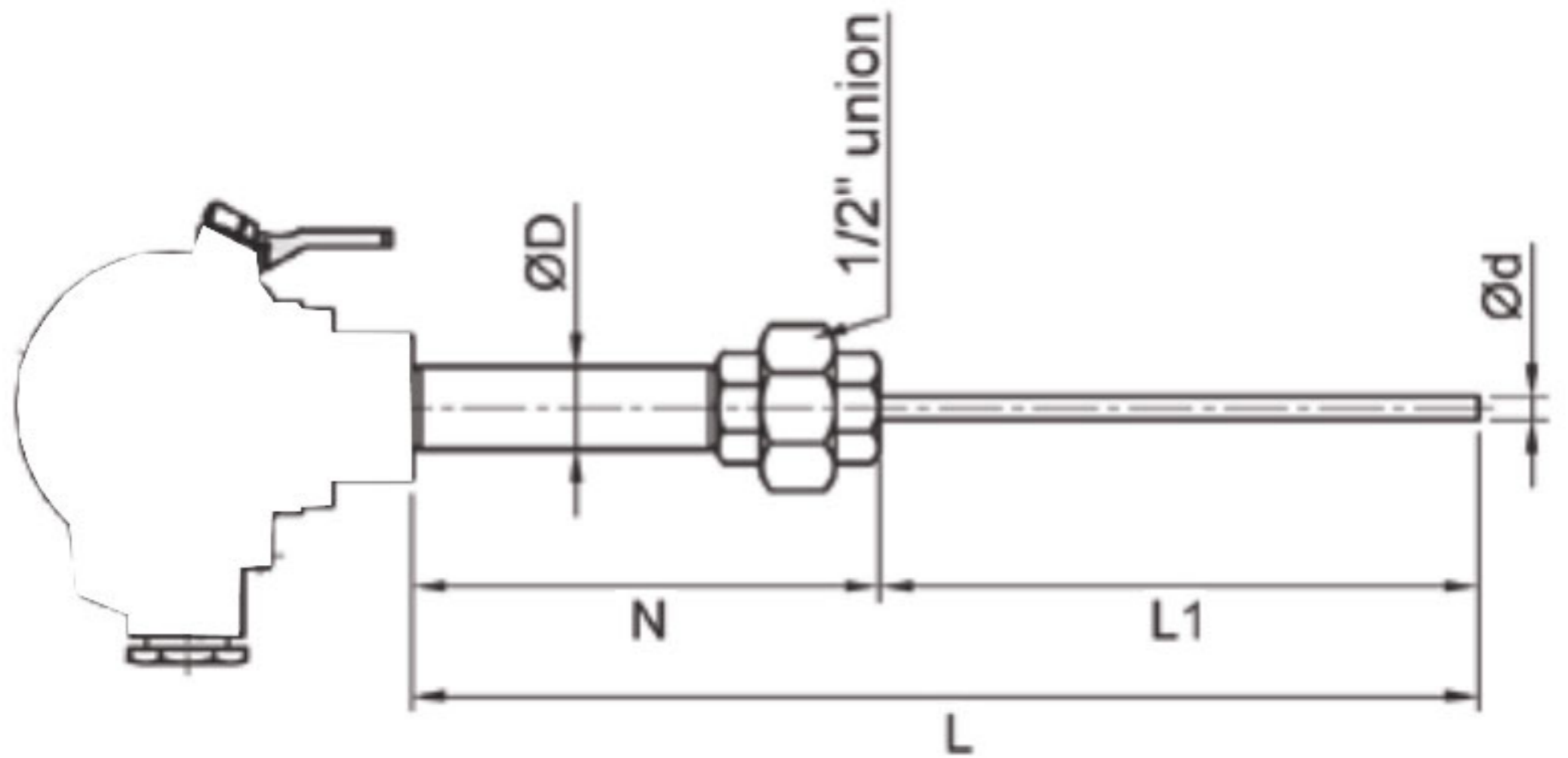


Generally, one of the Nipple (N), Nipple-Record (NU), Nipple-Record-Nipple (NUN) connections is selected in thermowell assemblies of M/Is. Head and well connection is made with 1/2 NPT.

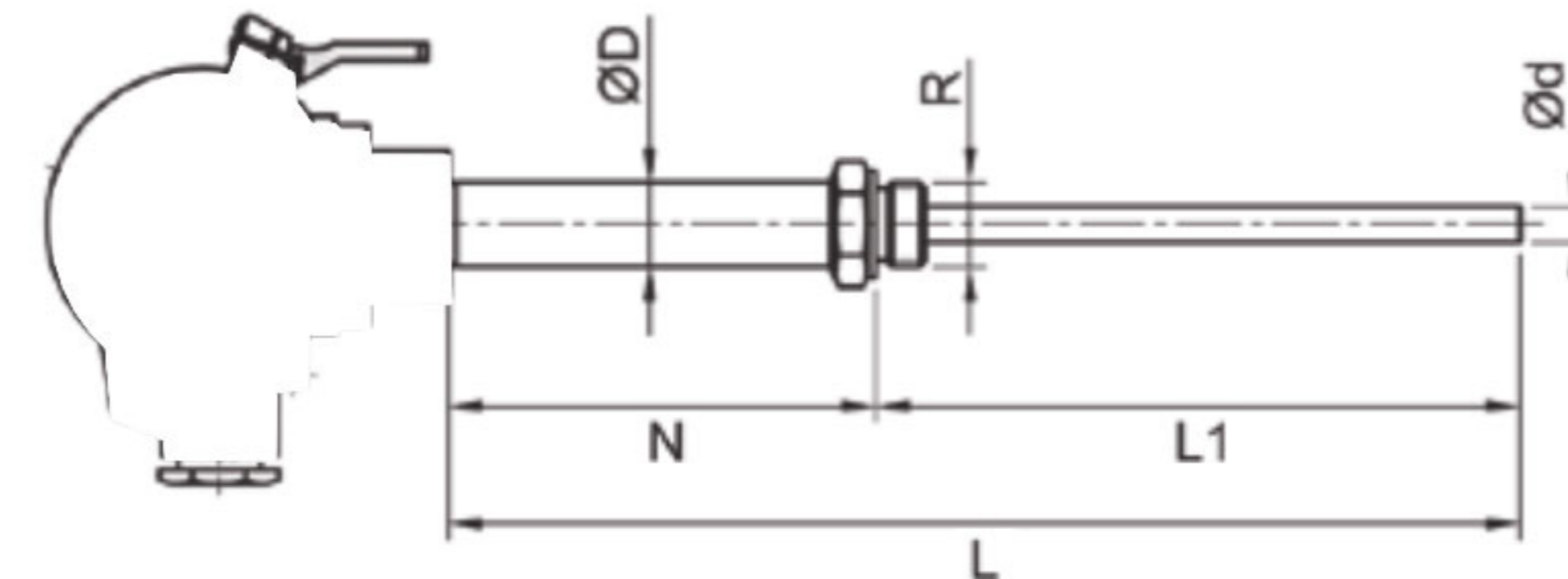
MI-300-NUN Nipple-Record-Nipple



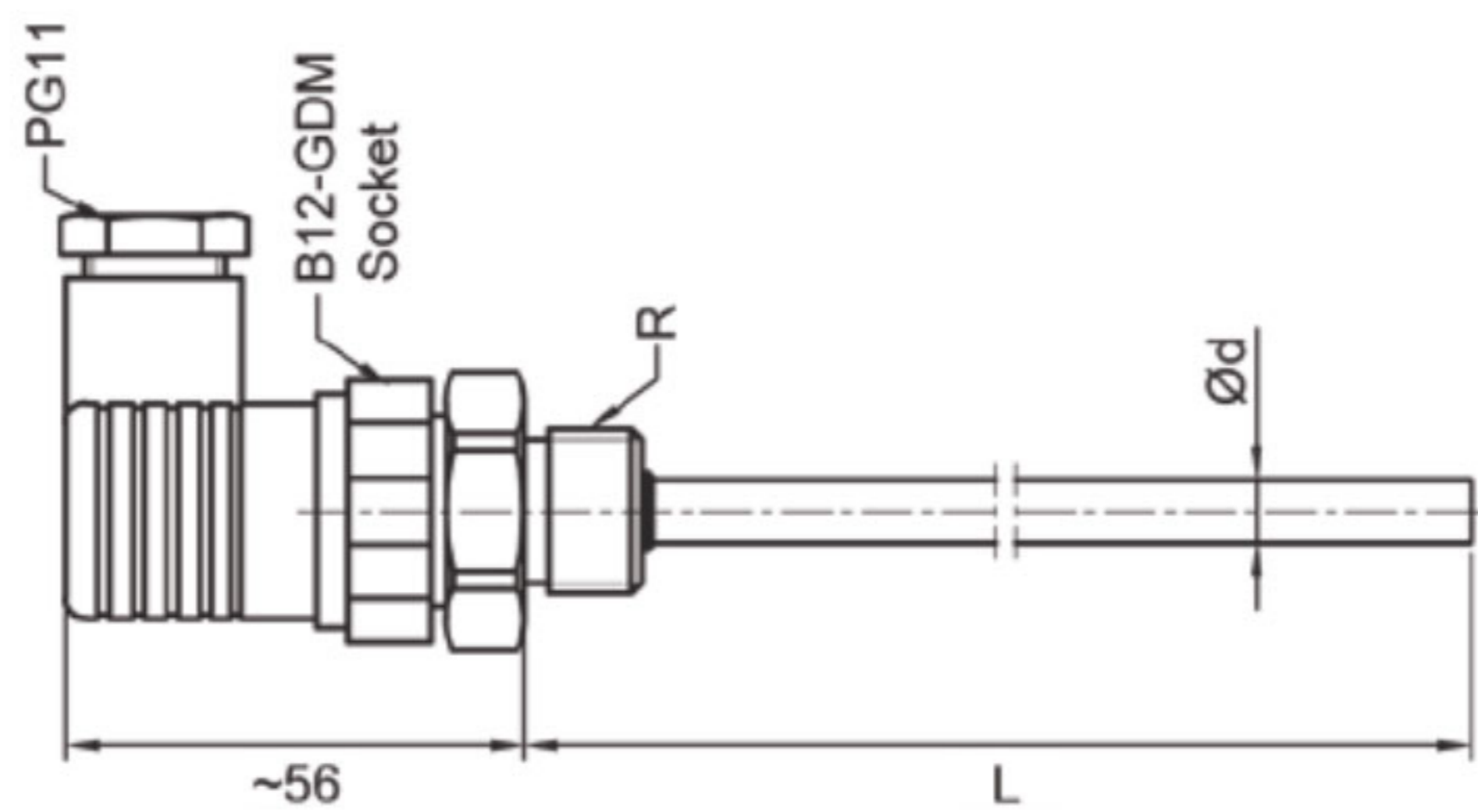
MI-300-N Nipple-Record



MI-300-R Straight-Record

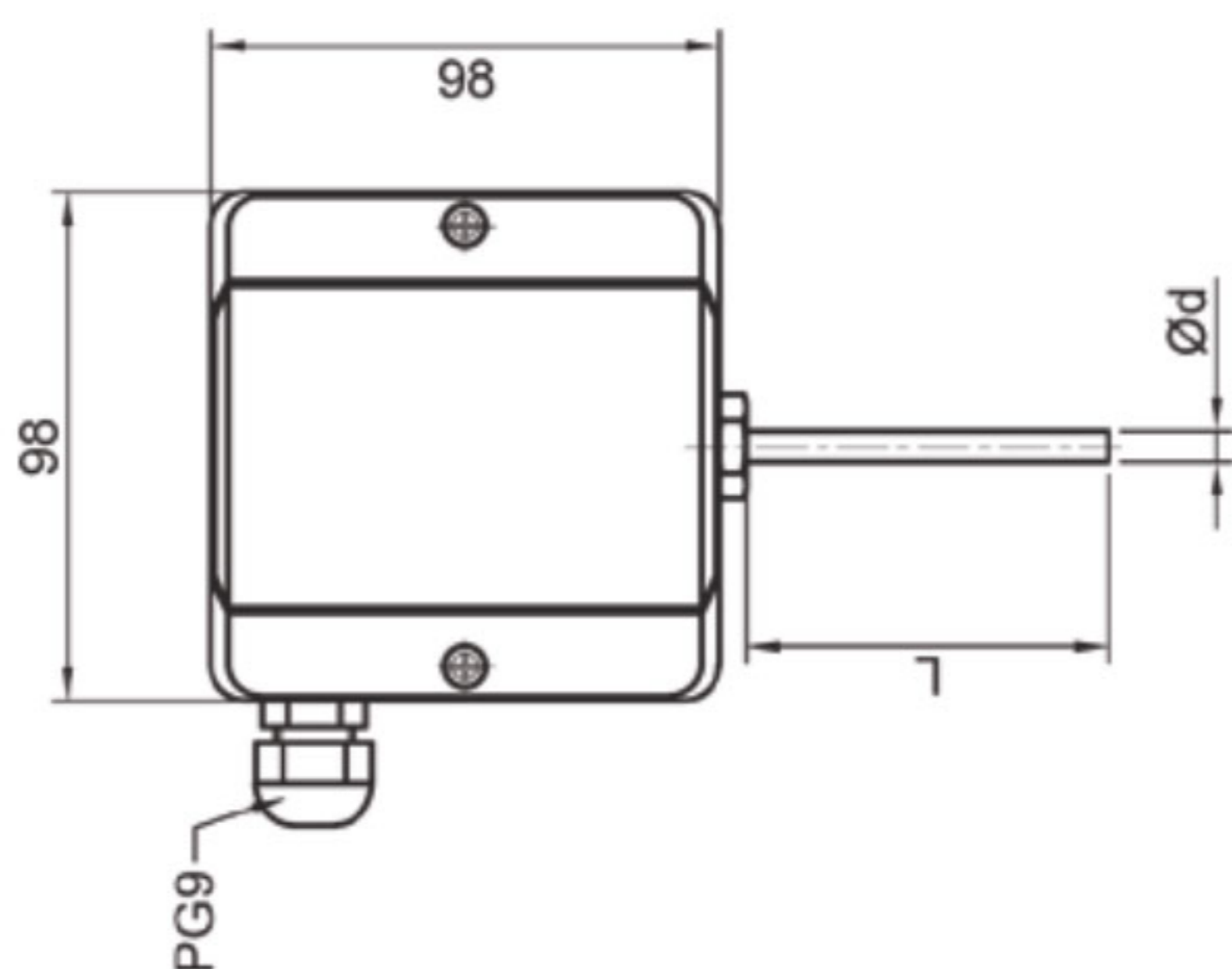


MI-210



Solenoid has GDM connector connection and is a model with a union. The standard record is G1/2 finger. Length, diameter and record information should be given in the order.

MI-220



It is used for precise measurement of air ambient temperatures. it is wall mounted. Analog output can be taken with the converter to these models.

RTD TEMPERATURE TRANSMITTER T01

Measuring range of -50°C to 600°C
 Possibility of inset changing without stopping the process
 Connection terminals with 2,3,4 and 6 wires
 IP68 DIN B from cast aluminum head
 Terminal with programmable 4-20 mA analogue output



Prod. code	Sensor	Diameter (mm)	Plunge Length (mm)	Cooling Length	Process Connection	Output
T01	0 - (PT100)	6	50	0 - (No)	0 - (G1/2")	0 - (4-20 MA)
T02	1 - (PT500)	8	100	1 - (Yes)	1 - (G1")	1 - (4-20 MA+Hart)
T03	2 - (PT1000)	10	120	.	2 - (Clamp)	2 - (0-10V)
T04	3 - (NI100)	12	150	.	3 - (Flange)	3 - (RTD 2-wire)
T05	4 - (CU100)	.	160	.	4 - (Dynamic)	4 - (RTD 3-wire)
.	5...	.	200	.	5 - (Immersion)	5 - (RTD 4-wire)
.	.	.	.	.	6	6 - (TC)
.	.	.	.	.	7	7 - (2xTC)
.	X - (Special)	.	.	.	8	8 - (2xRTD)
.	B - (TC)	.	.	.	9	9 - (Wired)
.	E - (TC)	.	.	.	X - (Special)	X - (Special)
.	J - (TC)	.	.	.	.	.
.	K - (TC)	.	.	.	.	.
.	N - (TC)	.	.	.	.	.
.	R - (TC)	.	.	.	.	.
.	S - (TC)	.	.	.	.	.
.	T - (TC)	.	.	.	.	.
.	C - (TC)	.	.	.	.	.
.	D - (TC)	.	.	.	.	.
.

Example:

ETRANS-T01-0-6-100-0-00

ETRANS-T01-K-10-150-1-36

TEMPERATURE TRANSMITTER T02 WITH RTD DISPLAY



Measuring range of -50°C to 600°C
 Possibility of inset changing without stopping the process
 Connection terminals with 2,3,4 and 6 wires
 IP68 DIN B from cast aluminum head
 Terminal with programmable 4-20 mA analogue output

Prod. code	Sensor	Diameter (mm)	Plunge Length (mm)	Cooling Length	Process Connection	Output
T01	0 - (PT100)	6	50	0 - (No)	0 - (G1/2")	0 - (4-20 MA)
T02	1 - (PT500)	8	100	1 - (Yes)	1 - (G1")	1 - (4-20 MA+Hart)
T03	2 - (PT1000)	10	120	.	2 - (Clamp)	2 - (0-10V)
T04	3 - (NI100)	12	150	.	3 - (Flange)	3 - (RTD 2-wire)
T05	4 - (CU100)	.	160	.	4 - (Dynamic)	4 - (RTD 3-wire)
.	5...	.	200	.	5 - (Immersion)	5 - (RTD 4-wire)
.	.	.	.	.	6	6 - (TC)
.	.	.	.	.	7	7 - (2xTC)
.	X - (Special)	.	.	.	8	8 - (2xRTD)
.	B - (TC)	.	.	.	9	9 - (Wired)
.	E - (TC)	.	.	.	X - (Special)	X - (Special)
.	J - (TC)	.	.	.	.	.
.	K - (TC)	.	.	.	.	.
.	N - (TC)	.	.	.	.	.
.	R - (TC)	.	.	.	.	.
.	S - (TC)	.	.	.	.	.
.	T - (TC)	.	.	.	.	.
.	C - (TC)	.	.	.	.	.
.	D - (TC)	.	.	.	.	.
.

Example:

ETRANS-T01-0-6-100-0-00

ETRANS-T01-K-10-150-1-36

RTD EX-PROOF TEMPERATURE TRANSMITTER T03

Measuring range of -50°C to 600°C
 Possibility of inset changing without stopping the process
 Connection terminals with 2,3,4 and 6 wires
 IP68 DIN B from cast aluminum head
 Terminal with programmable 4-20 mA analogue output



Prod. code	Sensor	Diameter (mm)	Plunge Length (mm)	Cooling Length	Process Connection	Output
T01	0 - (PT100)	6	50	0 - (No)	0 - (G1/2")	0 - (4-20 MA)
T02	1 - (PT500)	8	100	1 - (Yes)	1 - (G1")	1 - (4-20 MA+Hart)
T03	2 - (PT1000)	10	120	.	2 - (Clamp)	2 - (0-10V)
T04	3 - (NI100)	12	150	.	3 - (Flange)	3 - (RTD 2-wire)
T05	4 - (CU100)	.	160	.	4 - (Dynamic)	4 - (RTD 3-wire)
.	5...	.	200	.	5 - (Immersion)	5 - (RTD 4-wire)
.	.	.	.	.	6	6 - (TC)
.	.	.	.	.	7	7 - (2xTC)
.	X - (Special)	.	.	.	8	8 - (2xRTD)
.	B - (TC)	.	.	.	9	9 - (Wired)
.	E - (TC)	.	.	.	X - (Special)	X - (Special)
.	J - (TC)	.	.	.	.	.
.	K - (TC)	.	.	.	.	.
.	N - (TC)	.	.	.	.	.
.	R - (TC)	.	.	.	.	.
.	S - (TC)	.	.	.	.	.
.	T - (TC)	.	.	.	.	.
.	C - (TC)	.	.	.	.	.
.	D - (TC)	.	.	.	.	.
.

Example:

ETRANS-T01-0-6-100-0-00

ETRANS-T01-K-10-150-1-36

RTD EX-PROOF TEMPERATURE TRANSMITTER T04

Measuring range of -50°C to 600°C
 Possibility of inset changing without stopping the process
 Connection terminals with 2,3,4 and 6 wires
 IP68 DIN B from cast aluminum head
 Terminal with programmable 4-20 mA analogue output



Prod. code	Sensor	Diameter (mm)	Plunge Length (mm)	Cooling Length	Process Connection	Output
T01	0 - (PT100)	6	50	0 - (No)	0 - (G1/2")	0 - (4-20 MA)
T02	1 - (PT500)	8	100	1 - (Yes)	1 - (G1")	1 - (4-20 MA+Hart)
T03	2 - (PT1000)	10	120	.	2 - (Clamp)	2 - (0-10V)
T04	3 - (NI100)	12	150	.	3 - (Flange)	3 - (RTD 2-wire)
T05	4 - (CU100)	.	160	.	4 - (Dynamic)	4 - (RTD 3-wire)
.	5...	.	200	.	5 - (Immersion)	5 - (RTD 4-wire)
.	.	.	.	.	6	6 - (TC)
.	.	.	.	.	7	7 - (2xTC)
.	X - (Special)	.	.	.	8	8 - (2xRTD)
.	B - (TC)	.	.	.	9	9 - (Wired)
.	E - (TC)	.	.	.	X - (Special)	X - (Special)
.	J - (TC)	.	.	.	.	.
.	K - (TC)	.	.	.	.	.
.	N - (TC)	.	.	.	.	.
.	R - (TC)	.	.	.	.	.
.	S - (TC)	.	.	.	.	.
.	T - (TC)	.	.	.	.	.
.	C - (TC)	.	.	.	.	.
.	D - (TC)	.	.	.	.	.
.

Example:

ETRANS-T01-0-6-100-0-00

ETRANS-T01-K-10-150-1-36

BAYONETTE TYPE TEMPERATURE TRANSMITTER T05

Measuring range of -50°C to 600°C
 Possibility of inset changing without stopping the process
 Connection terminals with 2,3,4 and 6 wires
 IP68 DIN B from cast aluminum head
 Terminal with programmable 4-20 mA analogue output



Prod. code	Sensor	Diameter (mm)	Plunge Length (mm)	Cooling Length	Process Connection	Output
T01	0 - (PT100)	6	50	0 - (No)	0 - (G1/2")	0 - (4-20 MA)
T02	1 - (PT500)	8	100	1 - (Yes)	1 - (G1")	1 - (4-20 MA+Hart)
T03	2 - (PT1000)	10	120	.	2 - (Clamp)	2 - (0-10V)
T04	3 - (NI100)	12	150	.	3 - (Flange)	3 - (RTD 2-wire)
T05	4 - (CU100)	.	160	.	4 - (Dynamic)	4 - (RTD 3-wire)
.	5...	.	200	.	5 - (Immersion)	5 - (RTD 4-wire)
.	.	.	.	.	6	6 - (TC)
.	.	.	.	.	7	7 - (2xTC)
.	X - (Special)	.	.	.	8	8 - (2xRTD)
.	B - (TC)	.	.	.	9	9 - (Wired)
.	E - (TC)	.	.	.	X - (Special)	X - (Special)
.	J - (TC)	.	.	.	.	.
.	K - (TC)	.	.	.	.	.
.	N - (TC)	.	.	.	.	.
.	R - (TC)	.	.	.	.	.
.	S - (TC)	.	.	.	.	.
.	T - (TC)	.	.	.	.	.
.	C - (TC)	.	.	.	.	.
.	D - (TC)	.	.	.	.	.
.

Example:

ETRANS-T01-0-6-100-0-00

ETRANS-T01-K-10-150-1-36



RTD WITHOUT INDICATOR (T06) AND WITH INDICATOR (T07) TEMPERATURE TRANSMITTER (PT100)

Measuring range of -50°C to 200°C
 Possibility of inset changing without stopping the process
 IP65 protection class DIN43650 socket.
 Terminal with programmable 4-20 mA analogue output

Prod. code	Sensor	Diameter (mm)	Plunge Length (mm)	Cooling Length	Process Connection	Output
T01	0 - (PT100)	6	50	0 - (No)	0 - (G1/2")	0 - (4-20 MA)
T02	1 - (PT500)	8	100	1 - (Yes)	1 - (G1")	1 - (4-20 MA+Hart)
T03	2 - (PT1000)	10	120	.	2 - (Clamp)	2 - (0-10V)
T04	3 - (NI100)	12	150	.	3 - (Flange)	3 - (RTD 2-wire)
T05	4 - (CU100)	.	160	.	4 - (Dynamic)	4 - (RTD 3-wire)
.	5...	.	200	.	5 - (Immersion)	5 - (RTD 4-wire)
.	.	.	.	.	6	6 - (TC)
.	.	.	.	.	7	7 - (2xTC)
.	X - (Special)	.	.	.	8	8 - (2xRTD)
.	B - (TC)	.	.	.	9	9 - (Wired)
.	E - (TC)	.	.	.	X - (Special)	X - (Special)
.	J - (TC)	.	.	.	.	.
.	K - (TC)	.	.	.	.	.
.	N - (TC)	.	.	.	.	.
.	R - (TC)	.	.	.	.	.
.	S - (TC)	.	.	.	.	.
.	T - (TC)	.	.	.	.	.
.	C - (TC)	.	.	.	.	.
.	D - (TC)	.	.	.	.	.
.

Example:
ETRANS-T01-0-6-100-0-00
ETRANS-T01-K-10-150-1-36

IN-HEAD TRANSDUCER



Input Pt100, Thermocouple
 Output 4-20 mA
 Adjustable Scale
 Free Setting Software

Product Code	Explanation
ETRANS/D148	RTD,TC,Ohm,Mv,Level
ETRANS/D248	RTD,TC,Ohm, İzolasyonlu

BAYONETTE TYPE THERMOCOUPLES (FE-CONST)



PRODUCT CODE	DIAMETER	ELEMENT TYPE	IMMERSION LENGTH	CABLE LENGTH
GT-ETB3OFO6-1Ç	Ø6	J Type	30mm	1m. / 1,5m. / 2m. / 3m. / 4m. / 5m.
GT-ETB12FO8-1Ç	Ø8	J Type	12mm	1m. / 1,5m. / 2m. / 3m. / 4m. / 5m.
GT-VTB3OFO6-1Ç	Ø6	J Type	30mm	1m. / 1,5m. / 2m. / 3m. / 4m. / 5m.
GT-VTB12FO8-1Ç	Ø8	J Type	12mm	1m. / 1,5m. / 2m. / 3m. / 4m. / 5m.
GT-DTB3OFO6-1Ç	Ø6	J Type	30mm	1m. / 1,5m. / 2m. / 3m. / 4m. / 5m.
GT-DTB12FO8-1Ç	Ø8	J Type	12mm	1m. / 1,5m. / 2m. / 3m. / 4m. / 5m.

Fix Cable
Fully Isolated
Standard Thread Size
M12x1,75

BAYONETTE TYPE THERMOCOUPLES/RTD (PT100)



PRODUCT CODE	DIAMETER	ELEMENT TYPE	IMMERSION LENGTH	CABLE LENGTH
GT-ETB3OPO6-1Ç	06	PT-100	30mm	1m.
GT-ETB3OPO6-1,5Ç	06	PT-100	30mm	1,5m.
GT-ETB3OPO6-2Ç	06	PT-100	30mm	2m.
GT-ETB3OPO6-3Ç	06	PT-100	30mm	3m.
GT-ETB3OPO6-4Ç	06	PT-100	30mm	4m.
GT-ETB3OPO6-5Ç	06	PT-100	30mm	5m.
GT-ETB12PO8-1Ç	08	PT-100	12mm	1m.
GT-ETB12PO8-1,5Ç	08	PT-100	12mm	1,5m.
GT-ETB12PO8-2Ç	08	PT-100	12mm	2m.
GT-ETB12PO8-3Ç	08	PT-100	12mm	3m.
GT-ETB12PO8-4Ç	08	PT-100	12mm	4m.
GT-ETB12PO8-5Ç	08	PT-100	12mm	5m.

Fix Cable
Fully Isolated
Standard Thread Size
M12x1,75

