DTR-Exd-01
(2010-10-07)

APPLICATION MANUAL

SAFETY INSTRUCTION

Flameproof temperature sensors
type ***T****-Exd-*-*-*…

II 2 GD Ex d IIC T6

Ex tD A21 IP68 T85°C

or

I M2 Ex d I

LIMATHERM SENSOR Sp. z o.o., 34-600 Limanowa, ul. Tarnowska 1, tel. (18) 337 99 00 , fax (18) 337 99 10
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1. GENERALY INFORMATION

DIRECTIVE 94/9/EC - ATEX

ATEX Directive is the "New Approach Directive" which is in use in the members of EC States from July 1, 2003. The main object of this directive is to stipulate requirements that are essential for the free circulation of products within the European Economic Community. In order to do this, National Standards need to be harmonized based on the article 100A in the Union Treaty. Starting from July 1, 2003 products must satisfy the requirements of this directive before they can be marketed and transported freely, or used. This is the first time that directive about equipment designed to operate in an explosive atmosphere resulting from the presence of combustion dust. Therefore, zones 20, 21 and 22 are complementary to zones 0, 1 and 2 defined for gases and vaporous. The magnitude of the risk of faults are the same in these zones. Trough its products marking requirements, the directive introduces the concept of zones and gaseous atmospheres and/or atmospheres containing dust in which the equipment may be installed.

TABLE 1: TYPES OF EXPLOSION PROTECTION APPLIED IN THE TEMPERATURE SENSORS

Type of Ex protection	*Protection concept*	*Marking*	*Standard*
flameproof	contain the explosion, quench the flame	d	PN-EN 60079-1
increased safety	mechanical, no arcs, no spark, no hot surfaces	e	PN-EN 60079-7
intrinically safe	electrical, limitation of arcs and spark energy and hot surfaces	i	PN-EN 50020

TABLE 2: WAYS OF EXPLOSION PROTECTION FOR POTENTIALLY EXPLOSIVE ATMOSPHERES

Category		*Type of flameable substance*	*Level of protection characteristic of protection*	*Zone*	*Possible type of protection*
Gr.I	*Gr.II*				
	1G	gases, mists, vaporous	- very high protection level - two independent ways of protection - resistance against two independent damages	0	Ex ia, Ex dib or Ex d with mechanical separation
	1D	dusts		20	- protection by enclosure, min. IP6X - protection by restriction surface temperature - protection by avoiding spark ignition
M1		methane		-	-
	2G	gases, mists, vaporous	- high protection level - one way of protection - damage expected	1	Ex ib or Ex e or Ex d
	2D	dusts		21	- protection by enclosure, min IP6X - protection by restriction surface temperature - protection by avoiding spark ignition
M2		methane		-	-
	3G	gases, mists, vaporous	- normal level protection - protection suitable for normal working conditions	2	Ex ib lub Ex e lub Ex d
	3D	dusts		22	- protection by enclosure, min IP5X - protection by restriction surface temperature

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TABELA 3: ZONES CLASSIFICATION

Gases, vaporous, mists G	*Dusts D*	*Existing of explosion atmosphere*	*Number value*
Zone 0	Zone 20	Continously under normal operation conditions	> 1000 hours/year
Zone 1	Zone 21	Are likely existing under normal operating conditions	10 ÷ 1000 hours/year
Zone 2	Zone 22	Not likely existing under normal operating conditions	< 10 hours/year

TEMPERATURE CLASS

Electrical apparatus Group II, Category 2G shall be qualified to the temperature class, regarding maximum surface temperature reached under external working conditions.

TABELA 4:

Temperature class	*Maximum surface temperature Ts*	*Spontaneous ignition temperature of the gases*
T1	450°C	>450°C
T2	300°C	> 300°C < 450°C
T3	200°C	> 200°C < 300°C
T4	135°C	> 135°C < 200°C
T5	100°C	> 100°C < 135°C
T6	85°C	> 85°C < 100°C

Because sensor manufacturer is not able to foresee actually operation conditions of the sensor and also to fix temperature class, on the data sheet was declared temperature classes responding top temperatures of the sensor for design of the each sensor. Actually, temperature class can be respectively lower depend on surface temperature Ts reached in the working conditions.

! In any case the maximum surface temperature Ts can't be higher than spontaneous ignition temperature of the gases, vaporous or mists.

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Table 5: TEMPERATURE CLASS FOR GASES GROUPS

Acc.to Dz.U.Nr 92/90.

Temperature class / *Explosiveness group*	*T1*	*T2*	*T3*	*T4*	*T5*	*T6*
IIA	acetone, propylene, toluene, carbon oxide, ammonia	ethanol, etyl alkohol, n-butane, cyclohexanone, trichloroethylene	petrol, cyclohexan, n-decan, n-hexan, petroleum	acetic aldehyde	-	-
IIB	town gas, hydrogen, cyanide	ethylene oxide, propylene oxide, butadiene, acrylonitryle	hydrogen sulfide acroleline, crotone aldehyde	ethyl ether, dioksan	-	-
IIC	hydrogen	acetylene	hydrazyne	-	bisulfide carbon	-

PERMISSIBLE MAXIMUM SURFACE TEMPERATURE

For electrical apparatus Group II, Category 2D shall be given maximum surface temperature reached under working conditions.

! In any case maximum surface temperature Ts can't be higher than maximum surface temperature, which is defined by:

- **Tsmax = 2/3 Tc** **Tc – dust cloud self-ignition temperature**
- **Tsmax = T5 mm – 75 K** **T5mm – dust layer 5mm self-ignition temperature**

For dust layer thick from 5 to 50mm Tsmax shall be lower in accordance to standard EN 61241-0
For dust layer excessively thick, estimating of maximum permissible surface temperature shall be done under testing.

2. NOTES OF SAFETY

Flameproof temperature sensors are designed to use in hazardous location both gas and dust atmospheres. If used incorrectly it is possible that application – related danger may arise.

Flameproof sensors may be installed, connected, commissioned, operated and maintained by qualified and authorized personnel only, under strict observance of these application manual, any relevant standards, legal requirements, and where appropriate, the certificate.

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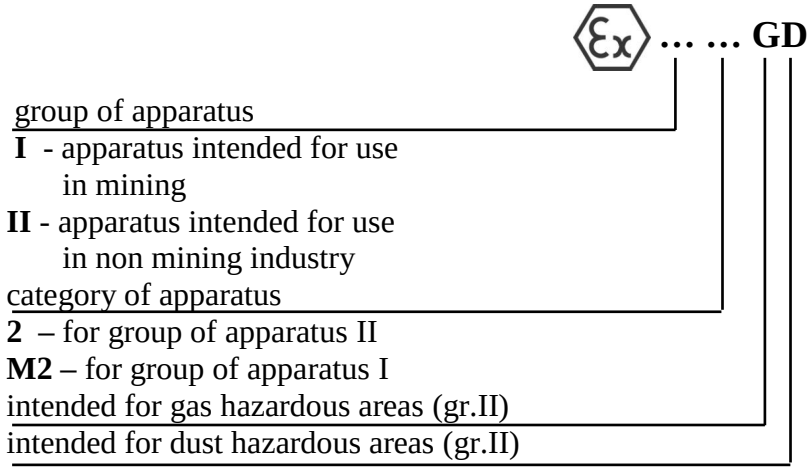
3. APPLICATION

Temperature sensors are designed for temperature measurement in the industrial installations for measurement, signalization, monitoring, remote controlling in a range of industry branches, where hazardous areas of gas and dust occurs.

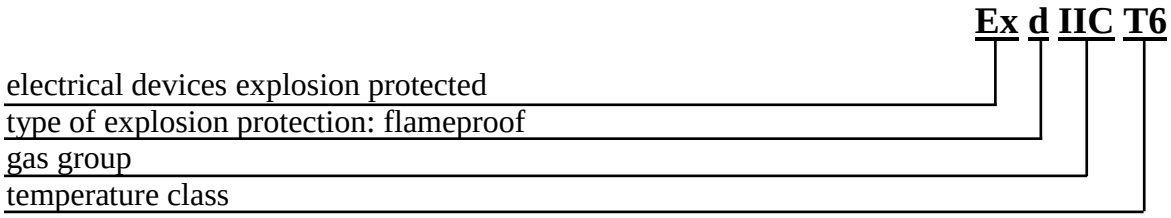
Standards according to 94/9/WE (ATEX):

- PN-EN 60079-0
- PN-EN 60079-1
- PN-EN 61241-0
- PN-EN 61241-1

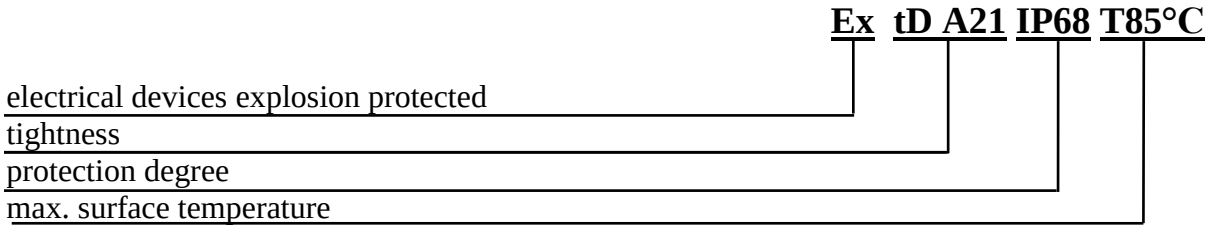
Destination to the ATEX Directive 94/9/WE (ATEX):



Kind of explosion protection for gases, vaporous and mist:



Kind of explosion protection for dusts:



Kind of explosion protection for group of apparatus I:

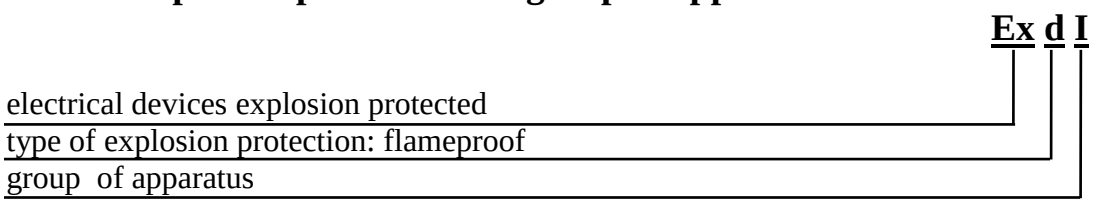


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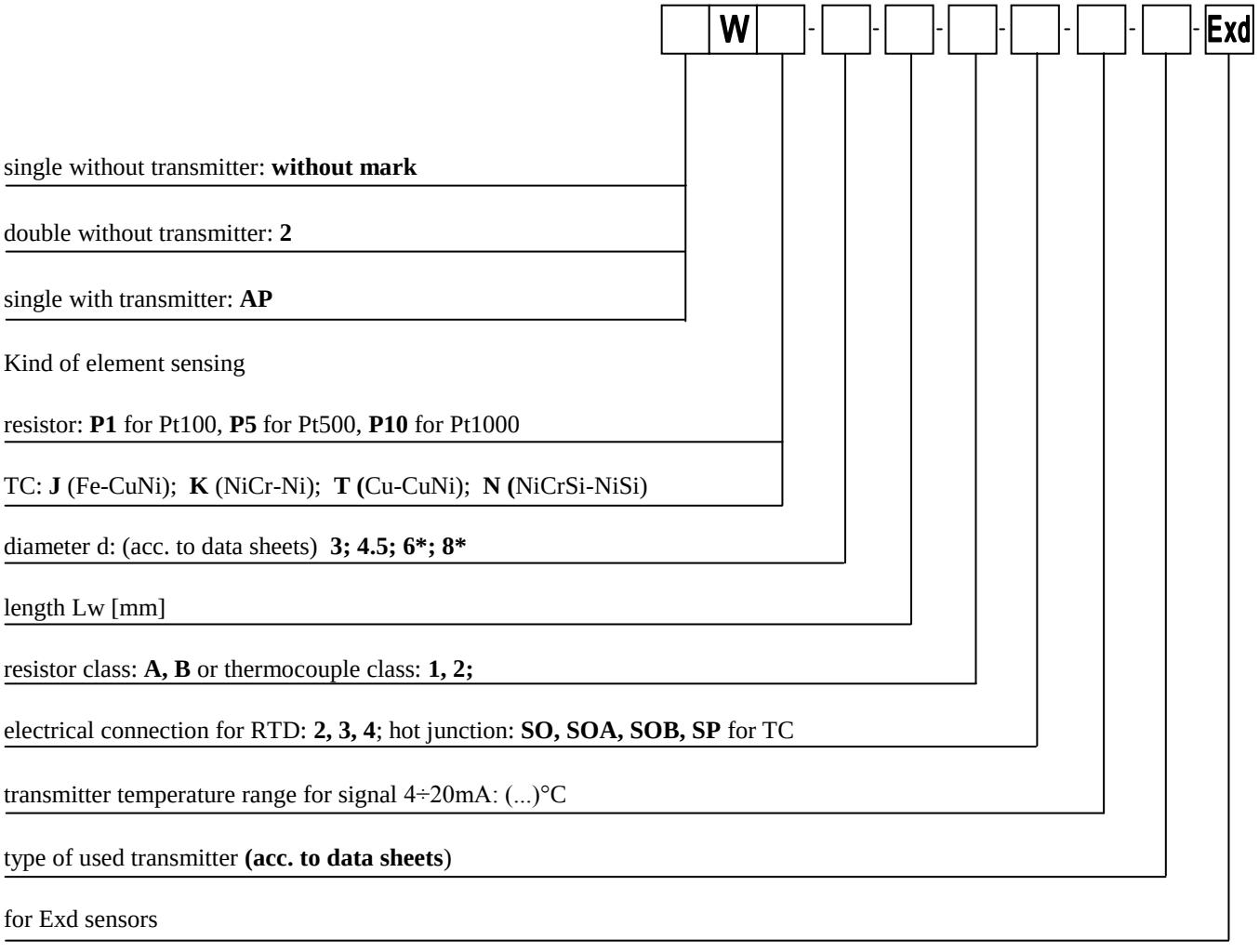
TABLE 6: PERMISSIBLE PLACES OF SENSORS INSTALLATION

Hazardous areas		Category to ATEX
Explosion atmosphere of gases, vaporous, mists	Zone 0	1G
	Zone 1	1G, 2G
	Zone 2	1G, 2G, 3G
Dust explosion atmosphere	Zone 20	1D
	Zone 21	1D, 2D
	Zone 22	1D, 2D, 3D

Way of marking mineral insulated cables



* standard performance with long sleeve (35mm),
if short sleeve (10mm) w requirement additional letter "k"
(only for Ø6 and Ø8).

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Way of marking temperature sensor

single without transmitter: **without mark**

double without transmitter: **2**

single with transmitter: **AP**

Kind of element sensing:

resistor: **OP** thermocouple: **TJ, TK, TT, TN**

thermowell: **GB, GN, P, I, T, SW, SWT or SWG**

protection method: **Exd**

aluminium connection head: **AS1, AS2, AS3, AS4**
or stainless steel: **NS1, NS2**

thermowell material: **e.g. 1.4541**

immersion length L [mm] / thermowell diameter d [mm], **e.g. 180/11**

thermowell dimension thread: **M20x1,5; G1/2; 1/2NPT** (thermowell GB, GN, SWG)

flange type: **DN20** lub **DN25** (thermowell T, SWT)

resistor class: **aA*, aB*** or thermocouple class: **1, 2**

electrical connection for RTD: **2, 3, 4**; hot junction: **SO, SOA, SOB, SP** for TC

transmitter temperature range for signal 4÷20mA: (...)°C

type of used transmitter **(acc. to data sheets)**

diameter of supply cable: **a** (3,2mm-8,7mm); **b** (6,1mm-11,7mm); **c** (6,5mm-14mm) acc. to STAHL

* a = 1 for Pt100
a = 5 for Pt500
a =10 for Pt1000

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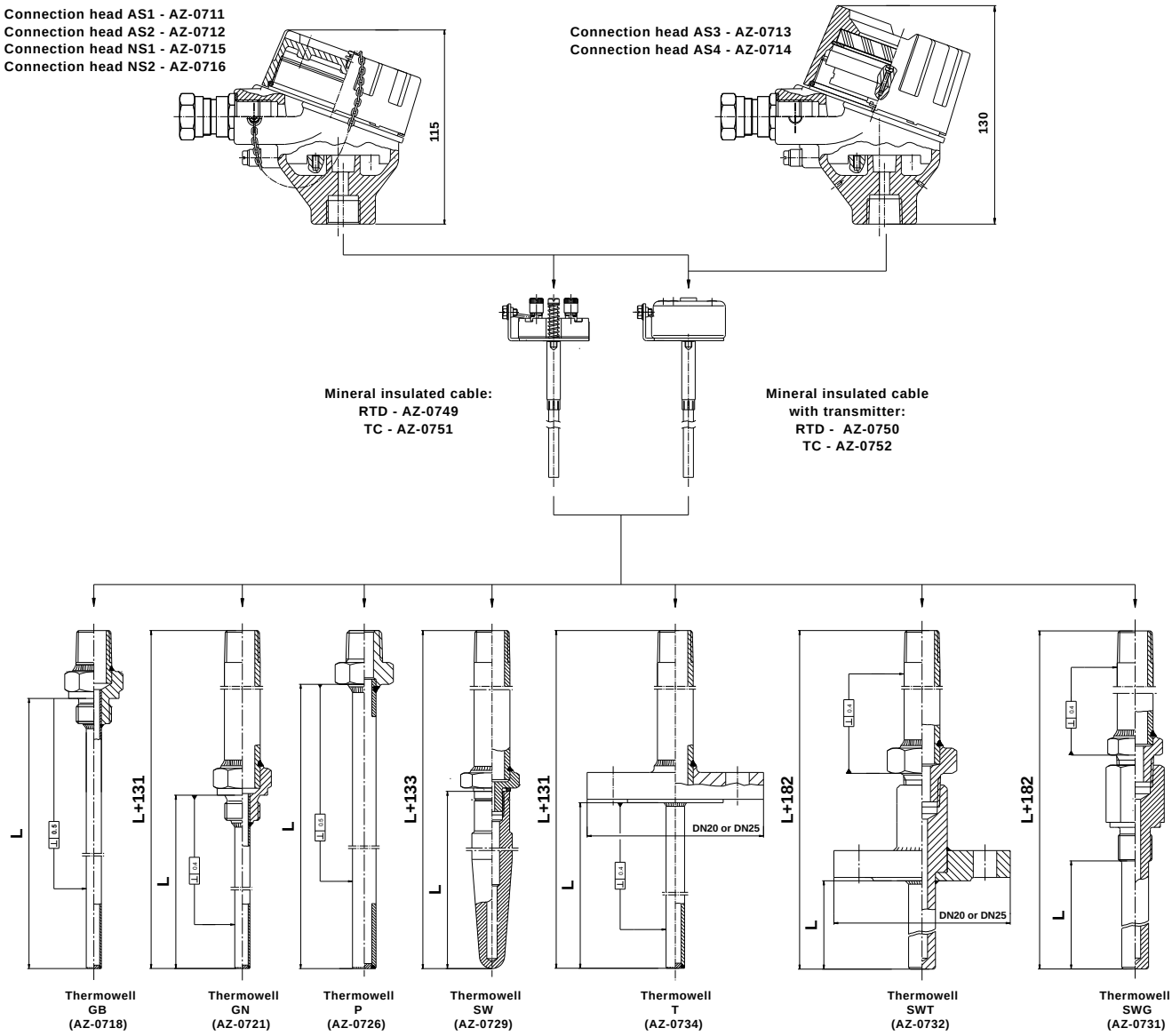
4. CONSTRUCTION



L – immersion length

Fig. 1

Temperature sensors consist of flameproof connection head and exchangeable measuring insert mineral insulated cable, in which is situated single or double resistor or one or two termocouple.
In each case, hole d_1 (see table 7) in connection head body with mineral insulated cable create flameproof joint. In case of temperature sensors with additional thermowell and flameproof joint in hole d_1, these element create mechanical separation – additional flameproof element. Connection heads AS1, AS2, AS3, AS4 and NS1, NS2 have separately EC-type examination certyfication: FTZÚ 03 ATEX 0074U and FTZÚ 06 ATEX 0326U. Inside connection head on insert flange is mounted terminal block, transmitter or transmitter with display. Connection heads are equipped i cable gland with thread M20x1,5 Ex II 2GD Ex d IIC or Ex I M2 Exd I. **Temperature sensors intended for use in group I should content additional thermowell.**

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Connection heads

Connection heads AS1, AS2, AS3, AS4 and NS1, NS2 are made on aluminium die-casting or stainless steel and content three flameproof joint:

a) Cover thread **M80x1,5**. Connection head cover is protected by wrench-head screw 2mm.
b) Socket thread for cable gland M20x1,5. Connection head are equipped in one or two cable gland.
c) Flameproof joint Ø6,1; Ø8,1; Ø10,1 for mineral insert and process thread (1/2"NPTmod).

TABLE 7

Connection head

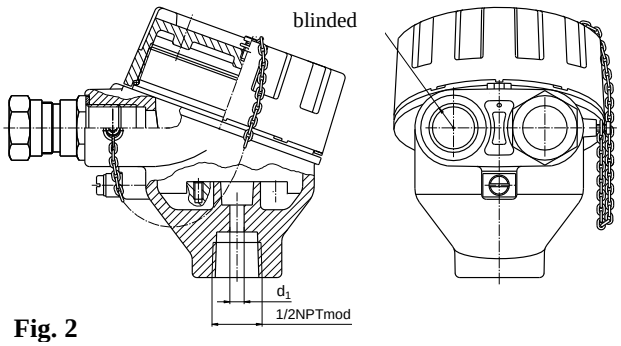
<table>
<tr>
<td>Technical data:
• performace: flameproof Ex d
• material: aluminium die-casting Mg < 6%
• cover seal: silicon rubber or fluoroelastomer VR1
• coating: creodure spray enamel, color alu: Cal
• service temperature: -50 ÷ 150°C for silicon rubber
-20 ÷ 200°C for fluoroelastomer VR1 rubber
• EC-type examination certificate FTZÚ 03 ATEX 0074U</td>
<td>Technical data:
• performace: flameproof Ex d
• material: stainless steel 1.4401, 1.4301, 1.4541
• cover seal: silicon rubber or fluoroelastomer VR1
• service temperature: -50 ÷ 150°C for silicon rubber
-20 ÷ 200°C for fluoroelastomer VR1 rubber
• EC-type examination certyficate: FTZÚ 06 ATEX 0326U</td>
</tr>
<tr>
<td>AS1
• standard cover
• one cable gland Exd
M20x1,5
d_1: Ø6,1H8 / Ø8,1H8 / Ø10,1H7
blinded
 

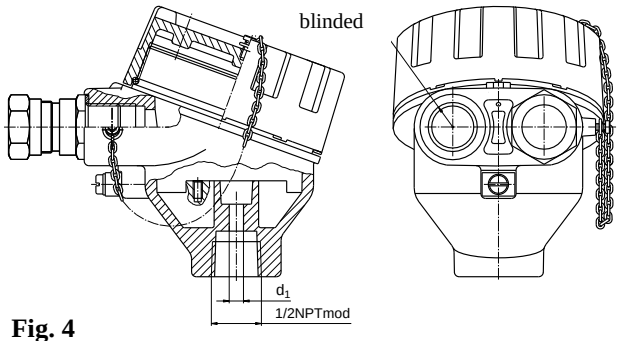
Fig. 2</td>
<td>NS1
• standard cover
• one cable gland Exd
M20x1,5
d_1: Ø6,1H8 / Ø8,1H8 / Ø10,1H7
blinded
 

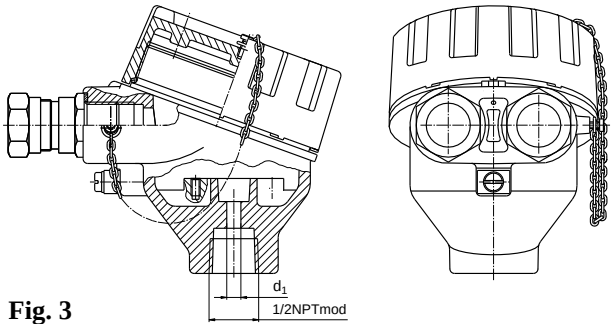
Fig. 4</td>
</tr>
<tr>
<td>AS2
• standard cover
• two cable gland Exd
M20x1,5
d_1: Ø6,1H8 / Ø8,1H8 / Ø10,1H7
 

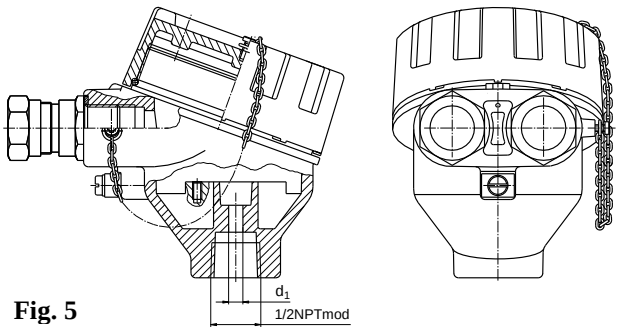
Fig. 3</td>
<td>NS2
• standard cover
• two cable gland Exd
M20x1,5
d_1: Ø6,1H8 / Ø8,1H8 / Ø10,1H7
 

Fig. 5</td>
</tr>
</table>

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TABLE 8

Connection head with display

Technical data

- performace: flameproof Ex d
- material: **aluminium die-casting Mg < 6%**
- cover seal: silicon rubber
- coating: creodure spray enamel, color alu: Cal
- window material: glass
- service temperature: -40 ÷ 85°C
- EC-type examination certificate: FTZÚ 03 ATEX 0074U

AS3

- cover with window
- one cable gland Exd
- LED display type LPI-02

non intrinsically safe

d_1
Ø6,1H8
Ø8,1H8
Ø10,1H7

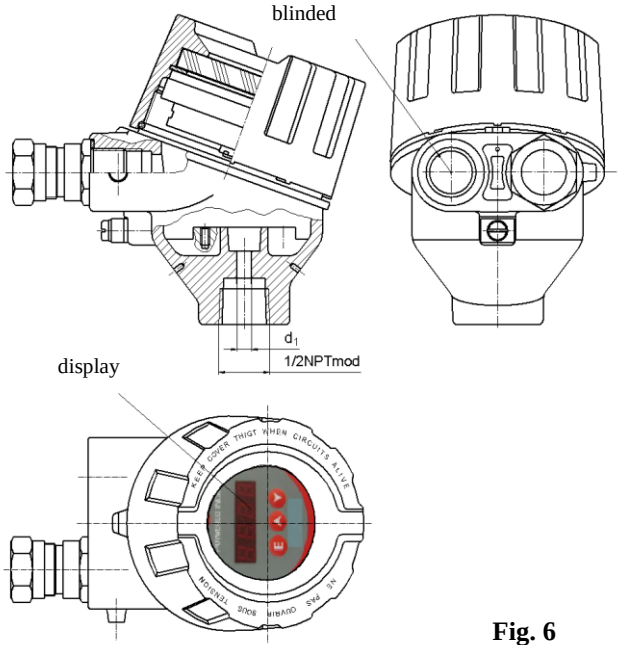

Fig. 6

AS4

- cover with window
- two cable gland Exd
- LED display type LPI-02

non intrinsically safe

d_1
Ø6,1H8
Ø8,1H8
Ø10,1H7

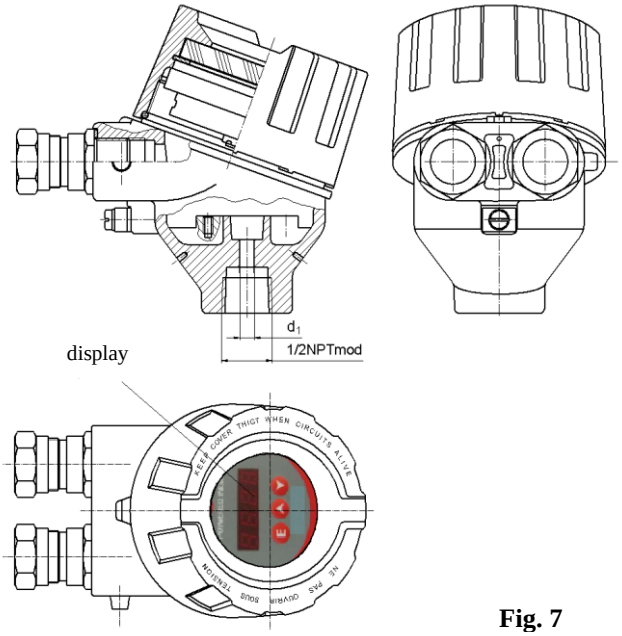

Fig. 7

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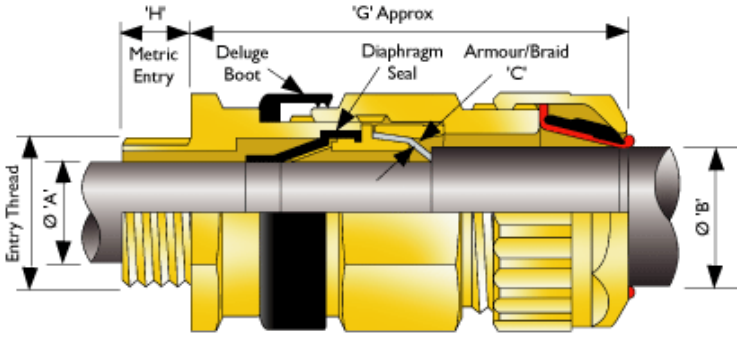
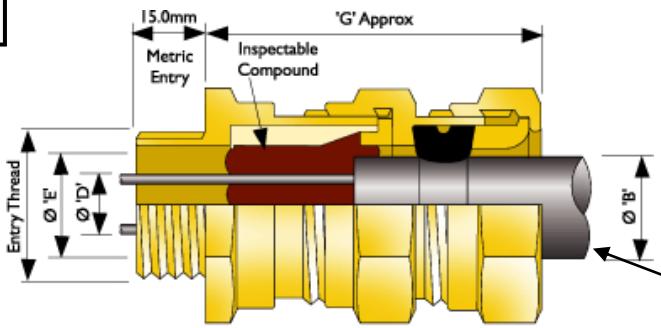
CABLE GLANDS

firm STAHL type. 8163/1-A2F



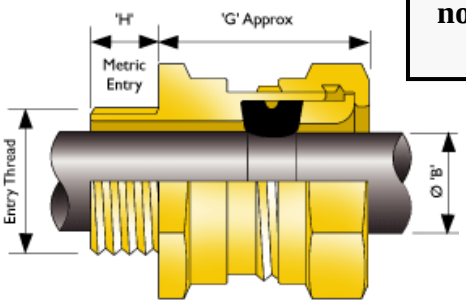
firm HAWKE type 501/453

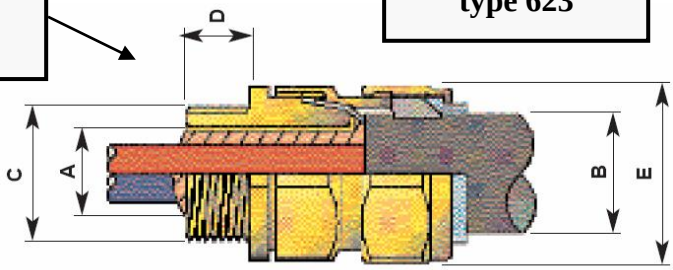


firm HAWKE type 501/421

firm HAWKE type 623

firm PROTEX no. 88845 or 88924





Connection heads are equipped in different cable glands, it depends on group (I or II), wires type and wires diameter e.g.:

- Cable gland type 8163 firm STAHL. Service temperature -60°C to +130°C, IP66 to IP68. Atest Sira 06 ATEX 1188X; ⟨Ex⟩ I M2 Ex d I.
- Cable gland type 501/421 firm HAWKE International for non-armoured cables. Service temperature -60°C to +100°C for zones 1, 21, 2, 22 for gas group IIA, IIB, IIC, degree protection IP68. Atest Baseefa 06 ATEX 2070X; ⟨Ex⟩ II 2 GD Ex d IIC.
- Cable gland type 501/453 firm HAWKE International for armoured and braided cables. Service temperature -60°C to +100°C for zone 1, 21, 2, 22 for gas group IIA, IIB, IIC, degree protection IP66 to IP68. Atest Bassefa 06 ATEX 2078X; ⟨Ex⟩ II 2 GD Ex d IIC.
- Cable gland type 623 firm HAWKE International. Service temperature -60°C to +80°C, degree protection IP66 to IP68. Atest Bassefa 06 ATEX 0177X; ⟨Ex⟩ I M2 Ex d I.
- Another cable glands Ex d with ATEX, degree protection IP66÷68.

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PROGRAMMABLE LOOP POWERED LED DISPLAY – type LPI-02
ONLY FOR CONNECTION HEADS AS3 and AS4

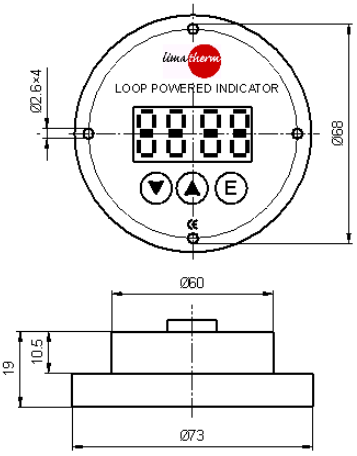

Fig. 8

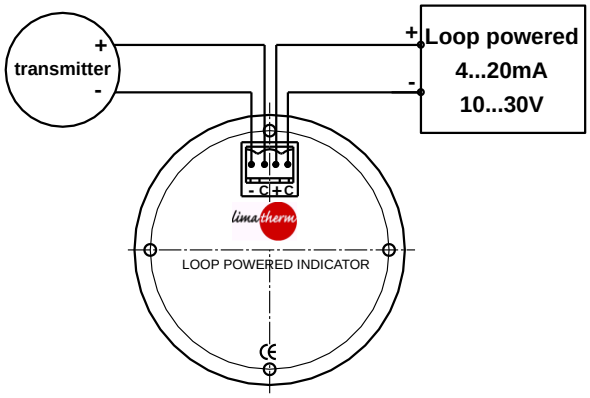

Fig. 9

TABLE 9

TECHNICAL DATA			
			
Performances		**Functionalities**	
Reference operating condition	25ºC	Parameters	Zero, span, decimal point, refresh rate, unit
Max. measured error	0,1% of the programmed range+/-1digit	Indication limits	-1999 to +9999
Influence of ambient temperature (temp. drift)	20ppm/ºC of measuring range at 20ºC of reference temperature	Programmable range	-1999 to +9999
Output signal	4...20 mA	Decimal point position	0,1,2,3 decimals
Supply voltage	24V (10...30V)	Over-load limits	From 3.5 to 20.5 mA
Voltage drop out	3,3V at 4mA 3,7V at 20mA		
Minimum curent of LED activation	3,5 mA	Refresh rate	From 1 to 10 second
Display	LED, 4 digits 7 segments, hight 9,5mm		
Visible dimension	30x14	Calibration points	Zero (4 mA) and span (20 mA), stored on FLASCH
Display characteristics	6400ucd for If=10mA	Unit	ºC, ºF, ºK, % in cycle: 4sec. value - 2sec unit
Data storage	FLASCH	**Mechanical construction**	
Storage period	10 years (non powered)	Electrical loop connection	2 terminals, max. wire section 1mm² (16 AWG)
Mounting 4 holes/90º	Ø 2,6 , Ø 68	Dimension	Ø73 x 19 mm
Operating conditions		Weight	75g
Ambient temperature	-20...80ºC	Short mark display closed in the connection haed or hausings	....dig – standard version
Storage temperature	-30...80ºC	Application, Fixing	XD-AD dig - directly by screw 2xM2,5x 12 XD-ADF dig - directly by screw 2xM2,5x 12 XD-I dig – fixing kit: KD-L2
Moisture	25 do 95% bez kondensacji		
Ingress protection	IP 20		
Electromagnetic compatibility	carried out with positive results EN 61000, EN 55022		

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5. INSTALLATION

A. ON THE BORDER OF TWO ZONES: 0; 20 and ZONE: 1; 21,

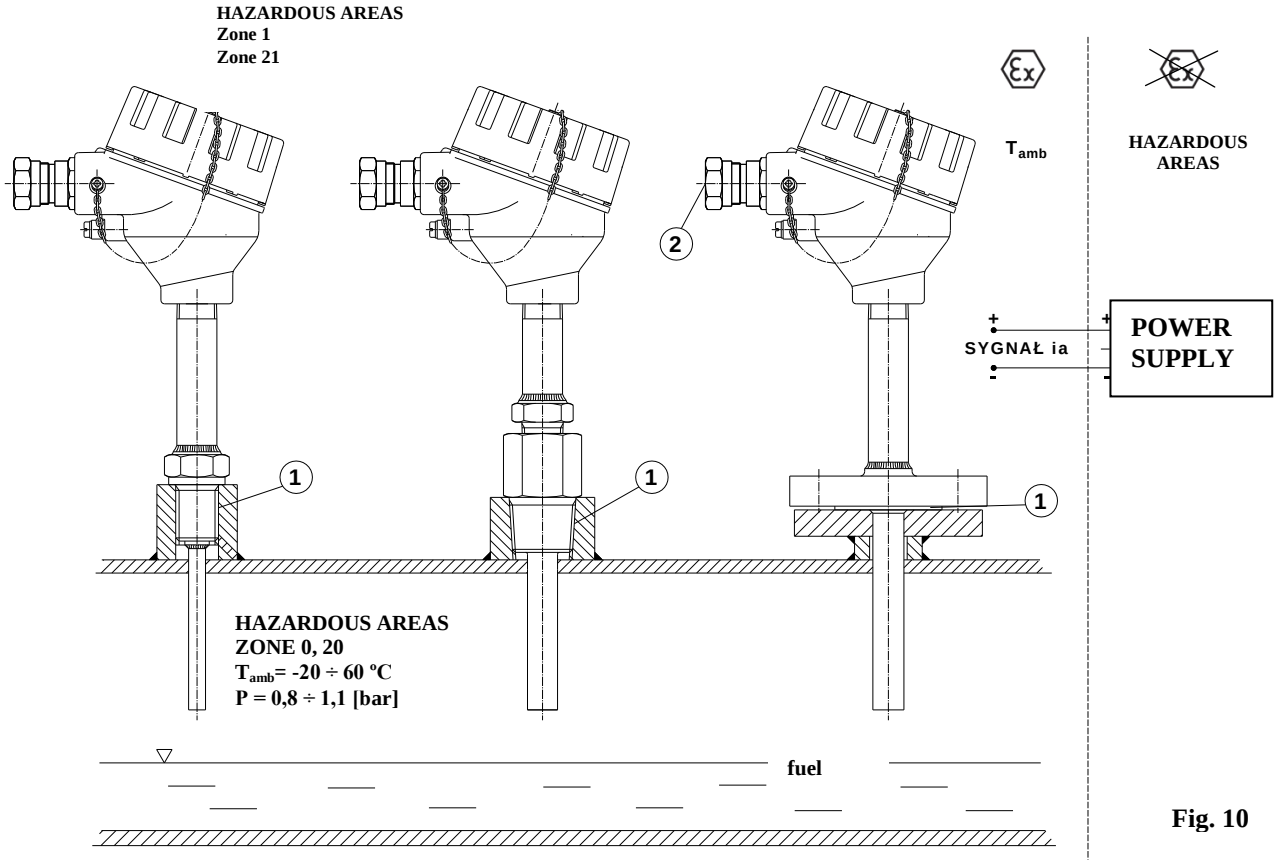

Fig. 10

B. CONNECTION HEAD AND EXTENSION PIPE IN THE ZONES 1, 21, IMMERSION PART OUT OF ZONE

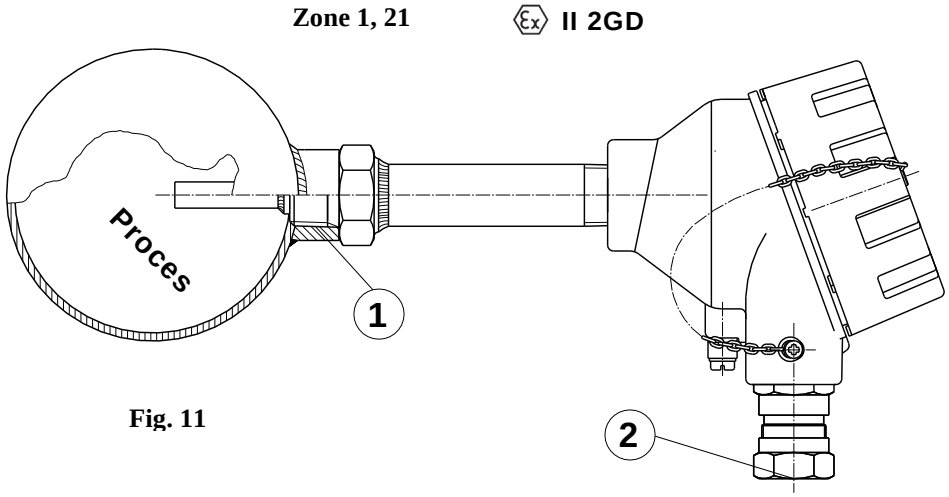

Fig. 11

1 - Sealed thread, to ensure tightness from measuring process. Parallel threads to be sealed on the collar. Taper threads to be sealed by teflon tape or sealing material (e.g. LOCTITE). Flange joint with gasket.

2 - Cable glands ATEX Ex II 2GD Ex d IIC or Ex I M2 Exd I suitable for cable diameter. IP min 65.

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Generally, all temperature sensors install in optionally work position. Dependent on thermowell kind, work place - follow a rule:

- Temperature sensors should installed (if possible) in available work place, in order to service easy method and allow to change mineral insert.
- A few metres long temperature sensors (particularly at high temperature) install in vertical position.
- Temperature sensors install in pipeline, in order to resistor or thermocouple fare a pipeline axis.
- During install temperature sensors with thermowell intended for weld, mineral insert screw off during weld and protected inside thermowell, e.g. plug.
- During install flameproof temperature sensors should take into account thermowell conduction of heat and ambient temperature, in order to assure suitable temperature class of temperature sensor.

Table 10. TIGHTENING MOMENTS FOR THREAD JOINTS

Tightening moments for thermowells and compression fittings			
Type of thread			Max tightening moment [Nm]
M20×1,5; G1/2; 1/2NPT			115
M24×1,5			200
M27×2; G3/4; 3/4NPT			275
M33×2; G1; 1NPT			506
Tightening moments for screws of flange joints			
Screw - nut	Class of screw	Class of nut	Max tightening moment for nut [Nm]
Screw M12×1,5 with steel nut, zinc-plated	5.8	5	50
	8.8	8	94
	10.9	10	125
	12.9	12	150
Tightening moment for press caps of threaded compression fittings (sensor fixing)			
Type of compression fitting			Max tightening moment [Nm]
UG-8-12			275
UG-8-15			375

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6. CONNECTION OF SENSOR TO THE UNINTRINSICALLY SAFE CIRCUIT.

Resistors and thermocouple can co-operated with different instruments (measuring instruments, regulators or transmitters with output signal 4…20 mA, 0÷10V).

Maximal electrical parameters:

- **Maximal voltage: U_i = 10V**
- **Maximal current I_i = 10 mA for Pt100; I_i = 3 mA for Pt1000, Pt 500**
- **Maximal power: P_i = 50 mW**

Way of marking resistance terminal

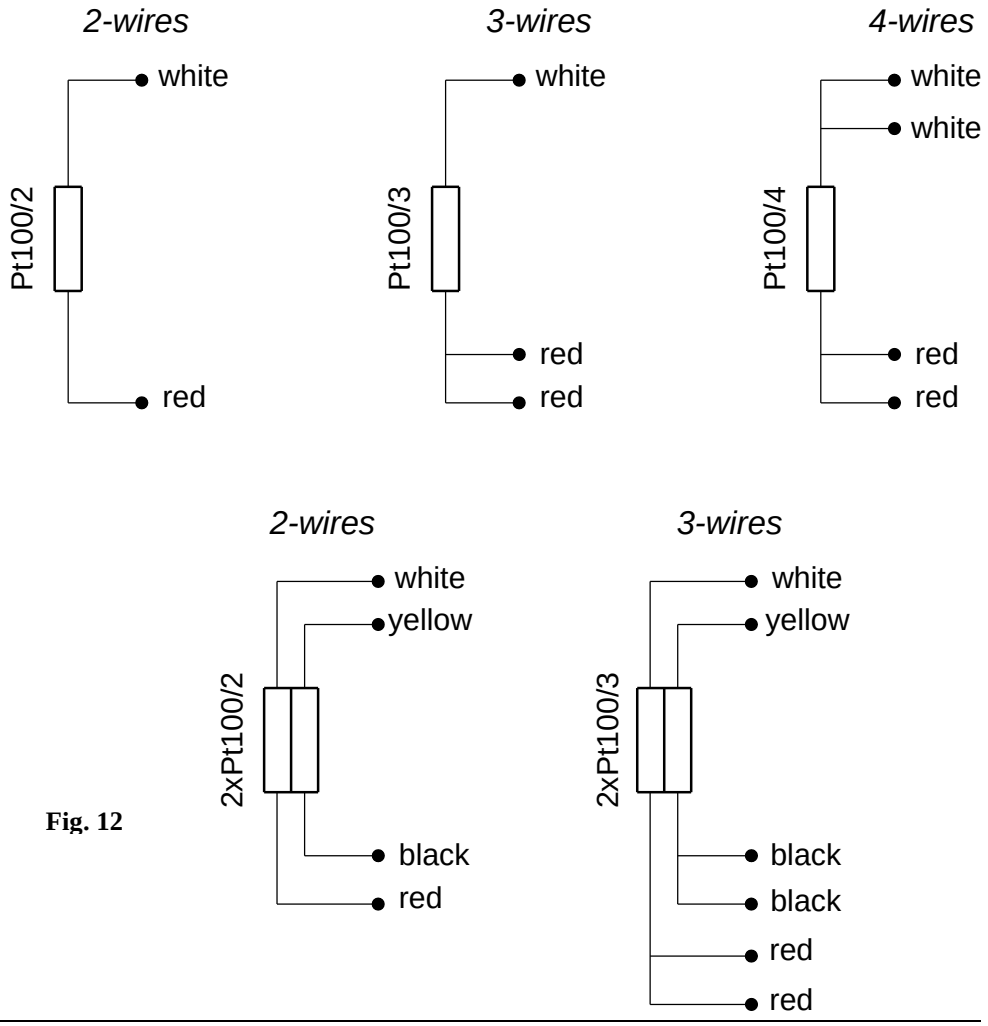

Fig. 12

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Diagram of connection thermocouple insert

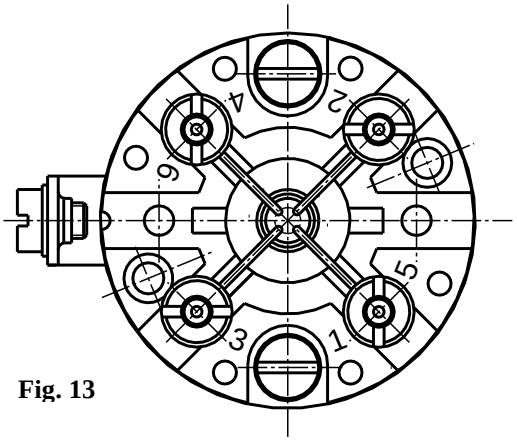
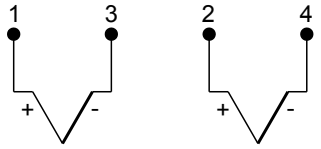
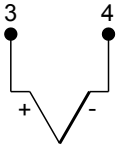


Fig. 13

Double thermocouple 2 x K or 2 x J or 2 x T or 2 x N



Single thermocouple 1 x K or 1 x J or 1 x T or 1 x N



Marking "+" for plus thermocouple.
For :
J - grey
K- green
N- red
T- brown
For double thermocouple one circuits marking, marking two terminals " O "

Sensor grounding

Sensor enclosure can be grounded locally to the structure. When it is not sure that this metallic connection (by threated connector of the sensor thermowell) is enough good, the sensor housing to be grounded by wire with cross section minimum 4mm^2 in accordance to scheme below.

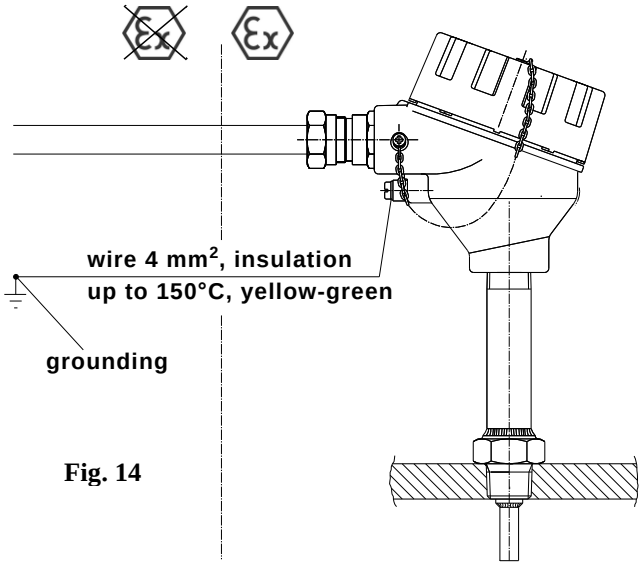


Fig. 14

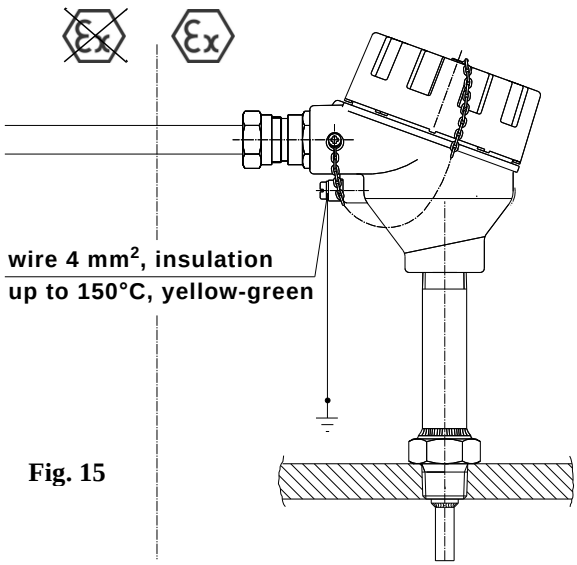


Fig. 15

! Data sheets contents diagrams of transmitter connection.

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Table 11: TECHNICAL DATA OF TRANSMITTER USED EXCHANGEABLE IN THE SENSORS

		FlexTop 2211	FlexTop 2221	FlexTop 2231	IPAQ-H	APAQ	LTT-03 B
							
Output signal		4..20 mA	4..20 mA	11 mA ± 1 mA	4..20 mA	4..20 mA	4..20 mA
Supply voltage		6,5..30V DC	8..35V DC	9..32V DC	6,5..36V DC	6,5..32V DC	7,5..30V DC
Burden resistance		$R_{obc.}=\frac{U-6,5V}{23mA}$	$R_{obc.}=\frac{U-12V}{23mA}$	$R_{obc.}=\frac{U-9V}{23mA}$	$R_{obc.}=\frac{U-6,5V}{22mA}$	$R_{obc.}=\frac{U-6,5V}{25mA}$	$R_{obc.}=\frac{U-7,5V}{22mA}$
Circuit galvanic isolation	**U**	< 30 VDC	< 30 VDC	< 20 VDC	1500VAC\1min	-	
	I	< 0,1 A	< 0,1 A	< 100 mA	-	-	
	P	< 0,75 W	< 0,75 W	< 0,75 W	-	-	
Communication way		-	HART HCF	Profibus PA ver. 3,0 VPD 1	-	-	-
Explosion protection concept		Non intrinsically safe	Non intrinsically safe	Non intrinsically safe	Non intrinsically safe	Non intrinsically safe	Non intrinsically safe
Interference emission		EN-50 982-2	EN-50 982-2	EN 61 326	-	-	EN 61 326 class B
Noise immunity		EN-50 981-1	EN-50 981-1	EN 61 326	-	-	Industrial requirements

		MESO-H	LTT-01	LTT-01-H	ROSEMOUNT 248H		
							
Output signal		4..20 mA	4..20 mA	4..20 mA	4..20 mA		
Supply voltage		10..42V DC	-	10..35V DC	18..42V DC		
Burden resistance		$R_{obc.}=\frac{U-10V}{23mA}$	$R_{obc.}=\frac{U-8V}{22mA}$	$R_{obc.}=\frac{U-10V}{22mA}$	R > 250Ω		
Circuit galvanic isolation	**U**	-	3,75 kV / 50Hz	-	500VAC		
	I	-	-	-	-		
	P	-	-	-	-		
Communication way		HART	-	HART	HART		
Explosion protection concept		Non intrinsically safe	Non intrinsically safe	Non intrinsically safe	Intrinsically safe		
Interference emission		-	-	EN 61 326 class B	-		
Noise immunity		-	-	Industrial requirements	-		

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7. GUIDELINE FOR ESTIMATION OF TEMPERATURE CLASS OF THE SENSOR

– gas potential explosive atmosphere G.

Temperature class of the apparatus determine its the hottest surface, which can appear during normal operation, it means temperature measurement of the process in the measuring range.

Because sensor manufacturer is not able foreseen actually operation condition of the sensor, on the data sheets and certificate was declared temperature class responding top temperature declared measuring range regardless influence of ambient T_{amb} and self-heating T_e temperature.

Actually maximum surface temperature and responding temperature class of sensor working on the object can be lower than declared by sensor producer in accordance to Table 1. in the standard EN 60079-0.

The hottest sensor surface can be surface of electronic transmitter, connection heads or surfaces around sensing element (RTD, TC).

If process temperature T_p is lower than ambient temperature T_{amb} the hottest surface of the sensor will be surface of transmitter / connection head.

$$\mathbf{T_p < T_{amb}}$$

TabLE 12: SENSORS WITHOUT TRANSMITTER

Sensor type	Measuring range	Range of temperature class	Ambient temperature T_{amb}	The hottest surface in the most disadvantageous conditions
Category Ex II 2 G,				
All types with and without thermowell • RTD • TC	*(-20 ÷ 60°C)* -200°C ÷ T_{amb} -40°C ÷ T_{amb}	T6	-40 ÷ 75°C	*(connection head, Fig. 16)* Connection head, Fig. 17

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Table 13: SENSORS WITH TRANSMITTER

Sensor type	Measuring range	Range of temperature class	Ambient temperature T_{amb}	The hottest surface in the most disadvantageous conditions
Category Ex II 2 G,				
All types with and without thermowell • RTD • TC	*(-20 ÷ 60°C)* -200°C ÷ T_{amb} -40°C ÷ T_{amb}	T5	See table no. 15	*(connection head, Fig. 16)* Connection head, Fig. 17
		T6		

Tx – maximal temperature T_{amb} for temperature class for type of used transmitter

Table 14: SENSORS WITH TRANSMITTER* AND DISPLAY

Sensor type	Measuring range	Range of temperature class	Ambient temperature T_{amb}	The hottest surface in the most disadvantageous conditions
Category Ex II 2 G,				
All types with and without thermowell • RTD • TC	*(-20 ÷ 60°C)* -200°C ÷ T_{amb} -40°C ÷ T_{amb}	T6	-40 ÷ 80°C	*(connection head, Fig. 16)* Connection head, Fig. 17

- transmitter APAQ

Retain temperature class of connection head is limited by inside power dissipation and depends on connection head type according to table no. 15 (Values $P_{roz.}$ in brackets for connection heads NS1, NS2 while the rest for connection heads AS1, AS2, AS3, AS4).

Table 15: MAXIMAL DISSIPATION POWER FOR CONNECTION HEAD CLASS TEMPERATURE

$T_{amb.}$	Class T6 ΔT[K]	Max. $P_{roz.}$ [W]	Class T5 ΔT[K]	Max. $P_{roz.}$ [W]
40ºC	40K	10 (*9*)	55K	15,5 (*13*)
55ºC	25K	6,0 (*4,7*)	40K	10,0 (*9*)
70ºC	10K	1,9 (*1,45*)	25K	6,0 (*4,7*)
85ºC	--	--	10K	1,9(*1,45*)

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If process temperature T_p is higher than ambient temperature T_{amb} the sensor surface will be heated by process temperature T_p and ambient temperature T_{amb}.

$$\mathbf{T_p > T_{amb}}$$

In case of sensors working in the explosion atmospheres when $T_p > T_{amb}$ the hottest places of the sensor are:

- the tip of the measuring insert – outer surface has contact with explosive gas mixture.

Table 16: SENSORS WITHOUT TRANSMITTER, SENSORS WITH TRANSMITTER, WITH TRANSMITTER AND DISPLAY

Sensor type	Measuring range *	Range of temperature class	Ambient temperature	The hottest surface in the most disadvantageous conditions
Category Ex II 2 G,				
All sensors type except: sensors with thermowell GB and sensors without thermowell (T..I) •RTD •TC J •TC K •TC T •TC N	 T_{amb} ÷ 450°C T_{amb} ÷ 450°C T_{amb} ÷ 450°C T_{amb} ÷ 350°C T_{amb} ÷ 450°C	 T1...T6 T1...T6 T1...T6 350°C...T6 T1...T6	-40 ÷ 75°C without transmitter with transmitter (see table no. 15) -40 ÷ 80°C with transmitter and display	• inner surface of the thermowell bottom • outer surface of the tip of measuring insert Fig. 17
•Sensor TOPGB, APTOPGB •Sensor TT(J,K,T,N)GB APTT(J,K,T,N)GB •Sensor TOPI, APTOPI •Sensor TTJI, APTTJI •Sensor TTTI, APTTTI •Sensor TTKI, APTTKI •Sensor TTNI, APTTNI	T_{amb} ÷ 135°C T_{amb} ÷ 135°C T_{amb} ÷ 600°C T_{amb} ÷ 700°C T_{amb} ÷ 350°C T_{amb} ÷ 1200°C T_{amb} ÷ 1200°C	T4...T6 T4...T6 T 600°C...T6 T 700°C...T6 T 350°C...T6 T 1200°C...T6 T 1200°C...T6	-40 ÷ 75°C without transmitter with transmitter (see table no. 15) -40 ÷ 80°C with transmitter and display	• tip of measuring insert or Fig. 18 • outer sheath of measuring insert behind compression fitting Fig. 19

* without influence of ambient temperature T_{amb} and self-heating T_e
Tx – maximal temperature T_{amb} for temperature class for type of used transmitter

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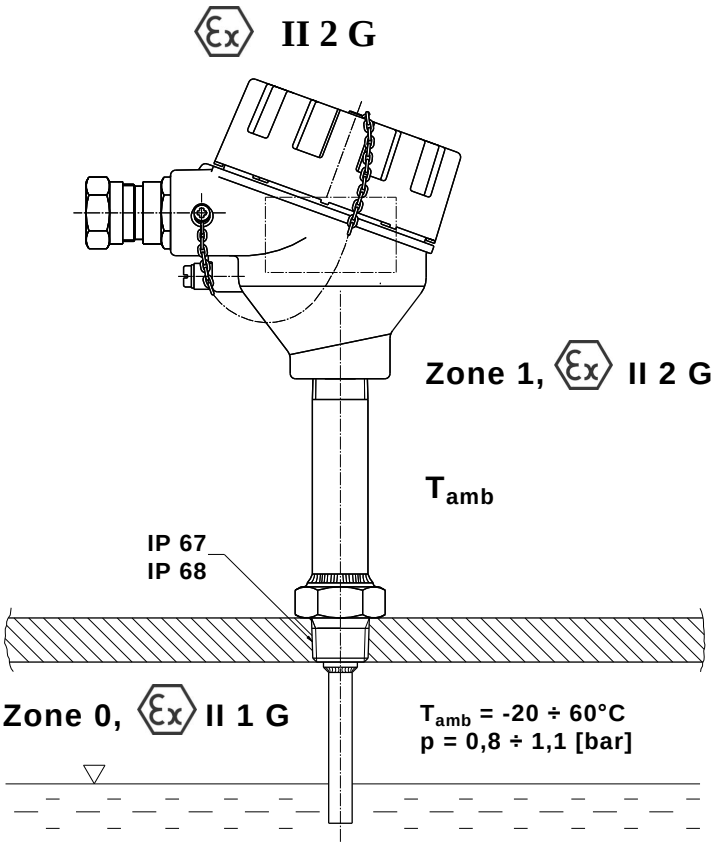

Fig. 16

! For sensors working on Zone 0 / 1 border the temperature class of the sensor is T6

Maximal process temperature ≤ Permissible temperature for temperature class of surrounding gas, mist, vapour type

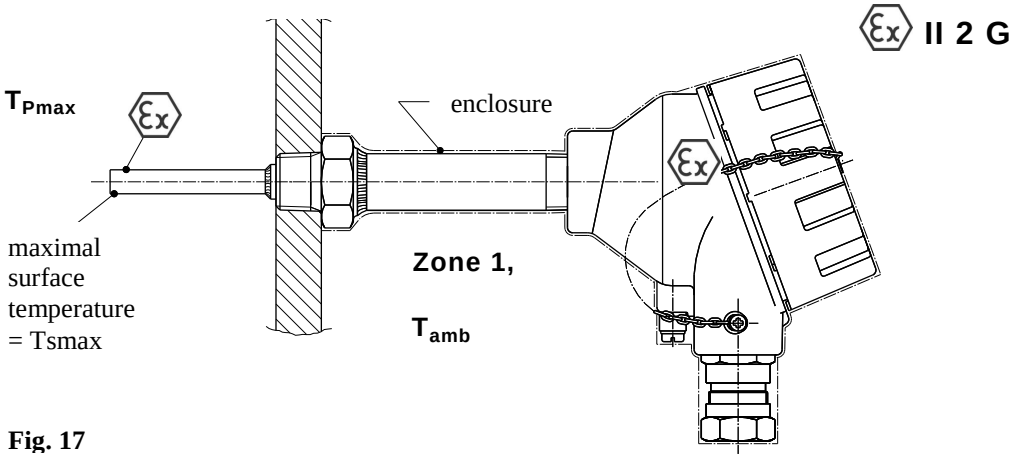

Fig. 17

$T_{Pmax} \leq$ T1...T6

! For all sensors except (T..I), the max process temperature T_{pmax} must not be higher than the temperature of temperature class for surrounding explosive mixture.

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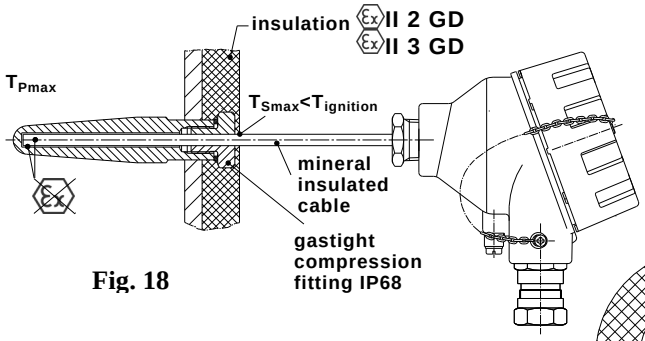

Fig. 18

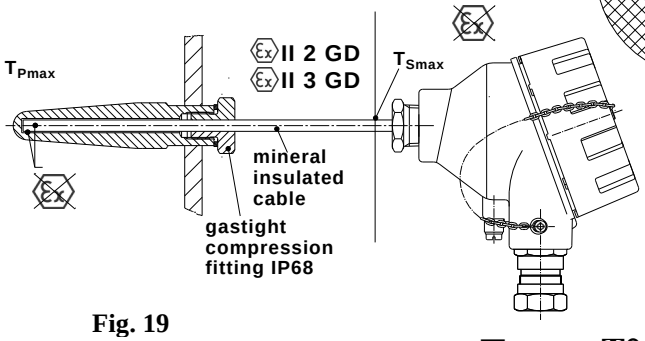

Fig. 19

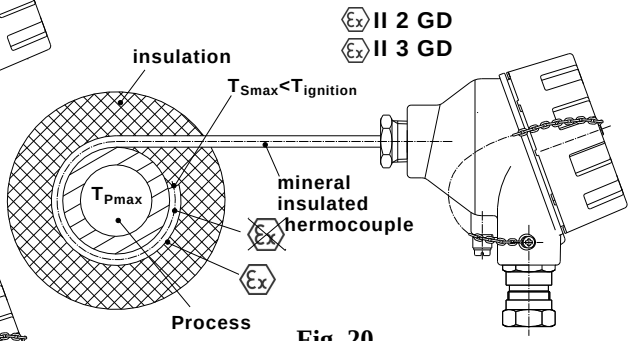

Fig. 20

$T_{Pmax} > T°C...T6$
$T_{Smax} < T°C...T6$

! For sensors (T..I), the max process temperature T_{pmax} can be higher than class temperature for present explosion mixture under condition, that conducting heat and radiation heat from temperature process T_p do not worm none sensor surface exposed to explosion atmosphere higher than ignition temperature of the explosive mixture.

! Designer of the installation is responsible for such sensor type choosing and way his installation so as to after sensor installation during extreme working conditions temperature of the hottest surface will be lower than temperature of class temperature for surrounding gas, mist, vaporous type.

7. GUIDELINE FOR ESTIMATION OF MAXIMAL PERMISSIBLE SURFACE TEMPERATURE OF THE SENSOR – dust explosive atmosphere D.

Maximal surface temperature of the sensor can be reached during operation in extreme conditions. Because tightness of the sensor is IP6X (dust-tight enclosure) dust must not ingress inside and this concerns outside surface of the sensor.

If process temperature T_p is higher than ambient temperature T_{amb} sensor surfaces will be wormed by process temperature T_p, ambient temperature T_{amb} and self-heating.

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Maximum surface temperature of the sensor having contact with explosive dust mixture must not exceed 2/3 self-inflammation temperature of dust cloud or 75K lower from self-ignition temperature of dust layer thickness up to 5mm (p.6.1 and 6.2 PN-EN 61241-0).

Table 17. PART OF TEXT „Mieszaniny wybuchowe”; in accordance with Code NF PA 325 M-1984

Dust	Self-inflammation temperature for		Minimum inflammation energy (cloud) (mJ)	Minimum explosion concentration (cloud) [g/m^3]
	Layer	Cloud		
Agricultural dust				
Starch (wheat)	380	400	25	25
Peanuts (husks)	210	460	50	45
Wheat (bulk)	220	500	60	65
Wood / pine (sawdust)	260	470	40	35
Cocoa	240	510	100	75
Unprocessed cotton	520	-	100	190
Cellulose	270	480	80	55
Dextrin	390	410	40	40
Flour / wheat	440	440	60	50
Corn starch	-	380	30	40
Milk powder	200	490	50	50
Cork	210	460	35	35
Malt	250	400	35	35
Rice	450	510	100	85
Soya (flour)	340	550	100	60
Sugar	400	370	30	45
Metallic dust				
Ground aluminium (*)	460-900	550-700	50-120	45-120
Aluminium flakes (*)	400-900	600-700	10-100	40-60
Aluminium powder (*)	490-700	550-800	15-160	40-140
Tin	430	630	80	190
Ferro-titanium	400	370	80	140
Magnesium aluminium	480	430	80	20
Silicon	950	780	96	160
Thorium	280	270	5	75
Uranium	100	20	45	60
Zinc	540	690	960	460
Carbonated materials				
Adipic acid	-	550	60	35
Fumaric acid	-	520	35	85
Dicumyl peroxide	180	560	30	45

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Soap	500	640	120	83
Sulphur	220	190	15	35
Vitamin B1 nitrate	-	360	60	35
Vitamin C (ascorbic acid)	280	460	60	70
Chemicals				
Asphalt	550	510	40	35
Tar	-	630	25	45
Bituminous coal	180	610	30	50
Charcoal	180	530	20	140
Graphite	580	-	-	-
Lignite	200	450	30	30
Plastic, rubber				
Carboxymethylcellulose	310	460	140	60
Ethylcellulose	350	370	10	25
Methylcellulose	340	360	-	30
Polyvinyl accate	-	550	160	40
Polyacrylonitrile	460	500	20	25
Polyethylene	380	450	30	20
Sodium resinate	220	350	60	40
Viscose (rayon)	250	520	240	55
Polypropylene	-	420	30	20

(*) Depending on size grading and manufacture process

In case other type of dusts has not been mentioned in the above table T_{Smax} shall be evaluated on the base relevant standards and scores of testing.

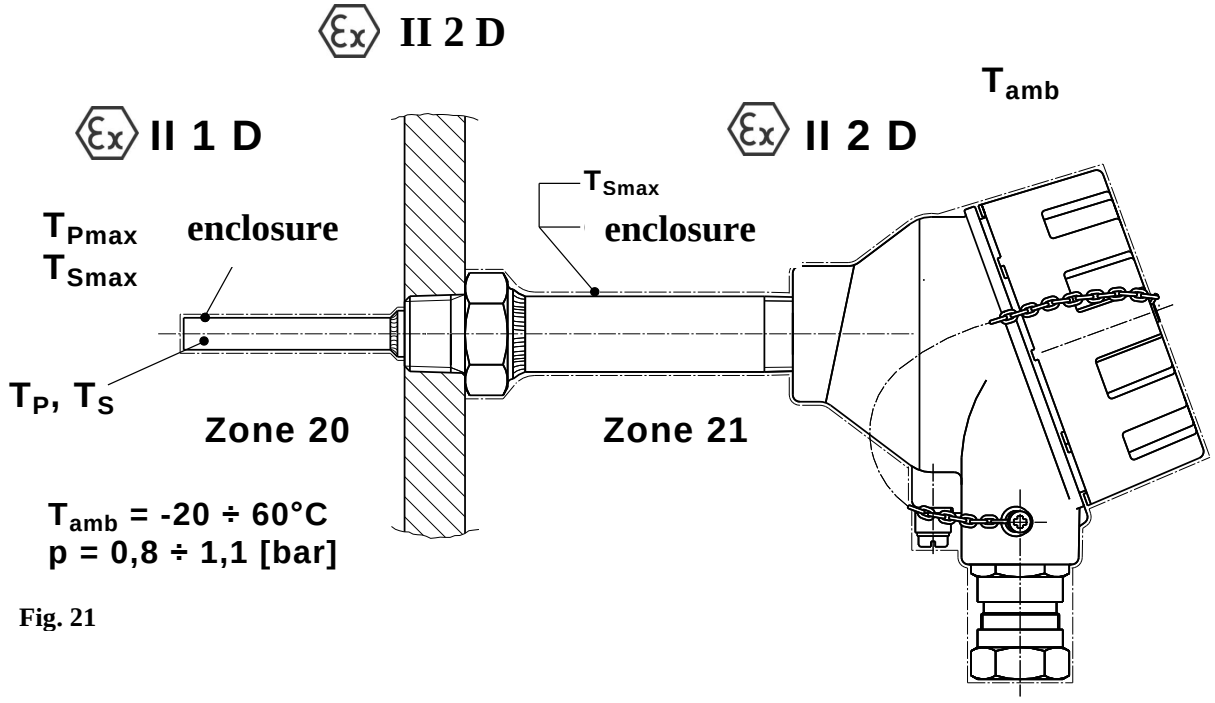

Fig. 21

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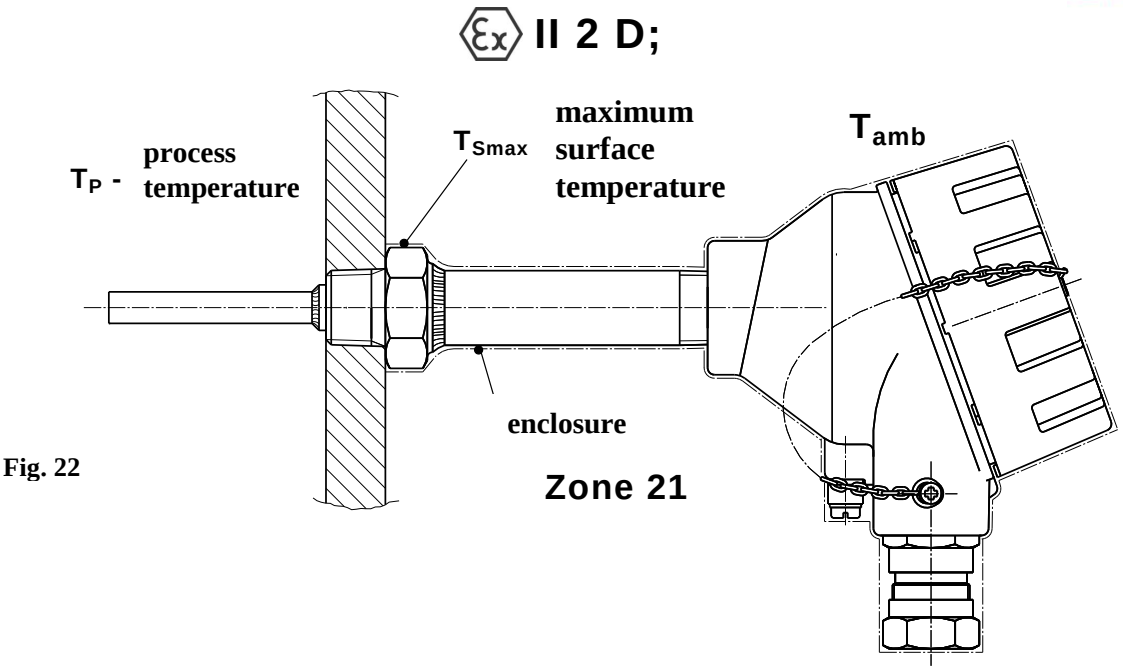

Fig. 22

! Designer of the installation is responsible for such sensor choosing and way his installation so as to after sensor installation during extreme working conditions, temperature the hottest surface will not be higher than 2/3 of dust cloud self-inflammation temperature T_{Cl} or dust layer self-inflammation temperature T_{5mm} – 75K.

Other cases of using sensor and adequate conditions are given by standard PN-EN 61241-0.

8. ENVIRONMENTAL CONDITIONS

- Ambient temperature depend on sensor type acc. to Table: 12, 13, 14, 16,
- Humidity max 80%,
- Sensors are designed to use indoor and outdoor location.

9. TIGHTNESS. IP DEGREE.

Ordered in Limatherm Sensor Sp. z o.o. sensor can equipped with appropriate cable gland:

- for sensor intended for use in potentially gas G or dust D explosive atmospheres ATEX II GD Ex d IIC approved
- for sensor intended for use (group I) ATEX I M2 Ex d I approved

All cable glands are pointed out by LIMATHERM SENSOR, so as to include foreseen to use cable diameter.

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In case ordering a sensor without cable gland, fitter is obliged to mount certified cable gland for destination of sensor (I or II group).

In case of defect mineral insulated cable or loss technical parameters, user can change it individual.

All parts of the sensors are assembled using tightening moment which ensure comply declarated IP degree rating. During sensor installation on the object, after electrical connection to the intrinsically safe circuit shall:

- tighten / install cable glands:
  Handling shall be done in accordance with gland producer's manual.

- Using screwdriver tighten by hand cover screw.

! Tightening with appropriate moment of cable gland and cover with the help of screw.

10. DOCUMENTS

To the each sensor is enclosed:

- Application manual for sensor.
- Application manual for cable gland ATEX approved.
- Data sheet for transmitter
- Warranty.
- Declaration of conformity.

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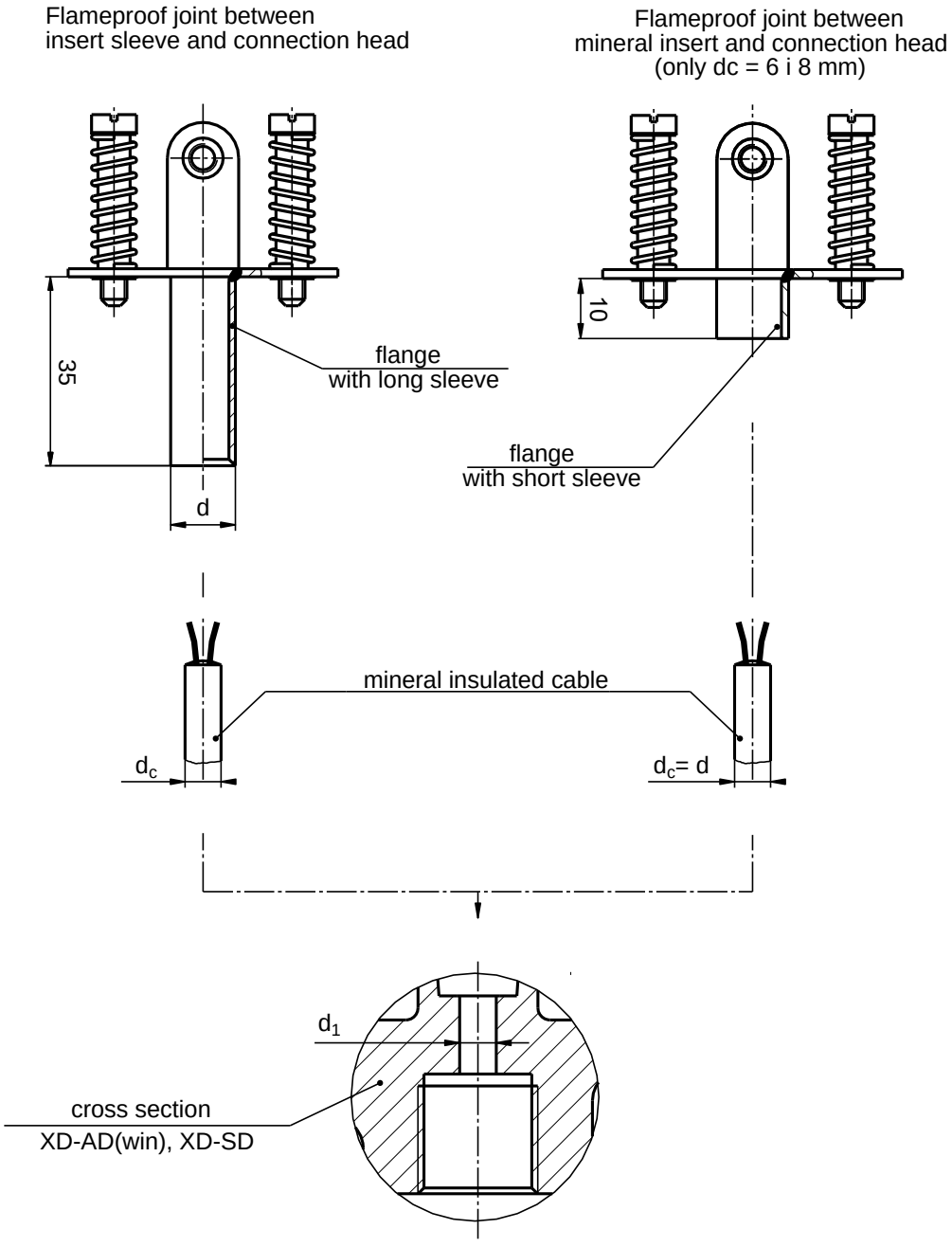
Flameproof joint between mineral insert and connection heads XD-AD(win), XD-SD



Mineral insert dc [mm]	d_1 [mm]	d [mm]	flameproof joint [mm]
Ø 3	Ø 6.1H8	Ø 6 $^{+0.06}_{-0.03}$	0.04 - 0.148
Ø 4.5	Ø 6.1H8	Ø 6 $^{+0.06}_{-0.03}$	0.04 - 0.148
Ø 6	Ø 8.1 H8	Ø 8 $^{+0.06}_{-0.02}$	0.04 - 0.142
Ø 8	Ø 10.1H7	Ø 10 $^{+0.06}_{-0.03}$	0.04 - 0.138

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