

Armatures Metals

Installation and Maintenance Instructions



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3. Intended use
4. General description
5. Description of armature
6. Technical data
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Preface

This instruction manual is written to assist the user in proper procedures for trouble-free operation.

It is explicitly pointed out that optek-Danulat GmbH assumes no responsibility for loss or damage caused due to improper use of this instruction manual or products described herein.

This manual is protected by copyright. However, the user may produce copies and translations if required for correct operation of the products.

On request, this manual is available in other languages as well as in digital format (Acrobat® Reader 7.0 required).

Our products are being continuously improved. Technical data is subject to change without notice.

Essen, Juni 2012

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1 Using the instruction manual

1.1 Validity of this instruction manual

This instruction manual is an appendix of the sensor body data sheet and is valid for all armatures whose sensor body data sheet is explicitly related to this instruction manual.

Data found on the sensor body data sheet takes precedence if there are inconsistencies in documentation.

Follow the instruction manual for every operation. If the sensor is not used as described in this instruction manual, your safety and the sensor function may be affected.

To maintain reliability of the product, enhance its life cycle, and avoid down times, follow the instructions given in this manual.

Furthermore, please follow local accident prevention and environmental protection instructions, as well as recognized technical regulations for safe and professional operation.

1.2 Pressure Equipment Directive (PED)

This instruction manual describes armatures (mounted or in pieces) for inline sensors manufactured by optek-Danulat GmbH which are pressure equipment with respect to their classification according to the following paragraphs of the pressure equipment directive 97/23/EC from May 29, 1997:

- Article 1, paragraph 2, figure 2.1.4
- Article 3, paragraph 1, figure 1.1 and 1.3
- Article 3, paragraph 3

Responsibility for the design and manufacture of these armatures is optek's.

All certifications and assessments concerning PED were done in cooperation with the notified body of TÜV Nord CERT GmbH, identification number 0045.

Our standard is to classify optek armatures in category I and II according to Annex II of the PED and to manufacture them according to Module E1, quality assurance, Annex III of the PED.

Furthermore it is possible to manufacture armatures, which are classified in category I, corresponding to Module A, internal production control, according to Annex III of the PED. In these cases the sensor body is not marked with the identification number of the notified body.

When the line size is less than or equal to DN25, design and manufacturing of the armatures is done with German sound engineering practices as described in article 3, paragraph 3 of the PED. In that case, the armature is not classified according to the categories and no conformity assessment is undergone. The PED furthermore defines that armatures to whom Article 3 (3) applies must not bear the CE marking.

optek guarantees that all armatures have the same production quality. The design and manufacturing of armatures less than or equal to DN25 meets or exceeds the safety requirements defined in category I of the PED.

Material, line size, or existing process conditions may necessitate variations in assessment. In these instances, other assessment models of the PED will be used. If so the conformity of declaration for the construction of armatures will be done according to Module G, Annex III of the PED.

1.3 Pictograms and signal words

Important information in this instruction manual is marked with the following pictograms:

**Danger!**

This pictogram indicates immediate danger to life and health of persons.
The text next to the symbol gives information on how to avoid bodily injuries.

**Caution!**

This pictogram indicates information on how to avoid material damage.

**Note!**

This pictogram indicates instructional or general advice.

If the use of personal protective equipment can avoid or reduce danger it will be marked with the corresponding symbols:



Wear safety glasses.



Wear safety suit.

2 Returns and disposal

2.1 Declaration of decontamination

For the safety of our employees and because of legal regulations we need a signed "declaration of decontamination" before your return can be handled. This signed declaration must be included with the shipping documents on the outside of the packaging.

Any returns which were exposed to hazardous substances and were not professionally decontaminated are not accepted and will be sent back on your cost.

optek's declaration of decontamination and contact information can be found on our website www.optek.com.

2.2 Disposal

Special legal regulations apply to the return and disposal of industrial waste equipment. However, manufacturer and user can contractually agree on which party is to fulfill these legal obligations.

Observe current national disposal regulations.

To dispose packaging material, please separate materials into the following groups:

- Paper / paperboard
- Plastic

For disposal, disassemble the system components and separate them according to different material groups.

Dispose of materials according to national and local regulations.

If no agreement has been made, products may be shipped to optek for disposal.

3 Intended use

Armatures delivered by optek are suitable for gases and liquids of the fluid groups 1 and 2 and tables 1 and 3 for vessels respectively. Tables 6 and 8 of Annex II of the PED are effective for piping.

Maximum allowable pressure (PS), volume (V), line size, and type of process fluid influence the classification of the armature. Armature classification and assessment can be found in the applicable sensor body data sheet.

Furthermore surrounding piping must be supported to ensure no mechanical stress is placed on optek armatures.

External forces may not be induced through the process connections, this includes changes in length with respect to temperature.

The armature is designed for static/ constant pressure with limitations/ restrictions concerning the working overpressure defined in the PED.

For materials where the creep strength is restricted a value of 10^5 h has been used.

Influences like abrasion, corrosion or other interactions between the process medium and the material were not considered.

To cover a wide spectrum of different process conditions, optek armatures can be manufactured from different materials and can be combined with multiple combinations of window gaskets and windows.

The choice of appropriate material related to the process medium and the process conditions is the responsibility of the designer and the operating company of the plant.

Allowable operating temperatures (TS) and allowable changes of temperature in particular depend on the choice of windows and gaskets.

optek armatures are available with a multiple choice of different process connections which have to be selected from the designer and the operating company of the plant depending on the process medium.

The process connections are not described in this manual.

The designer and the operating company of the plant have the responsibility to follow technical rules regarding the different process connections and have to ensure compliance with the permitted operating conditions (e.g. PS, TS) through appropriate technical and organizational arrangements.

Permitted technical rules as well as local and national regulations (e.g. the PED related to the conformity validation, identification and final inspection of the plant) have to be followed.

The manufacturer is not liable for damage resulting from use other than intended.

Intended use includes following all directions put forth in this instruction manual. Product specifications can be found in the applicable sensor body data sheet.

The pressure equipment directive is valid in the EU Member States. If using optek armatures outside EU Member States follow local pressure equipment regulations.

4 General description

Definitions:

- **Sensor body** - connects to the process line
- **Mounting set of window rings** -
2 x windows + 2 x window rings + 16 x screws (with washers)
- **Armature** - sensor body + mounting set of window rings + 4 x O-Rings
- **Sensor assembly** - lamp assembly + detector assembly
- **Sensor** - armature + sensor assembly

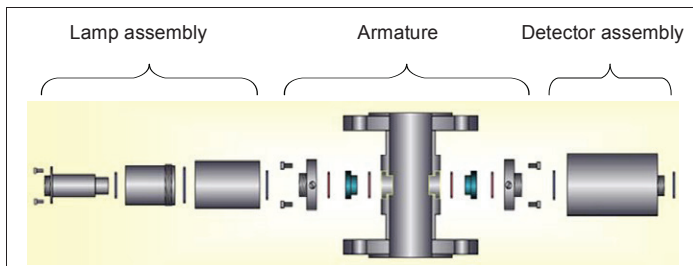


Fig. 1 Exploded view, example: sensor AF26



Caution!

- Window gaskets always need to be installed between windows and sensor bodies and between windows and window rings.
- Depending on the sensor assembly, three different window rings are available.
- Three different types of windows can be used: Pyrex[®], Sapphire and Sapphire Biotech (slit optimized).
- Armatures are sealed even without the sensor assembly attached.



Note!

When attaching the sensor assembly to the armature ensure correct installation of the gaskets between the window rings and the sensor assembly.

Table 1 Sensor configuration

1.	Sensor assembly	AF16 AF26 AF56	TF16 TF56	AF45 AF46	DTF16
2.	Sensor body	PN: 0120-_-_-_-_-_-			PN: 0121-_-_-_-_-_-
3.	Mounting set of windows	Window rings M24 / M24	Window rings M24 / M58	Window rings M24 / M58 / FL59	
	• Pyrex® (Borosilicate glass)	X	X	-	-
	• Sapphire	X	X	X	-
	• Sapphire Biotech	X	X	X	X
4.	Window gaskets (Set of 4) ¹⁾	O-Ring 21.95 x 1.78 mm			
	Silikon (FDA)	X	X	-	-
	Viton® (FDA)	X	X	X	-
	EPDM (FDA, USP class VI)	X	X	X	X
	Kalrez® 4079	X	X	X	-
	Viton® FEP (FDA)	X	X	X	-
	Fluoraz® 797	X	X	X	-
	Kalrez® 1050 LF	X	X	X	-
	Kalrez® 6375	X	X	X	-
	Chemraz® 513	X	X	X	-
	Buna® (FDA)	X	X	X	-
	Kalrez® 6230 (FDA, USP Class VI)	X	X	X	-

¹⁾ window gaskets for DTF16: set of 6



Note!

- To cover a wide spectrum of different process conditions, optek armatures can be manufactured from different materials and can be combined with multiple combinations of window gaskets and windows.
- The choice of appropriate material related to the process medium and the process conditions is the responsibility of the designer and the operating company of the plant.
- Window type and O-Ring type may affect allowable operating temperature (TS) and pressure (PS). See table 11 on page 31, table 12 and table 13 on page 32 for more information.
- Because there are a variety of components that may be chosen to configure the most conservative specification is valid for the entire sensor.

5 Description of armature

5.1 Design of armature

The armature drawings described in this chapter are examples and are not representative of all available metallic armatures. Shape, size, and connection type may differ from armatures delivered with this instruction manual.

5.1.1 Design of armature AF / TF

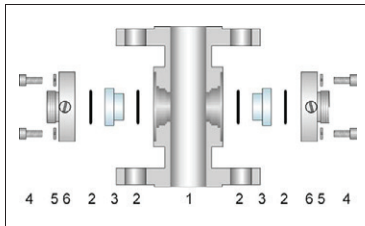


Fig. 2 Exploded view: armature with mounting set M24-M24

Tab. 2 Exploded view explanation of mounting set M24-M24

No.	Explanation
1	Sensor body
2	O-Ring $\varnothing 21.95 \times 1.78$ mm
3	Windows
4	Screw M5 x 12, DIN 912
5	Washer M5, DIN 7980
6	Window ring M24 - 8M5

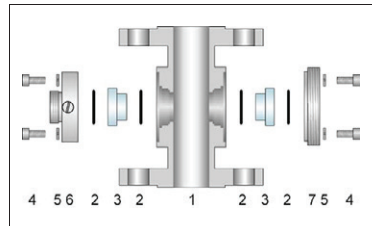


Fig. 3 Exploded view: armature with mounting set M24-M58

Tab. 3 Exploded view explanation of mounting set M24-M58

No.	Explanation
1	Sensor body
2	O-Ring $\varnothing 21.95 \times 1.78$ mm
3	Windows
4	Screw M5 x 12, DIN 912
5	Washer M5, DIN 7980
6	Window ring M24 - 8M5
7	Window ring M58 - 8M5



Fig. 4 Armature with mounting set M24-M24, e.g. for sensors AF16, AF26



Fig. 5 Armature with mounting set M24-M58, e.g. for sensors TF16, AF45, AF46

5.1.2 Design of armature DTF

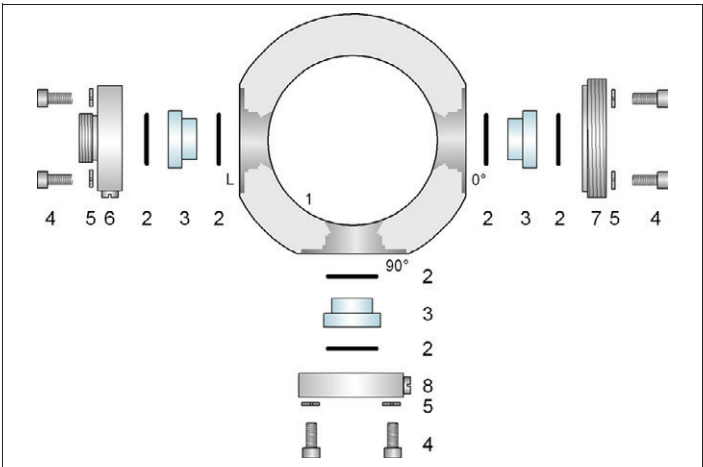


Fig. 6 Exploded view of armature DTF

Tab. 4 Exploded view explanation of armature DTF

No.	Explanation	No.	Explanation
1	Sensor body	5	Washer M5, DIN 7980
2	O-Ring $\varnothing 21.95 \times 1.78$ mm	6	Window ring lamp assembly M24 - 8M5
3	Windows	7	Window ring detector assembly 0° absorption / 11° scattered light M58 - 8M5
4	Screw M5 x 12, DIN 912	8	Window ring detector assembly 90° scattered light FL59 - 8M5



Fig. 7 Example of assembled armature with window rings M24 - 8M5, FL59 - 8M5, and M58 - 8M5

5.2 Marking according to PED

Armatures are marked on the sensor bodies according to the PED. Indications of the marking are illustrated as an example in table 5. According to the pressure equipment directive, armatures delivered by optek must, among other indications, bear the CE marking.

Sensor bodies with nominal sizes below or equal to DN25 constructed and manufactured by optek according to article 3, paragraph 3 are an exception. Those armatures must not bear the CE marking.

Tab. 5 Example for marking according to PED

Armatures	not according to article 3, paragraph 3 PED	according to article 3, paragraph 3 PED
Manufacturer's name	optek-Danulat	optek-Danulat
Line size	1.5"	1"
Data for OPL (A-A)	F40	F20
Part number	0120-1946-33	0120-2911-33
Manufacturer's mark	according to manufacturer	according to manufacturer
Serial No.	PO-18189-27227-007	PO-18178-27218-001
Material code	1.4435	1.4435
Charge No.	710019	715025
Line size (PED)	DN40	DN25
Allowable product temperature	TS -40 °F to +248 °F	TS -40 °F to +248 °F
Allowable operating pressure	PS 20 bar	PS 20 bar
Allowable test pressure	PT 30 bar	PT 30 bar
CE mark	CE ¹⁾	
Identification number	0045 ¹⁾	

¹⁾ Some armatures with special material contain the CE mark without the identification number



Fig. 8 Example of armature marking to which article 3, paragraph 3 of the PED does not apply



Fig. 9 Example of armature marking to which article 3, paragraph 3 of the PED does apply

**Caution!**

- Do not exceed the allowable pressure (PS) or allowable test pressure (PT).
- Product temperatures above allowable temperature (TS) are allowed by reducing the allowable pressure (PS).
- Please take note of the table for allowable pressure at elevated temperature written in the applicable sensor body data sheet.
- Allowable operating temperature (TS) and pressure (PS) can be found on the appropriate sensor body data sheet. Window type and O-Ring type may affect allowable operating temperature (TS) and pressure (PS). See table 11 on page 31, table 12 and table 13 on page 32 for more information.

6 Technical data

The complete documentation of the armature includes: the sensor body data sheet, and the optek-armatures instruction manual. Technical data and the drawing of the sensor body and information about allowable operating conditions are found in the sensor body data sheet.

All other technical specifications of the components which are necessary for the assembly of the armature are included in this manual

6.1 Allowable operational conditions

Surrounding piping must be supported to ensure no mechanical stress is placed on optek armatures. External forces may not be induced through the process connections, this includes changes in length with respect to temperature.

The armature is rated for static pressure with limitations concerning the working overpressure defined in the PED.

For materials where the creep strength is restricted a value of 10⁵ h has been used. Influences such as abrasion, corrosion or other interactions between the process medium and the material were not considered.

To cover a wide spectrum of different process conditions, optek armatures can be manufactured from different materials and can be combined with multiple combinations of window gaskets and windows.

The choice of appropriate material related to the process medium and the process conditions is the responsibility of the designer and the operating company of the plant. Allowable operating temperatures (TS) and allowable changes of temperature in particular depend on the choice of windows and gaskets (see table 11 on page 31, table 12 and table 13 on page 32 for more information).

Armatures delivered by optek are available with multiple choices of process connections which have to be selected from the designer and the operating company of the plant depending on the process medium. The process connections are not described in this manual. The designer and the operating company of the plant have the responsibility to follow technical rules regarding the different process connections and have to ensure compliance with the permitted operating conditions (e.g. PS, TS) through appropriate technical and organizational arrangements.

Permitted technical rules as well as local and national regulations (e.g. the PED related to the conformity validation, identification, and final inspection of the plant) have to be followed.

6.2 Sensor Body Data Sheet


Sensor Body Data Sheet Messzellendatenblatt																																															
01	Part Number Teilenummer	0120-3507-33																																													
02	Description Benennung	TC L14AM7-0.5-.0120S33F020																																													
03	Process Connection Prozessanschluss	Clamp TC L14 AM7																																													
04	Line Size Nennweite	0.50 inch																																													
05	F-value F-Wert	20 mm = OPL with window combination A-A (OPL mit Fensterkombination A-A)																																													
06	Face-to-Face Dimension Bauhöhe	96 mm 3.78 inch																																													
07	Weight Gewicht	1,3 kg 2.9 lbs																																													
08	Material Werkstoff	Stainless Steel SS 316 L (1.4435) dF < 0.5 %, BN2 Edelstahl 1,4435 (SS 316L) dF < 0,5 %, BN2																																													
09	Surface (wetted) Oberfläche (innen)	Ra < 0,4 µm (15.7 µinch) - electro-polished																																													
10	Allowable Pressure PS Zulässiger Druck PS	10 mbar - 20 bar (0.15 psi - 290 psi)																																													
11	Allowable Test Pressure PT Zulässiger Prüfdruck PT	30 bar (435 psi)																																													
12	Allowable Temperature TS Zulässige Temperatur TS	-40 °C / + 120 °C (-40 °F / +248 °F)																																													
13	Allowable Pressure at elevated Temperature Zulässiger Druck bei erhöhter Temperatur	<table border="1"> <thead> <tr> <th>TS [°C]</th> <th>60 °C</th> <th>65 °C</th> <th>70 °C</th> <th>75 °C</th> <th>80 °C</th> <th>120 °C</th> <th>150 °C</th> <th>200 °C</th> <th>250 °C</th> <th>300 °C</th> </tr> <tr> <th>TS [°F]</th> <th>140 °F</th> <th>149 °F</th> <th>158 °F</th> <th>167 °F</th> <th>176 °F</th> <th>248 °F</th> <th>302 °F</th> <th>392 °F</th> <th>482 °F</th> <th>572 °F</th> </tr> </thead> <tbody> <tr> <td>PS [bar]</td> <td>20</td> <td>20</td> <td>20</td> <td>20</td> <td>20</td> <td>20</td> <td>18</td> <td>16</td> <td>15</td> <td>14</td> </tr> <tr> <td>PS [psi]</td> <td>290</td> <td>290</td> <td>290</td> <td>290</td> <td>290</td> <td>290</td> <td>261</td> <td>232</td> <td>217</td> <td>203</td> </tr> </tbody> </table>		TS [°C]	60 °C	65 °C	70 °C	75 °C	80 °C	120 °C	150 °C	200 °C	250 °C	300 °C	TS [°F]	140 °F	149 °F	158 °F	167 °F	176 °F	248 °F	302 °F	392 °F	482 °F	572 °F	PS [bar]	20	20	20	20	20	20	18	16	15	14	PS [psi]	290	290	290	290	290	290	261	232	217	203
TS [°C]	60 °C	65 °C	70 °C	75 °C	80 °C	120 °C	150 °C	200 °C	250 °C	300 °C																																					
TS [°F]	140 °F	149 °F	158 °F	167 °F	176 °F	248 °F	302 °F	392 °F	482 °F	572 °F																																					
PS [bar]	20	20	20	20	20	20	18	16	15	14																																					
PS [psi]	290	290	290	290	290	290	261	232	217	203																																					
14	Pressure Equipment Directive (97/23/EC) Druckgeräterichtlinie (97/23/EG)	Technical Requirements according Article 3, Paragraph 3 Technische Anforderungen gemäß Artikel 3, Absatz 3																																													
15	Drawing Zeichnung	0120-3507-33 release: 23.04.2010																																													
16	Instruction Manual Bedienungsanleitung	PN: 1004-3001-xx																																													
17	Allowed Windows Zulässige Fenster	<input checked="" type="checkbox"/> 1-Pyrex (TS: 0-120 °C/32-248 °F • PS: 20 bar/290 psi • PT: 30 bar/435 psi) <input checked="" type="checkbox"/> 2-Sapphire (Saphir) <input checked="" type="checkbox"/> 3-Sapphire (Saphir) - Biotech																																													
18	Special Notes Besondere Hinweise	low volume design / niedriges Volumen: OPL 1 mm < 20 ml / OPL 20 mm < 26 ml Solid Block - no welding / Vollmaterial - keine Schweißnähte																																													
19	<ol style="list-style-type: none"> This sensor body data sheet is valid only with the appropriate instruction manual. Pressure and temperature ratings specified herein may be subject to limitations - see instruction manual. The appropriate choice of material for all wetted parts is the sole responsibility of the user. The above specifications are not valid for use with pH- or conductivity- components - see instruction manual 1004-2015-xx for further information 																																														
	<ol style="list-style-type: none"> Dieses Messzellendatenblatt ist nur gültig in Verbindung mit der zugehörigen Bedienungsanleitung. Druck und Temperatur können Einschränkungen unterliegen - siehe Bedienungsanleitung. Die richtige Werkstoffauswahl für alle medienberührenden Teile liegt in der Verantwortung des Betreibers. Bei Verwendung von pH- und Leitfähigkeits-Komponenten gelten obige Spezifikationen nicht - siehe Bedienungsanleitung 1004-2015-xx für weitere Informationen. 																																														
This sensor body data sheet was released / Dieses Messzellendatenblatt wurde freigegeben		01. Jul 2010																																													
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optek-Danulat GmbH • Emscherbruchallee 2 • D-45456 Essen • Germany • www.optek.com																																															

Fig. 10 Example of a sensor body data sheet

6.4 Dimensions of the sensors depending on the F-values of the sensor body

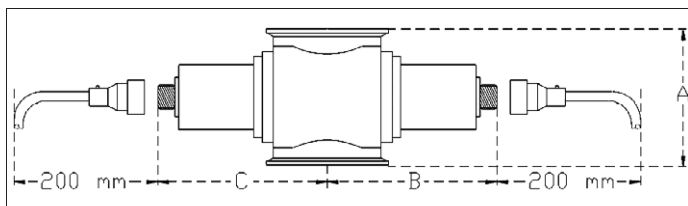


Fig. 12 Dimensions of the sensors depending on the F-values of the sensor body

F-value = OPL with window combination A-A, for further information, see chapter 8.4, page 30

A = installation height, sensor body-dependent (see sensor body data sheet)

B = detector side

C = lamp side

Tab. 6 Dimensions of the sensors depending on the F-values of the sensor body

F-value sensor type	F00		F20		F40		F50		F60		160	
	B [mm]	C [mm]	B [mm]	C [mm]	B [mm]	C [mm]	B [mm]	C [mm]	B [mm]	C [mm]	B [mm]	C [mm]
AF16	130	175	140	185	150	195	155	200	160	205	210	255
AF26	165	175	175	185	185	195	190	200	195	205	245	255
AF45	130	230	140	240	150	250	155	255	260	260	210	310
AF46	145	230	155	240	165	250	170	255	175	260	225	310
AF56	130	175	140	185	150	195	155	200	160	205	210	255
TF16-N	n.a.	n.a.	n.a.	n.a.	160	195	165	200	170	205	n.a.	n.a.
TF56-N	n.a.	n.a.	n.a.	n.a.	160	195	165	200	170	205	n.a.	n.a.

7 Installation

7.1 Installation of armature in the piping

Before installing the sensor, the armature has to be installed into the pipeline.

Observe the following conditions:

- Do not install the armature directly behind valves or other flow obstacles.
- Make sure that no extraneous light sources are located near the sensor in order to ensure proper measuring results.
- To avoid errors in measurement, ensure the sensor body is completely filled with the process medium at all times during operation.
- Windows and window rings must be mounted to the sensor body according to chapter 8.2.2, page 24.
- Surrounding piping must be supported to ensure no mechanical stress is placed on the armature.
- The armatures are not designed to carry external loads.
- If external influences (e.g. corrosion, abrasion, welding, or repairs) damage the armature optek's warranty is voided.
- Do not exceed allowable operating conditions as stated in the applicable sensor body data sheet.



Note!

- Armatures delivered by optek are available with multiple choices of process connections which have to be selected from the designer and the operating company of the plant depending on the process medium.
- The process connections are not described in this manual.
- The designer and the operating company of the plant have the responsibility to follow technical rules regarding the different process connections.

7.2 Installation of armature AF / TF

As a basic principle, install the sensor body into the pipeline with sensor assemblies in a horizontal position (s. Fig. 13 and Fig. 14).

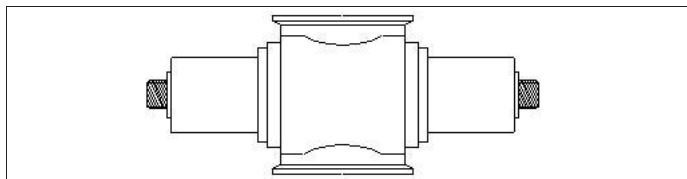


Fig. 13 Vertical alignment of standard sensor body

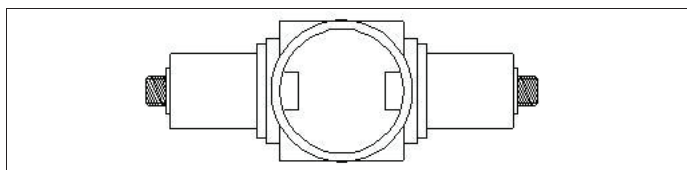


Fig. 14 Horizontal alignment of standard sensor body

Avoid installing sensors in a vertical position (see Fig. 15). Deposits on the lower window or air bubbles on the upper window may affect accurate measurements.

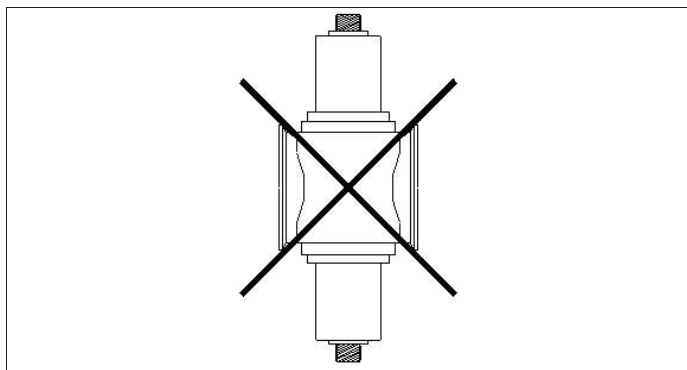


Fig. 15 No vertical alignment of the sensor assemblies

7.3 Installation of armature DTF

Install the sensor body into the pipeline in a vertical position with the sensor assemblies in a horizontal position (see Fig. 16). The arrow on the sensor body has to point in the direction of the process medium flow. Preferably, the sensor body should be installed in a riser with upward flow. In this case, the arrowhead has to point upwards.

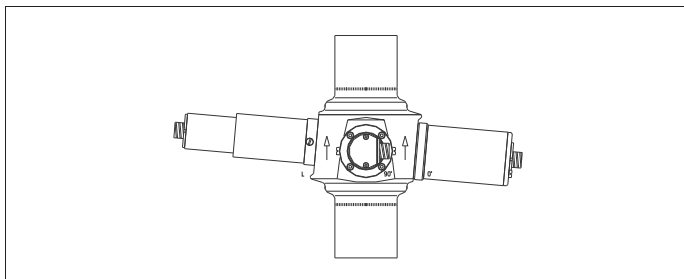


Fig. 16 Vertical alignment



Note!

- Always connect airpurge (e.g. dry oil-free instrument air, nitrogen, etc.) prior to introducing a medium to the process to prevent condensation. For more information see sensor manual DTF.

Installation with horizontal alignment is allowed as described below, but not recommended. If an installation with horizontal alignment is necessary, the sensor body and its sensor assemblies have to be aligned in a certain way (preferred position, see Fig. 17). Otherwise, deposits on the lower window or air bubbles on the upper window might affect accurate measurements.

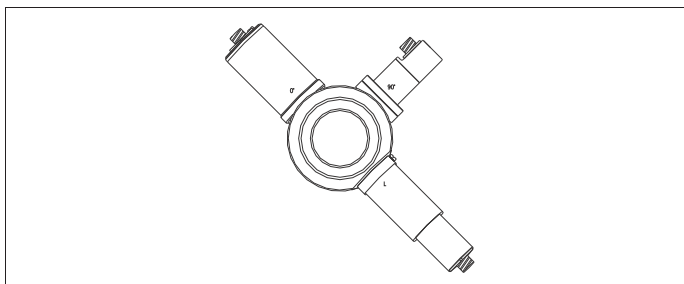


Fig. 17 Horizontal alignment of standard sensor body, preferred position

If the described installation is not possible due to lack of space, install the sensor body in one of the positions shown in Fig. 18.

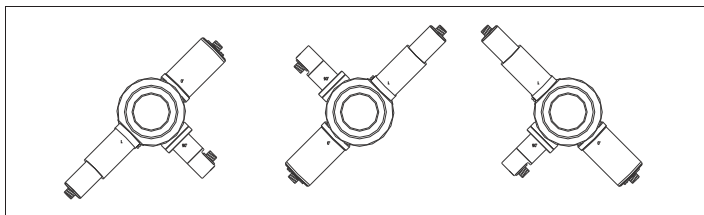


Fig. 18 Horizontal alignment of standard sensor body

Vertical installation of the sensor assembly (see Fig. 19) is not allowed while the armature is in a horizontal position. Deposits on the lower window or air bubbles on the upper window may affect accurate measurements.

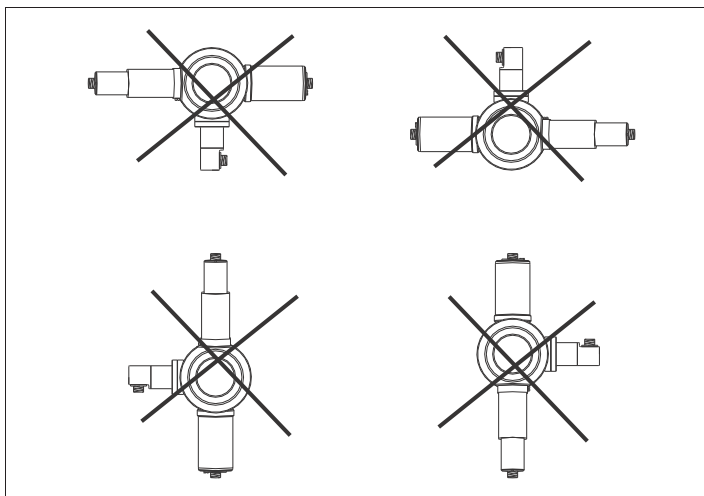


Fig. 19 No vertical alignment of the optical arms

7.4 Airpurge

If the temperature of the process medium is too low, the temperature of the air inside the optical housing may fall below the dew point. This leads to condensation on the window surfaces. To prevent condensation, there are airpurge connections on the window rings of the sensor body or on the optical housings of the sensor.

**Note!**

- Always connect airpurge if the product is more than 10 °C (18 °F) cooler than the ambient temperature.
- The installation procedure depends on the sensor type. For further information see sensor manual.

8 Maintenance

8.1 Maintenance / Repair

Armatures delivered by optek are compact, machined with high precision, and made from high quality materials. However, preventive maintenance or routine repairs may become necessary.

It is the end user's responsibility to ensure functionality and safety of the armature at all times. Parts in direct contact with the product (wetted parts) may require significantly shorter maintenance intervals due to specific process conditions or products.

For repairs and maintenance follow the instructions in chapter 8.2, page 23 and chapter 8.3, page 29.

Repairs should be done by authorized and technically qualified personnel only



Note!

- Damaged sealing surfaces may cause leakage.
- Using non specified parts may adversely affect the technical specifications of armatures or decrease operational safety.
- The end user must use appropriate gasket material for process and operating conditions.
- Before performing maintenance on the armature, ensure the pipe is empty, depressurized, and at ambient temperature.
- To ensure a proper seal, always use new gaskets after performing maintenance.

8.2 Disassembly and assembly of armature

8.2.1 Disassembly

To disassemble the armature the following tools are required:

- 4 mm hexagonal wrench
- Phillips screw driver
- 3 mm hexagonal wrench (for DTF only)

Proceed as follows:

1. Release the cable connections of the sensor by hand. Use the phillips screw driver to release cables with stainless steel plug protectors.
2. Unscrew the sensor assemblies by hand. The DTF armature also requires removing the 90° detector assembly with a 3 mm hexagonal wrench.
3. Remove the screws and washers from the window rings.
4. Remove the window rings from the sensor body.
5. Remove the windows from the sensor body. Hold the windows on their unfinished surfaces.
6. Remove the 21.95 x 1.78 mm O-Rings from the flute of the window rings on the sensor body side.
7. Remove the 21.95 x 1.78 mm O-Rings from behind the windows.
8. To ensure a proper seal, always use new gaskets after performing maintenance.
9. Clean the windows of the sensor body with Isopropanol.



Danger!

Isopropanol is an irritant.

Observe the safety regulations when handling Isopropanol.



Note!

- Disassembly is only allowed by authorized and technically qualified personnel.
- Improper installation can negatively influence safety standards.
- The use of non specified components is not allowed.

8.2.2 Assembly

To assemble the armature the following tools are required:

- 4 mm hexagonal wrench
- Phillips screw driver
- 3 mm hexagonal wrench (for DTF only)

Proceed as follows:

1. Place O-Ring 21.95 x 1.78 mm in lowest groove of the window area of sensor body.
2. Clean windows with Isopropanol.
3. Hold the window on its unfinished surface.
4. Insert window with its lip on the O-Ring.
5. Check O-Ring for even seating. O-Rings should be circular when viewed through the window.
6. Place O-Ring 21.95 x 1.78 mm in the inside flute of the window ring.
7. Place window ring in the turned groove in the sensor body.
8. Note the position of the airpurge connection (1 in Fig. 20).

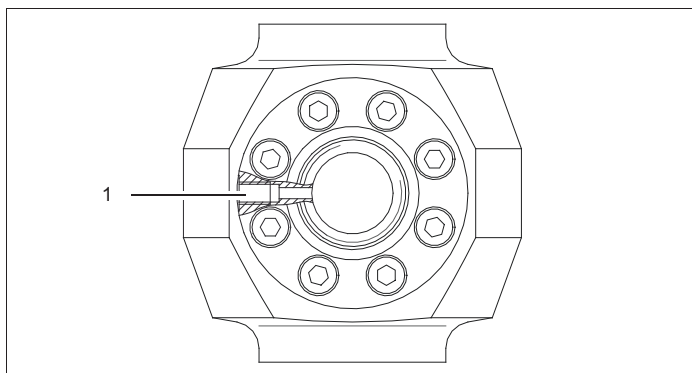


Fig. 20 Position of airpurge connection



Danger!

Isopropanol is an irritant.

Observe the safety regulations when handling Isopropanol.



Note!

- Assembly is only allowed by authorized and technically qualified personnel.

9. Add 8 washers M5, DIN 7980 to the window ring.
10. Add 8 screws M5 x 12 DIN 912 to the window ring.
11. Tighten screws according to Fig. 21 with pre-torque setting 1.0 Nm.
12. Tighten screws according to Fig. 21 with final-torque setting 4.5 Nm.

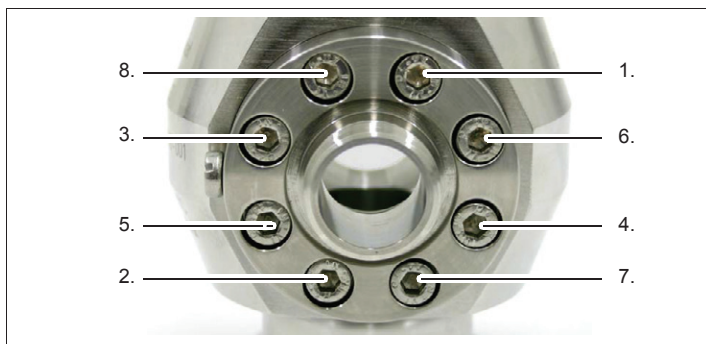


Fig. 21 Bolting sequence

13. Repeat the assembly procedure for all window rings.
14. Final inspection: ensure the armature is built properly, and inspect it for any signs of physical damage.
15. Perform pressure test (see chapter 8.3, page 29).



Caution!

- To prevent leaks or damage to the armature always use a torque wrench.



Note!

- If needed, different torque values are listed in the sensor body data sheet. In this case data on the sensor body data sheet takes precedence.

When assembling the DTF armature, use window ring FL59 - 8M5 for the 90° detector assembly. When installing the FL59 - 8M5 note the correct airpurge position (see Fig. 22).

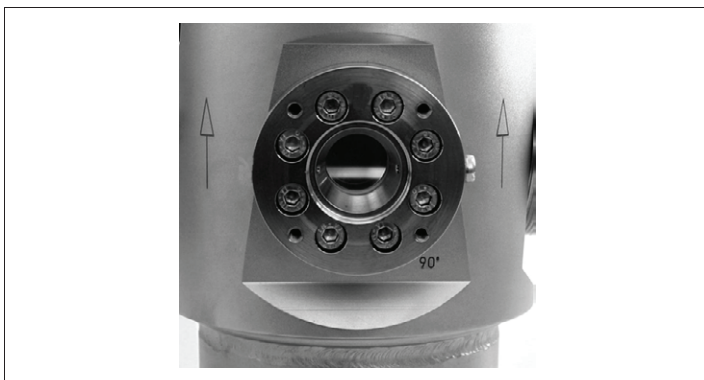


Fig. 22 Armature DTF with window ring FL59 - 8M5 of 90° detector assembly



Note!

- Improper installation can negatively influence safety standards.
- The use of non specified components is not allowed.
- The choice of appropriate material related to the process medium and the process conditions is the responsibility of the designer and the operating company of the plant.
- Window type and O-Ring type may affect allowable operating temperature (TS) and pressure (PS). See table 11 on page 31, table 12 and table 13 on page 32 for more information.

8.2.3 **Parts required for assembly of armature AF / TF**

Tab. 7 *Parts required for assembly*

Qty.	Part	Part number
1	Sensor body according to sensor body data sheet	0120-xxxx-yy
1	Window ring for lamp assembly, see table 8 on page 28	0120-xxxx-03 ¹
1	Window for lamp assembly, type of windows in table 10 on page 30	0410-xxxx-yy
1	Window ring for detector assembly, see table 8 on page 28	0120-xxxx-03 ¹
1	Window for detector assembly, type of windows in table 10 on page 30	0410-xxxx-yy
4	O-Ring 21.95 x 1.78 mm, material according to table 12 on page 32	0203-0015-yy
16	Screw M5 x 12, DIN 912	0220-0157-03 ¹
16	Washer M5, DIN 7980	0220-0149-03 ¹
1-2	Screw M5 x 6, DIN 84	0220-0037-03
1-2	O-Ring 4.0 x 1.0 mm	0203-0001-02

¹⁾ material 1.4571 ,unless otherwise specified in sensor body data sheet

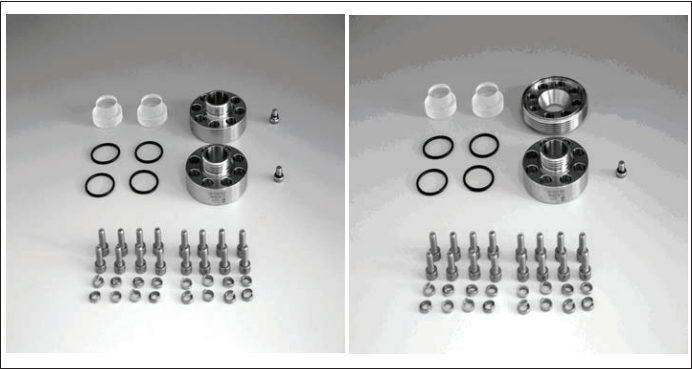


Fig. 23 *Parts required for assembly (Window rings, windows, screws, washers, and gasket set)*
Left: Window mounting set M24-M24, e.g. for sensor AF16, AF26
Right: Window mounting set M24-M58, e.g. for sensor TF16, AF45, AF46



Note!

- Use only certified screws M5x12 DIN 912, made by a listed manufacturer showing head marking HZ A4-70 (HZ = manufacturers sign).
- The choice of appropriate material related to the process medium and the process conditions is the responsibility of the designer and the operating company of the plant.
- Window type and O-Ring type may affect allowable operating temperature (TS) and pressure (PS). See table 11 on page 31 and table 12 on page 32 for more information.

The selection of window rings is done according to the table below:

Tab. 8 Selection of window rings

Sensor:	AF16	AF26	AF45	AF46	AF56	TF16	TF56
Window ring lamp assembly:	M24-8M5	M24-8M5	M58-8M5	M58-8M5	M24-8M5	M24-8M5	M24-8M5
Window ring detector assembly:	M24-8M5	M24-8M5	M24-8M5	M24-8M5	M24-8M5	M58-8M5	M58-8M5

8.2.4 Parts required for assembly of armature DTF

Tab. 9 Parts required for assembly

Qty.	Part	Part number
1	Sensor body according to sensor body data sheet	0120-xxxx-yy
1	Window ring M24 - 8M5 for lamp assembly	0120-2020-03
3	WindowTyp 3A	0410-0350-03
1	Window ring M58 - 8M5 for detector assembly 0° absorption / 11° Scattered light	0120-2030-03
1	Window ring FL59 - 8M5 for detector assembly 90° scattered light	0120-2045-03
6	O-Ring 21.95 x 1.78 mm, material according to table 13 on page 32	0203-0015-yy
24	Screw M5 × 12, DIN 912	0220-0157-03
24	Washer M5, DIN 7980	0220-0149-03
2	Screw M5 × 6, DIN 84	0220-0037-03
2	O-Ring 4.0 × 1.0 mm	0203-0001-02



Fig. 24 Parts required for assembly of armature DTF



Note!

- Use only certified screws M5x12 DIN 912, made by a listed manufacturer showing head marking HZ A4-70 (HZ = manufacturers sign).
- The choice of appropriate material related to the process medium and the process conditions is the responsibility of the designer and the operating company of the plant.
- Window type and O-Ring type may affect allowable operating temperature (TS) and pressure (PS). See table 11 on page 31 and table 13 on page 32 for more information.

8.3 Pressure Test



Wear safety glasses.



Wear safety suit.

Scope of the inspection

- Armature is complete and correctly mounted.
- There is no visible damage on the armature.

Pressure test procedure:

1. Place armature in a test bench.
2. Assemble and seal test setup carefully. Use splash guard if necessary.
3. Fill armature and supply line with water.
4. First degassing of test setup.
5. Apply 1-5 bar pressure.
6. Second degassing of test setup.
7. Apply 1-5 bar pressure.
8. Increase pressure to rated operational pressure (PS) (specified on armature and the sensor body data sheet).
9. Increase pressure to rated test pressure (PT) (specified on armature and the sensor body data sheet).
10. Maintain pressure for at least 5 minutes.
11. Check armature for leakage or damage.



Note!

- Pressure test should only be performed by authorized and technically qualified personnel.
- Make sure there are no gas bubbles or trapped air in the test setup.
- Use water for pressure test.
- Refer to test bench manufacturer's safety guidelines.

8.4 Windows

Optical path length (OPL) is the face to face distance between windows when properly installed in an armature. This is the distance light travels through the process medium.

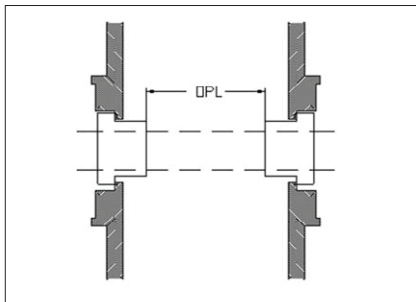


Fig. 25 Optical path length

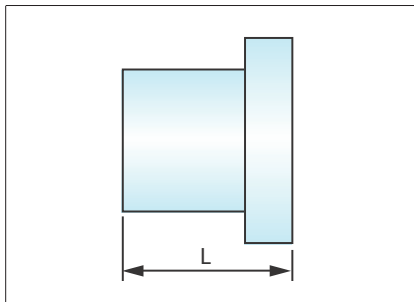


Fig. 26 Window length

F-value (F_{xy}) is the OPL of two A windows properly installed in an armature. The F-value is written on the sensor body as well as in the sensor body data sheet. To determine the OPL of an armature take the F-value of the sensor body and add or subtract the "change in OPL" from table 10 based on the types of windows used.

Formula to calculate OPL:

Actual OPL = F_{xy} + (change window 1 + change window 2) [mm]

Example

Sensor body with F-value: F40

Desired OPL: 25.0 mm

Window 1: Type 1B (Change in OPL: -5.0 mm)

Window 2: Type 1C (Change in OPL: -10.0 mm)

Actual OPL = 40.0 mm - 5.0 mm - 10.0 mm
= 25.0 mm = Desired OPL

Tab. 10 Available window types

Window	Length L [mm]	Change in OPL [mm]	Pyrex® Typ 1 standard part number	Saphir Typ 2 standard part number	Saphir Typ 3 Biotech part number
AM	11,5	+ 2,5	-	0410-0056-03	0410-0356-03
AT	13,0	+ 1,0	-	-	0410-0360-03
A	14,0	0	0410-0050-01	0410-0050-03	0410-0350-03
BM	16,5	- 2,5	-	0410-0057-03	0410-0357-03
BT	18,0	- 4,0	-	-	0410-0361-03
B	19,0	- 5,0	0410-0051-01	0410-0051-03	0410-0351-03
CM	21,5	- 7,5	-	0410-0058-03	0410-0358-03
CT	23,0	- 9,0	-	-	0410-0362-03
C	24,0	- 10,0	0410-0052-01	0410-0052-03	0410-0352-03

The following window materials are available:

Tab. 11 Window specifications

Material	Classification	Process temperature	Process pressure
Pyrex® (Borosilicate glass)	Typ 1 Standard	0 - 120 °C (32 - 248 °F)	0 - 20 bar (0 - 290 psi)
Sapphire	Typ 2 Standard	-40 - 300 °C (-40 - 572 °F)	0 - 400 bar (0 - 5800 psi)
Sapphire Biotech	Typ 3 Biotech	-40 - 300 °C (-40 - 572 °F)	0 - 400 bar (0 - 5800 psi)

Depending on the material the windows are classified as type 1, type 2, and type 3. All window types are available in different lengths.

Sapphire windows are marked with a code that includes their part number. Pyrex® windows are not marked.



Caution!

- Do not use Pyrex® windows above PS 20 bar.
- Do not expose Sapphire windows to sudden temperature changes in the medium > 30 °C (54 °F) within 5 minutes.
- Ensure no cold condensate hits the windows especially during the sterilization process.



Note!

- TF16 and TF56 sensors use only type A windows on the detector side. The standard optical path length for these sensors is 40 mm.
- DTF16 sensors use type 3A windows only.
- An OPL smaller than 1 mm is not recommended.
- The choice of appropriate material related to the process medium and the process conditions is the responsibility of the designer and the operating company of the plant.
- Pyrex® windows are not allowed for AF 45 and AF 46 sensors.
- Window type and O-Ring type may affect allowable operating temperature (TS) and pressure (PS). See table 11 on page 31, table 12 and table 13 on page 32 for more information.

8.5 Gaskets

Only O-Rings that come into contact with the process medium are described in this manual. Only elastomeric O-Rings are used in optek armatures.

Tab. 12 Released gaskets for AF and TF sensors

Gaskets (Qty. 4)	Material	Process temperature	Part number
O-Ring 21.95 x 1.78 mm	Silicone (FDA)	-60 - 225 °C (-76 - 437 °F)	1203-0004-0015-01
	Viton® (FDA)	-20 - 200 °C (-4 - 392 °F)	1203-0004-0015-02
	EPDM (FDA, USP Class VI)	-40 - 160 °C (-40 - 320 °F)	1203-0004-0015-03
	Kalrez® 4079	max. 316 °C (max. 600 °F)	1203-0004-0015-04
	Viton® / FEP (FDA)	-20 - 200 °C (-4 - 392 °F)	1203-0004-0015-05
	Fluoraz® 797	-5 - 232 °C (23 - 450 °F)	1203-0004-0015-06
	Kalrez® 1050 LF	max. 288 °C (max. 550 °F)	1203-0004-0015-07
	Kalrez® 6375	-20 - 275 °C (-4 - 527 °F)	1203-0004-0015-08
	Chemraz® 505	-30 - 230 °C (-22 - 466 °F)	1203-0004-0015-09
	Chemraz® 513	-30 - 210 °C (-22 - 410 °F)	1203-0004-0015-10
	Buna® (FDA)	-25 - 125 °C (-13 - 257 °F)	1203-0004-0015-14
	Kalrez 6230 (FDA, USP Class VI)	max. 260 °C (max. 500 °F)	1203-0004-0015-16

Tab. 13 Released gaskets for DTF16 sensors

Gaskets (Qty. 6)	Material	Process temperature	Part number
O-Ring 21,95 x 1,78 mm	EPDM (FDA, USP Class VI)	-40 - 160 °C (-40 - 320 °F)	1203-0006-0015-03



Note!

- The selection of a suitable gasket material should only be performed by authorized and technically qualified personnel.
- Silicone is not allowed with sensors AF45, AF46 and AF56-SF.
- Using O-Rings with dimensions other than those specified by optek may adversely affect the technical specifications of armatures, damage other components, or decrease operational safety.
- Window type and O-Ring type may affect allowable operating temperature (TS) and pressure (PS). See table 11 on page 31, table 12 and table 13 for more information.
- Metal gaskets are not allowed.
- Backup rings are not allowed.
- To ensure a proper seal, always use new gaskets after performing maintenance.

9 Declaration of conformity

Manufacturer:

optek Danulat GmbH
Emscherbruchallee 2
45356 Essen
Germany

Declares that metallic armatures with all belonging assemblies whose part number written in the sensor body data sheet are dedicated to the manual for metallic armatures with the part number 1004-3001-02, conform with the requirements of the pressure equipment directive 97/23/EC from May 29, 1997.

All essential requirements according to article 3, paragraph 1 of the PED have been met.

Line 14 of the sensor body data sheet shows the classification of the armature and applicable proof modules.

Armatures marked with article 3, paragraph 3 in line 14 were developed and manufactured with German sound engineering practices.

In all other cases the armatures were classified in respect to appendix III of the PED using the AD2000 directive.

Quality management control for module E1 was supervised by TÜV Nord CERT GmbH with the identification number 0045.

In accordance with module G, TÜV Nord CERT GmbH certifies the EC inspection document as well as the EC declaration of conformity.

All relevant documents will be available for 10 years after the fabrication of the product.

Essen, 26.07.2010

optek-
Danulat GmbH
Emscherbruchallee 2
45356 Essen • Tel. 0201 / 63 409-0



Dipl. Ing. Jürgen Danulat
Managing Director

This declaration confirms with EN 45014.

10 **Contacts**

For further help or information regarding your product or its application into your system please contact your local spirax sarco representative. Alternatively visit our international website, select your global location and search / request a visit or telephone call from a Spirax Sarco engineer.

www.spiraxsarco.com

