

Operating Instructions

OUSAF12

Optical sensor combined with flow assembly
OUA260 for absorbance measurement

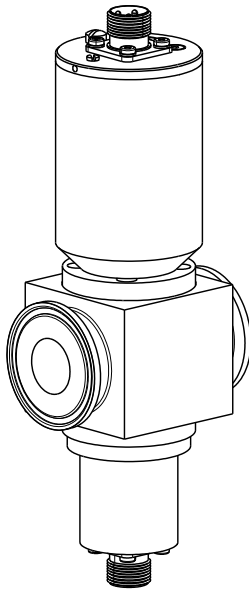


Table of contents

1	About this document	4	8.4	OUSAF12 collimated lamp replacement	23
1.1	Warnings	4	8.5	Sensor window and gasket replacement	24
1.2	Symbols	4			
2	Basic safety instructions	5	9	Repair	25
2.1	Requirements for personnel	5	9.1	List of spare parts OUSAF12 Sensor . . .	25
2.2	Designated use	5	9.2	List of spare parts OUA260 Flow assembly	25
2.3	Workplace safety	5	9.3	Return	28
2.4	Operational safety	6	9.4	Disposal	28
2.5	Product safety	6			
3	Product description	7	10	Accessories	29
3.1	Design of OUSAF12 with OUA260 flow assembly	7	10.1	Flow assembly	29
3.2	Measuring principle	8	10.2	Transmitters	29
			10.3	Cables	29
4	Incoming acceptance and product identification	9	11	Technical data	30
4.1	Incoming acceptance	9	11.1	Input and Output	30
4.2	Product identification	9	11.2	Environment	30
4.3	Scope of delivery	10	11.3	Process	30
4.4	Certificates and approvals	10	11.4	Mechanical construction	30
5	Mounting	11		Index	31
5.1	Mounting conditions	11			
5.2	Mounting the sensor	14			
5.3	Post-mounting check	14			
6	Electrical connection	15			
6.1	Connecting the sensor	15			
6.2	Post-connection check	16			
7	Commissioning	17			
7.1	Function check	17			
7.2	Sensor calibration	17			
7.3	Filter check with Easycal	18			
8	Maintenance	19			
8.1	Maintenance schedule	19			
8.2	OUSAF12 gas filled lamp replacement .	21			
8.3	OUSAF12 standard incandescent and high luminescence lamp replacement	22			




1 About this document

1.1 Warnings

Structure, signal words and color coding of warning information are in compliance with ANSI Z535.6 specifications ("Product safety information in product manuals, instructions and other collateral materials").


Structure of information	Meaning
<p>⚠ DANGER Causes (/consequences) Possible consequences if ignored ▶ Corrective action</p>	<p>This symbol alerts you to a dangerous situation . Failure to avoid the situation will result in a fatal or serious injury.</p>
<p>⚠ WARNING Causes (/consequences) Possible consequences if ignored ▶ Corrective action</p>	<p>This symbol alerts you to a dangerous situation . Failure to avoid the situation can result in a fatal or serious injury.</p>
<p>⚠ CAUTION Causes (/consequences) Possible consequences if ignored ▶ Corrective action</p>	<p>This symbol alerts you to a dangerous situation . Failure to avoid this situation can result in minor or more serious injuries.</p>
<p>NOTICE Cause/situation Possible consequences if ignored ▶ Measure/note</p>	<p>This symbol alerts you to situations which may result in damage to property.</p>

1.2 Symbols

-  Additional information, tip
-  Permitted or recommended
-  Not permitted or not recommended

2 Basic safety instructions

2.1 Requirements for personnel

- ▶ Installation, commissioning, operation and maintenance of the measuring system must only be carried out by trained technical personnel.
 - ▶ The technical personnel must be authorized by the plant operator to carry out the specified activities.
 - ▶ The electrical connection may only be performed by an electrical technician.
 - ▶ The technical personnel must have read and understood these Operating Instructions and must follow the instructions they contain.
 - ▶ Measuring point faults may only be rectified by authorized and specially trained personnel.
-  Repairs not described in the enclosed Operating Instructions may only be carried out directly at the manufacturer's or by the service organization.

2.2 Designated use

The OUSAF12 sensor is used for determining the VIS/NIR absorbance of a liquid medium. It is suitable for a variety of applications in different industries.

Suspended solids measurement in

- Pharmaceutical and Biotech
- Chemical
- Pulp and Paper

Product interface detection in

- Food and Beverage
- Chemical
- Oil and Gas

Any other use than the one described here compromises the safety of persons and the entire measuring system and is not permitted. The manufacturer is not liable for damage caused by improper or non-designated use.

2.3 Workplace safety

As the user, you are responsible for complying with the following safety conditions:

- Regulations for explosion protection
- Installation instructions
- Local standards and regulations

2.4 Operational safety

- ▶ Before commissioning the entire measuring point, make sure all the connections are correct. Ensure that the electrical cables and hose connections are not damaged.
- ▶ Do not operate damaged products, and safeguard them to ensure that they are not operated inadvertently. Mark the damaged product as defective.
- ▶ If faults cannot be rectified, the products must be taken out of service and secured against unintentional commissioning.

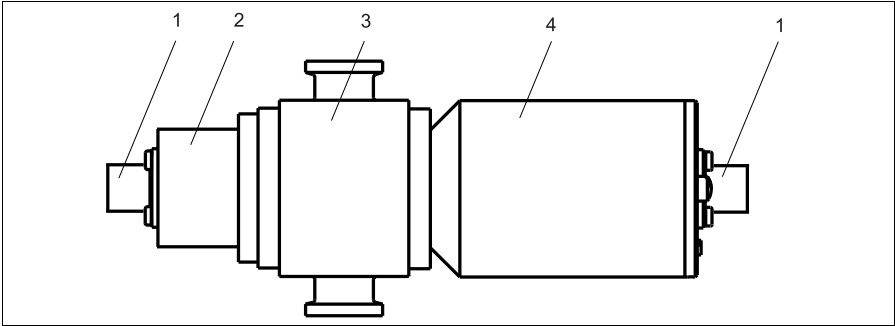
2.5 Product safety

The product is designed to meet state-of-the-art safety requirements, has been tested and left the factory in a condition in which it is safe to operate.

Relevant regulations and European standards have been observed.

3 Product description

3.1 Design of OUSA12 with OUA260 flow assembly



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Fig. 1: Design of OUSA12 with OUA260 flow assembly

1 Cable connector
2 Lamp assembly

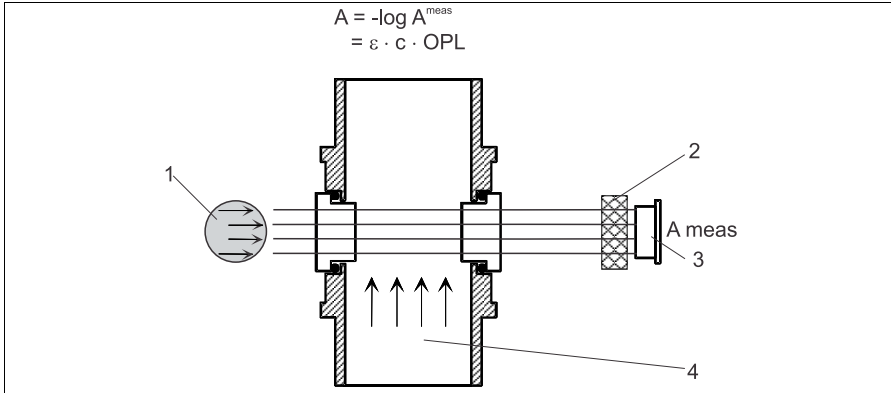
3 OUA260 flow assembly (to be ordered separately)
4 Detector assembly

Detector and lamp may vary depending on options ordered.

3.2 Measuring principle

Absorption light method

The measuring principle is based on the Lambert-Beer law. There is a linear dependency between the absorption of light and the concentration of the absorbing substance. A light source emits light waves through the medium and the transmitted light is measured on the detector side. The light intensity is determined by a photodiode and converted into a photo current. The final conversion into absorption units (AU, OD) is done by the related transmitter.



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Fig. 2: Absorption sensor with no reference

- | | | | |
|---|--------------------|---|----------------------|
| 1 | Light source | 3 | Measurement detector |
| 2 | Measurement filter | 4 | Medium |

4 Incoming acceptance and product identification

4.1 Incoming acceptance

- Make sure the packaging is undamaged!
Inform the supplier about any damage to the packaging.
Keep the damaged packaging until the matter has been settled.
- Make sure the contents are undamaged!
Inform the supplier about damage to the contents. Keep the damaged products until the matter has been settled.
- Check that the order is complete and agrees with your shipping documents.
- The packaging material used to store or to transport the product must provide shock protection and humidity protection. The original packaging offers the best protection. Also, keep to the approved ambient conditions (see "Technical data").
- If you have any questions, please contact your supplier or your local sales center.

4.2 Product identification

4.2.1 Nameplate

Nameplates can be found:

- On the outside of the housing
- On the packaging (adhesive label, portrait format)


The nameplate provides you with the following information on your device:

- Order code
- Extended order code
- Serial number
- Protection class
- Environment

Compare the data on the nameplate with your order.

4.2.2 Product identification

The order code and serial number of your device can be found in the following locations:

- On the nameplate
-  To find out what device version you have, enter the serial number indicated on the nameplate in the search screen at the following address:
www.products.endress.com/OUSAF12

4.3 Scope of delivery

The scope of delivery depends on the ordered version.

Isolated order

- 1 detector and lamp assembly without flow assembly
- Operating Instructions

Assembled to flow assembly

- Detector and lamp assembly installed
- OUA260 flow assembly
- Operating Instructions depending on the used transmitter

If you have any questions, please contact your supplier or your local sales center.

4.4 Certificates and approvals

4.4.1 Ex approval

- ATEX II 2G EEx d IIC T5
- FM Cl.1, Div. 1, Group B, C, D

4.4.2 FDA conformity

All non-metallic wetted parts comply with FDA Regulations 21 CFR 177.2600. The plastic and elastomeric wetted parts of the sensor have passed the bio-reactivity tests according to USP <87> and <88> class VI.

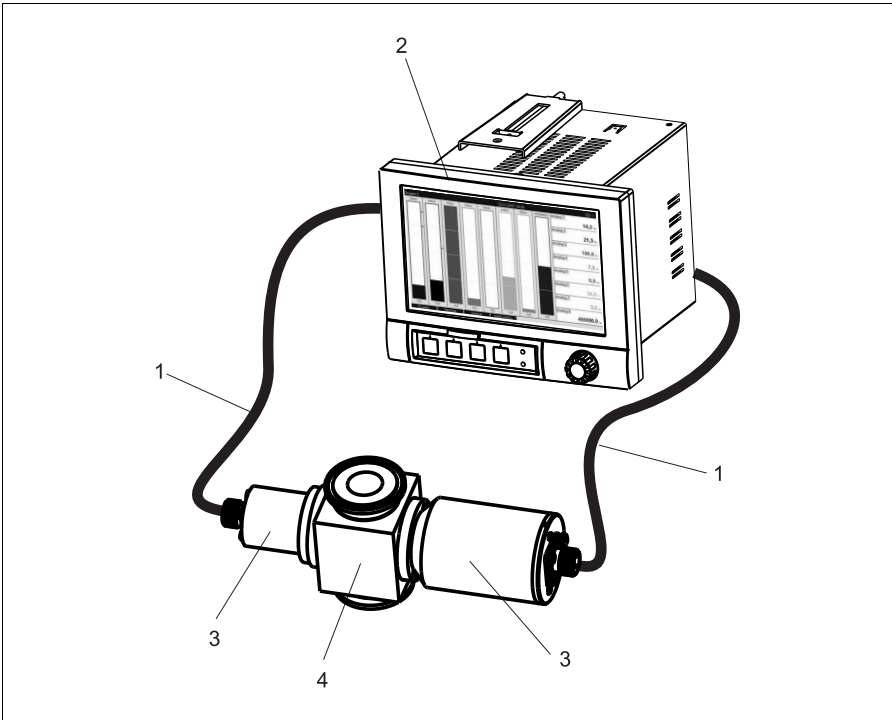
5 Mounting

5.1 Mounting conditions

5.1.1 Measuring system

A complete measuring system comprises:

- Transmitter Memograph CVM40
- Optical sensor OUSA12
- Flow assembly OUA260
- Cable set OUK10



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Fig. 3: Example of a measuring system

- 1 Cable set OUK10
- 2 Transmitter Memograph CVM40
- 3 Optical sensor OUSA12
- 4 Flow assembly OUA260

5.1.2 Dimensions

The sensor dimensions depend on the flow assembly.

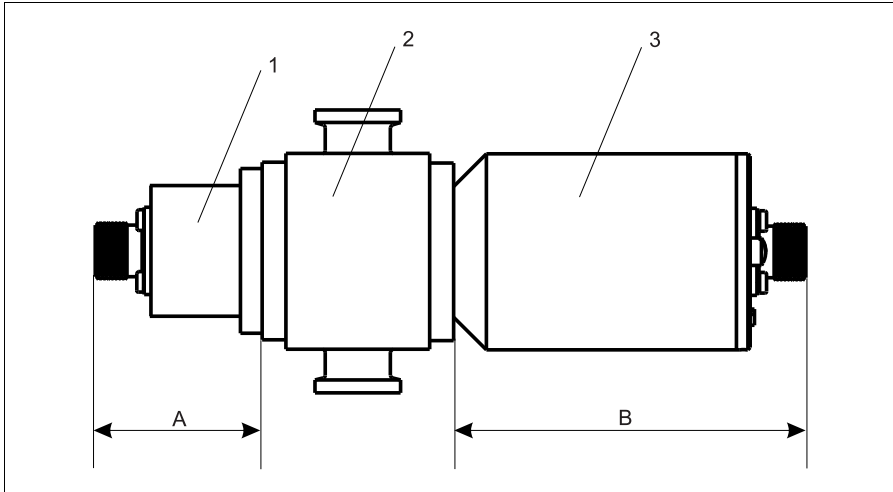


Fig. 4: General dimensions of OUSAF12 with OUA260 flow assembly

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- 1 Lamp assembly
- 2 OUA260 flow assembly (to be ordered separately)
- 3 Detector assembly

Detector and lamp may vary depending on options ordered.

The sensor dimensions depend on the flow assembly.

Lamp assembly type	"A" Dimension
High luminescence and Standard incandescent lamp	33.78 mm (1.33")
Gas filled lamp	33.78 mm (1.33")
Collimated lamp	151.3 mm (5.96")

Detector assembly type	"B" Dimension
Standard	101.6 mm (4.0")
Easycal	101.6 mm (4.0")

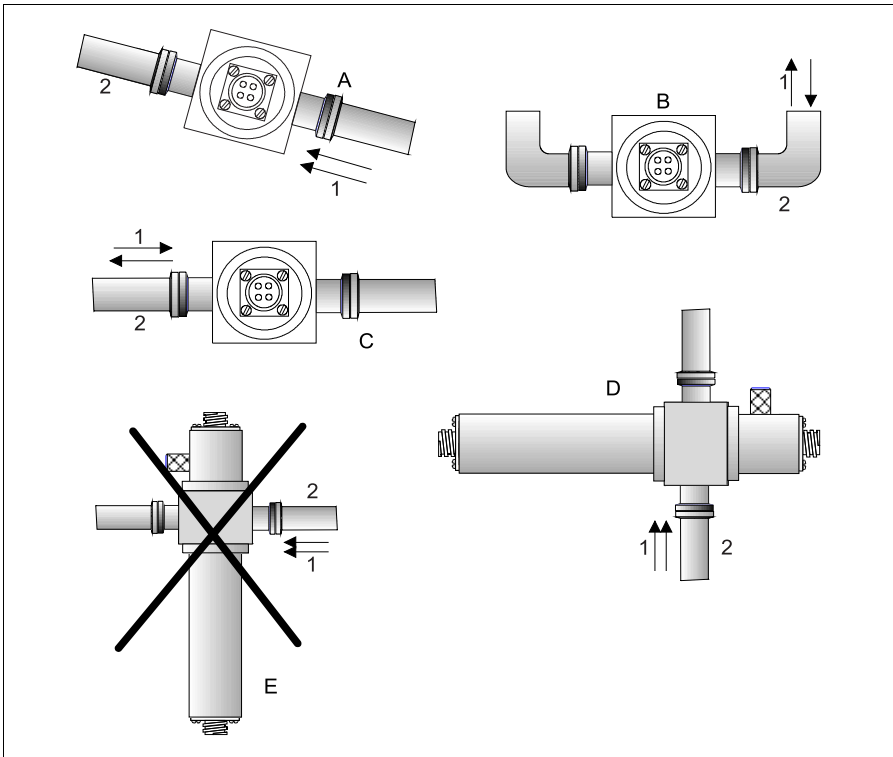
For flowcell dimensions please refer to OUA260 documentation TI 418C/07/EN.

i Make sure to leave an additional clearance of approx. 5 cm (2") at the lamp end and detector end of the sensor to allow for installation of the sensor cables.

5.1.3 Mounting angle

Sensors are designed for in-line use with the related OUA260 flow assembly. The flow assembly can be installed either directly in a process line or in a by-pass line. The OUSAF12 sensor cannot be used without the OUA260.

- Make sure that the sensor and detector housings are horizontal. This will ensure that the optical window surfaces are in a vertical position which will help to prevent buildup on the window surfaces.
- Install the sensor upstream of pressure regulators.
- Allow adequate space for the connection of cables at the ends of the lamp and the detector housing.
- Operating sensors under pressure will help to avoid air or gas bubble evolution.



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Fig. 5: Sensor installation


- | | | | |
|---|------------|---|----------------|
| A | Preferred | E | Never |
| B | Acceptable | 1 | Process flow |
| C | Avoid | 2 | Process piping |
| D | Best | | |

5.2 Mounting the sensor

If the OUSAF12 is ordered with the OUA260, it will be shipped mounted to the flow assembly and is ready for commissioning.

Otherwise, for sensor installation, proceed as follows:

1. Install the flow assembly OUA260 via the process connections into the process.
2. Screw the sensor onto the flow assembly.

 Be sure to install the lamp and detector O-rings.

 The lamp and detector can be mounted and removed without affecting process line integrity.


When installing, allow adequate space for the connection of cables at the ends of the lamp and detector housings. Access to these areas is also important for connection/disconnection purposes.

NOTICE

External forces

Make sure to leave enough space when installing the sensor to prevent sensor damage. The cable will be twisted.

- ▶ Ensure that sensor bodies are protected against damage caused by external forces such as carts on adjacent walkways.
- ▶ Remove the cable before screwing the lamp or detector onto the flow assembly.
- ▶ Avoid exerting excessive tensile force on the cable (e. g. from jerky pulling).

 When using metallic assemblies and installation equipment, comply with national grounding regulations.

5.3 Post-mounting check

- Sensor and cable undamaged?
- Compliance with permissible sensor installation position?

6 Electrical connection

⚠ WARNING

Device is energized

Inappropriate connection can cause serious injuries or death

- ▶ The electrical connection must only be carried out by a certified electrician.
- ▶ Technical personnel must have read and understood the instructions in this manual and must adhere to them.
- ▶ **Prior to beginning** any wiring work, make sure voltage is not applied to any of the cables.

6.1 Connecting the sensor

The OUSAF12 sensor is connected to the transmitter via the pre-terminated or labeled cable set OUK10 (to be ordered separately). Terminals and labeling might vary with the transmitter in use.

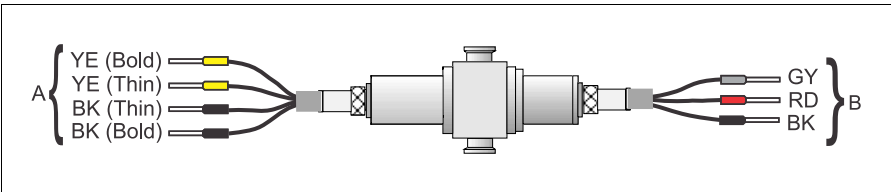


Fig. 6: Connecting cable for OUSAF12

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- A Power supply for lamp
- B Signal transmission of measurement detector

Terminal CVM40	Cable OUK10 for sensor OUSAF12	
	Color	Assignment
S1.5	GY	Shield
S1.1	RD	Sensor Mea +
S1.2	BK	Sensor Mea -
V1.1	YE (Bold)	Lamp voltage +
V1.3	YE (Thin)	Lamp sense +
V1.4	BK (Thin)	Lamp sense -
V1.2	BK (Bold)	Lamp voltage -

6.2 Post-connection check

Instrument status and specifications	Remarks
Are the sensor, assembly or cable damaged?	Visual inspection
Electrical connection	Remarks
Are the installed cables strain-relieved and not twisted ?	
No loops and cross-overs in the cable run?	Check seating (pull slightly)
Are the signal cables correctly connected according to the wiring diagram?	
Are all screw terminals tightened?	
Are all cable entries installed, tightened and sealed?	
Are the PE distributor rails grounded (if present)?	Grounding at place of installation

7 Commissioning

7.1 Function check


Before first commissioning, check if:

- the sensor is correctly installed
- the electrical connection is correct

7.2 Sensor calibration


If the sensor is ordered together with a transmitter, the complete measuring system is factory-calibrated and ready to use.

The procedure outlined in section 7.2.1 is used for factory calibration.

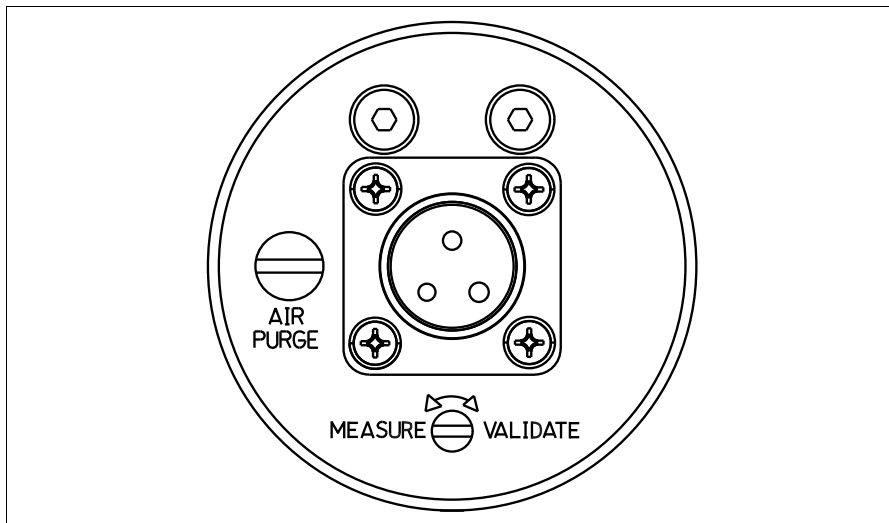
-  Before calibration, the unit has to be powered up for at least 30 minutes.

7.2.1 Liquid calibration procedure

A liquid solution of a known optical density (at the wavelength of the sensor) must be used for instrument calibration. The choice of calibration liquid is determined by the user and will be application dependent.

-  When preparing solutions, it is very important to measure the optical absorbance of every prepared solution (at the wavelength of the sensor) on a certified laboratory spectrophotometer.

1. Prepare liquid solution with known optical density.
2. Start CVM40.
3. Adjust value for standard solution (Default 2.0 AU) to value of your liquid solution.
4. Select "Start calibration optical sensor".
5. Follow the instructions on the screen.
6. Rinse out with and fill the sensor with high purity turbidity free water and check the zero point of the instrument. (Rinse and fill the flow assembly minimum 3 times)
7. Follow the instructions on the screen.
8. Empty the sensor and fill with your liquid solution. (Rinse and fill the flow assembly minimum 3 times)
9. Follow the instructions on the screen.



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Fig. 7: Verification filter housing and controls

7.3 Filter check with EasyCal

A reference filter is supplied with each standard sensor to perform a function check of the instrument without requiring the use of calibration solutions. The filter can be rotated into the sensor light path and therefore simulating absorbance in the optical chain.

When used in conjunction with an initial liquid standard calibration procedure, the reference filter can be used for routine system checking. Calibration can be traced to the controlled standard used to verify the original calibration solutions and can therefore satisfy validation procedures.

During initial calibration of a sensor/analyzer pair, liquid standards must be used to calibrate the full-scale response of the system. After calibration, by filling the sensor with water and ensuring the analyzer reads zero, a value for the reference filter can be obtained by inserting the reference filter into the light path and noting the analyzer display reading. At any time in the future, reinserting the reference filter and checking that the analyzer reads the same with the sensor filled with water can check the analyzer calibration.

8 Maintenance

8.1 Maintenance schedule

Certain maintenance needs to be performed for OUSAF12 sensor. The service and maintenance interval time is application dependant.


Maintenance check list	
Lamp replacement	Typical lamp replacement is 8,000 to 10,000 hours.
Sensor window and gasket replacement	Window replacement is only required when the windows become damaged.
Wetted O-rings replacement	Wetted O-rings have to be replaced based on specific needs of process. Do not re-use O-rings.

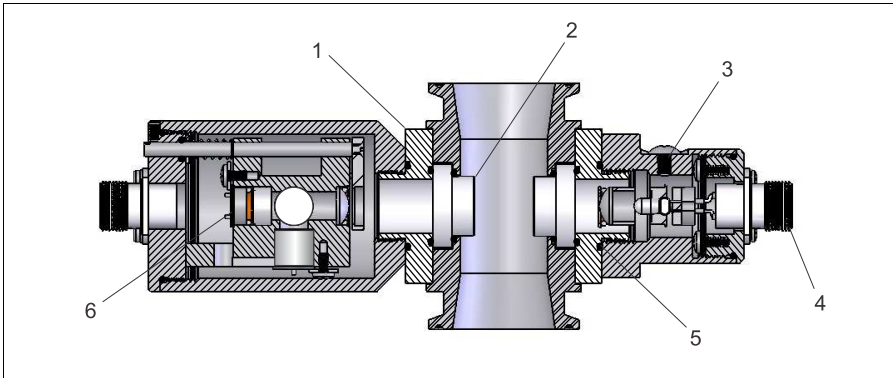
NOTICE

Sensitive optical components

If not handled carefully optical components can be damaged or contaminated.

- ▶ The procedures described in this section should only be carried out by qualified maintenance staff.
- ▶ Clean all optical components with a suitable lint free lens cleaning tissue and ethanol. Both the high luminescence and gas-filled lamps are replaced identically.

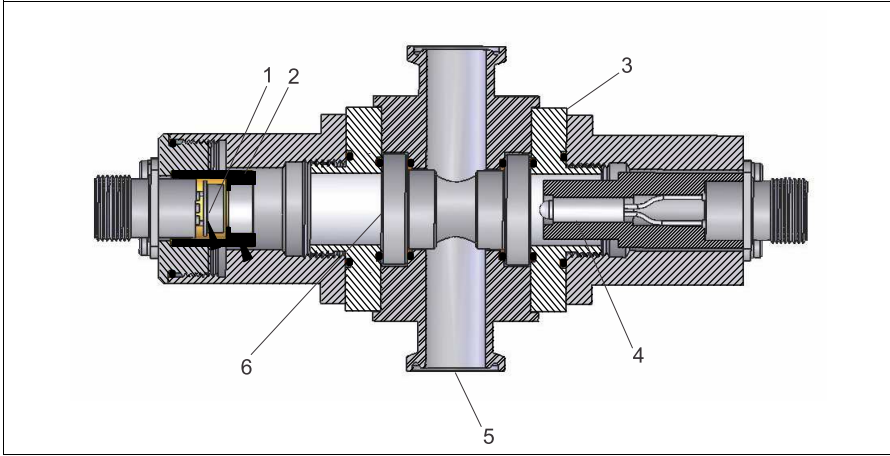
 Refer to EXP-1 lamp instructions to replace lamp for hazardous area versions.



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Fig. 8: Cross-sectional view of a typical OUSAF12 sensor

- | | | | |
|---|--------------------------|---|-----------------------------|
| 1 | Window ring | 5 | O-rings |
| 2 | Flowcell windows | 6 | Measurement detector filter |
| 3 | Halogen lamps | | |
| 4 | Environmental connectors | | |

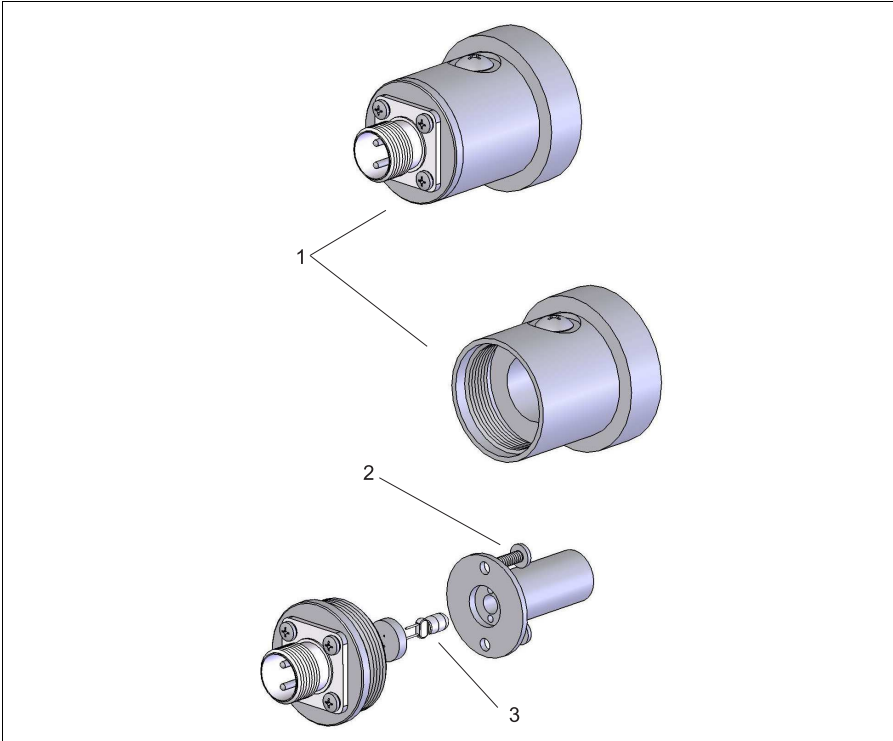


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Fig. 9: Cross-sectional view of a typical OUSAF12 sensor - Standard reference



- | | | | |
|---|-------------------------|---|-----------------|
| 1 | Measurement detector | 5 | Process flow |
| 2 | Optional optical filter | 6 | Flowcell window |
| 3 | Window ring | | |
| 4 | Standard lamp | | |

8.2 OUSA12 gas filled lamp replacement

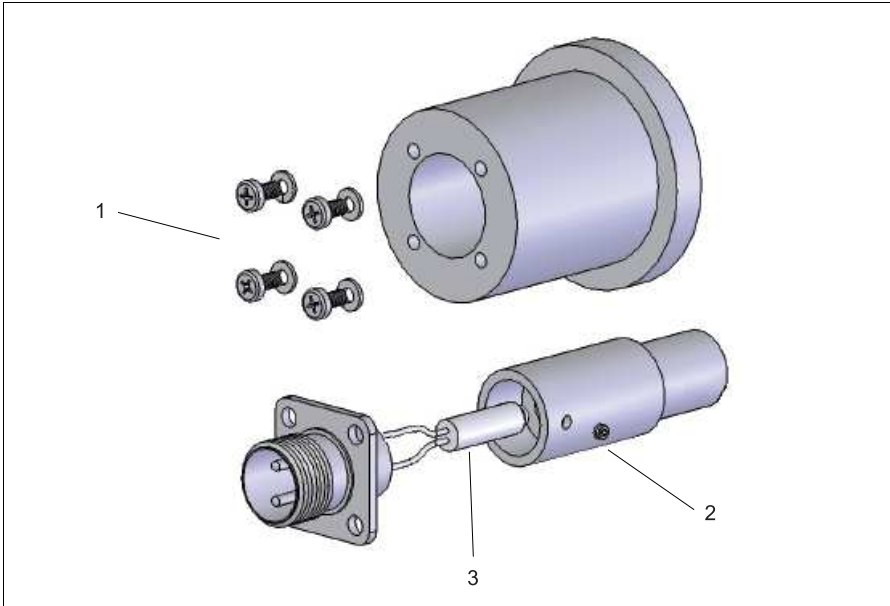


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Fig. 10: Illustrative standard lamp replacement procedure for gas filled lamps

1. To replace the lamp, remove the lamp assembly from the flowcell by turning it counterclockwise.
2. Remove the back of the lamp assembly from the lamp housing (1 in Figure 9) by pulling it out.
 -  Use a wrench or pliers on the square mounting plate.
3. Remove the two 6-32 screws and carefully remove the lens assembly (2 in Figure 9).
4. Carefully remove the halogen lamp and spacer and install the new lamp in reverse order. Clean with alcohol before re-assembly (3 in Figure 9).
 -  Do not touch the lamp with your bare hands!
5. Replace the lamp O-rings.
6. Reinstall the lamp assembly onto the flowcell by turning it clockwise.
7. After lamp replacement zero point adjustment is needed.

8.3 OUSAF12 standard incandescent and high luminescence lamp replacement

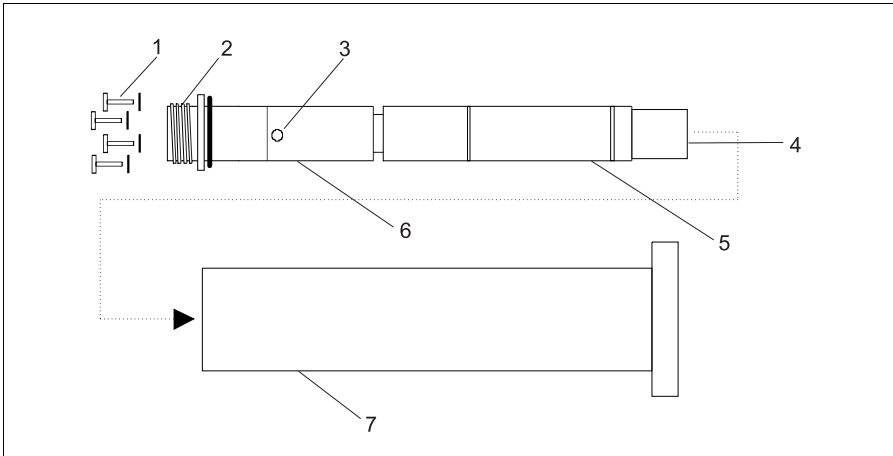


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Fig. 11: Illustrative lamp replacement procedure for standard incandescent and high luminescence lamps

1. To replace the lamp, remove the lamp assembly from the flowcell by turning it counterclockwise.
2. Remove the 4 screws and washers that hold the connector in place (1 in Figure 11).
3. Pull the connector out of the lamp housing.
 - i** For the standard incandescent lamp replacement the whole lamp assembly will be exchanged. Continue with number 7. of these directions.
4. For high luminescence lamp replacement continue to remove the lamp's cover by unscrewing the 2 set screws (2 in Figure 11).
5. Replace the lamp/connector assembly (3 in Figure 11).
 - i** Do not touch the lamp with your bare hands!
6. Clean the lamp with lint free tissue.
7. Follow steps 2 to 4 in reverse order using the new lamp assembly.
8. Replace the lamp O-rings.
9. Reinstall the lamp assembly onto the flowcell by turning it clockwise.
10. After lamp replacement zero point adjustment is needed.


8.4 OUSAF12 collimated lamp replacement



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Fig. 12: Illustrative lamp replacement procedure for collimated lamps

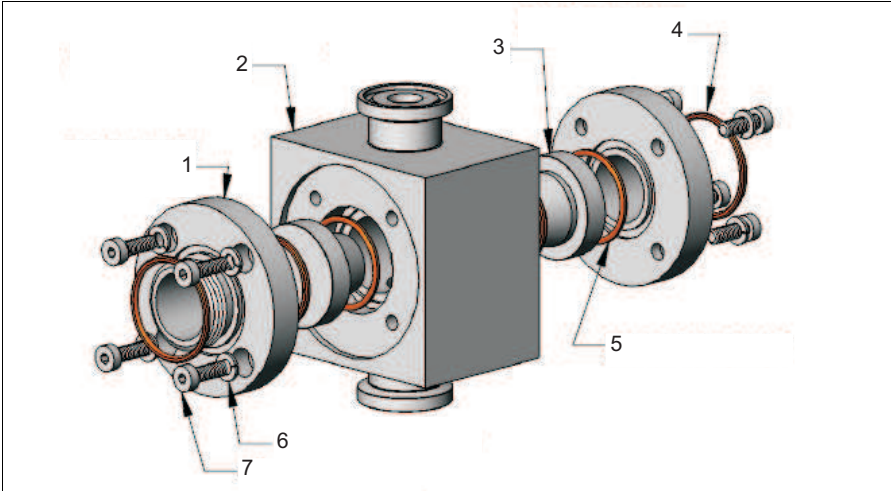
- | | | | |
|---|---|---|--|
| 1 | 4 M3 SS screws and lock washers | 5 | Projection optics assembly |
| 2 | Connector | 6 | Lamp assembly (screws in projection optics assembly) |
| 3 | 2 set screws | 7 | Lamp housing |
| 4 | Assembled lamp and projection optics ready for replacement in housing | | |

1. To replace the lamp, disconnect the lamp cable from the lamp housing and unscrew the housing from the sensor body.
2. Remove the 4 screws and washers from the lamp connector and carefully remove the lamp assembly and projection optics assembly from the housing. The lamp assembly and the connector are integral. The lamp assembly screws into the projection optics assembly.
3. Loosen the 2 set screws on the lamp assembly. Carefully unscrew and replace with a new lamp assembly.
 -  Do not over tighten.
4. Insert the reassembled projection optics and lamp assembly with the connector mounting holes aligned to the tapped holes in the lamp housing body. Insert fully and replace the 4 screws and washers.
5. After lamp replacement zero point adjustment is needed.

8.5 Sensor window and gasket replacement

Windows must be replaced with the same type to maintain path length. The illustration below is a typical flowcell assembly. Replacement of windows or window seals or other maintenance requiring the disassembly of the sensor uses the following procedure:

i To replace the windows and seals, the sensor must be removed from the process line.



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Fig. 13: Typical flow assembly/window replacement

1	Typical window ring	5	O-ring window gasket 2-020.864 x.070 (4 pcs.)
2	Typical tri-clover fractional flowcell	6	M4 SS split washer (8 pcs.)
3	Quartz window (2 pcs.)	7	M4 x 12 mm SKT-HD (8 pcs.)
4	O-ring body gasket 2-022.989 x.070 (2 pcs.)		

1. Remove the lamp and the detector housings from the sensor body.
2. Remove the 4 socket head screws from each window retaining ring and remove the rings. Be careful to loosen the screws evenly and alternately around the window retaining ring. If the window is 'stuck', apply Acetone to the window seal area and let soak for several minutes. This may assist in freeing the windows from the seals.
3. Gently push/ease the windows out of the sensor.
4. Inspect the window area and clean as necessary. Inspect the windows for any signs of abrasive wear or chipping. If any is apparent, replace the windows. Discard the 'O' rings and replace with new ones of the same material type. Reassemble the sensor in the reverse order, taking care to cross-tighten the window retaining ring screws evenly to prevent uneven seating. If the sensor path length has been changed, the analyzer module must be configured to reflect the new path length. After every re-assembly of an OUSAF12 sensor, it is necessary to carry out a liquid calibration with its associated analyzer.

i Upon re-assembly, insure that the lamp assembly is mounted on to the side of the flow cell with the "shorter" length of the two windows.

9 Repair

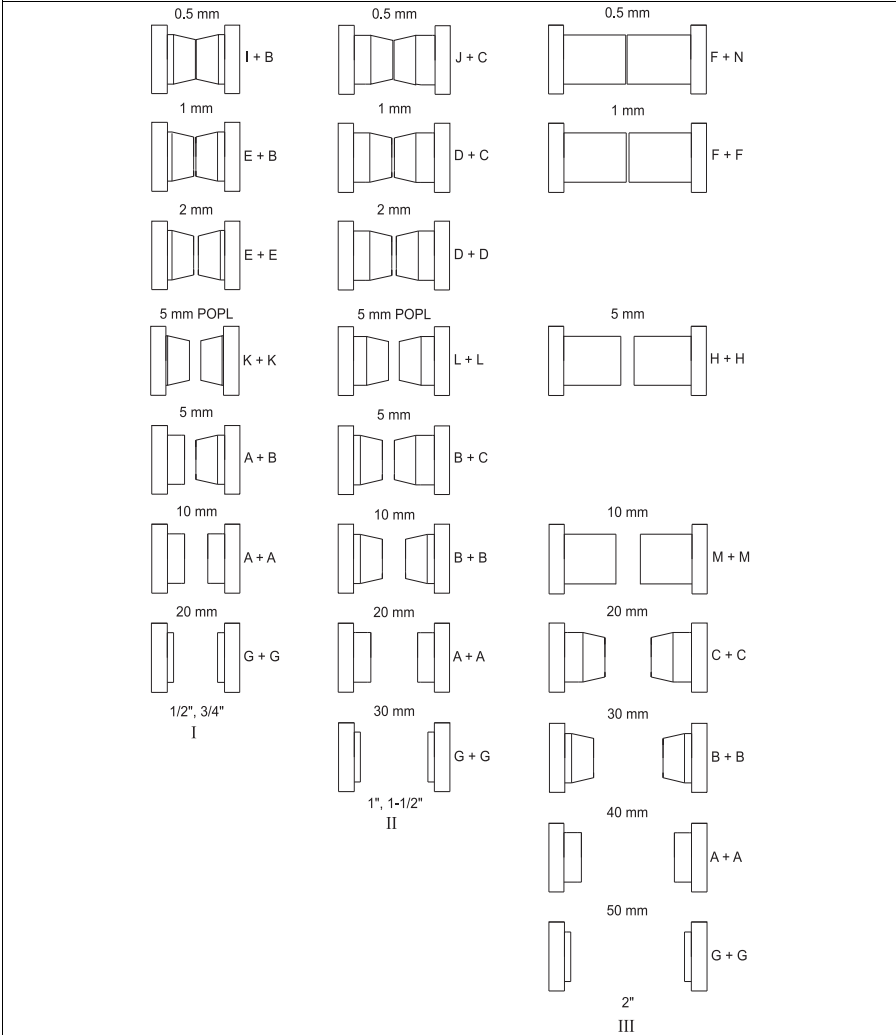
9.1 List of spare parts OUSAF12 Sensor

Order no.	Identifier
71142978	KIT OUSAFxx Gas Filled Lamp
71142624	Kit OUSAF12 Incandescent Lamp
71142626	Kit OUSxF1x Collimated Beam Lamp
71142977	Kit OUSAFxx High Luminiscence Lamp
71210161	KIT OUSxFxx Connector Dust Cover

9.2 List of spare parts OUA260 Flow assembly

Order no.	Identifier
71136357	KIT OUA260 Window O-rings EPDM (USP)
71136358	KIT OUA260 Window O-rings Kalrez
71136359	KIT OUA260 Window O-rings Silicone
71136360	KIT OUA260 Window O-rings Viton (USP)
71136387	KIT OUA260 Window Quartz 14 mm
71136388	KIT OUA260 Window Quartz 16.5 mm
71136389	KIT OUA260 Window Quartz 18.5 mm
71136390	KIT OUA260 Window Quartz 18 mm
71136391	KIT OUA260 Window Quartz 19 mm
71136392	KIT OUA260 Window Quartz 21.5 mm
71136393	KIT OUA260 Window Quartz 23.5 mm

Order no.	Identifier
71136394	KIT OUA260 Window Quartz 23 mm
71136395	KIT OUA260 Window Quartz 24 mm
71136397	KIT OUA260 Window Quartz 31.5 mm
71136398	KIT OUA260 Window Quartz 33.5 mm
71136400	KIT OUA260 Window Quartz 34 mm
71136406	KIT OUA260 Window Quartz 9 mm
71142537	KIT OUA260 Lamp and Detector O-Rings
71142621	KIT OUA260 Window Pyrex 24mm
71142623	KIT OUA260 Window Sapphire 24mm
71136396	KIT OUA260 Window Pyrex 9mm
71210133	KIT OUA260 Window Pyrex 14mm
71210134	KIT OUA260 Window Sapphire 14mm
71210135	KIT OUA260 Window Pyrex 16.5mm
71210136	KIT OUA260 Window Pyrex 19mm
71210137	KIT OUA260 Window Sapphire 19mm
71210138	KIT OUA260 Window Pyrex 23mm
71210139	KIT OUA260 Window Sapphire 23mm
71210142	KIT OUA260 Window O-rings Buna "N"



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Fig. 14: Window types and lengths

A	14.0 mm (0.55")	H	31.5 mm (1.24")	I	Window types for assemblies with triclamp connection and 1/2" and 3/4" line sizes
B	19.0 mm (0.75")	I	18.5 mm (0.73")	II	Window types for assemblies with triclamp connection and 1" and 1-1/2" line sizes
C	24.0 mm (0.94")	J	23.5 mm (0.93")	III	Window types for assemblies with triclamp connection and 2" line sizes
D	23.0 mm (0.91")	K	16.5 mm (0.65")		
E	18.0 mm (0.71")	L	21.5 mm (0.85")		
F	33.5 mm (1.32")	M	29.0 mm (1.14")		
G	9.0 mm (0.35")	N	34.0 mm (1.34")		

9.3 Return

The device must be returned if repairs or a factory calibration are required, or if the wrong device has been ordered or delivered. According to legal regulations, Endress+Hauser, as an ISO-certified company, is required to follow certain procedures when handling returned products that are in contact with medium.

To ensure swift, safe and professional device returns, please read the return procedures and conditions on the internet site:

www.services.endress.com/return-material

9.4 Disposal

The device contains electronic components and must therefore be disposed of in accordance with regulations on the disposal of electronic waste.

Please observe local regulations.

10 Accessories



In the following sections, you find the accessories available at the time of issue of this documentation. For information on accessories that are not listed here, please contact your local service or sales representation.

10.1 Flow assembly

OUA260 flow assembly for hygienic sensors

- For sensor installation in pipe lines
- Materials: stainless steel 316L or Kynar (further materials available on request)
- Many process connections and path length versions available
- Order according to product structure, see Technical Information TI418C/07/EN

10.2 Transmitters

CVM40 Memograph

- Graphic transmitter for inline photometers and data manager
- Order according to product structure, see Technical Information TI457C/07/EN

OUM910 transmitter

- Transmitter for measurement of simple color and concentration of process liquids
- Order according to product structure

10.3 Cables

OUK10 cable set

- Pre-terminated or labeled cables for connection of OUSAF1x sensors
- Order according to product structure

11 Technical data

11.1 Input and Output

Measured input variable	Process absorption and optical density
Output signal	Photo detector current (100pA ~ 1uA)
Wavelengths	Broadband, NIR (780 nm+), 400 nm, 420 nm, 430 nm, 540 nm, 950 nm, and 1134 nm

11.2 Environment

Ambient temperature	0 to 55 °C (32 to 131 °F)
Storage temperature	-20 to 70 °C (-4 to 158 °F)
Relative humidity	5 to 95 %
Ingress protection	IP 65 (NEMA 4) for all optical parts

11.3 Process

Process temperature	0 to 90 °C (32 to 194 °F) continuous max. 130 °C (266 °F) for 2 hours
Process pressure	up to 100 bar (1450 psi), depending on material, line size and process connection of flow assembly

11.4 Mechanical construction

Dimensions	See section "Mounting".
Weight	1.225 kg (flow cell not included)
Materials	Sensor housing: Stainless steel 316L
Light source	High Luminescence Lamp (Wavelength filter 450 nm and above) Gas Filled High Output Lamp (Wavelength filter below 450 nm) Collimated Incandescent Lamp (extended resolution) Standard Lamp
Lamp life	10,000 hours typical
Detectors	Silicon detectors, hermetically sealed
Filters	Multilayer narrow passband interference filter

Index

A

- Accessories 29
- Approvals 10

C

- Calibration 17
 - Liquid calibration 17
- Certificates 10
- Checking
 - Connection 16
 - Installation 14
- Commissioning 17
- Connection
 - Direct connection 15

D

- Design of OUSAF12 7
- Designated use 5
- Dimensions 12
- Disposal 28

E

- Electrical connection 15
- Environment 30
- Ex approval 10

F

- FDA conformity 10
- Filter check 18

G

- Gasket replacement 24

I

- Identification
 - Serial number 9
- Incoming acceptance 9
- Input 30
- Installation
 - Check 14

L

- Lamp replacement OUSAF12 21–23

M

- Maintenance 19
- Measuring principle 8
- Measuring system 11
- Mechanical construction 30
- Mounting 11, 14
- Mounting angle 13

N

- Nameplate 9

O

- Operational safety 6

P

- Process 30
- Product description 7
- Product safety 6

R

- Repair 25
- Replacement
 - Collimated lamp OUSAF12 23
 - Gas filled lamp OUSAF12 21
 - High luminescence lamp OUSAF12 22
- Return 28

S

- Safety instructions 5
- Scope of delivery 10
- Sensor design 7
- Sensor window replacement 24
- Serial number 9
- Spare parts 25

T

- Technical data 30
 - Environment 30
 - Input 30
 - Mechanical construction 30
 - Process 30

W

- Warnings 4
- Workplace safety 5

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