

Glas Tube Flowmeter
FAG1190-87, FAG1190-97, FAG1190-98
(10A1187/10A1190)



Product Designation
FAG1190-87, FAG1190-97, FAG1190-98

Operating Instruction

Part No. D184B003U02

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Manufacturer:

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1 Standard Safety Information

1.1 Instrument Safety Standards

- This instrument satisfies the safety requirements defined in the Pressure Equipment Guideline and is designed using the latest state of the art technology. It was tested at the factory, based on the safety requirements, and was shipped in proper working order. In order to maintain this condition over the expected life of the instrument the requirements described in this Operating Instruction must be observed.
- Please observe the special information for starting-up the instrument in the explosion protected areas.

1.2 Regulated Usage of Pressure Equipment „Variable Area Flow Measurement Principle“

This instrument is designed to

- transport liquids, gases (including unstable gases) and steam (fluids)
- measure the actual volume flowrate at constant operating conditions (pressure, temperature, density). An output of the flowrate in normal or mass units is possible.

Included in the Regulated Usage requirements are:

- installation compatible within the specified limits
- observing and following the information relative to allowable fluids
- observing and following the information in this Operating Instruction
- observing and following the information in the accompanying documents (Specification sheet, Diagrams, Dimension Drawings)

The following uses of the instrument are prohibited:

- installation as an elastic compensation piece in a pipeline, e.g. for compensating pipeline misalignment, pipeline vibrations, pipeline expansions, etc.
- use as a step ladder, e.g. for assembly purposes.
- use as a support for external loads, e.g. as a bracket for pipelines etc.
- material removal by drilling the housing or the addition of materials or parts by painting (covering the Name Plate), welding or soldering.
- repairs, modifications and additions and the use of replacement parts are only permitted as described in this Operating Instruction. Additional tasks must be approved by ABB. We accept no liability for unauthorized tasks.

The operation, service and maintenance requirements in this Operating Instruction must be observed. The manufacturer assumes no responsibility for damages resulting from improper or prohibited use.

1.3 Specification Limits

The instrument is designed exclusively for use within the specifications listed on the Name Plate and in the Operating Instruction. The following limits must be observed:

- the **allowable pressure (PS)** and the **allowable fluid temperature (TS)** must be \leq less than the pressure-temperature values (p/T-Ratings) listed in this Operating Instruction. The specifications of the Factory Tag / Instrument Tag must be observed.
- the maximum and minimum operating temperatures .
- the allowable ambient temperature range specified in the instrument Data sheet not be exceeded
- The Protection Class of the housing is IP 65 per EN60529.

1.4 Allowable Fluids

Caution



- Only fluids may be metered for which assurance is available, either from technical information or operational experience of the user, that the chemical and physical properties of the fluid wetted parts in the flowmeter (process connections, meter tube and float) will not be adversely affected during the expected life of the flowmeter.
- Fluids with unknown characteristics may only be metered if the user performs periodic inspections to assure that the safety parameters of the flowmeter have not been compromised.

1.5 Safety Signs, Symbols, Name and Factory Plates and CE-Mark

All safety signs, symbols and the Name and Factory Plates are to maintained in a readable condition and replaced if damaged or lost. Observe the following general information:

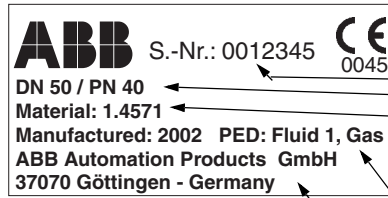
| | | |
|--|----------------------|--|
| | Warning | Information indicating a risk or dangerous situation which could result in serious injury or even death to personnel. |
| | Caution | Information indicating a dangerous situation or unsafe procedure which could result in injury to personnel or damage to property. |
| | Attention | Information indicating a situation which may cause damage to the product or something in its vicinity if it is not corrected. |
| | Information | Information („Important“) indicating user tips or other important information which, if ignored, may result in a loss of comfort or influence the function of the instrument. (Not an indication of a dangerous/harmful situation). |
| | Ex-Protection | This symbol defines an instrument with Ex-Protection. For use in Ex-Areas the applicable specifications in the Chapter „Ex-Protection“ must be observed. |
| | CE-Mark | <p>Die CE-Mark symbolizes the compliance of the instrument with the following guidelines and the fulfillment of the their basic safety requirements:</p> <ul style="list-style-type: none"> • CE-Mark on the Name Plate (on the converter) <ul style="list-style-type: none"> – Compliance with Ex-Guideline 94/9/ EG (only for instruments with Ex-Protection) • CE-Mark on the Factory Plate (on the flowmeter primary) <ul style="list-style-type: none"> – Compliance with the Pressure Equipment Directive (PED) 97/23/EG <p>A CE-Mark is not present on the Factory Plate for pressure equipment if:</p> <ul style="list-style-type: none"> – the max. allowable pressure (PS) is less than 0.5 bar. – a minimum pressure risk exists (meter sizes \leq DN 25 [1“]), a certification procedures are not required. |

1.6 Specifications on the Factory Plate

The Factory Plate is mounted on the housing of the flowmeter primary. The CE-Mark is used on two differing Factory Plates as a function of the size of the pressure equipment (> DN 25 [1"] or ≤ DN 25 [1"]) (see also Art.3 Par. 3 PED/DGRL 97/23/EG):

a) Pressure Equipment for Sizes > DN 25 [1"]

The Factory Plate includes the following specifications:



- CE-Mark (with the Number of the issuing Agency) to certify compliance of the instrument (pressure equipment) with the requirements in PED.
- Manufacturer's Serial number for identification of the pressure equipment.
- Meter size and pressure rating of the pressure equipment
- Material used to manufacture the pressure equipment and gasket material (fluid wetted).
- Year of manufacture and specification of the applicable fluid group per PED (**P**ressure **E**quipment **D**irective [DGRL]) Fluid Group 1 = hazardous fluids, liquid, gas (including unstable gases)
- Pressure equipment manufacturer's name.

b) Pressure Equipment for Sizes ≤ DN 25

This Factory Plate contains most of the same specifications included on the plate described above a) with the following differences



- There is no CE-Mark on the pressure vessel per Art. 3 Par. 3 of PED/DGRL.
- The the reason for the exception is described in Art. 3 Par. 3 of PED/DGRL. The pressure equipment is categorized as SEP (= **S**ound **E**ngineering **P**ractice).

1.7 Personnel Qualifications

The mechanical and electrical installation, start-up and maintenance of the instrument should only be carried out by trained technicians who have been authorized to perform these tasks by the system operator. The technicians must have read and understood this Operating Instruction and follow its instructions.

1.8 User Responsibilities

- Prior to use for metering corrosive or aggressive fluids the user must consider the resistance of the fluid wetted parts. ABB will gladly provide assistance in their selection, however cannot not accept any liability for their selection.
- Observe the National Codes in your country relative to the installation, functional tests, repair and maintenance of electrical equipment.

1.9 Possible Dangers During Transport

Note during transport of the instrument to the installation site:

- that the center of gravity may be off-center
- possible obstacles into which the instrument may bump and
- secure meter during transport

1.10 Possible Dangers During Installation

Before installing assure that:

- the flow direction agrees with the direction arrow .
- the instrument is installed in a stress free manner (parallel mating flanges) and that gaskets suitable for the operating conditions are used.
- the pipeline up- and downstream from the flowmeter is supported (see Information in the main portion of this Operating Instruction).

1.11 Possible Dangers During Electrical Installation

- Only technical people may take the electrical connection in accordance with electrical plans.
- Ground the flow system.



Attention

- All repairs or maintenance tasks should be performed by qualified service personnel.

1.12 Possible Dangers During Use in Ex-Areas

Special requirements apply in Ex-Areas for connecting the alarm signals. Observe the requirements listed in the Ex-Chapter in this Operating Instruction.

1.13 Possible Dangers During Operation

- The enterprise with abrasiven fluids and/or cavitation can lead to the damage of pressure conducting parts.
- With flow of hot media affecting the surface can lead to burns.
- Aggressive fluids can lead to Korrosion and abrasion. Under pressure standing media can withdraw thereby prematurely.

1.14 Possible Dangers During Inspection and Maintenance

- Prior to working on the instrument (opening, removal) assure that the instrument and the adjacent pipeline or reservoir are depressurized.



Attention

- Before opening the instrument ascertain whether hazardous material had been present in the flowmeter. Hazardous residues may still be present in the flowmeter and exit when it is opened.
- If pipeline vibrations are present, it is recommended that the flange bolts and nuts be secured to prevent their loosening.
- Within the framework of operator responsibilities, perform a regular periodic inspection to check:
 - flowmeter operation
 - seal integrity
 - wear (corrosion, abrasion, cavitation)

1.15 Returns

If it is necessary to return the instrument for repair or recalibration to the ABB factory in Göttingen, Germany, use the original packaging material or a suitable protective packing material. Please indicate the reason for the return.



Information! In Accordance with EU Hazardous Materials Guidelines

- The owner of special wastes is responsible for its decontamination and must observe the following regulations when shipping it:
- All flowmeter primaries and/or flowmeter transmitters which are returned to ABB Automation Products for repair are to be free of any hazardous materials (acids, bases, solvents, etc.). Any hazardous material in any cavities, e.g. between the meter tube and the housing, is to be flushed and neutralized. Written confirmation that these measures have been carried out should accompany the flowmeter.
- If the user cannot completely remove the hazardous materials, then appropriate documents should accompany the shipment acknowledging this condition. Any costs incurred by ABB to remove and decontaminate the hazardous materials during the repair will be billed to the owner of the instrument.



Attention

This Operating Instruction contains instructions for the start-up and testing of the flowmeter as well specifications for the flowmeter design. The manufacturer reserves the right to make hardware changes which represent technological advances. Information about updates and possible expansions may be obtained from the ABB factory in Göttingen, Germany or from your ABB Sales Office.

2 Functional Description

The Glass Tube Flowmeters of the Series FAG1190-87, FAG1190-97, FAG1190-98 operate on the Variable Area principle and are suitable for metering the flowrate of liquids and gases.

The position of the float in the conical metering tube is proportional to the flowrate. The position is read on the scale on the metering tube. Four different scale formats are available:

- Diameter ratio scale Dt/Df .
The ratio of the inside diameter of the metering tube to the outside diameter of the float.
Only for metering tube sizes 1/16", 1/8" and 1/4"
- Percent scale
- Millimeter scale
- Direct reading scale in engineering units

A flowrate table is included with all flowmeters utilizing diameter ratio scales. When operating conditions change, the user can prepare appropriate flowrate tables.

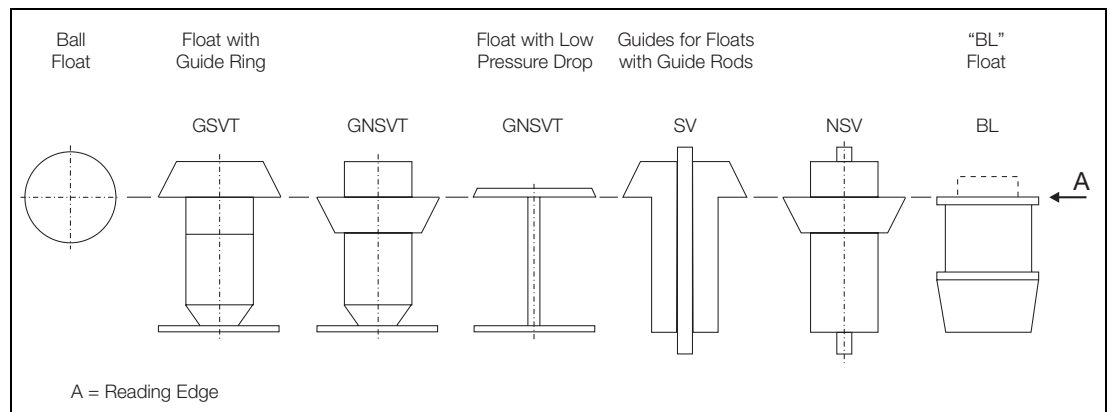
The standard design for flowmeter sizes 1/2" to 2" includes a percent scale. A factor tag is attached to the flowmeter indicating the flowrate equivalent to 100%. The remaining scale values can be calculated using a linear proportionality. A special flowrate curve is therefore not required. Upon request conversion equations for other operating conditions will be provided.

Flowmeter Designs

- FAG1187 with pipe coupling connections per DIN 2950
- FAG1195 with female threaded connections (upon request)
- FAG1197 with female threaded connections
- FAG1197 with threaded sanitary adapters per DIN 11851 for the Food Industry
- FAG1198 with flanged connections

2.1 Float Shapes

The reading edges of the floats, shown below, are different for the various float shapes.



3 Installation

3.1 General

Check that the allowable operating conditions will not be exceeded at the location where the flowmeter is to be installed (see Specifications). Possible injuries may result if the metering tube should break. Provide for flying glass protection if the instrument has been ordered **without** a polycarbonate protection tube.

As a rule, flowmeters for gas applications should be installed as close as possible to pipe restrictions and if possible, a valve should be installed in the outlet fitting. The inside diameter of the pipeline should be reduced to its minimum size. For liquids however, the pipeline can be sized based on economic considerations.

Variable Area flowmeters must be installed vertically with the outlet at the top. Please you remove besides the wood bar in the measuring tube.

3.2 Pressurized and Volume Chambers

Pressurized or volume chambers tanks are often utilized in flowmeter installations in order to damp pulsations and quiet float oscillations. This is especially advantageous when the flow is produced by piston pumps or compressors. When pressurized chambers are utilized for liquids, the pressurizing gas connections should be at the top.

If the instrument and the fluid should not come in contact with each other, volume chambers are used. The correct size for the pressurized or volume chambers appropriate for the installation will be supplied upon request.

Installation Recommendations

See also VDI/VDE-Guideline 3513 Sheet 3, Selection and Installation Recommendations for Variable Area Flowmeters.

Damping and Compression Oscillations when Metering Gases

If a specific critical volume is exceeded between the closest throttling location up- or downstream of the flowmeter compression oscillations (float bounce) may occur when the operating pressure is low.

To prevent these self generating compression oscillations the following measures can be applied:

- Select a flowmeter with the lowest possible pressure drop.
- Minimize the pipeline length between the flowmeter and the closest up- or downstream throttling location.
- Increase the operating pressure, considering its effect on the flowrate values due to the changes in the gas density at the new operating conditions.

3.3 Assembly and Installation in the Pipeline

The installation must be stress free. The Series FAG1187 and FAG1190 flowmeters are designed for pipeline installations. The smaller size flowmeters can usually be supported by the pipeline. If this is not possible, (e.g. in plastic pipelines or for larger size flowmeters), then the flowmeter and pipeline should be supported using wall or mounting brackets. The upper and lower coupling nuts in the Series FAG1187 can be loosened and the instrument removed to the side from the pipeline.

The flowmeter can readily be removed and reinstalled for cleaning or any other purpose.

3.3.1 Minimum Required Upstream Pressure for Gas Metering

Even with pulsation free flow, spontaneous float oscillations (float bounce) may occur. They are caused when the critical volume is exceeded between the closest throttling location up- or downstream of the flowmeter at low operating pressures. To prevent these self generating compression oscillations the following measures should be employed:

- Minimize the pipeline length between the flowmeter and the closest up- or downstream throttling location
- Reduce the usual 10 - 100 % flow range to 25 - 100 %
- Set the lower flowrate value by approaching it from a higher value
- Increase the operating pressure, considering its effect on the flowrate values due to the changes in the gas density at the new operating conditions.

3.4 Start-Up

At start-up, increase the flowrate stepwise by slowly opening the shut off valve. This will preclude pressure shocks which could possibly damage the float, float stops or the glass metering tube. When metering liquids, a method to bleed the pipeline system at start-up should be considered if required. The flowrate is read from the graduations on the scale on the metering tube at the location of the reading edge of the float. The reading edges for the various float shapes are shown in the figure on Page 10.

If a strong float vibrations occur when metering low flowrates and the lower portion of the scale is normally not used, the problem can be resolved by utilizing a flowmeter with a longer inlet float stop. This will preclude using the lower portion of the scale. Relief can also be attained by installing a larger sized flowmeter with a low pressure drop float.

3.5 Maintenance

3.5.1 Removal of the Metering Tube and Float

The float is a precision machined part. Therefore it is especially important to assure that the guide ring and metering edge are not damaged. A damaged float will result in inaccuracies and possible damage to the metering tube. The metering tube should not be exposed to any shock or other stresses. When removing the metering tube, note where the float stops are installed. During reassembly the float stops must be reinstalled in their original locations. Use the following procedure to remove the float and metering tube:

- Remove the flowmeter from the pipeline. Slowly loosen the allen head screws in the upper fitting.
- Slowly pull the metering tube upward and remove it from the flowmeter housing. The float should not fall out of the metering tube or be damaged.

Reinstall in the reverse manner. Damaged O-rings should be replaced and coated with silicone or other lubricant prior to installing the metering tube.

Attention

Do not grease the O-rings for oxygen metering. For these applications the BAM tested Voltalef lubricants may be used.

If the float incorporates a guide ring, it must point in the direction of the inlet.

Attention

For the guarantee of the function and security only original spare parts may in accordance with Parts catalog to be used.



4 Specifications

4.1 Max. allowable operating pressure

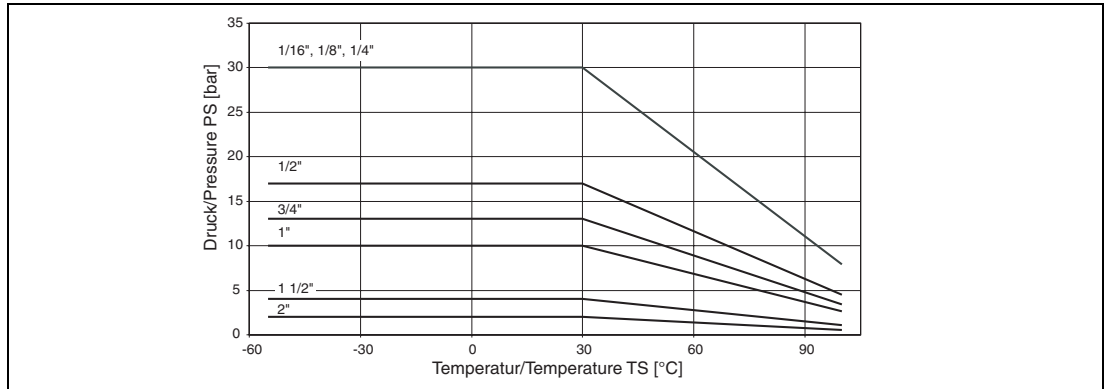


Fig. 1: Gases

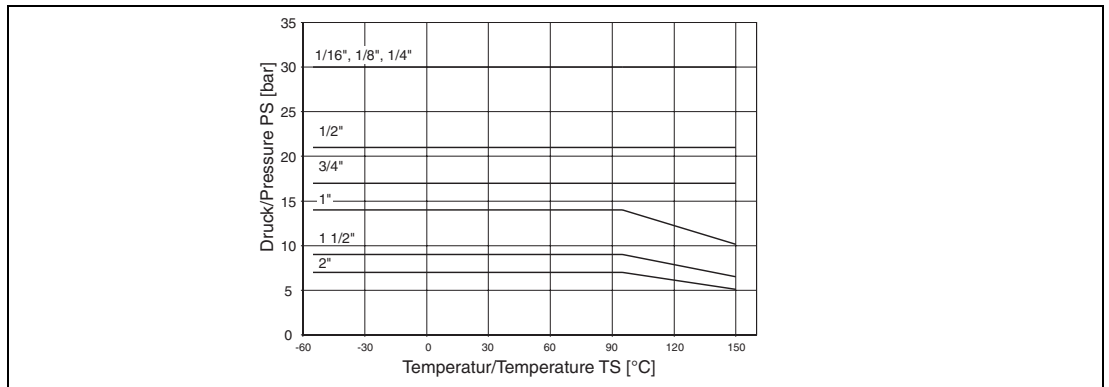


Fig. 2: Liquids



For fitting material PVDF the max. fluid temperature is limited up to 120°C,
for fitting material PVC up to 60°C!

Max. allowable fluid temperature

| | |
|-------------------------|------------------|
| O-Rings Buna N | -20 °C – +100 °C |
| O-Rings Viton A | -20 °C – +180 °C |
| Äthylene-Propylene EPDM | -20 °C – +100 °C |
| PVC floats | up to 40 °C |

Accuracy Classes (per VDI/VDE 3513)

| | |
|------------------------|-----|
| Meter size 1/16" | 6 |
| Meter sizes 1/8" to 2" | 1,6 |
| Meter sizes 1/2" to 2" | 6 |
| with „BL“/float design | |

Connections

Threaded or flanged connections see dimensions

Weight

See dimensions

5 Dimensions

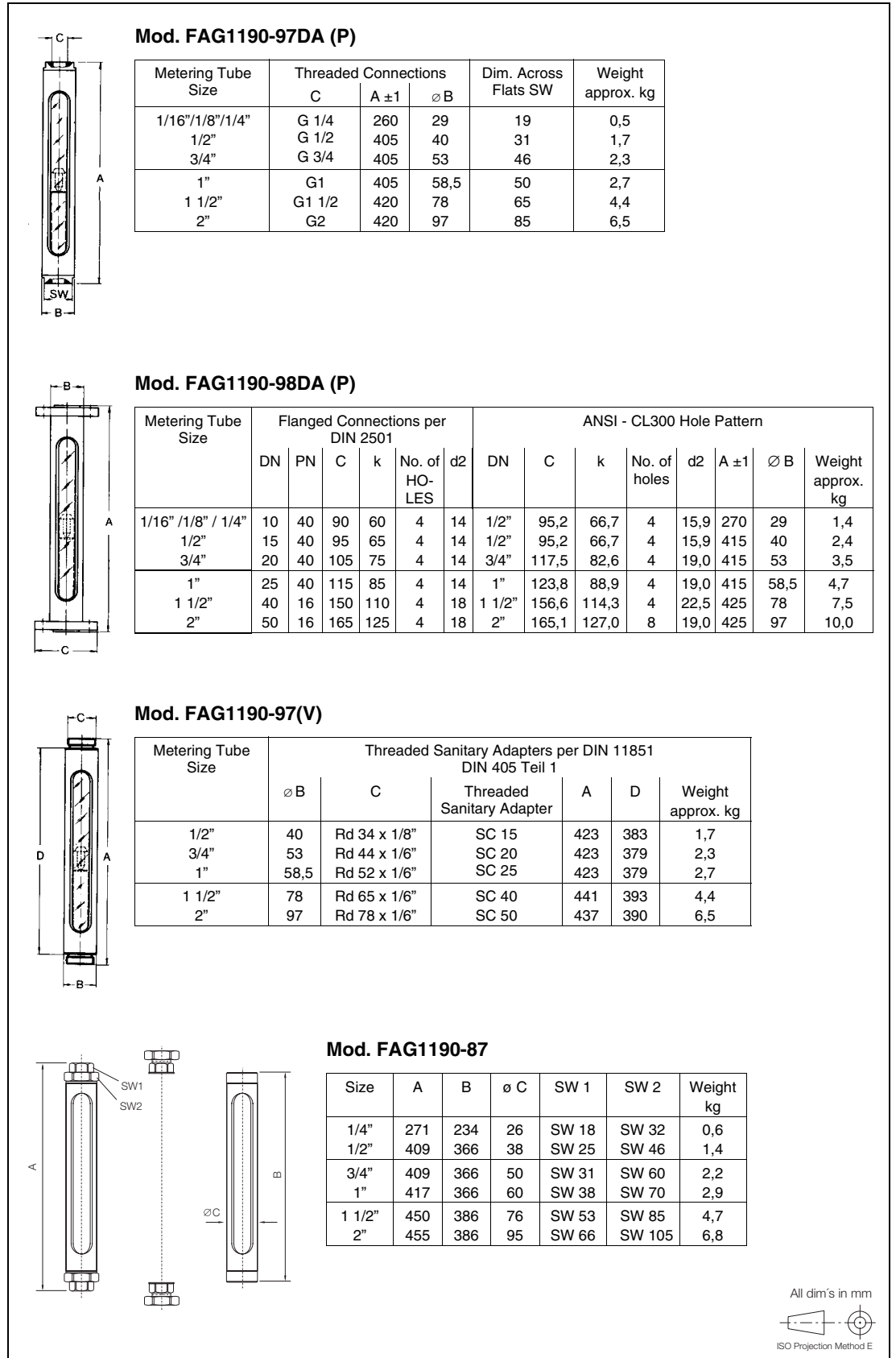


Fig. 3:

All dim's in mm

 ISO Projection Method E

6 Accessories Alarm Signal Transmitter 55AX1000 for FAG1190-87, FAG1190-97, FAG1190-98

6.1 Application

The Alarm Signal Transmitter includes one or two limit switches, (inert gas switches) which are actuated by a magnet embedded in the float. It is used in conjunction with the float designs G(N)SVT, (N)SVP and BL. (Please observe the footnotes in the Flow Range tables).

6.2 Operation

The Alarm Signal Transmitter is positioned in a guide slot in the flowmeter housing and can be adjusted over the entire flow range. The inert gas switches are configured as bistable contacts. The signal from the lower alarm is initiated when the float drops below the lower alarm switch position. The contact is closed. The signal from the upper alarm is initiated when the float travels above the upper switch position. The contact is closed. The circuits (between the alarm switches and the transistorized Switch Amplifier KF_) are intrinsically safe. The Switch Amplifier must, however, be installed outside of the Ex-Zone.



Fig. 4:

6.3 Specifications

Switch Type

Bistabil

Contact Configuration

Lower alarm value: Contact opens for a rising float

Upper alarm value: Contact closes for a rising float

Cable Length

1.75 m

SIHF-J 2 x 0.5 mm²

Allow. Ambient Temperature

-20 to +60 °C

Operating voltage U_B = 30 V, 10 VA

Switch Amplifier

KF_SR2-Ex1W: for 1 alarm switch

KF_SR2-Ex2W: for 2 alarm switches

7 Accessories, Needle Valves

7.1 Series FAG1190-87 (10A1187)

Application

Installed separately in the pipeline up- or downstream from the flowmeter.

Design

Female threaded connections

Design Features

- Material: Brass, PN 100, max. 100 °C
- In-line valve fitting
- Good adjustable

Specifications

| Part No. | Part No. for O ₂ Application | Dimensions | | | | | |
|------------|--|------------|----|-----|----|------|-----|
| | | DN | ∅D | A | C | E | SW1 |
| 1D125D1004 | D125D001U01 | G 1/4 | 50 | 72 | 10 | 50 | 22 |
| 1D125D1005 | D125D001U02 | G 1/2 | 63 | 72 | 12 | 55 | 25 |
| 1D125D1006 | D125D001U03 | G 3/4 | 63 | 95 | 14 | 67 | 32 |
| 1D125D1017 | D125D001U04 | G 1 | 90 | 130 | 17 | 74,5 | 40 |

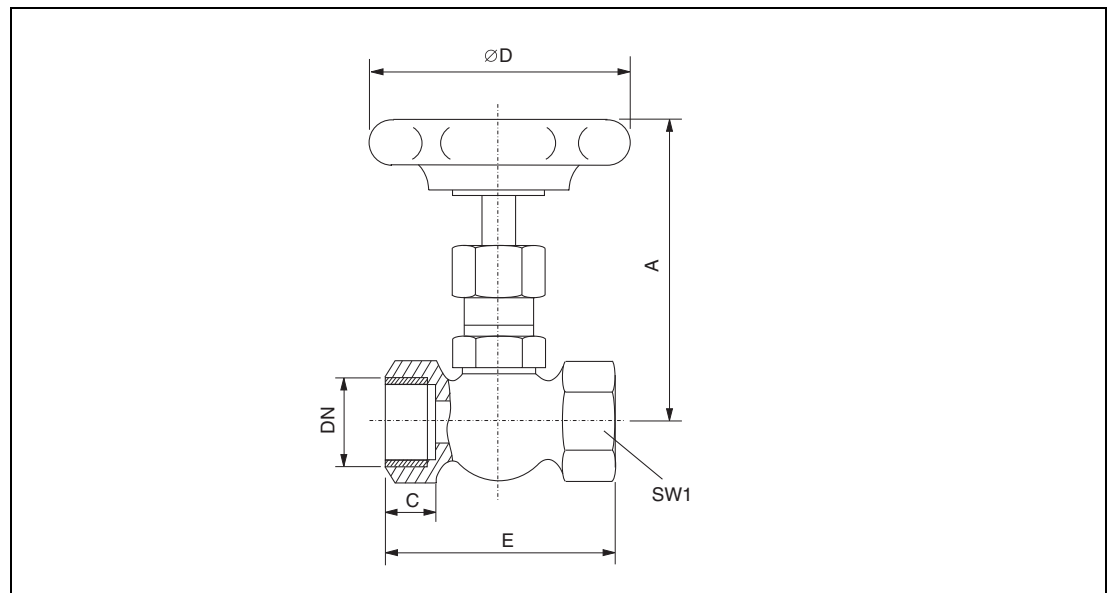


Fig. 5:

7.2 Serie FAG1190-97 (10A1197)

Application

Installed separately in the pipeline up- or downstream from the flowmeter.

Design

Female threaded connections

Design Features

- Material: SST 316 TI [No. 1.4571] PN 200, max. 180 °C
- In-line valve fitting
- Good adjustable

Specifications

| Part No. | Dimensions | | | | | |
|-------------|------------|----|-----|----|----|-----|
| | DN | ØD | A | B | C | E |
| 1D125D1001 | G 1/4 | 50 | 72 | 25 | 13 | 50 |
| 1D125D1002 | G 1/2 | 63 | 72 | 30 | 16 | 60 |
| 1D125D1003 | G 3/4 | 63 | 95 | 35 | 18 | 75 |
| 1D125D1019 | G 1 | 90 | 130 | 45 | 22 | 100 |
| D125D003U02 | 1/4" NPT | 50 | 72 | 25 | 13 | 50 |
| D125D003U01 | 3/8" NPT | 50 | 72 | 25 | 13 | 55 |
| D125D003U03 | 1/2" NPT | 63 | 72 | 30 | 16 | 60 |

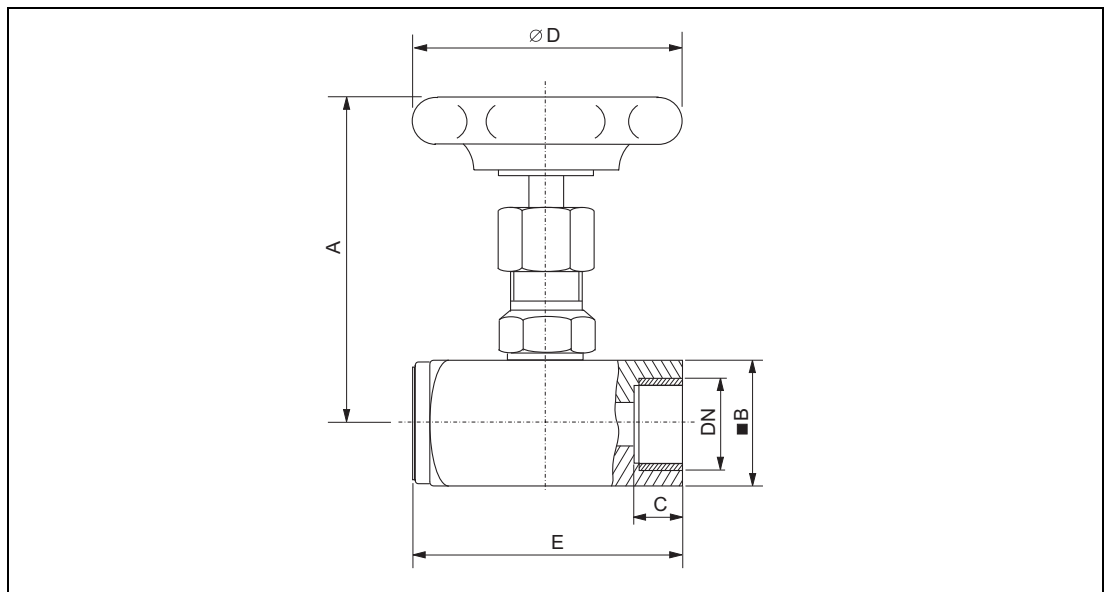


Fig. 6:

7.3 Additional Ex-Area Specifications

The glass tube variable area flowmeters can be installed in Ex-Areas classified Zone 2 and Zone 22 without any additional restrictions.

The instrument identifications are: II 3G T6 or 3D T85 °C.

For the higher fluid temperatures these Temperature Classes and Surface Temperature specifications apply.

Please consider:

- The chemical resistance/temperature specifications of the gaskets.
- The allowable pressures.
- The allowable ambient conditions.

Attention

The instruments must be installed so that external mechanical stresses cannot act on the flowmeter.



To avoid electrostatic charges, the pipe housing must be connected to PA (< 1G). This connection is generally achieved over the process connections. If necessary, use a pipe clamp to connect PA to the pipe housing.

EN 50281-1-2 as well as 60079-14 are to be observed.

Only original parts may be used for repair.

The alarms are also designed for Ex-Areas classified Zone 2/22 Identification EEx nA IIC T6.

The rated voltage is $U_{Rat} = 60 \text{ V}$.

Corrosive metal particles are not permitted in the fluid. Gas inclusions in liquid flow applications and pulsating flows are to be avoided. Use only slow opening valves.

8 Certifications

8.1 EU-Certificate of Compliance



EG-Konformitätserklärung EC-Certificate of Compliance



Hiermit bestätigen wir die Übereinstimmung der
Herewith we confirm that our

Glaskonus-Durchflussmesser
Glass Tube Flowmeter

Modell 10A11.. / FAG11..
Model 10A11.. / FAG11..

mit den grundlegenden Sicherheits- und Gesundheitsanforderungen gem. der Richtlinie 94/9/EG des Rates der Europäischen Gemeinschaft. Die Sicherheits- und Installationshinweise der Produktdokumentation sind zu beachten.
are in compliance with the Essential Health and Safety Requirements with refer to the council directives 94/9/EC of the European Community. The safety and installation requirements of the product documentation must be observed.

Die Glaskonus-Durchflussmesser dienen zur Messung des Durchflusses von Gasen und Flüssigkeiten.
The Glass Tube Flowmeter are utilized to meter the flow rate of gases or liquids.

Geräte-Kennzeichnung: II 3 G T6 bzw. II 3 D T 85°C ... T_{MED}
EEx n A IIC T6 (nur Grenzalarm)
Apparatus code: II 3 G T6 resp. II 3 D T85°C ... T_{MED}
EEx n A IIC T6 (Alarm only)

Sicherheitstechnische Daten: siehe Betriebsanleitung D184B003U15
Safety values: *resp. refer to Instruction Manual D184B003U02*

Angewandte Normen: EN 13 463-1:2001 EN 50 021:1999
Standards:

Göttingen, 25. Juni 2003

[Handwritten Signature]
Unterschrift / Signature

BZ-13-8016, Rev.1, 6029

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Amtsgericht Frankfurt/Main
Handelsregister:
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USt-IdNr.: DE 115 300 067

Vorsitz des Aufsichtsrates:
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Geschäftsführung:
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Joachim Braun
Erik Huggare
Dr. Peter Tenwiesch

Bankverbindung:
Commerzbank AG Frankfurt
Konto 589 635 200
BLZ 500 400 00

8.2 EC-Declaration of Conformity





 0045

EG-Konformitätserklärung
EC-Declaration of Conformity

Hiermit bestätigen wir die Übereinstimmung des aufgeführten Gerätes mit den Richtlinien des Rates der Europäischen Gemeinschaft, welche mit dem CE-Zeichen gekennzeichnet sind. Die Sicherheits- und Installationshinweise der Produktdokumentation sind zu beachten.
Herewith we confirm that the listed instrument is in compliance with the council directives of the European Community and are marked with the CE marking. The safety and installation requirements of the product documentation must be observed.

| | |
|--|---|
| Hersteller: <i>manufacturer:</i> | ABB Automation Products GmbH, 37070 Göttingen - Germany |
| Modell: <i>model:</i> | 10A11.. |
| Richtlinie: <i>directive:</i> | Druckgeräterichtlinie 97/23/EG <i>pressure equipment directive 97/23/EC</i> |
| Einstufung: <i>classification:</i> | Ausrüstungsteile von Rohrleitungen <i>pipng accessories</i> |
| Normengrundlage: <i>technical standard:</i> | AD 2000 Merkblätter |
| Konformitätsbewertungsverfahren: <i>conformity assessment procedure:</i> | B1 (EG-Entwurfsprüfung) + D (Qualitätssicherung Produktion) <i>B1 (EC design-examination) + D (production quality assurance)</i> |
| EG-Baumusterprüfbescheinigung: <i>EC type-examination certificate:</i> | Nr. 07 202 4534 Z 0024/2/H |
| benannte Stelle: <i>notified body:</i> | TÜV Nord e.V. Rudolf-Diesel-Str. 5 37075 Göttingen - Germany |
| Kennnummer: <i>identification no.</i> | 0045 |

Göttingen, den 03.12.2002



ppa
 (B.Kammann, Standortleiter APR Göttingen)

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