MIVI

Technical Manual

Process tuning rod probe for viscosity, density and temperature measurements

Original version

REF.: 379/4

SOFRASER
Pioneering viscometry since 1972

IMPORTANT

1° READ CAREFULLY THIS MANUAL. THE APPLICATION OF WARRANTY IS SUBJECTED TO STRICT OBSERVANCE OF INSTRUCTIONS.

2° THE OFFSET ADJUSTMENT IN THE AIR MUST BE THE FIRST TASK COMPLETED WHEN THE MIVI IS INSTALLED ON ITS MOUTING.

- Clean and dry the vibrating rod of the viscometer in order to make it **neat and dry**;
- Install the sensor on the process and fix it with its screws; these must be tightened at the nominal torque;
- Be sure the process is empty. The **rod must be vibrating in the air**;
- Power on the device and **wait at least 30 minutes**;
- Follow the instructions given in § 3.1.1 and in the electronic device manual delivered with the equipment.

3° PRACTICAL ADVICES AND IMPORTANT WARNINGS ARE ALSO LISTED IN § 2.4.

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1. General presentation

1.1 Principle

The measuring chain is composed of two inseparable elements: the sensor and the electronics device that controls it (also called transducer). The sensor cannot be used with another electronic device because they are matched together as one vibrating system, and vice versa.

The provided viscosity information is relative. In the same fluid and under the same environmental conditions, the information is the same. For two fluids with a different rheological behaviour, the response can be different. Since it is perfectly repeatable, it just needs a different correlation.

The active part of the sensor is composed of a vibrating rod held in oscillation at resonance frequency (also called tuning-type) by driving magnets. When the rod is immersed into a viscous material, the amplitude of the vibration is dampened. The vibration amplitude and its frequency vary according to the viscosity and the density of the product where the rod is immersed. The sensor receiving coil detects the response and the signal is converted to a viscosity value through the electronics device. The factory calibration is performed with certified viscosity standards.

The transducer acquires the coils' voltages and generates various signals. These signals represent the properties being measured. It is also in charge of powering the whole system.

A choice of electronic from simple transducer to touchscreen PLC/HMI provides process information (viscosity, density or temperature) through different kinds of output.

1.2 Various models

The MIVI sensor can be assembled in many different ways to match with the process needed parameters. Here are the main designs:

- general standard sensor;
- sanitary sensor;
- Ex-proof sensors (ATEX, FM, JIS, KOSHA);
- high pressure sensors (up to 1 000 bar);
- special models, according to the requirements (material and design);

When required, a temperature probe can be incorporated in the MIVI sensor. Standard temperature probe is a Pt100 class B.

Overview of the product range is available in document ref. 280 (see APPENDIX D).

Special sensors can be manufactured on demand. Contact the local distributor.

1.3 Cable wires allocation

wire	colour	item
A B	blue brown	Coil 1
C D	transparent black	Coil 2
E F G	red yellow green	Pt100 Temperature probe (optional)
N/A	metal	Earth

1.4 Directives and Standards

1.4.1 European Pressure Equipment Directive and EMC directive

Up to 60 bars, MIVI sensors are in accordance to the article 4.3 of the PED 2014/68/UE. In case of higher pressure, sensors are agreed one by one.

The mounting flange is an accessory to be welded on the process line. It means it cannot be individually certified but has to be certified with the whole process line.

MIVI sensors have been designed and manufactured according to the electrical safety rules.

1.4.2 ATEX and IECEx flameproof enclosure certification

Marking is

 II 2G and/or II 2D and/or II 2GD

Ex db IIC T* Gb and/or Ex tb IIIC IP6X T* Db

(*)≤ Tamb≤(*) see tables APPENDIX A for ATEX, APPENDIX B for IECEx

Be sure the sensor's certification is in accordance to the security level required on your process location: area classification, equipment group, protection method, gas type, temperature codes...

MIVI sensors are in agreement with 2014/34/EU directive (ATEX) for equipment installed in explosive gas atmospheres or in presence of combustible dust.

Area classification and equipment installation rules are detailed into EN 60079-0 standards and EN 60079-1 standard for gas or EN 60079-31 standard for dust.

MIVI sensors comply with the following standards for equipment installed in explosive gas atmospheres or in presence of combustible dust.

IEC 60079-0 - Explosive atmospheres - Part 0: General requirements
IEC 60079-1 - Explosive atmospheres - Part 1: Equipment protection by flameproof enclosures "d"
IEC 60079-31 - Explosive atmospheres – Part 31: Equipment dust ignition protection by enclosure 't'

To always keep the maximum security level, the proper functioning and the warranty, do not open it.

Check as often as possible that the information indicated on the sensor's identification plate is still visible.

1.4.3 FM flameproof enclosure certification

MIVI FM sensors are in agreement with FMRC-3615 class (FM) for equipment installed in explosive gas atmospheres:

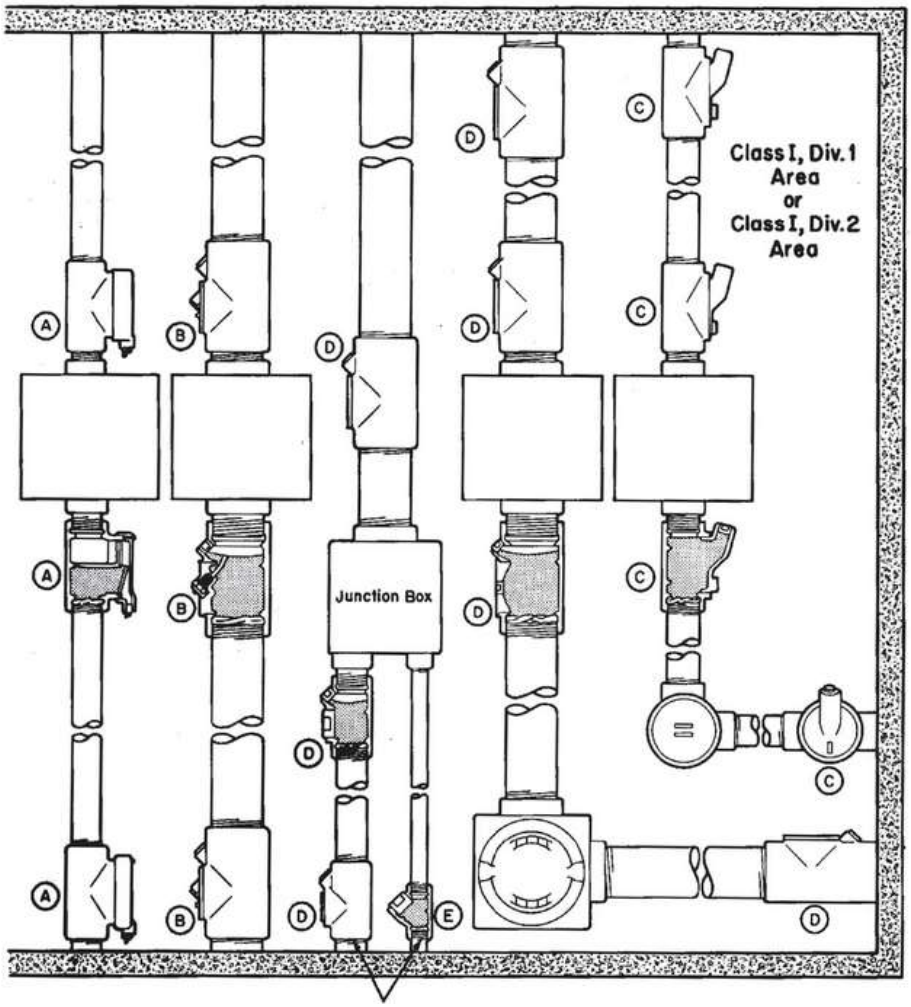
FM APPROVED MIVI FM

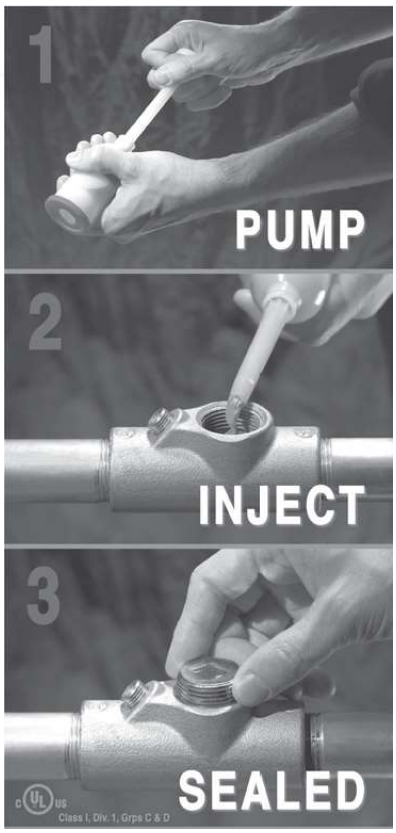
Class I, Div. 1, Groups A, B, C & D T4A
ambient temp. range: from -20°C to 100°C

For FM sensors, it is necessary to add a protection in accordance to the area's risks level. As long as the cable is in a hazardous area, it should be protected as recommended in the 2011 NEC code digest, appendix IV.

Our sensors are certified until the end of the flexible conduit, where we connected a NPT joint (see APPENDIX D). For connecting the sensor in agreement with the class, the installer should follow the instructions given in the 2011 NEC code digest, appendix IV.

This means a conduit seal has to be connected to our NPT joint, according to the examples you have hereunder.





Note: In order to protect the inner part of the sensor (body + flexible conduit) during transportation, we use a black silicone tape to cover the NPT joint's end. This has nothing to do with a FM approved protection and shall be removed while being installed on site.

Hereunder are some features of the conduit seals to be installed.

EYS and EZS sealing fittings:

- Restrict the passage of gases, vapors, or flames from one portion of the electrical installation to another at atmospheric pressure and normal ambient temperatures.
- Limit explosions to the sealed-off enclosure.
- Prevent pre-compression or “pressure piling” in conduit systems.

While not an NEC requirement, many engineers consider it good practice to sectionalize long conduit runs by inserting seals not more than 50 to 100 feet apart, depending on the conduit size, to minimize the effects of “pressure piling.”

Sealing fittings are required:

- at each entrance to an enclosure housing an arcing or sparking device when used in Class I, Division 1 and 2 hazardous locations. To be located as close as practicable and, in no case, more than 18" from such enclosures. The enclosure's installation instructions may specify a distance less than 18";
- at each entrance of 2" size or larger to an enclosure or fitting housing terminals, splices, or taps when used in Class I, Division 1 hazardous locations. To be located as close as practicable and, in no case, more than 18" from such enclosures;
- in conduit systems when leaving the Class I, Division 1 or Division 2 hazardous locations;
- where cables terminate at enclosures that are required to be explosion proof;
- where cables leave Class I, Division 1 locations and where they leave a Class I, Division 2 location if they are attached to process equipment that may cause a pressure of over 6 in. of water to be exerted on a cable end.

1.4.4 ATEX and IEC Ex intrinsic safety certification

Marking is


II 1G Ex ia IIC T6 to T1 Ga

(*)≤ Tamb≤(*) see tables APPENDIX C

MIVI sensors are in agreement with ATEX directive 2014/34/EU and the associated standards EN 60079-0, EN 60079-11, but also with the IEC 60079-0 and the IEC 60079-11.

Be sure the sensor’s certification is in accordance to the security level required on your process location: area classification, equipment group, protection method, gas type, temperature codes...

To always keep the maximum security level, the proper functioning and the warranty, do not open it.

Check as often as possible that the information indicated on the sensor’s identification plate is still visible.

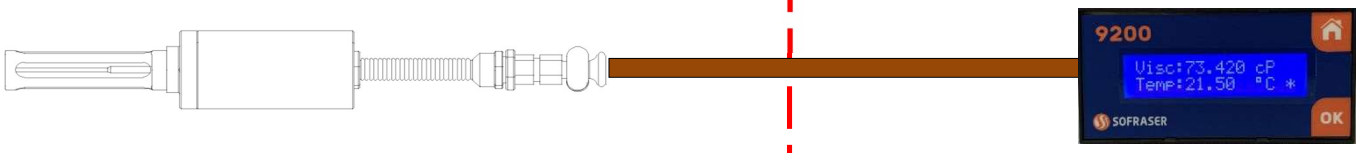
1.4.5 Installation in hazardous area

Here are the possible ways to install the MIVI sensors in a hazardous area.

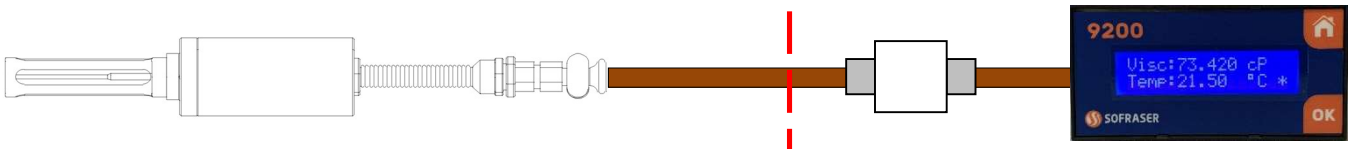
HAZARDOUS AREA ***SAFE AREA***

Ex d : zone 1 or zone 2

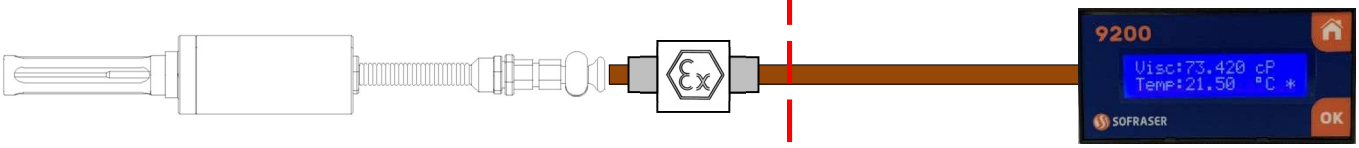
- ***Standard installation for a MIVI-ADF linked to a transducer***



- ***The MIVI-ADF sensor is linked to the transducer with the help of a standard connection box***

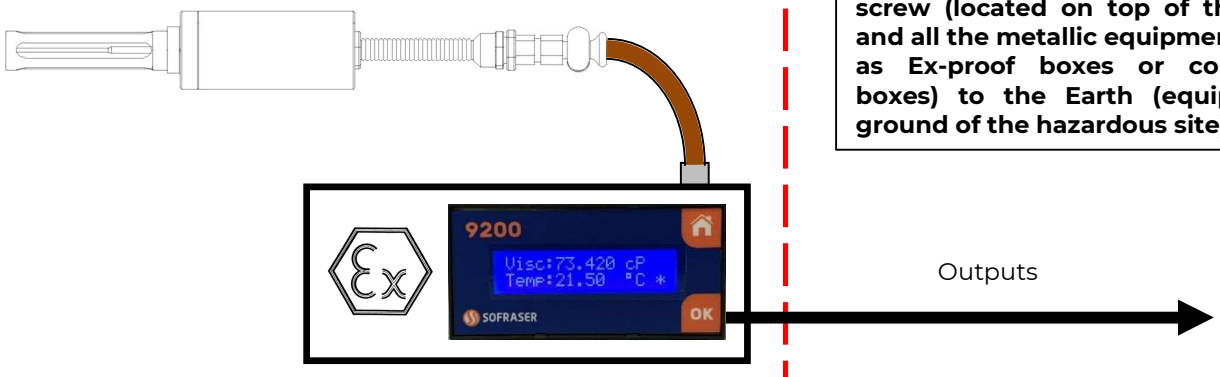


- ***The MIVI-ADF sensor is linked to the transducer with the help of an Ex-proof connection box***



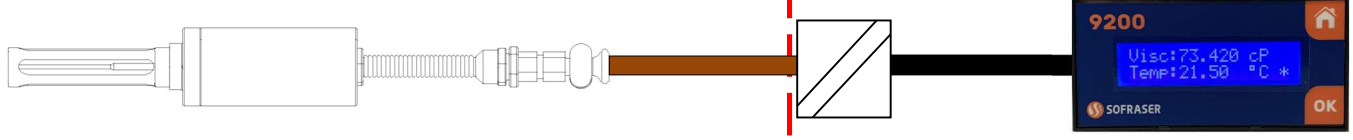
- ***The transducer device is installed in the hazardous area with the help of an Ex-proof box and linked to PLC/HMI or SCADA in safe area***

Always connect the sensor's Earth screw (located on top of the body) and all the metallic equipments (such as Ex-proof boxes or connection boxes) to the Earth (equipotential ground of the hazardous site).



Ex i : zone 0, zone 1 or zone 2

- ***Standard installation for a MIVI-SI linked to a transducer through intrinsic safe barriers (one for each coil plus another for the PT100) (See Appendix C)***



1.4.6 Other certifications

Japanese Ex approval is available at Sofraser distributor in Japan.

Korean Ex approval is available at Sofraser distributor in South Korea.

MIVI sensor with “standard” design, relevant flow through cell/measuring chamber/pot, mounting flange to be welded and cap are registered under CRN n° 0F16467.2 by Absa, for the Alberta province (MAWP 6895kpa, design temperature 300°C, MDMT -200°C).

MIVI sensor with “sanitary” design is still manufactured according to the original file and 3A certificate N° 1013 dated March 30th, 1999. Compared to “standard” design, the gaps and threads were soil can accumulate and become source of contamination are eliminated, improving the efficiency of the CIP (Cleaning in Place). In food and beverage, pharmaceutics, biotech, cosmetics... MIVI with “sanitary” design is best combined with electropolish finishing that reduces the roughness of the wetted parts surface, and installed on its mounting accessory without its flow damper.

2. Installation

2.1 Checking the equipment after receipt

First and foremost, check the conformity with the ordered equipment. Mainly check if all the parts needed to mount the equipment are delivered. The parts that are intended to be mounted on the process shall be given to the concerned department, for the installation preparation.

Place the sensor on a soft foam plate, connect it to the processor (see Technical manual of the processor) and switch it on. The rod shall start vibrating and the viscosity indication shall be zero or close. When touching the rod, the value shall increase.

In case of a subnormal operation occurs, check as follows:

- power supply, connections, cables;
- vibrating rod's shape and condition (no bending, no damages, ...).

If it is not immediately used, store the viscometer in its original packaging that should also be used for transportation.

2.2 Sensor installation

It operates in any position, even upside down. Its active part has to be permanently immersed into the fluid (low part of the network or reactor). If the fluid temperature varies widely and fast, choose the upside down or horizontal position, in order to allow proper air convection among the sensor body. **Nevertheless, we recommend to install the sensor in a horizontal position or with the cable gland oriented to the ground.**

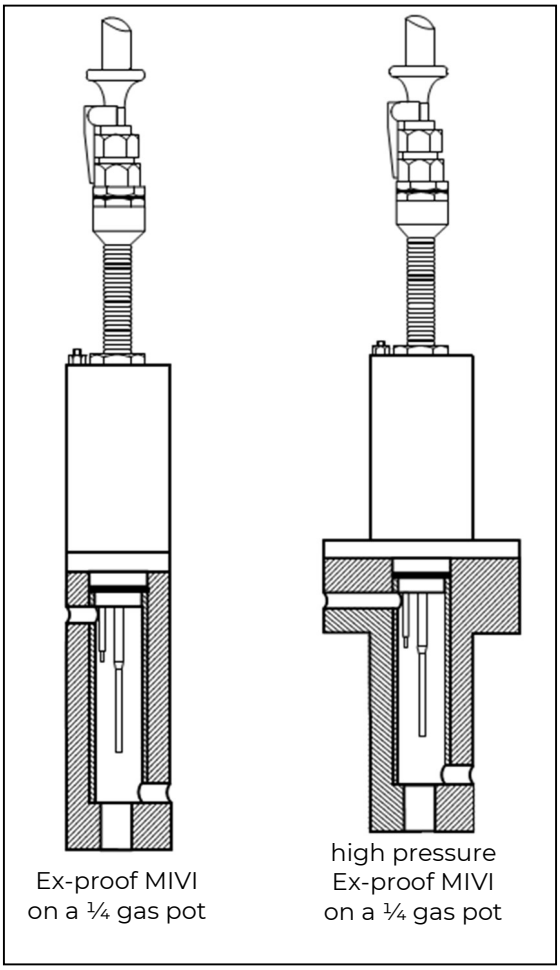
The product-contact part or even the sensor body can be used up to 200, 250 or 300 °C (392, 482 or 572 °F) depending on the sensor category but the temperature at the output of cable must not exceed the temperature written on the marking plate that is 100 °C (212 °F) by default.

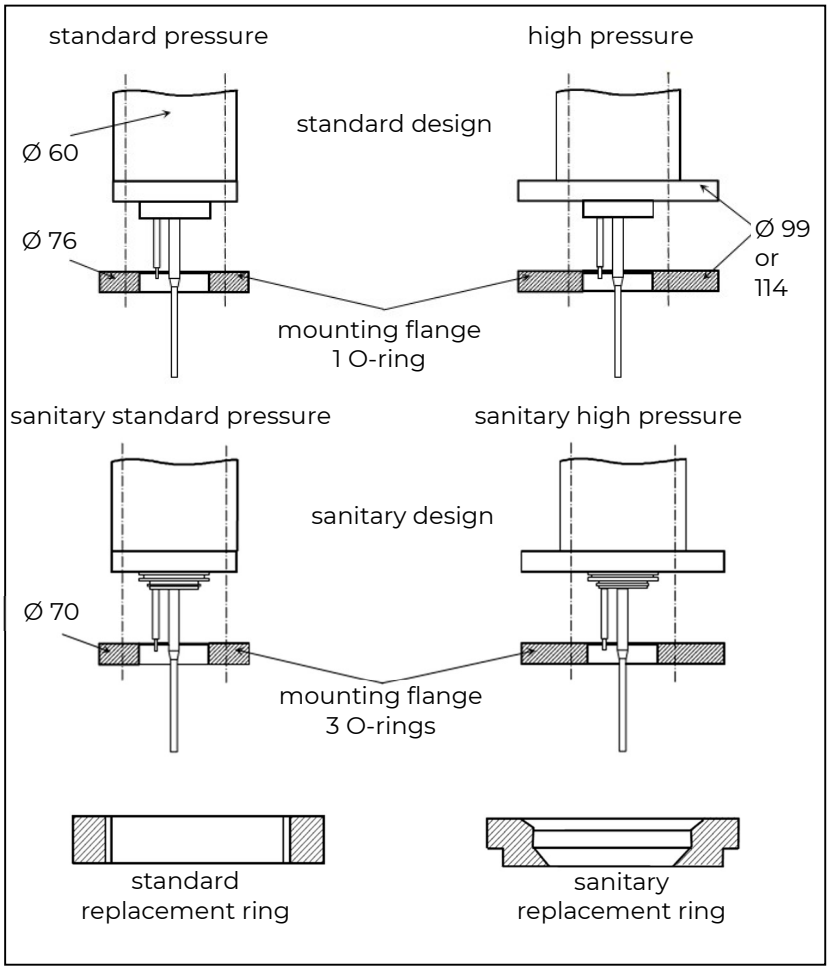
It is screwed to its mounting flange with the help of 4 screws M6X100 (or 8 screws M8 or M10 for high pressure MIVIs). The mounting flange has to be welded close to the device generating the viscosity variations (heater, mixer, reactor, etc...). Retention, high flow velocities, strong vibrations and high magnetic fields have to be avoided.

According to the application, the mounting flange material can be:

- stainless steel 1.4404 (316L);
- other materials, according to the requirement.

2.2.1 Various mountings and models





Details about mounting accessories are available in technical leaflets reference 320, 328 and 329 (see APPENDIX D). When it normal production cycle, the vibrating rod must be continuously and fully immersed in the fluid.

2.2.2 Elbow mounting

The flange is welded on a right angle straight tee as indicated in figure 1.

The minimal pipe diameter is of 32 mm.

The length of the branch must be reduced as much as possible.

The flange and the pipe axes have to be superimposed.

The flow direction is as indicated on figure 1 (unless for fibrous fluids where the flow is inverted and the flow damper removed).

A free area of at least 150 mm length is necessary.

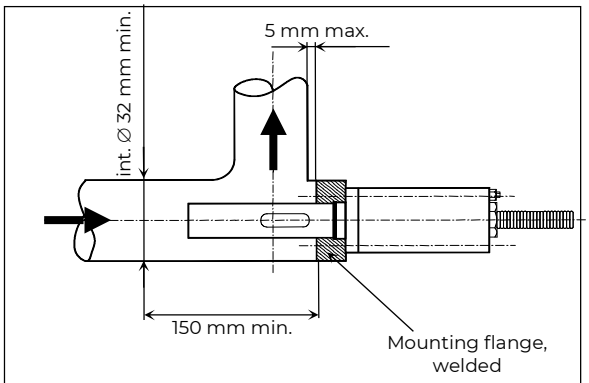


figure 1

Advice: Choose a sensor position in order to assure a permanent fluid renewal and to avoid the existence of “dead zones”.

2.2.3 Plane side mounting

The flange is welded on a metal plate as indicated on figure 2.

The free area around the vibrating rod has to be at least ∅ 40 and 150 mm length.

In order to avoid parasitic vibrations, the plate where the flange is welded must be **thicker than 5 mm**.

Advice: Preferably choose a horizontal position for the rod placement with all the liquid flows turned to the top in order to avoid the apparition of bubbles.

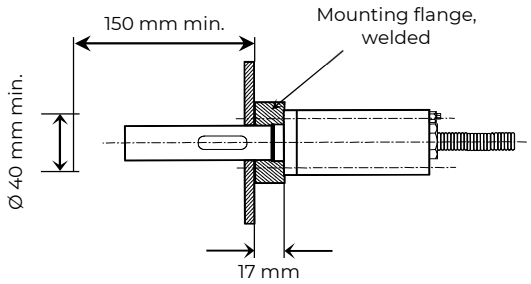


figure 2

2.2.4 Mounting on flow cell, for small flow rates or pilot plant

The small size of the sensing element allows many different mounting features according to the user's requirements. See example on figure 3 for the mounting cell (chamber/pot).

on flow cell

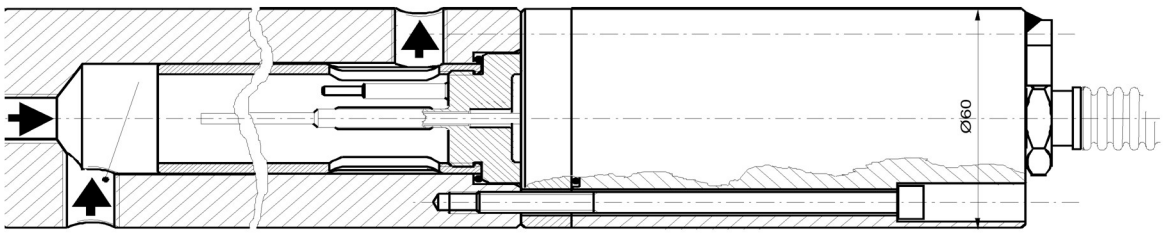


figure 3

2.2.5 Replacement cap and ring

For the standard pressure models, most of the mounting accessory sets delivered by Sofraser are provided with an obturator kit (cap, O-ring, 4 fixing screws CHC M6) that allows the process to work when the sensor has to be removed.

For some applications and operating conditions it may be advised to install the MIVI without its flow damper. In this case the flow damper must be replaced by the replacement ring that is delivered with most of the mounting flanges.

2.2.6 Other mountings

Other mountings are possible; refer to technical procedure reference 319 (see APPENDIX D).

2.3 Practical advices

2.3.1 Flow damper

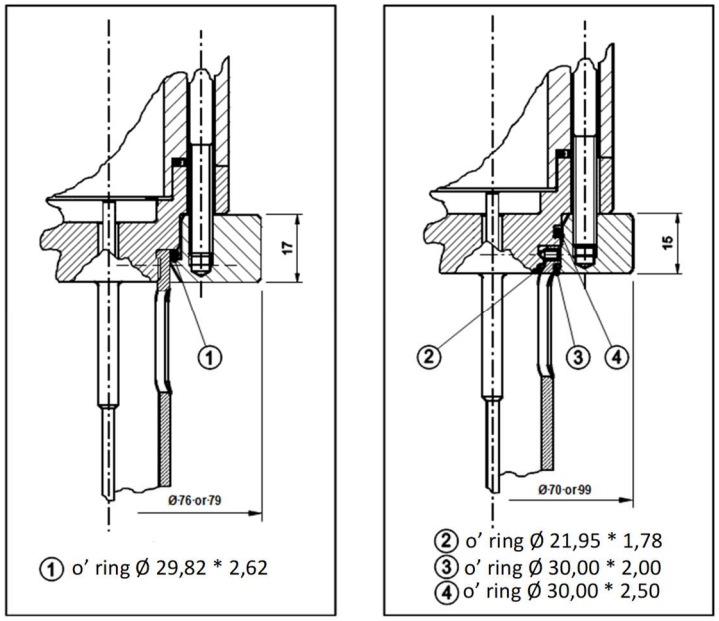
Each sensor is equipped with a flow damper (tube) in order to stabilize the flow around the vibrating rod. The fluid renewal is done through the slits of the damper. Slits length and width have been set by SOFRASER according to the full scale range of the sensor and the type of mounting (on pipe, on reactor, on flow cell ...).

It is advised to keep it on the sensor unless the sensor is used in particular conditions: on flow cell mounting, sanitary use, very viscous fluids. At the time of the assembly on the mounting flange and during transport, it also protects the rod from mishandling. Before installing the MIVI on its mounting accessory check that flow damper is firmly screwed on the neck of the MIVI sensor.

2.3.2 Tightness

Tightness between MIVI sensor and its mounting accessory is assured by one O-ring (three for the sanitary model). Check that the O-ring(s) material is compatible with your fluid and the operating temperature.

The flow damper of MIVI with base design (left drawing) is screwed on the neck of the vibrating rod flange. But removing the flow damper of MIVI with sanitary design requires to unscrew the 4 M3 STHC screws (right drawing) in order to release it from the neck of the vibrating rod flange.



When the MIVI sensor is installed without the flow damper, the replacement ring delivered with the mounting accessory (see technical leaflets ref. 320, 328 or 329), that has the same dimensions than the flow damper base, must be placed on the head of the MIVI sensor in order to maintain the O-ring(s) and ensure tightness.

Check that the maximum operating pressure of your process is within the nominal pressure of your MIVI sensor.

MIVI sensor with cable gland is rated IP67. Nevertheless, for long term utilization, cable gland and cable must be oriented in the bottom direction. IP 67 tightness is only secured when the cable gland is firmly screwed on the cable. Cable gland should never be **loosened** or **dismantled**.

After installation, proceed to the pressure proofing (limited to 150 % of the rated pressure of your MIVI sensor).

2.3.3 Fluid homogeneity

The MIVI is fully compatible with biphasic fluids, gas emulsions and solid suspensions. There is no impact with particles size up to 1 mm; larger particles could disturb the measurement and/or damage the sensor.

Presence of bubbles in the fluid doesn't disturb significantly the MIVI as long as the concentration and diameter don't affect the properties of the centimetric diameter size of the volume taken into account by the measures.

It is strongly recommended to carry out the measurement on a homogenized fluid so that the measurement is representative of the fluid.

2.3.4 Chemical compatibility

Check that Material Of Construction (MOC) of your MIVI sensor is compatible with your fluid and the operating temperature.

For information, the MOC of the wetted parts of the standard MIVI sensor is 316L stainless steel. In option, PTFE, ADLC and enamel coatings as well as special alloys and electropolish finishing are available.

For information the sheath of the standard cable of the MIVI sensor is in PVC material and its cable gland is in chrome-plated brass.

2.3.5 Temperature compatibility

Check that the maximum temperature of your process is within the nominal temperature of your MIVI sensor. For information, standard MIVI sensor has a 200 °C (392°F) nominal temperature. In option 250 or 300 °C (482 or 572 °F) are available. MIVI sensors with incorporated Pt100 temperature probe must not be used above 250 °C.

The temperature of the cable and especially at the output of cable gland must not exceed the temperature written on the marking plate (100 °C (212 °F) by default).

2.3.6 Pressure compatibility

During normal operation, do not exceed the MIVI sensor rated pressure.

2.3.7 Sensor handling

Do not drop nor knock the MIVI sensor.

Knocking the rod will have an effect on the factory calibration. It can be corrected on site.

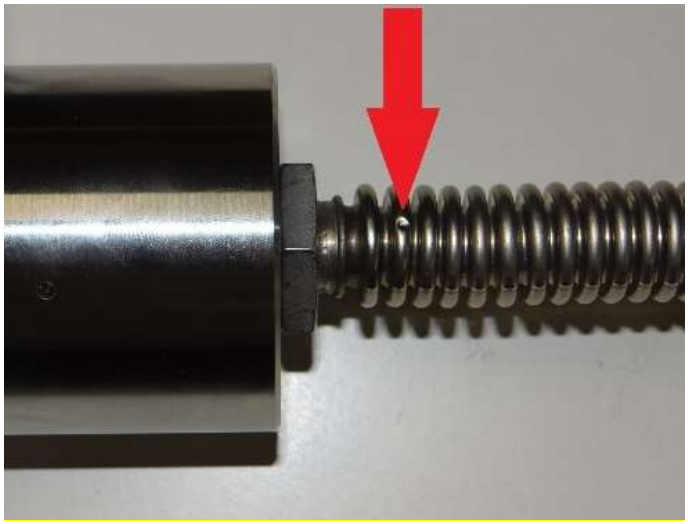
Bending may block the vibration of the rod and require factory maintenance.

In the case it is necessary to work without the flow damper, the mounting of the MIVI sensor must be made with precaution, in order to avoid knocking or bending the vibrating rod.

Same precaution must be followed when removing the MIVI sensor from its mounting accessory. As soon as the sensor is removed, screw immediately its flow damper tube in order the secure the rod.

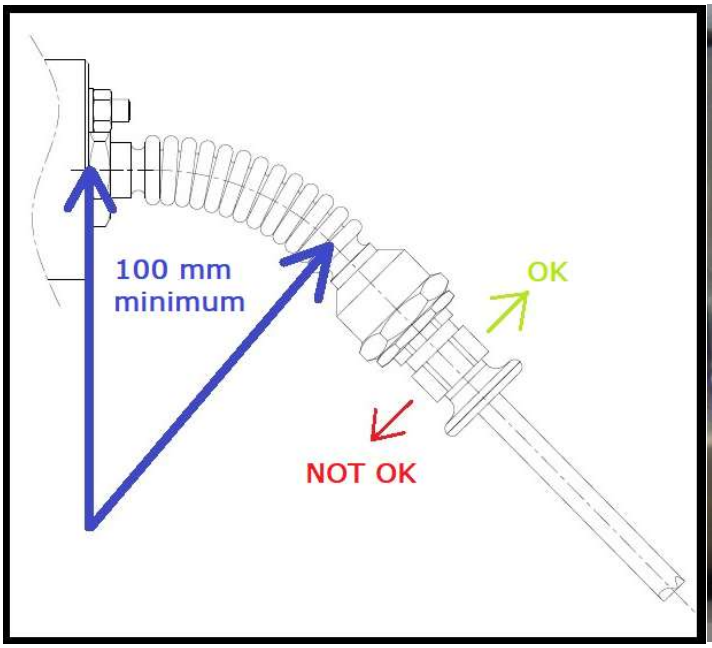
In any case when moving or shipping don't forget to install back the flow damper on the head of the MIVI sensor in order to secure the rod.

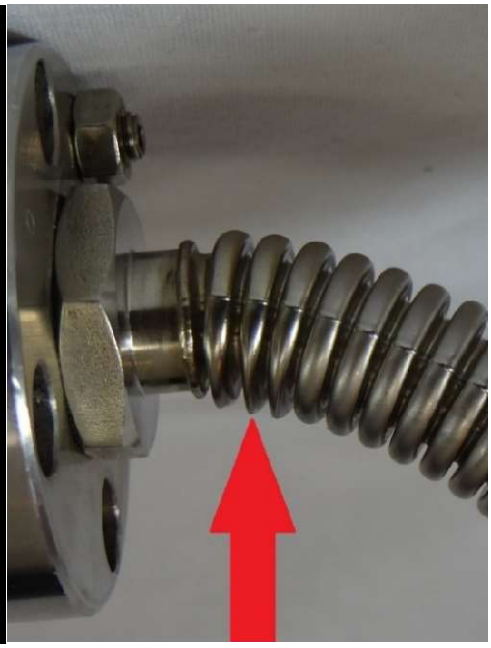
Don't knock the flexible pipe or the cable gland; the knocking the flexible pipe or the cable gland can create damages and leaks.



The minimal bending radius at the flexible pipe (electric outlet) is of 100 mm.

A shorter radius can crush the turns, initiate cracks, generate leakage inside of the MIVI, then failure.





Don't knock, pinch, crush, twist or bend the cable. Its minimum bending radius is 100 mm. Don't modify the length of the cable; modification may impact the response of the viscometer. The length of the cable of ATEX Ex-proof MIVI sensor must not be reduced and must remain at least equal to 3 meters.

Protect the MIVI sensor against mechanical damages due to impact, pinching, crushing, twisting and bending that aren't covered by the warranty

2.3.8 Mounting screws torque

Torque at the mounting screws: 9 N.m ± 1 at the M6×100 screws (4), or 21 N.m ± 1 at the M8 screws (8 for the high pressure design), or 42 N.m ± 1 at the M10 screws (8 for the very high pressure design).

2.3.9 Grounding and wiring

The MIVI sensor and the electronic devices must be connected to a good earth ground at same voltage level. Use the screw dedicated to the grounding that is implemented on the MIVI sensor.

2.4 Checking the equipment when placed in the process line

Before starting the process, check that the viscosity information is stable (vibrating rod in the air). If not, check first the strength of the sensor fitting. Otherwise rotate the sensor of 90° (4 possible positions). Choose the position where the information is the most stable. Locate this position in order to restore it when the sensor is removed and reinstalled.

Adjust the mounting offset, at room temperature. The rod is vibrating in the air.

2.5 Offset adjustment in air

The offset of the raw signal must be performed before utilization and introducing fluid in the process. This is a mandatory step to ensure the reliability of the measure.

The clean and dry rod must vibrate in the air since at least half an hour before the offset adjustment is carried out, in order to warrant the homogeneity and the stability of the MIVI temperature on its mounting accessory (best at ambient temperature). Refer to the manual of the electronics for the detailed instructions.

The amplitude, corrected with an offset, is shifted so that the viscosity value is 0.00 cP.

When offset is confirmed, write it down as well as the raw values (see electronics manual) in the follow up file of your instrument.

2.6 Reference point

When possible, note the viscosity information and raw values when a cleaning or rinsing solution is flowing.

Beside of the condition “in the air”, this can be used as reference for some periodic controls of the equipment. The operation must be done each time in the same conditions (rod in the air, or in the cleaning solution). Such a control can be assimilated to a self-checking. If the original calibration has been modified, the reference values will of course be those obtained with the new calibration.

3. Operation and calibration

3.1 MIVI utilization

Be sure that the offset in the air has been performed before introducing the fluid in the process. Refer to the electronics manual for display, advanced data processing and output features.

3.2 Periodic checking

Conformity to regulations relative to Quality Insurance implicates a periodic control of the measuring equipment used in the manufacturing operations, taking in consideration (or correcting) their drift in time.

It is proved that this equipment drift is negligible. However, it is good to check their aspect and their response once a year, at the same time as the other process equipment. A quick control is possible from time to time, if the sensor active part is in air, or immersed in a cleaning or rinsing solution. As long as these values stay similar, we can say that the sensor operation is right among its whole range (if no intermediate re-programming occurred).

3.3 Modification of the previous calibration

The paired transducer has been programmed in order to perfectly answer to the customer's needs. These settings are noted in the factory "specific notes and manufacturing parameters" pages that are delivered with the documentation. The factory calibration is performed with certified viscosity standards (Newtonian mineral oils). In normal conditions, there is almost no drift of the calibration. Nevertheless, the need for calibration update isn't abnormal.

At first, be sure that the modification is necessary, and not consecutive of a non-coherent comparative information (different measuring conditions, bad standards, inaccurate or wrong laboratory measurements ...). The initial calibration parameters are protected and can only be modified at SOFRASER. For any modification, check in the electronic manual if this operation is allowed or contact your distributor.

Calibration update at SOFRASER workshop is the first solution. Please contact your distributor or SOFRASER after sales team.

Calibration can be checked and updated in process conditions. Run your process in steady state conditions, record viscometer reading, take a sample and determine its viscosity with your reference method at the process temperature, compare and, if necessary, adjust the viscometer's response thanks to the correlation / correction feature of the electronics.

Third method is to control the response by using the on lab stand method described in SOFRASER technical procedure (Ref.: 307-308) and Newtonian mineral type oils (see APPENDIX D).

Similar control and adjustment can be performed for the optional incorporated temperature probe thanks to the Pt100 calibration features (see electronics manual).

4.Maintenance

4.1 Periodic maintenance

MIVI sensor has no moving parts and can be operated without maintenance in some specific conditions.

Nevertheless, SOFRASER advises to check the MIVI sensor once a year.

Each end user can reduce or increase this period of time according to his policy and specific operation conditions.

The check can be done by end user, SOFRASER distributor or SOFRASER after sales workshop.

SOFRASER advises to proceed to hereunder check:

Check	Expected	Action in case of not expected status
Visual inspection of cable	No damages, no cut, no twist, …	Stop the viscometer, especially if used in Ex area, and send the unit back to SOFRASER for maintenance of the cable
Visual inspection of the cable gland	No damages, no broken parts, no dismounted parts, not loose, the cable is securely held by the cable gland, …	Stop the viscometer, especially if used in Ex area, and send the unit back to SOFRASER for maintenance of the cable gland
Visual inspection of flexible tube	No damages, no crack, no cut, no crushed turns, bending radius according to instructions	Stop the viscometer, especially if used in Ex area, and send the unit back to SOFRASER for maintenance of the flexible tube
Visual inspection of the junction between sensor body and flexible tube	No backlash on the assembly of flexible on MIVI sensor body. Presence of the blocking piece on ATEX sensor	Stop the viscometer, especially if used in Ex area, and send the unit back to SOFRASER for maintenance
Visual inspection of the marking plate	Presence of the marking plate, readable serial number, Ex classification, maximum operating conditions and consistency with process conditions and SOFRASER electronics serial number	Refer to delivery note and specific notes if information aren't readable. Investigate why MIVI sensor is used with electronics that hasn't the same serial number. Unless there is an explained reason found the electronics that has been matched with sensor by SOFRASER

Remove the MIVI from its mounting accessory. Take care and warrant the absence of pressure, hazardous chemicals, excessive temperature…, before releasing the mounting screws. Check that MIVI has been installed with its flow damper. If not and in case of doubt take much care to not knock nor bend the rod while removing MIVI from its mounting accessory. You can replace the fixing screws by threaded guide rod.

Remove the flow damper. Take much care to not damage, bend or knock the rod. Do not insert tool in the slots of flow damper in order to release the flow damper. Use appropriate solvent to dissolve eventual traces of product.

- Clean the vibrating rod.
- Take much care to not damage, knock or bend the rod.
- Use appropriate solvent to dissolve and remove product.
- Do not use tools like hard brushes to clean the rod.

Check	Expected	Action in case of not expected status
Visual inspection of the O-ring(s)	O-ring(s) must not be damaged, altered by temperature and/or chemical reaction.	Check the compatibility of the O-ring(s) material with your product and process conditions. Whatever it is recommended to replace the O-ring(s) each time you re-install the MIVI on your process. Contact your distributor or SOFRASER for spares.
Visual inspection of the vibrating rod	Vibrating rod must be straight (not bent) The larger diameter part (6mm) of the rod must not show any impact. No damage or attacks on optional coating	Contact your distributor or Sofraser Contact your distributor or Sofraser Check the compatibility of MOC and/or coating with your fluids and process conditions. Contact your Distributor or Sofraser.
Check the response of the viscometer (see chapter 3.2)	Absence of shift of response since last check or acceptable shift.	See chapter 3.2.1

Clean and dry the inside of your mounting accessory before installing the MIVI back on your process and setting the offset in the air.

4.2 Troubleshooting

Troubles are mainly detected thanks to the display and the outputs of SOFRASER electronics (See APPENDIX D for the references of specific manual of the electronics matched with your MIVI sensor).

In case of subnormal operation, check the following points:

- Electrical connections (connectors, cables, power supply…)
- Remove the sensor from the process and clean it
- Check that the vibrating rod is not bent

When powered on, check with the finger there is a vibration at the end of the rod. At this moment, the viscosity information (displayed on the electronic device) has to increase.

If abnormal measurements and the raw signals cannot be explained, please do the hereunder checks:

Check	**Expected**
Resistance of coil 1 Between wires A and B	Resistance is about 150, or 200 Ohms, at ambient temperature
Resistance of coil 2 Between wires C and D	Resistance is about 150, or 200 Ohms, at ambient temperature
Isolation between coils and body of MIVI sensor	No short circuit between coils and between coils and body of the MIVI sensor
Resistances of Pt100 probe Between wires E and F Between wires wires E and G Between wires wires F and G	About 108 Ohms at 20°C About 108 Ohms at 20°C About 0.4 Ohms for a MIVI sensor with 3 meters of standard cable
Tweak gently the end of the vibrating rod with one of your fingers	Diapason type noise that disappears after a hand of seconds. Sound must not be deaf and brief.
If above checks are OK, and if available, connect your MIVI to a spare Sofraser electronics. *Best same electronics model and matched with similar MIVI and full scale range.*	Rod is vibrating and there is a response to viscosity increase. Note display, raw values, serial number of electronics and contact your Distributor or Sofraser

4.3 Return instructions

Please contact your distributor or SOFRASER and ask for the Return Materials Authorization form. Complete viscometer must be sent back in its original packaging, with filled RMA form and decontamination statement.

4.4 End of life

MIVI sensor is design for 24/7 utilization and can be used during years and even decades.

At its end of life MIVI sensor can be dismantled and each part can be recycled. SOFRASER advises to send the equipment back to its workshop. SOFRASER will dismantle the sensor and reuse or send the parts to the relevant recycling channels.

Appendix A: SPECIFIC CONDITIONS OF USE FOR ATEX MIVI-ADF

Ambient temperature for gas atmosphere:

	Ambient temperature depending of the different parts of this apparatus		
Temperature class	*Main body and sensor part (without pipe)*	*Entry of enclosure (without pipe)*	*Entry of enclosure (with pipe)*
T1	-20°C ≤ Tamb ≤ +300°C	N/A	-20°C ≤ Tamb ≤ +190°C
T2	-20°C ≤ Tamb ≤ +285°C	N/A	
T3	-20°C ≤ Tamb ≤ +190°C	-20°C ≤ Tamb ≤ +190°C	
T4	-20°C ≤ Tamb ≤ +125°C	-20°C ≤ Tamb ≤ +125°C	-20°C ≤ Tamb ≤ +125°C
T5	-20°C ≤ Tamb ≤ +90°C	-20°C ≤ Tamb ≤ +90°C	-20°C ≤ Tamb ≤ +90°C
T6	-20°C ≤ Tamb ≤ +75°C	-20°C ≤ Tamb ≤ +75°C	-20°C ≤ Tamb ≤ +75°C

Ambient temperature for gas and dust atmosphere:

Temperature class		*Ambient temperature depending of the different parts of this apparatus*		
Gas	*Dust*	*Main body and sensor part (without pipe)*	*Entry of enclosure (without pipe)*	*Entry of enclosure (with pipe)*
T1/T2/T3	T180	-17°C ≤ Tamb ≤ +180°C	-17°C ≤ Tamb ≤ +180°C	-17°C ≤ Tamb ≤ +180°C
T4	T125	-17°C ≤ Tamb ≤ +125°C	-17°C ≤ Tamb ≤ +125°C	-17°C ≤ Tamb ≤ +125°C
T5	T90	-17°C ≤ Tamb ≤ +90°C	-17°C ≤ Tamb ≤ +90°C	-17°C ≤ Tamb ≤ +90°C
T6	T75	-17°C ≤ Tamb ≤ +75°C	-17°C ≤ Tamb ≤ +75°C	-17°C ≤ Tamb ≤ +75°C

Other specific conditions:

The cable and the cable entry used shall have an operating temperature equal at the maximum ambient temperature at the entry of enclosure.

The entry of this apparatus is equipped with cable gland certified with a protection mode compatible for the intended use.

EXAMPLE of link with marking plate specific information, and wording

Example for a standard temperature MIVI sensor Ex db IIC T3 Gb

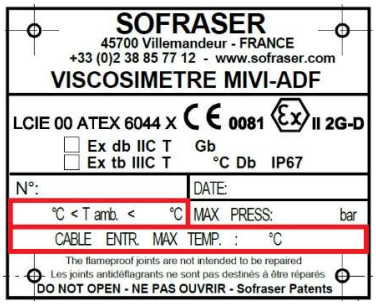
Sensor part = vibrating rod (ambient temperature must remain within the range “0 °C < T amb. > 190 °C”

Main body = body of the MIVI sensor (ambient temperature must within the range “0 °C < T amb. > 190 °C”

Enclosure = MIVI sensor from vibrating rod to entry of the cable gland

Pipe = flexible tube or rigid tube

Entry of enclosure = entry of cable gland (ambient temperature must remain below “CABLE ENTR MAX TEMP.: 100 °C”



Appendix B: SPECIFIC CONDITIONS OF USE FOR IECEX MIVI-ADF

Ambient temperature for gas atmosphere:

	Ambient temperature depending of the different parts of this apparatus		
Temperature class	*Main body and sensor part*	*Entry of enclosure (without pipe)*	*Entry of enclosure (with pipe)*
T4	-20°C ≤ Tamb ≤ +125°C	-20°C ≤ Tamb ≤ +100°C	-20°C ≤ Tamb ≤ +100°C
T5	-20°C ≤ Tamb ≤ +90°C	-20°C ≤ Tamb ≤ +90°C	-20°C ≤ Tamb ≤ +90°C
T6	-20°C ≤ Tamb ≤ +75°C	-20°C ≤ Tamb ≤ +75°C	-20°C ≤ Tamb ≤ +75°C

Ambient temperature for gas and dust atmosphere:

Temperature class		*Ambient temperature depending of the different parts of this apparatus*		
Gas	*Dust*	*Main body and sensor part*	*Entry of enclosure (without pipe)*	*Entry of enclosure (with pipe)*
T4	T125°C	-17°C ≤ Tamb ≤ +125°C	-17°C ≤ Tamb ≤ +100°C	-17°C ≤ Tamb ≤ +100°C
T5	T90°C	-17°C ≤ Tamb ≤ +90°C	-17°C ≤ Tamb ≤ +90°C	-17°C ≤ Tamb ≤ +90°C
T6	T75°C	-17°C ≤ Tamb ≤ +75°C	-17°C ≤ Tamb ≤ +75°C	-17°C ≤ Tamb ≤ +75°C

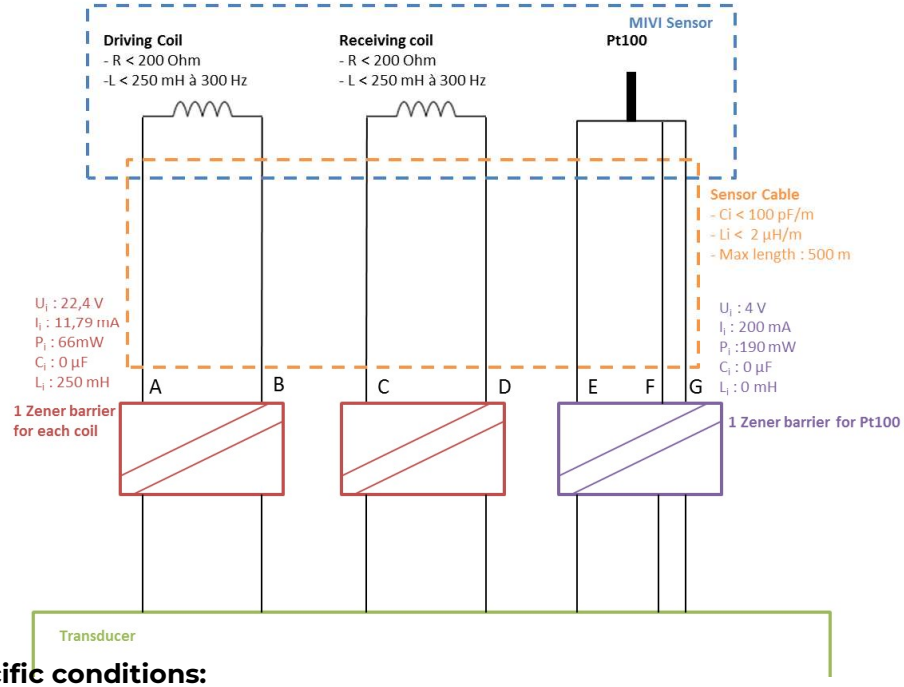
Other specific conditions:

Used special fasteners with yield stress >= 450 MPa.

The special fasteners can be replaced only by the identical fasteners - contact the manufacturer.

Appendix C: SPECIFIC CONDITIONS OF USE FOR ATEX AND IECEX MIVI-SI

Intrinsically Safe installation



Other specific conditions:

The equipment can be only connected to intrinsically safe certified associate equipment. These combinations must be compatible as regards with the intrinsic safety rules (see electrical parameters).

Approval's ambient temperature limits:

- Sensor body: -40°C to +200°C (200°C version) or -40°C to +300°C (300°C version)

- Cable: -40°C to +100°C

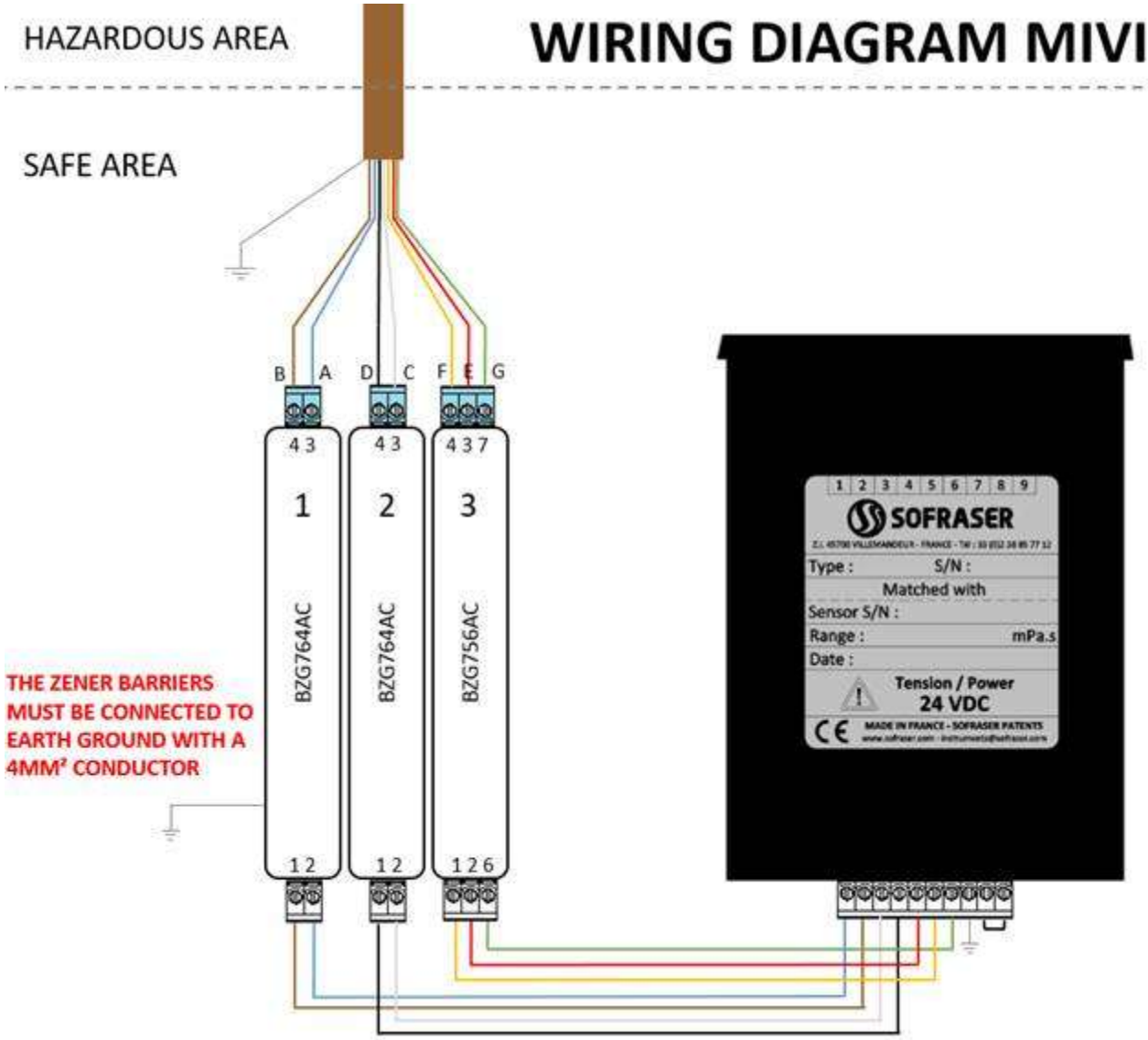
Cable length must be defined in such a way that total capacitance of sensor and cable does not exceed the maximum permitted capacitance of certified power supply.

To avoid the effects of process temperature and other thermal effects, care shall be taken to ensure that the temperature at sensor body and cable parts does not exceed assigned ambient temperature range.

The temperature classification depends on the ambient temperature as follows:

Temperature class	Ambiant temperature	
	With Pt100 sensor	Without Pt100 sensor
T6	-40°C ≤ Tamb ≤ +35°C	-40°C ≤ Tamb ≤ +65°C
T5	-40°C ≤ Tamb ≤ +50°C	-40°C ≤ Tamb ≤ +80°C
T4	-40°C ≤ Tamb ≤ +85°C	-40°C ≤ Tamb ≤ +115°C
T3	-40°C ≤ Tamb ≤ +150°C	-40°C ≤ Tamb ≤ +180°C
T2	-40°C ≤ Tamb ≤ +245°C	-40°C ≤ Tamb ≤ +275°C
T1	-40°C ≤ Tamb ≤ +300°C	-40°C ≤ Tamb ≤ +300°C

EXAMPLE of wiring with a 9200 transmitter:



Appendix D: LIST OF OTHER SOFRASER DOCUMENTS

Drawing C-1585 – description of MIVI sensors (2 pages)

Drawing C-1887 – description of MIVI sensor with FM approval

Technical leaflet ref. 320 – mounting flange

Technical leaflet ref. 328 – mounting flange for sanitary MIVI sensor

Technical leaflet ref. 329 – flow cell / measuring chamber

Technical procedure ref. 319 - Main MIVI mountings

Technical procedure ref. 307 - How to use MIVI on lab stand

Technical procedure ref. 308 - check list

Manual ref. 380 – 9200 transmitter

Manual ref. 380 – 9000 transducer

Manual ref. 390 – 9510 processor

Manual ref. 396 – 9710 processor

Contact your distributor or Sofraser with the serial number of your viscometer for relevant versions of the document.