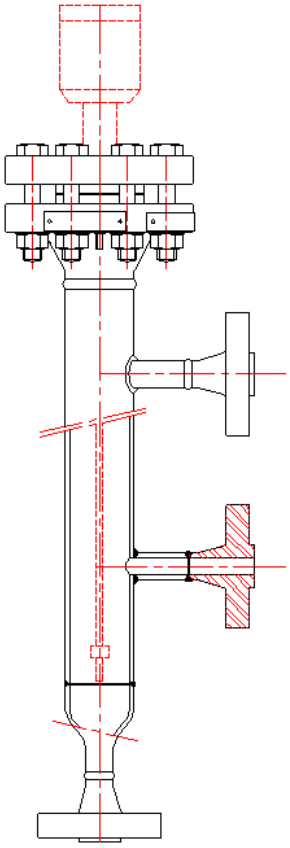
FLUID CONTROL

A division of the WIKA group



INSTALLATION / OPERATION / MAINTENANCE INSTRUCTIONS

Instrument Chambers

PLEASE RETAIN FOR FUTURE USE

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Revision G

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CONTENTS

1: Symbols Used

The following symbols are used in these operating instructions:

Warning: If ignored injury or damage to property can occur.
Danger: If ignored serious injury or damage to property can occur.
Caution: Failing to comply with these instructions can lead to malfunction of or damage to the instrument chamber.

Ex Applications
Instructions which must be complied with when the unit is used in potentially explosive environments and to meet the requirements of the EC type examination certificate.

Information
Facts and information concerning proper operation of the Instrument chamber

Instructions for electrical installation
Information on proper electrical installation.

Safety information

Read these instructions before installation and putting into operation.

Installation commissioning and maintenance should only be carried out by suitably qualified personnel in conjunction with these instructions.

Comply with the relevant safety regulations when using the equipment.

The instrument chamber must not be modified as this will invalidate the warranty and or the product certification.

Measures must be taken to prevent risks to persons and property in the event of a defect.

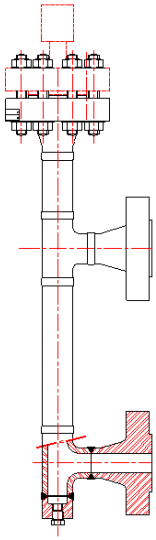
Do not operate the instrument chamber in the immediate vicinity of strong electromagnetic fields (minimum distance: 1 m) as this may give rise to incorrect readings.

Comply with the maximum current and voltage ratings as stated in the technical data section.

TC Fluid Control – Instrument Chambers

Under the requirements of the Pressure Equipment Directive (PED 97/23/EC), Instrument Chambers can not be classified as a pressure safety device. This equipment can only be used for liquid fluid measurement.

2: General description & principle of operation



The TC Fluid Control Instrument Chambers are used in conjunction with liquid level sensors and are designed to give an uninterrupted level indication of most liquids including steam condensate as well as arduous chemicals. For certain applications, it can also sense an interface level within the chamber.

The Instrument Chamber comprises of a sealed bridle / bypass arrangement in which a variety of different liquid level sensors can be accommodated. The principle of operation is dependent on the type of sensor fitted inside the chamber. See the sensor I.O.M. for details.

3: PED Approval – EC Certificate of conformity

TC Fluid Control Instrument Chambers are manufactured in accordance to the requirements as specified in the Pressure Equipment Directive 97/23/EC and where applicable to ATEX Mechanical Directive 94/9/EC. Design codes used are in accordance with ASME B31.3 (Lloyds 0038) or AD2000 (TÜV 0036). Refer to the Declaration of Conformity supplied for details.

WARNINGS:

1. The maximum operating conditions are specified on the tag plate and must not be exceeded. Exceeding these limits may lead to a failure of the chamber integrity and possible harm to persons/property.
2. The material selection of the chamber system must be suitable/ resistant for the media and environmental conditions.
3. Design parameters allow the chamber to operate at elevated temperatures. Measures should be in place to avoid contact with hot equipment.
4. It is the client's responsibility to fit an appropriate pressure relief safety device within the system being monitored.
5. It is the client's responsibility to take appropriate measures to ensure no risk of over pressurisation of the chamber in the event of an external fire.
6. The instrument chamber system must not be modified, as this will invalidate the certification.
7. Ensure vent and drain plugs/fittings are sealed prior to service. Check for tightness.
8. Any work carried out on this equipment must be covered by a 'permit to work' procedure.
9. It is recommended that the instrument chamber system should be inspected on an annual basis. Inspect for corrosion and wear both internally and externally.
10. Earth bond appropriate equipment / ancillaries to comply with ATEX requirements. (Also see separate level sensor I.O.M.)
11. Ensure level sensor is rated accordingly.
12. Ensure the chamber is protected from impact, any external loadings or vibration.
13. Ensure correct gaskets/seals are fitted and are compatible with the media and process conditions. Ensure the correct torque is applied to the appropriate bolting.
14. This equipment must not be used as a support for other equipment or personnel.
15. Where chamber supports are provided, ensure these are fixed accordingly.
16. It is the user responsibility to ensure that the chamber is fitted to a vessel of a similar linear expansion rate. High differentials can cause additional stress exerted onto the nozzle connections. Consult TC Fluid Control Sales for alternative options.
17. Where there is a hazard or danger present, warning signs should be displayed according to the local and national standards. Any isolation device fitted must comply with these standards.
18. Operators must wear protective clothes / equipment (PPE) according to local circumstances, regulations or site requirements.

Notes:

Disposal or return of this equipment should be in accordance to regional / national guidelines or directives. Ensure that there is no residue remaining within the chamber that could cause possible harm.

4: Commissioning

1. Installation and commissioning of the instrument chamber should only be carried out by qualified and experienced engineer/ personnel.
2. All cabling and electrical connections must be carried out in accordance with the regulations and standards applicable in the country where the equipment is installed and by qualified personnel.
3. It is recommended that isolation valves should be fitted between the instrument chamber and the vessel. The selection of the gasket joints and fittings (bolting) to have the required corrosion resistance and rated accordingly.

5: Installation of Level Sensor.

Refer to the Level sensor IOM for detailed assembly procedure:
General procedure is as follows;

1. Place a gasket on top of the instrument chamber flange.
2. Lower the sensor with flange/adaptor into the chamber.
3. Tighten the bolts as per bolt torque procedure (see Section 7) / screw unit in.
4. Connect housing unit as specified in respective IOM.

Ensure that any sensor probes do not come into contact with the inner wall of the instrument chamber. Ensure centralizing discs (where applicable) are fitted to aid centralisation. Also check that the probe does not touch the bottom of the instrument chamber (where applicable).
It is recommended that the setting up procedure is carried out prior to installation onto the vessel. Refer to the respective manual for the procedure. If required, a functional test also can be performed when fitted onto the vessel. See section 8

6: Installation of the Instrument Chamber.

Before mounting the chamber into position, the following points should be taken into account.

1. Vessel connections on the vessel/tank must be vertically in line.
2. It is not recommended that connections are taken from inlet or discharge lines as excessive surging may occur within the chamber.
3. Centre to centre dimensions between vessel connections on the tank and gauge must be within 1.5 mm of each other.
4. Ensure connecting pipe work is adequately supported to reduce additional stress due to instrument chamber weight.

Fit the chamber to the vessel/tank using the appropriate rated fixtures and gaskets. Ensure that the gasket material is resistant to the temperature, media and its vapour. Make sure that the vessel flange bolting is tightened to the required torque value.

7: Bolt Torque.

Nominal Chamber size	Gasket Type	Bolt Material Grade	ANSI 150	ANSI 300	ANSI 600	ANSI 900	ANSI 1500	ANSI 2500
2”	Reinforced graphite laminate. PSM	ASTM A193 B8 Cl.1 ASTM A194 Gr. 8 Un-lubricated - Maximum	5/8” UNC 76 Nm 57 ft-lb	5/8” UNC 76 Nm 57 ft-lb	-	-	-	-
2”	Reinforced Graphite laminate. PSM	ASTM A193 B8 Cl.2 ASTM A194 Gr. 8	5/8” UNC 101 Nm 75 ft-lb	5/8” UNC 101 Nm 75 ft-lb	5/8” UNC 101 Nm 75 ft-lb	-	-	-
2”	Spiral wound 316/graphite SWJ	ASTM A193 B8 Cl.2 ASTM A194 Gr. 8	5/8” UNC 101 Nm 75 ft-lb	5/8” UNC 101 Nm 75 ft-lb	5/8” UNC 114 Nm 84 ft-lb	7/8” UNC 284 Nm 210 ft-lb	7/8” UNC 355 Nm 262 ft-lb	1” UNC 581 Nm 429 ft-lb
2”	Stainless Steel RTJ	ASTM A193 B7 ASTM A194 2H (lubricated u = 0.12)	5/8” UNC 101 Nm 75 ft-lb	5/8” UNC 101 Nm 75 ft-lb	5/8” UNC 114 Nm 84 ft-lb	7/8” UNC 284 Nm 210 ft-lb	7/8” UNC 355 Nm 262 ft-lb	1” UNC 581 Nm 429 ft-lb
2 1/2”	Reinforced graphite laminate. PSM	ASTM A193 B8 Cl.2 ASTM A194 Gr. 8	5/8” UNC 101 Nm 75 ft-lb	3/4” UNC 177 Nm 131 ft-lb	3/4” UNC 177 Nm 131 ft-lb	-	-	-
2 ½ “	Spiral wound 316/graphite SWJ	ASTM A193 B7 ASTM A194 2H (lubricated u = 0.12)	5/8” UNC 114 Nm 84 ft-lb	¾” UNC 177 Nm 131 ft-lb	¾” UNC 177 Nm 131 ft-lb	1” UNC 423 Nm 312 ft-lb	1” UNC 528 Nm 390 ft-lb	1 1/8” UNC 771 Nm 569 ft-lb
2 ½ “	Stainless Steel RTJ	ASTM A193 B7 ASTM A194 2H (lubricated u = 0.12)	5/8” UNC 101 Nm 75 ft-lb	¾” UNC 177 Nm 131 ft-lb	¾” UNC 177 Nm 131 ft-lb	1” UNC 423 Nm 312 ft-lb	1” UNC 475Nm 351 ft-lb	1 1/8” UNC 848 Nm 626 ft-lb
3”	Glass fibre + NBR binder	ASTM A193 B8 Cl.1 ASTM A194 Grade 8	5/8” UNC 76 Nm 57 ft-lb	¾” UNC 135 Nm 100 ft-lb	-	-	-	-
3”	Reinforced graphite laminate. PSM	ASTM A193 B8 Cl.2 ASTM A194 Gr. 8	5/8” UNC 101 Nm 75 ft-lb	¾” UNC 177 Nm 131 ft-lb	¾” UNC 200 Nm 148 ft-lb	-	-	-
3 “	Spiral wound 316/graphite SWJ	ASTM A193 B7 ASTM A194 2H (lubricated u = 0.12)	5/8” UNC 126 Nm 93 ft-lb	¾” UNC 177 Nm 131 ft-lb	¾” UNC 200 Nm 148 ft-lb	7/8” UNC 355 Nm 262 ft-lb	1 1/8” UNC 771 Nm 569 ft-lb	1 1/4” UNC 1186 Nm 875 ft-lb
3 “	Stainless Steel RTJ	ASTM A193 B7 ASTM A194 2H (lubricated u = 0.12)	5/8” UNC 101 Nm 75 ft-lb	¾” UNC 177 Nm 131 ft-lb	¾” UNC 200 Nm 148 ft-lb	7/8” UNC 319 Nm 235 ft-lb	1 1/8” UNC 771 Nm 569 ft-lb	1 1/4” UNC 1078 Nm 796 ft-lb

Bolting:

Bolt Specification and Grade	Nut Specification and Grade	Type Table 1B ASME B16.5	Remarks	Tensile p.s.i	Yield p.s.i.	Torque Values (above Table)
ASTM A193 B7	ASTM A194 Gr. 2H	High Strength	Quenched & Tempered up to 2 ½"	125,000	105,000	As per ASTM A193 B7
ASTM A193 B7M	ASTM A194 Gr.2HM	Intermediate Strength		100,000	80,000	As per ASTM A193 B7
ASTM A320 L7	ASTM A194 Gr.4	High Strength	Low Temperature Service	125,000	105,000	As per ASTM A193 B7
ASTM A320 L43	ASTM A194 Gr.4/7	High Strength	Low Temperature Service	125,000	105,000	As per ASTM A193 B7
ASTM A193 B8 Cl.2	ASTM A194 Gr. 8	Intermediate Strength	Up to ¾"	125,000	100,000	
ASTM A193 B8 Cl.2	ASTM A194 Gr. 8	Intermediate Strength	7/8" up to 1"	125,000	80,000	
ASTM A193 B8 Cl.2	ASTM A194 Gr. 8	Intermediate Strength	1 1/8" up to 1 ¼"	105,000	65,000	
ASTM A193 B8M Cl.2	ASTM A194 Gr. 8M	Intermediate Strength	Up to ¾" SS316	110,000	95,000	
ASTM A193 B8 Cl.1	ASTM A194 Gr. 8	Low Strength	Carbide solution treated	75,000	30,000	
ASTM A320 B8M Cl.1	ASTM A194 Gr. 8	Low Strength	SS316			

Guidance Notes.

1. Values are based on lubricated bolts (unless otherwise stated), fitted with corresponding nuts. Values are the minimum torque required to ascertain a seal. Please note that the final torque required to seal the gasket joint may vary greatly due to the effects of temperature, corrosion, level of lubrication and thread finish (higher torque values would be applied for non-lubricated bolting). When significant external mechanical or thermal loads are imposed on the flange joint, additional evaluation by an engineer may be required. Applied torque should not exceed 90% of the minimum ASME B31.3 specified Yield Strength.
2. The use of lubricants with a lower coefficient of friction lower than 0.11 can lead to excessive stress applied by wrenches or torque wrenches, and yielding or failure of flanges or bolting may result.
3. When significant external mechanical or thermal loads are imposed on the flange joint, additional evaluation by an engineer may be required. Applied torque should not exceed 90% of the minimum ASME B31.3 specified Yield Strength.
4. For alternative flanging, bolting and gasket configurations, consult TC Fluid Control for advice.
5. Bolts should be progressively tightened in a star pattern to ensure even gasket loading. Load should be applied in three stages, representing 30%, 60%, and 100% of the target torque values.

Flange Details	Bolting sequence- bolts numbered clockwise around the flange
4 Bolt Flange	1, 3, 2, 4.
8 bolt flange	1, 5, 3, 7, 2, 6, 4, 8.
12 Bolt flange	1, 7, 4, 10, 2, 8, 5, 11, 3, 9, 6, 12.

6. Following the first torque pass confirm that the flanges are parallel.
7. The information given in the above table should only be used as a guideline and are not mandatory.
8. The above table is based on ASME B16.5 flanges with designated sized bolts.
9. Torque tolerances: ± 2 ft-lb if torque value is less than or equal to 50 ft-lb
   ± 4 ft-lb if torque value is less than or equal to 100 ft-lb.
   ± 4 % if torque value is greater than 100 ft-lb.
10. Ensure all bolting is tightened to the required torque prior to bringing into service. It is recommended to re-tighten bolt/studs to the correct torque value after 24 hours in service when permissible.
11. Maximum and minimum service temperatures of the flange configuration are restricted by the materials selected (bolting and flanges).

8: Functional testing of the Instrument Chamber.

1. Ensure that the instrument chamber is isolated from the vessel.
2. Connect sensor as required following the correct electrical procedures (see sensor I.O.M.)
3. The level within the chamber can be imitated by pouring water or a suitable media (compatible dielectric constant) into the chamber via the top vent.
4. Perform 'set up' procedure as per manufacturer instructions. Record and calibrate.
5. Open the drain/drain valve and allow the water/suitable media to run out, thus simulating a falling level.
6. Check function of any other ancillaries fitted.
7. Close vent and drain.

9: Bringing into service.

Prior to bringing into service / commissioning, all bolting, plug, ancillary components, thread seals are checked for tightness. If there are no isolation valves fitted between the instrument chamber and vessel, then the gauge will automatically be brought into service along with the vessel.

When isolation valve are fitted, the procedure are as follows;

1. Allow time for the chamber to reach the operating temperature.
2. Ensure vent and drain connections are shut off.
3. **Slowly** open the isolation valve fitted to the **upper** vessel connection.
4. **Slowly** open the isolation valve fitted to the **lower** vessel connection. This will allow the liquid level to rise in the instrument chamber. Check read out accordingly.

10: Maintenance.

No maintenance is required other than periodic inspection to ensure that the chamber is free from foreign particles, sediment or scale etc.

11: Removal of the Instrument Chamber.

1. Isolate the instrument chamber from the source of pressure/media by closing the appropriate isolation valves.
2. Relieve the chamber of any internal pressure and fluid contents by opening the drain valve. Ensure all safety precautions are in place for safe disposal of the contents. Time must be allowed for the chamber and contents to cool prior to this operation.
3. **Warning:** The pressurised instrument chamber may contain potential hazardous fluids. Wear appropriate protective clothing.
4. When the chamber has cooled, isolate and remove any ancillary equipment.
5. Dismantle respective vessel connections and remove the chamber.
6. If the chamber is to be returned to TC Fluid Control, it is the responsibility of the user to ensure the chamber is cleaned and safe to handle without any special precautions. TC Fluid Control must be contacted prior to return of chamber and associated sensor (where applicable) TC Fluid Control reserve the right to charge any user for safe disposal if these precautions are not adhered too.

12: Service Life.

Service life depends upon the combination of pressure/temperature and the media. The effects of chemical agents, corrosion and vibration are covered by the requirements of the PED 97/23/EC. Alternative materials can be supplied for certain arduous conditions. Generally, service life for the gauge is 5 years unless otherwise specified. It is recommended that the instrument chamber system should be inspected on an annual basis. Inspect for corrosion and wear both internally and externally.

13: Insulation Jackets.

If fitted, TC Fluid Control insulation jackets have a service temperature range from -60℃ to +250℃ and are fabricated to suit a particular instrument chamber configuration.

14: Spares.

All replacement components must be genuine TC Fluid Control spares. When ordering, the TC Fluid Control job / order number including the tag number should be quoted. This information can be found on the nameplate, which is normally fitted onto the bottom flange.

15: Instrument Chambers subjected to ATEX requirements

An instrument chamber is outside the scope of ATEX as there is no “self source of ignition”. However by fitting an instrument (hazardous area approved) onto the gauge, the configuration then becomes an assembly, therefore considerations must be made for both approved and non-approved parts.

16: Temperature class

Relationship between ‘T’ rating Temperature class, Ambient and Process Temperatures for Non-Electrical Equipment.
Instrument Chambers Only.

Temperature Class	Process Temperature	Ambient Temperature
T1	≤ 450°C	-50 °C…+80 °C
T2	≤ 300°C	
T3	≤ 200°C	
T4	≤ 135°C	
T5	≤ 100°C	
T6	≤ 85°C	-50 °C…+60 °C

The operating conditions must not exceed the maximum process temperature shown in the above table for a given ‘T’ rating.
Also refer to manufacturers I.O.M. regarding ‘T’ rating and limitations covering use of equipment.

17: ATEX APPLICATIONS, Conditions for safe use:

1. For process media's which are subjected to gassing off or surging due to temperature changes, it is recommended to fit insulation around the chamber body.
2. No tools that may cause a spark to be used in a potentially explosive atmosphere unless covered by a 'Permit to Work' system / risk assessment.
3. Where there is a risk that has been identified, all isolated metallic parts must be earth bonded.
4. It is the customer responsibility to earth bond equipment in accordance with ATEX requirements or site standards. It is recommended that the minimum size of the earth cable is 16mm^2

18: Openings:

1. Ensure vent and drain plugs/fittings are sealed during service. Provisions should be made to stop any accidental venting to the atmosphere. Any removal of such devices must be re-installed.

19: Coatings – Antistatic coating and paints:

For ATEX applications where the instrument chamber is coated with non-antistatic paint, the following points should be noted. To prevent the build up of an electrostatic charge, one of the following parameters must be met.

Non Anti-static Coatings Group IIC	ATEX Category 1	ATEX Category 2	ATEX Category 3
Compliance	Yes	Yes	Yes
Hazardous Area Zone	Zone 0	Zone 1	Zone 2
Equipment Protection Level	EPL Ga	EPL Gb	EPL Gc
Gas Group	Group IIC	Group IIC	Group IIC
Maximum total thickness of coating.	Less than 0.2 mm (200 microns)	Less than 0.2 mm (200 microns)	Less than 0.2 mm (200 microns)
Breakdown voltage across layers	Less than 4kV	Less than 4kV	Less than 4kV
Surface resistance at 23± 2℃ and 50±5% humidity	Less than 1 G ohms	Less than 1 G ohms	Less than 1 G ohms
Substrate	To be earth bonded	To be earth bonded	To be earth bonded

Notes:

- For static dissipative coatings or paints, there are no limitations on paint thickness. Earth bonding is still recommended.
- For Gas groups IIA and IIB the maximum coating / painted thickness is limited to 2 mm.
- Any coating / paint applied over a metal surface must be earthed using an earth stud.

20: TROUBLE SHOOTING GUIDE

Refer to respective level sensor IOM for details covering equipment fitted onto the instrument chamber.

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