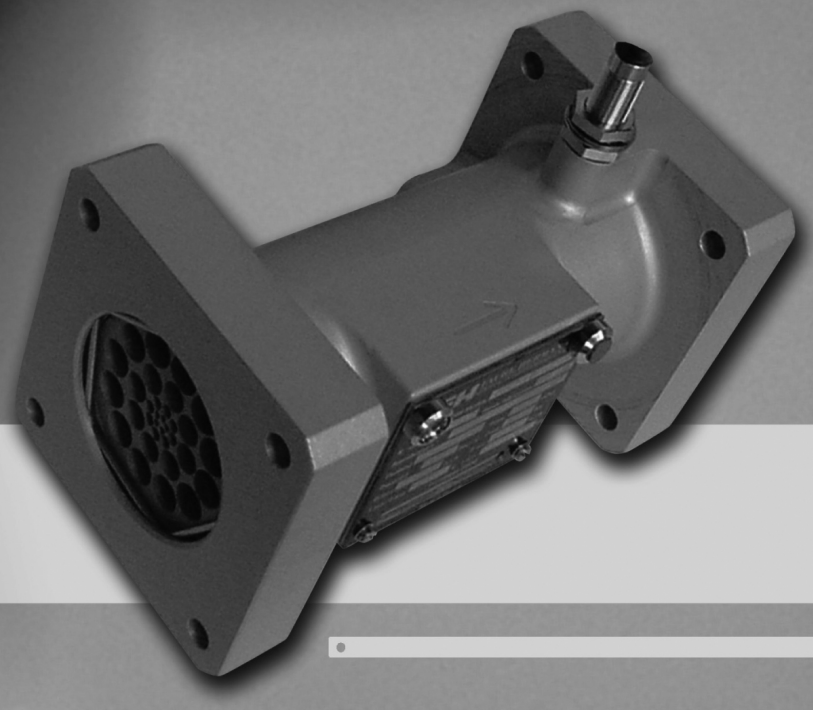
HELIFLU™ TCN

User's Manual



FAURE HERMAN

Mastering the Flow

Part of the Liquid Controls Group
A Unit of IDEX Corporation

IDEX CORPORATION

www.faureherman.nt-rt.ru

По вопросам продаж и поддержки обращайтесь:
Тел./факс: +7(843)206-01-48 (факс доб.0)
fhm@nt-rt.ru
www.faureherman.nt-rt.ru

General contents

Note: The detailed contents are inserted on the end of manual

Recommandations ATEX

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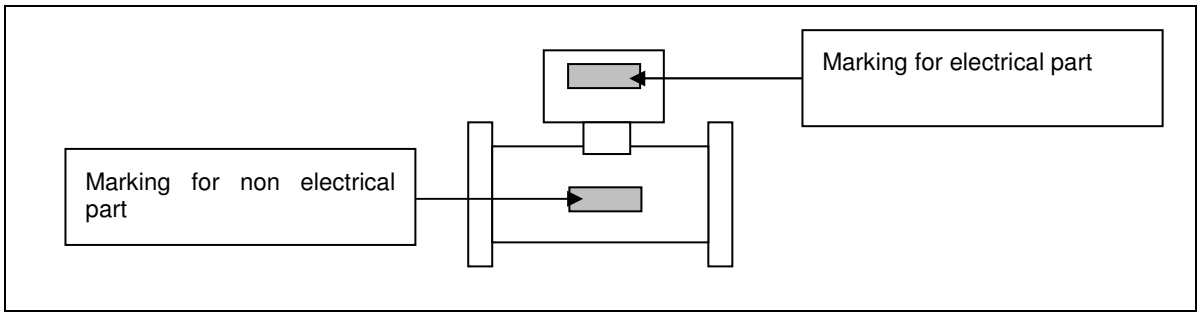
Тел./факс: +7(843)206-01-48 (факс доб.0)
fhm@nt-rt.ru
www.faureherman.nt-rt.ru

This equipment is an assembly of a non electrical part and an electrical part which are both ATEX certified relating to the design and construction of equipment intended for use in potentially explosive atmospheres (94/9/CE directive).

General:

For a safety utilization, be sure that you use this equipment in totally compliance with its ATEX certificate and nameplates indications, and respect the installation, maintenance and user's manuals of the equipment and its different parts.



This equipment is suitable in hazardous area complying with its protection system and the indications specified on its nameplates.

Electrical power must be "OFF" before and during Installation and Maintenance.

This equipment shall be handled with the greatest care and mounted in a location to avoid possible shocks.

Installation and Maintenance operation shall be done by means of suitable tools. Never use a hammer, impact wrench or any tools which can make sparks or damage the equipment protection system.

If this equipment is supposed to be connected to other devices, verify that the protection systems are compatible.

Installation, maintenance and repairs of this equipment shall be carried out by suitably trained personnel and the spare parts shall be approved by FAURE HERMAN.

No operations or repairs which can affect the protective system could be done on this equipment without FAURE HERMAN agreement.

For specifically installation and maintenance advices, contact FAURE HERMAN After Sales Department

For any contacts, **Don't forget to give us your equipment serial number.**

Non electrical part protective system:

The Turbine meter certification as a non electrical part is defined under the certificate number ***LCIE 05 ATEX 6042X***. This equipment is manufactured with a construction protective system in accordance with the European standards NF EN 13463-1 and NF EN 13463-5.

This equipment can be used in an II 2 G potentially explosive atmospheres (gas on surface in a zone 1).

Marking of the non electrical part of the equipment shall include the following ATEX indications:

Marking	Description
FAURE HERMAN	**Company name**
BP20154 - 72406 La Ferté Bernard	**Company address**
Made in France	
Equipment :	**Model**
S/N…	**Serial number**
Year	**Manufacturing year**
CE	**CE Logo**
T° min/max (Ts): According to application	**Fluid Temperature**
LCIE 05 ATEX 6042 X	**ATEX agreement number**
Ex	**ATEX marking**
II 2 G	**Equipment category**
c	**Protection type**
T6 to T4 (according to fluid temperature)	**Temperature classification**

The equipment can also carry the usual marking required by the manufacturing standards applying to such equipments.

For a safety utilization of the equipment, fluid temperature must be contained between -50°C and +100°C and the temperature classification is following.

$$T6 \text{ if } -50°C \leq T_{fluide} \leq +80°C$$
$$T5 \text{ if } +80°C \leq T_{fluide} \leq +95°C$$
$$T4 \text{ if } +95°C \leq T_{fluide} \leq +100°C$$

Electrical part protective system:

For the certification and the protective system of the electrical parts associated with this equipment, please refer to their own utilization, installation and maintenance manuals supplied with the equipment.

FAURE HERMAN reserves its right to change or modify procedures, specifications and products for their improvement.

The legal responsability of FAURE HERMAN applies only to the french text of the documents

Chapter 1: Introduction

TCN family

Flowmeters of the TCN family are especially designed to measure volume of liquids of medium viscosity (less than or equal to 10 cSt and LPG) within the framework of loading applications. For this purpose, as a general rule, they are installed on road tanker. The optimized operating flow range is comprised between 3 and 30 m^3/h. The higher limit may be exceptionally exceeded without reaching 120% of the set value.

Their simple and solid construction allows to warrant a very good accuracy and excellent measurement repeatability for a wide range of industrial applications.

The operating principle for this flowmeter type rests on the rotational velocity of a helical bladed impeller, positioned at the middle point of the piping, by means of an assembly made of magnets (fitted in the blades) – Hall effect transmitters (positioned into the flowmeter body).

Measuring the frequency of the generated electrical signal allows to calculate the liquid flow rate flowing through the pipe by means of the following expression:

$$Q = \frac{F}{K} \times 3600$$

where:
- Q Instantaneous flow rate (m^3/h)
- F Signal frequency (Hz)
- K Measuring sub-assembly related coefficient determined ans recorded during the factoy or site calibration (p/m^3) (refer to Appendix 2)

Metering pulses generated by the Hall effect transmitters enables the calculation of the volume flowed between both given instants, by means of the following expression:

$$V = \frac{N}{K}$$

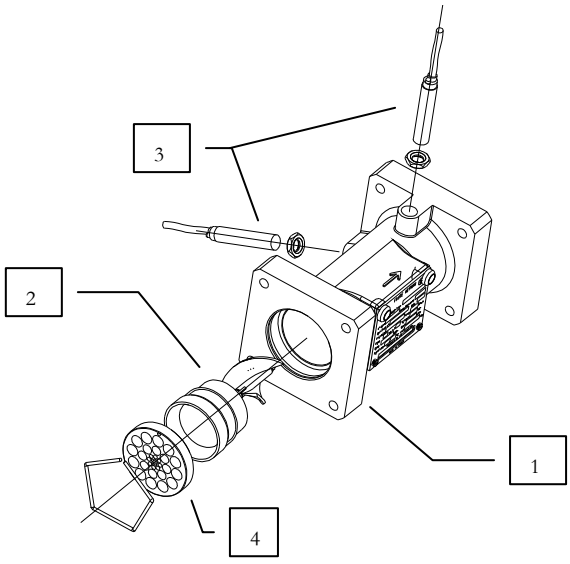
where:

- V Volume (m^3)
- N Number of totalized pulses
- K Measuring sub-assembly related coefficient determined and recorded during the factory or site calibration (p/m^3) (refer to Appendix 2)

Chapter 2: Description

Turbine flowmeters of the TCN family are designed according to the same principle and consist of the following components:

- Flanged body
- Measuring sub-assembly
- Detection unit
- Integrated flow straightener



TCN

Body

The flowmeter body is engineered in bulk machined or foundry aluminium alloy.

It is equipped with two coil wells (or boss) enabling thus to fit Hall effect pulse transmitters.

Position of the bosses is such that pulses generated by the 2 coils are not in phase. Downstream and upstream pipes are connected by means of square flanges (other types on request).

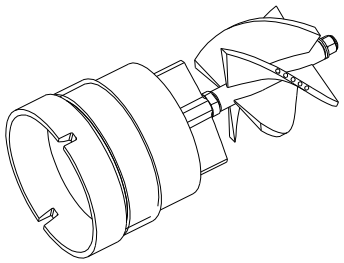
Upon the outside of the body:

- An arrow indicates the fluid flow direction,
- A manufacturer's nameplate to identify the equipment.

Measuring sub-assembly

The sub-assembly includes the totality of components contributing to the operation of the measuring element (impeller). It contains the following elements:

- Upstream stator made from a stainless steel piece of foundry, enabling the impeller centring into the flow measuring section.
- Impeller shaft,
- The helical bladed impeller, fitted with magnets generating electrical pulses through the detection system. An arrow engraved on the impeller indicates the flow direction.



Integrated flow straightener

Thanks to the plate flow straightener, the upstream flow interference effects can be limited. The plate is secured by means of a (stainless steel) retaining ring centred in a body groove.

Detection sub-assembly

Metering is triggered by two intrinsically safe Hall effect pulse transmitters, positioned into the flowmeter body so as to generate two diphase pulse trains.

These NAMUR coils are power supplied under a voltage of 8.2 V.

Chapter 3: Equipment reception and storage

On equipment reception and storage, check the correct condition of packing, in order to identify without delay possible damages inflicted during transportation.

Withdraw the flowmeter from its packing and check its correct condition, make sure the user's manual and the calibration certificate are included. Should the product be damaged and should documents be omitted.

Before commissioning the equipment, it is highly recommended to preserve it in its original packing, protected against severe climatic conditions and possible shocks.

The equipment shall be stored in clean and dry premises, the measuring chamber being protected and temperature shall range from –20°C to +70°C. In the event of extended storage (longer than 1 year), we recommend to verify the equipment in factory before its commissioning.

Chapter 4: Installation conditions

The general installation conditions of TCN turbine flowmeters shall adhere to a certain number of principles, to ensure the equipment reliability and to warrant long-term accurate, repeatable and stable measurements.

TCN turbine flowmeters can be installed horizontally and vertically, providing an ascending flow and providing the respect of the flow direction indicated on the arrows.

For fiscal applications, installation conditions of TCN turbine flowmeters are defined in the type approval and advocate upstream a pipe straight section at least equal to 5 times the flowmeter inlet diameter, should the flow control valve be positioned upstream from the flowmeter. Elbows, even positioned directly either upstream or downstream from the turbine flowmeter, do not need any specific precautions.

The flowmeter life time and the measurement reliability can be seriously reduced by the presence of gas and /or solid particles in the flowing liquid.

Presence of gas, in the form of bubbles or emulsion would involve a significant deterioration of performances, whereas the passage of gas "pockets" between two liquid sections could inflict damages to the impeller pivot system, leading to serious measurement errors.

Therefore it is recommended to make sure there is no risk of gas injection upstream from the measurement point and to provide, when required, a purge device or air eliminator upstream from the flowmeter. For an elevated installation, we recommend to avoid positioning the flowmeter in a "high" area inside of which a gas

pocket may be generated under the gravity effect and volume contraction during an interruption.

Presence of small-sized particles in the liquid flow may involve a gradual deterioration of the flowmeter fixed or mobile elements (bearing support cross piece, impeller), which would involve a gradual deterioration of performances, whereas the passage of larger solid elements, would inflict definitive damages on these same elements.

We recommend therefore to make sure there is no risk of solid particle injection upstream from the measurement point and install a filter whose mesh enables to stop solid elements with dimensions exceeding 0.5 mm.

Should a strainer and degassing system be used simultaneously, positioning the air eliminator as close as possible from the flowmeter is recommended.

In order to avoid any risk of liquid cavitation at the level of the measurement point, which would involve erratic measurements, we recommend to maintain a minimum pressure downstream from the flowmeter. This minimum value can be determined by means of the following formula for stable liquids at air pressure:

$$P_{\min} = 2 \times \Delta P + 1.25 \times P_V$$

With:

- P_{min} Minimum pressure downstream from the flowmeter
- ΔP Flowmeter pressure drop in the operating conditions (Appendix 1)
- P_V Vapour pressure of the liquid measured in the operating conditions

For LPG, the minimum pressure can be set to P_V + 1 bar.

Mechanical installation

When installing the flowmeter on the pipe, check:

- The cleanliness of the pipe upstream from the flowmeter,
- The flow direction, represented by an arrow on the manufacturer's nameplate,
- The correspondence between flanges and faces, on the pipe side and flowmeter side,
- The flowmeter alignment with the upstream and downstream pipes an the absence of obstacles preventing the correct liquid flow (gasket, …).
- The absence of excessive efforts supplied by the compensation of misalignments of upstream and downstream pipes by the flange tightening.
- The electrical connection position to avoid the cabling traction.

Do not forget that as for any measuring instrument, a turbine flowmeter shall be handled with the greatest care.

Electrical installation

TCN flowmeters are equipped with detection systems including Hall effect pulse transmitters with integrated pre-amplifier.

The flowmeter is connected to the site cabling as described in the pulse transmitter specific technical manual.

For an installation in hazardous area, these cables shall adhere to the applicable specific requirements.

Chapter 5: Commissionning

On completion of the flowmeter installation on the pipe and on completion of the electrical connection of pulse transmitter assembly, proceed with the installation filling.

During this operation, check the purging of gas present in the pipes, by means of the existing draining systems or through the flowmeter at very low flow rate.

Avoid sudden filling of the flowmeter, which may involve the rapid passage of gas "pockets", susceptible to inflict damages to the impeller pivot system.

Avoid the flowmeter extended use beyond the specified operating maximum flow rate.

Chapter 6: Maintenance

The TCN flowmeter does not require any specific maintenance, as its use remains within its operating limits.

For an application not subjected to periodical verification, we recommend to proceed with a verification of the measuring subassembly, at lest every three years. This verification may involve a replacement in workshops of the pivot system.

The TCN flowmeter may remain full of liquid, providing the liquid consistency does not change significantly in time.

In the event of extended interruption, it is recommended to keep the flowmeter full of liquid, in order to avoid sealing of pivots, except when the liquid may crystallize or solidify.

Chapter 7: Malfunction

Problem	Possible cause
The flowmeter overrates	1 – 2 – 5 - 7 – 8 – 9 – 10 – 11
The flowmeter underrates	1 – 2 – 3 - 4 – 5 – 6 – 8 – 9 – 10 – 11
Erratic indications	1 – 2 – 8 – 9 – 10 – 11
No signal	2 – 3 – 4 – 6

Possible cause		Corrections
1	Disturbing pulses	Check of wiring Check and replace when required the coil
2	Coil defect	Check the wiring Check and replace the coil
3	Magnetization loss	Replace the measuring sub-assembly
4	Damaged pivot system	Replace the measuring sub-assembly
5	Damaged impeller	Replace the measuring sub-assembly
6	Blocked impeller	Clean the measuring sub-assembly Replace the measuring sub-assembly
7	Deposits on the internal walls	Clean the measuring sub-assembly Check the installation conditions Check the totality of upstream elements Replace the measuring sub-assembly
8	Deformation of the flow profile	Check the installation conditions Check the totality of usptream elements Repair / clean the flowstraightener Clean the measuring sub-assembly

9	Presence of gas in the flow	Eliminate the source Check the totality of upstream elements Install a deaerator
10	Cavitation	Check the installation conditions Check the totality of upstream elements Repair / clean the flow straightener Increase the line pressure
11	Calibration problem	Replace the measuring sub-assembly

Chapter 8: Repair

References of spare parts

Here are the types of spare parts susceptible to be replaced (refer to the sketch page 3/11) by the FAURE HERMAN After-Sales Department:

- Calibrated measuring sub-assembly (2) – *Code 409475*
- Pulse transmitters (3) – *Code 301644 – Cable length 2m – Code 300729 cable length 5 m.*
- Integrated flow straightener *(4) – Code 405032.*
- Flow straightener retaining ring – *Code 201251*

Pulse transmitter replacement

This operation can only be performed when the instrument is de-energized:

- Disconnect the coil connection cables,
- Unscrew the fastening nuts,
- Withdraw the transmitter,
- Position the new coil, while ensuring the contact at the bottom of the well,
- Screw the fastening nuts,
- Re-install the connection cables,

Replacement of the measuring sub-assembly

This operation requires the flowmeter disassembly.

- ❑ Drain the measuring line,
- ❑ Disconnect the detection sub-assembly from the site cabling,
- ❑ Disassemble the flowmeter and install it vertically, side above, on a stable and "clean" surface,
- ❑ Withdraw the retaining ring securing the integrated flow straightener then the latter.

- ❑ Unscrew the inlet ring,
- ❑ Withdraw the measuring sub-assembly, vertically
- ❑ Insert the new measuring sub-assembly, while checking:
  - The flow direction,
  - The cleanliness of the body internal surfaces.
- ❑ Re-position and tighten the inlet ring,
- ❑ Re-position carefully both the flow straightener downstream positioning support and the retaining ring.

Chapter 9: Analysis of pressure related risks

The analysis of dangerous phenomena, derived from solicitations to which the equipment can be submitted when installed and used in reasonably foreseeable operating conditions, show the following points:

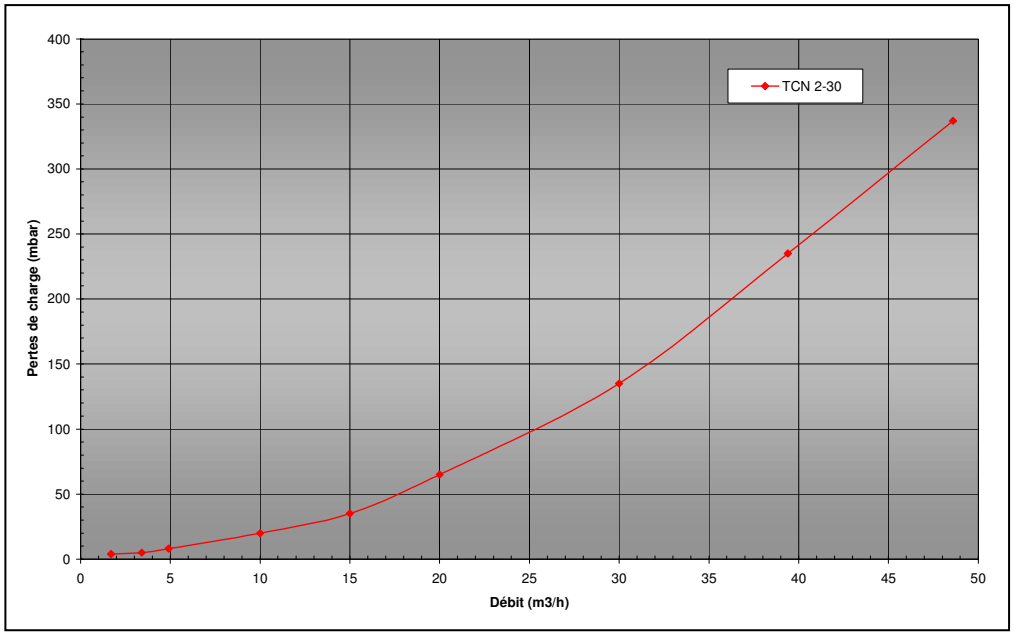
- There is no risk, in the sense of a dangerous phenomenon, related to the possible rupture of an internal element or component.
- The equipment design and overall dimensions comply with the state-of-the-art rules and equipment category calculation code (CODAP). Within this framework, using the equipment in reasonably foreseeable operating conditions do not allow to contemplate any risk, in the sense of a dangerous phenomenon.
- The operating restrictions and specific installation and implementation recommendations enabling to guarantee this absence of risk, are specified in Appendix 3.

> *Remark: Equipment disassembly*
> *By definition, the equipment is designed to operate under fluid pressure. Allowing for the potential danger these fluids represent, the equipment shall be imperatively and completely drained, before disassembling the equipment (complete disassembly or removal of a component under pressure).*

Appendix 1

Pressure drop

The graph below represents a typical experimental pressure drop record according to the flow rate for the flowmeter alone and for a fluid whose viscosity is 1.5 cSt.



Appendix 2

K-factor – Flow rate / Frequency Ratio

The K factor, expressing the number of pulses generated by the turbine flowmeter per unit of volume is determined during calibration. Values in the following table are given for information purposes.

	2-30
K (p/m³)	22800
Min. linear flow rate (m³/h)	3
• Min. linear Frequency (Hz)	19
Max. linear flow rate (m³/h)	30
• Max. linear Frequency (Hz)	190

Appendix 3

Operating limits – Special precautions

The equipment nominal operating field is specified on its nameplate. This field is mainly defined in terms of:

- Minimum/Maximum – Flowrate
- Maximum – Pressure
- Minimum/Maximum – Temperature

The flowrate restrictions specify the equipment optimal performance field (measurement accuracy and repeatability). The maximum value sets also the permissible continuous operating limit, without occasionally exceeding the 120 % of the set value.

The pressure and temperature restrictions involve exclusively the equipment mechanical dimensions and define the authorized operating field.

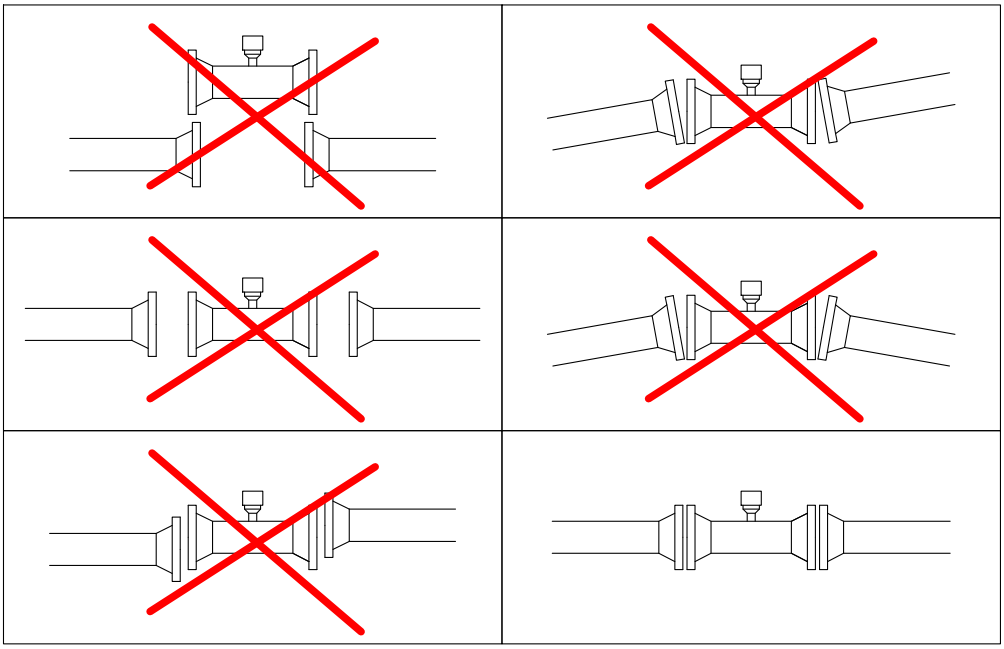
Equipment installation

Before installation, keeping the equipment in its original packing, sheltered from bad weather and possible impacts.

The equipment mechanical installation on the measurement line shall not generate excessive stresses. Especially, the alignment of upstream and downstream flanges shall allow to avoid the transmission of stresses on the equipment body.

The equipment shall be installed by means of suitable tools.

- Never use a hammer or impact wrench.
- No equipment element is designed to contribute to the tightening of connecting rods.
- Specific tools shall be used, when necessary, for the spacing between upstream and downstream flanges.



Lifting or pre-positioning means used, when necessary, shall be kept in place until installation achievement (tightening of all connecting rods).

Check the fitting of new gaskets, adapted to the application (material) and flange size.

Equipment disassembly

By definition, the equipment is designed to operate under fluid pressure.

Appendix 3

Allowing for the potential danger these fluids represent, the equipment shall be imperatively and completely drained, before disassembling the equipment (complete disassembly or removal of a component under pressure).

Should this draining need partial de-tightening of the equipment connecting rods, check the line is perfectly de-pressurized before de-tightening and installing the liquid recovery tank.

Flange gaskets shall not be re-used.

Remarks:
The equipment is a measuring instrument and shall be used as such.
The equipment body of associated components (flowstraightener, bosses …) are designed to support stresses in reasonably foreseeable operating conditions. They are not designed to be used as supports, equipment carry means or step.

Any modification brought to the equipment, susceptible to affect the pressure resistance, after delivery, is STRICTLY PROHIBITED.

For any replacement of Electronic Board, the used Electronic Board is subjected to restrictive disposal according to the ROHS standard. The disposal of the used Electronic Board should be either sent back to Faure Herman who will take care of its disposal, or dispose by the customer according to the EPA rules of its country.

Detailed content

Personal notes

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