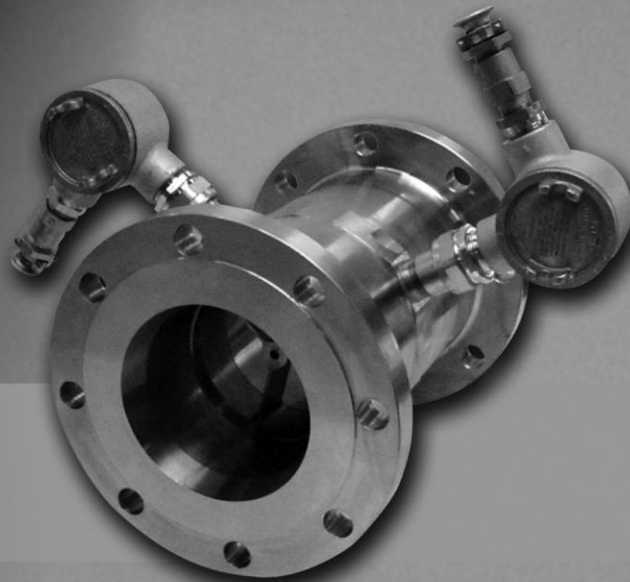


HELIFLU™ TCX

User's Manual



FAURE HERMAN

Mastering the Flow

*Part of the Liquid Controls Group
A Unit of IDEX Corporation*

IDEX

IDEX CORPORATION

Faure Herman

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Attention !

This manual contains important instructions and important warnings. It is essential to read and apply it before commencing installation, connection, and commissioning work.

Failure to observe these instructions and warnings may damage the flowmeter and endanger persons.

Qualification and training of the personnel

The flowmeter must be installed and maintained by personnel trained and qualified for this work.

Hazards arising from failure to observe the instructions and warnings

Failure to observe these instructions and warnings may:

- Endanger personnel as a result of mechanical, electrical, or chemical problems,
- Damage the flowmeter,
- Pollute the environment by releasing hazardous substances.

Safety at work

The safety instructions appearing in this manual must be observed, as must all accident prevention and occupational safety regulations in force in the country of installation.

Safety instructions

Disconnect the power supply and depressurize the flowmeter before servicing (prevention of electrical hazards and hazards created by pressurized equipment).

Conditions of operation

The reliability of the flowmeter is guaranteed only if it is installed and used as described in this manual. The extreme conditions of use indicated on the data plate must not be exceeded.

Reconditioning, repair, modifications

Reconditioning, repair, or modification are allowed only after Faure Herman has been consulted. The use of parts and accessories approved by Faure Herman avoids compromising safety. If any other parts are used, Faure Herman cannot be held liable for the consequences.

Transport, handling, and storage

The flowmeter must be handled with care so as to avoid damage.

Transport and handling must be performed using resources appropriate to the weight and bulk of the flowmeter.

When the flowmeter has lifting rings, they must be used. The flowmeter must in no case be handled or secured by the electrical boxes.

The use of end caps serves to protect the flanges during transport and handling.

Unpacking

The flowmeter must be checked and inspected in order to make sure that it has not been damaged and that nothing is missing. Protections and devices (such as screws) placed to immobilize moving parts must be withdrawn before installation.

Storage

If the flowmeter is not installed as soon as it is received, it must be suitably stored in a dry place, protected from the elements and from large temperature swings. For prolonged storage, arrangements to protect from damp may be necessary.

Return

Before any return, contact Faure Herman. If the flowmeter has been used with hazardous, corrosive, or toxic substances, the operator must make sure that it has been correctly rinsed, cleaned, and decontaminated before being returned to Faure Herman.



FAURE HERMAN

Mastering the Flow

www.faureherman.com

General contents

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

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ATEX recommendations

FR

Recommandations ATEX

Cet équipement est certifié ATEX et conforme aux exigences essentielles en ce qui concerne la sécurité et la santé pour la conception et la construction d'appareils destinés à être utilisés en atmosphères explosibles (Directive 94/9/CE).

Pour une utilisation en toute sécurité, assurez-vous que l'équipement est utilisé conformément aux indications définies dans le certificat ATEX et la plaque d'identification, et respectez les manuels d'utilisation, d'installation et de maintenance de l'équipement et des sous ensembles qui le composent.

L'installation, l'utilisation et la maintenance doivent être réalisées par un personnel formé et spécialisé comprenant l'une des langues du manuel.

S'il vous manque un manuel ou pour toute information, contactez le service Après-vente de FAURE HERMAN :

FAURE HERMAN
Route de Bonnetable – 72400 LA FERTE BERNARD
☎ +33 (0)2 43 60 28 80 - 📠 +33 (0)2 43 60 28 89
✉ fhservices@idexcorp.com

EN

ATEX recommendations

This equipment is ATEX certified and complies with the essential Health and Safety requirements relating to the design and construction of equipment intended for use in potentially explosive atmospheres (94/9/EC Directive).

On safety grounds, please ensure that this equipment is used in total compliance with the instructions given on the ATEX certificate and nameplate. Please consult the user manuals, equipment installation and maintenance manuals and the various parts used in this device.

This item of equipment must be installed and serviced by trained, specialist staff who understand one of the languages used in the manual.

If you require a manual or any additional information, please contact the FAURE HERMAN After Sales team:

FAURE HERMAN
Route de Bonnetable – 72400 LA FERTE BERNARD
☎ +33 (0)2 43 60 28 80 - 📠 +33 (0)2 43 60 28 89
✉ fhservices@idexcorp.com

ES

Recomendaciones ATEX

Este equipo certificado ATEX cumple con los requisitos esenciales relativos a la seguridad y la salud en el diseño y la construcción del material utilizable en atmósferas potencialmente explosivas (Directiva 94/9/CE).

Para un uso seguro, compruebe que el equipo se utiliza según las indicaciones descritas en el certificado ATEX y la placa de identificación, y respete los manuales de utilización, de instalación y de mantenimiento del equipo y de los elementos que lo componen.

La instalación, utilización y el mantenimiento deben efectuarse por un personal cualificado que entienda por lo menos uno de los idiomas del manual.

Si le falta un manual o para cualquier información, contacte con el servicio de postventa de FAURE HERMAN:

FAURE HERMAN
Route de Bonnetable – 72400 LA FERTE BERNARD
☎ +33 (0)2 43 60 28 80 - 📠 +33 (0)2 43 60 28 89
✉ fhservices@idexcorp.com

IT

Raccomandazioni ATEX

La presente apparecchiatura è certificata ATEX e conforme alle esigenze essenziali nell'ambito della sicurezza e la salute per la concezione e la costruzione d'apparecchi destinati a essere utilizzati in atmosfere potenzialmente esplosive (Direttiva 94/9/CE).

Per un utilizzo altamente sicuro, accertatevi che l'apparecchiatura sia usata conformemente alle indicazioni fornite nel certificato ATEX e nella piastra d'identificazione; rispettate i manuali d'utilizzo, installazione e manutenzione dell'apparecchiatura e dei sottoinsiemi che la compongono.

L'installazione, l'utilizzo e la manutenzione vanno effettuati da un personale formato e specializzato, edotto di una delle lingue del manuale.

Se vi manca un manuale o per qualsiasi informazione, contattate il Servizio Clientela di FAURE HERMAN:

FAURE HERMAN
Route de Bonnetable – 72400 LA FERTE BERNARD
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DA

ATEX anbefalinger

Dette udstyr er ATEX-certificeret og overholder de væsentlige sundheds- og sikkerhedsmæssige krav til design og konstruktion af apparater, der er beregnet til anvendelse i eksplosive atmosfærer (Direktiv 94/9/EF).

For en sikker anvendelse bør De sørge for, at udstyret anvendes i henhold til de forskrifter, der er defineret i ATEX-certifikatet og på identifikationsskiltet, og at bruger-, installations- og vedligeholdelsesvejledningerne for udstyret og de underenheder, det er sammensat af, overholdes.

Installationen, anvendelsen og vedligeholdelsen skal foretages af specialuddannet personale, som forstår et af de sprog, manualerne er udfærdiget på.

Hvis De mangler en manual eller for enhver anden information, kontakt venligst FAURE HERMAN's Serviceafdeling:

FAURE HERMAN
Route de Bonnetable – 72400 LA FERTE BERNARD
☎ +33 (0)2 43 60 28 80 - 📠 +33 (0)2 43 60 28 89
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SV

ATEX rekommationer

Denna utrustning är certifierad enligt ATEX och uppfyller de väsentliga kraven i fråga om säkerhet och hälsa vid utformning och tillverkning av apparater som är avsedda för användning i explosionsfarliga omgivningar (Direktiv 94/9/EG).

För en fullt säker användning, se till att utrustningen används i överensstämmelse med de anvisningar som figurerar i ATEX-certifikatet samt på identifikationsskylten, och följ instruktionsböckerna för användning, installation och underhåll av utrustningen och dess ingående underenheter.

Installationen, användningen och underhållet skall utföras av personal som är utbildad, specialiserad och som förstår något av instruktionsbokens språk.

Om du saknar någon av instruktionsböckerna eller för all annan information, kontakta FAURE HERMANs kundservice:

FAURE HERMAN
Route de Bonnetable – 72400 LA FERTE BERNARD
☎ +33 (0)2 43 60 28 80 - 📠 +33 (0)2 43 60 28 89
✉ fhservices@idexcorp.com



NO

ATEX anbefalinger

Dette utstyret er ATEX-sertifisert og oppfyller hovedkravene når det gjelder hensyn til sikkerhet og helse ved utforming og konstruksjon av utstyr til bruk i eksplosjonsfarlige omgivelser (Europaparlaments- og Rådsdirektiv 94/9/EF).

For full sikkerhet må det kontrolleres at utstyret benyttes i samsvar med anvisningene i ATEX-sertifikatet og på merkeplaten. Instruksjonene i brukerhåndbøker samt installasjons- og vedlikeholdsanvisninger for utstyret og delene det består av, må følges omhyggelig.

Installasjon, bruk og vedlikehold må utføres av spesialisert, faglært personell som forstår et av språkene i håndbøkene.

Hvis det mangler en håndbok eller hvis du trenger ytterligere opplysninger, vennligst ta kontakt med serviceavdelingen i FAURE HERMAN:

FAURE HERMAN
Route de Bonnétâble – 72400 LA FERTE BERNARD
☎ +33 (0)2 43 60 28 80 - 📠 +33 (0)2 43 60 28 89
✉ fhservices@idexcorp.com

NL

ATEX richtlijnen

Deze apparatuur heeft de ATEX certificering en beantwoordt aan de essentiële eisen inzake veiligheid en gezondheid voor het ontwerp en de bouw van apparaten bedoeld voor gebruik op plaatsen waar ontploffingsgevaar kan heersen (Richtlijn 94/9/EG).

Voor een veilig gebruik dient u te controleren of de apparatuur gebruikt wordt volgens de in het ATEX certificaat vermelde aanwijzingen en op het kenplaatje en de gebruiks-, installatie- en onderhoudshandleidingen van de apparatuur en de samenstellende onderdelen in acht te nemen.

De apparatuur moet geïnstalleerd, gebruikt en onderhouden worden door speciaal hiervoor opgeleid personeel dat minstens één van de talen van de handleiding begrijpt.

Indien een handleiding ontbreekt of u aanvullende informatie nodig heeft, neem dan contact op met de servicedienst van FAURE HERMAN:

FAURE HERMAN
Route de Bonnétâble – 72400 LA FERTE BERNARD
☎ +33 (0)2 43 60 28 80 - 📠 +33 (0)2 43 60 28 89
✉ fhservices@idexcorp.com

PL

Zalecenia ATEX

Niniejsze wyposażenie posiada certyfikat ATEX i jest zgodne z

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✉ fhservices@idexcorp.com

DE

ATEX Empfehlungen

Dieses Gerät ist ATEX-zertifiziert und entspricht den grundlegenden Sicherheits- und Gesundheitsanforderungen an Konstruktion und Bau für Geräte und Schutzsysteme zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen (Richtlinie 94/9/EG).

Für eine sichere Anwendung muss das Gerät gemäß den Angaben im ATEX-Zertifikat und dem Typenschild verwendet werden. Berücksichtigen Sie die Gebrauchs-, Installations- und Wartungshandbücher des Geräts und dessen Komponenten.

Installation, Gebrauch und Wartung müssen von spezialisiertem Fachpersonal durchgeführt werden, die eine der Handbuchsprachen verstehen.

Wenn Sie ein Handbuch oder weitere Informationen benötigen, wenden Sie sich bitte an den FAURE HERMAN-Kundendienst

FAURE HERMAN
Route de Bonnétâble – 72400 LA FERTE BERNARD
☎ +33 (0)2 43 60 28 80 - 📠 +33 (0)2 43 60 28 89
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PT

Recomendações ATEX

Este equipamento é certificado ATEX e está conforme às exigências essenciais no que concerne a segurança e a saúde para a concepção e a construção de aparelhos destinados a serem utilizados em atmosferas potencialmente explosivas. (Directiva 94/9/CE).

Para uma utilização com total segurança, assegure-se de que o equipamento é utilizado de acordo com as indicações definidas no certificado ATEX e na placa de identificação, e respeite os manuais de utilização, de instalação e de manutenção do equipamento e dos subconjuntos que o compõem.

A instalação, a utilização e a manutenção devem ser realizadas por um pessoal formado e especializado que compreenda uma das línguas do manual.

Se faltar-lhe um manual ou para quaisquer informações, entre em contacto com o Serviço Após-Venda da FAURE HERMAN:

FAURE HERMAN
Route de Bonnétâble – 72400 LA FERTE BERNARD
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✉ fhservices@idexcorp.com

FI

ATEX-Suosituksset

Tämä laite on ATEX-varmennettu ja vastaa turvallisuutta ja terveyttä koskevia oleellisia vaatimuksia koskien räjähdysvaarallisissa tiloissa käytettäviksi tarkoitettujen laitteiden suunnittelua ja valmistusta (Direktiivi 94/9/EY).

Turvallisuussyistä teidän tulee varmistaa, että laitetta käytetään ATEX-sertifikaatissa ja tunnistuslaatussa määritellyjen ohjeiden mukaisesti ja teidän tulee noudattaa laitteen käyttö-, asentamis- ja huolto-ohjeita sekä laitteen että sen muodostamien osien ollessa kyseessä.

Asentamisen, käytön ja huollon saa toteuttaa ainoastaan koulutettu ja erikoistunut henkilökunta, joka ymmärtää jotain käyttöohjeissa käytettyä kieltä.

Jos teillä ei ole käyttöohjeita tai haluatte lisätietoja, ottakaa yhteyttä myynninjälkeishuoltoon FAURE HERMAN:

FAURE HERMAN
Route de Bonnétâble – 72400 LA FERTE BERNARD
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✉ fhservices@idexcorp.com

ATEX recommendations

EL

Συστάσεις

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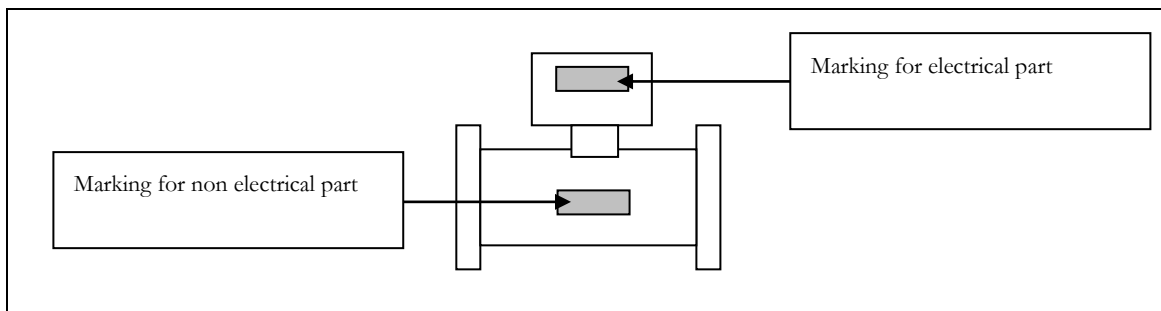
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This equipment is an assembly of a non electrical part and an electrical part which are both ATEX certified relating to the design and construction of equipment intended for use in potentially explosive atmospheres (94/9/CE directive).

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.

ATEX recommendations

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

| |
|---|
| <p>FAURE HERMAN Route de Bonnétable 72400 LA FERTE BERNARD Tel : +33 (0)2 43 60 28 80 Fax: +33 (0)2 43 60 28 70 E-mail: fhservices@idexcorp.com</p> |
|---|

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 6035X***. 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 BP20154 - 72406 La Ferté Bernard Made in France Equipment : S/N... Year CE T° min/max (Ts): According to application LCIE 05 ATEX 6035 X  II 2 G c T6 to T1 (according to fluid temperature) | Company name Company address Model Serial number Manufacturing year CE Logo Fluid Temperature ATEX agreement number ATEX marking Equipment category Protection type 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 +350 °C.

The temperature classification is following:

- T6 if $-50^{\circ}\text{C} \leq T_{\text{fluide}} \leq +80^{\circ}\text{C}$
- T5 if $+80^{\circ}\text{C} \leq T_{\text{fluide}} \leq +95^{\circ}\text{C}$
- T4 if $+95^{\circ}\text{C} \leq T_{\text{fluide}} \leq +130^{\circ}\text{C}$
- T3 if $+130^{\circ}\text{C} \leq T_{\text{fluide}} \leq +195^{\circ}\text{C}$
- T2 if $+195^{\circ}\text{C} \leq T_{\text{fluide}} \leq +290^{\circ}\text{C}$
- T1 if $+290^{\circ}\text{C} \leq T_{\text{fluide}} \leq +350^{\circ}\text{C}$

Warning: For models containing aluminium parts (Body, Impeller...) the fluid temperature is limited from -50°C to +100°C.

ATEX recommendations

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.

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

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



FAURE HERMAN

Mastering the Flow

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Chapter 1: Introduction

TCX family

Flowmeters of the TCX family are essentially designed to measure volumes of liquids of low to medium viscosity (less or equal than 75 cSt).

| Size (") | 1" | 1" ^{1/4} | 1" ^{1/2} | 2" | 3" | 4" | 6" | 8" | 10" | 12" |
|---------------------|----|-------------------|-------------------|----|----|----|----|----|-----|-----|
| Max Viscosity (cSt) | 10 | 10 | 10 | 10 | 20 | 30 | 45 | 55 | 65 | 75 |

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

The operating principle of this flowmeter type rests on the rotational velocity of a helical bladed impeller, positioned at the middle point of the piping, by means of magnets (fitted in the flowmeter body) and a coil (positioned in the flowmeter body).

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

- With: Q Instantaneous flow rate (m³/h)
F Signal frequency (Hz)
K Measuring sub-assembly related factor, determined and recorded during factory calibration or on site (p/m³) (refer to Appendix 2)



Metering pulses generated by the coil enables to calculate the volume flowed between two given periodic times by means of the following expression:

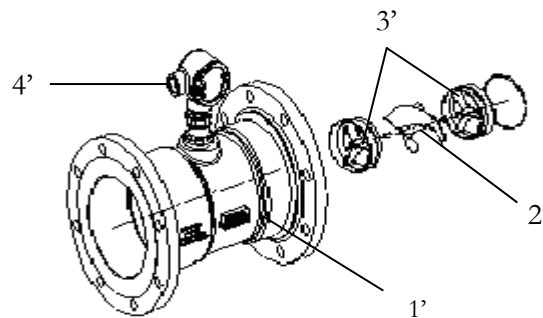
$$V = \frac{N}{K}$$

- with: V Volume (m³)
N Totalized pulse number
K Measuring sub-assembly related factor, determined and recorded during a factory calibration or on site (p/m³) (refer to Appendix 2)

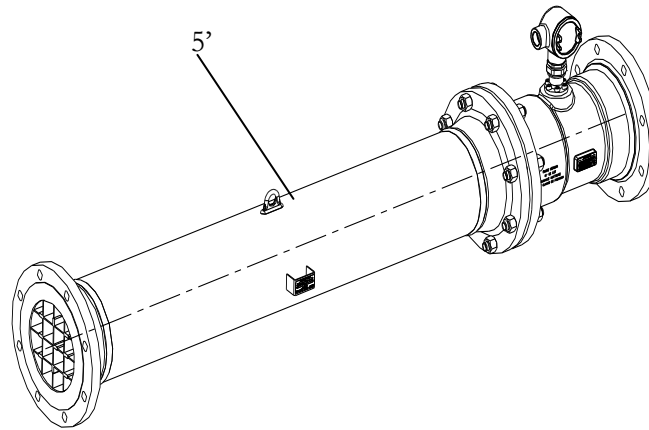
Chapter 2: Description and codification

Flowmeters of the TCX family are designed according to the same principle and include the following main elements (refer to Appendix 1):

- Flanged body (1')
- Helical bladed impeller (2')
- Upstream and Downstream bearing support cross piece (3')
- Detection sub-assembly (4')
- As an option, flowstraightener (5')



TCX



TCX with optional FLOWSTRAIGHTENER assembly

Body

According to the size, the body (1) is made of Stainless steel (AISI 316 or equivalent), Carbon steel or specific materials upon request and internally machined. This body receives an upstream bearing support cross piece (3), an impeller (2) and a downstream bearing support cross piece (4).

| Size < 3" | Size ≥ 3" |
|-----------------|-----------------|
| Stainless Steel | Carbon Steel |
| | Stainless Steel |

It is equipped with two coil wells (or boss) (14) enabling the installation of the detection coil (15) and the positioning of the electrical interfacing enclosure (16) receiving the pre-amplifier. Position of the bosses is such that pulses delivered by 2 coils are not in phase.

Chapter 2: Description and codification

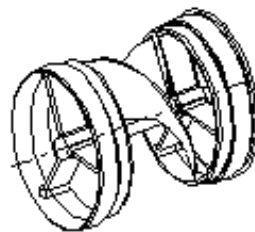
Upon the outside of the body:

- ❑ An arrow indicates the fluid flow direction,
- ❑ A manufacturer's nameplate (11) enables the equipment identification.

Measuring sub-assembly

This sub-assembly includes the totality of elements contributing to the correct operation of the measuring sub-assembly (impeller). It includes the following elements:

- The helicoidal dual or four-blade impeller (2) made of either light alloy or titanium (other materials according to option) and fitted with shafts (7 and 8) and magnets. The latter enable the generation of electrical pulses through the detection coil. On some models, these magnets may be fitted in the impeller hub. An arrow engraved on the impeller indicates the flow direction.
- Upstream (7) and downstream (8) shafts enabling the impeller centring and retained by a connecting rod (9),
- Upstream (3) and Downstream (4) bearing support cross piece manufactured in Stainless steel (AISI 316 or equivalent) receives the bearings (5) and (6) enabling the impeller centring.



Flowstraightener assembly (as an option)

Positioned upstream from the flowmeter and associated to the later, the purpose of the flowstraightener (12) is to straighten the fluid flow and to limit the upstream disturbances derived from bends or any other seldom elements.

It enables to improve and warrant the measurement accuracy.

It includes a cylindrical channel with flanges enabling its assembly with the flowmeter and the installation pipe.

Outside from the flowstraightener body, an arrow indicates the fluid flow direction. A manufacturer's nameplate (13) enables the identification. Inside, a set of cross plates or tubes regularizes the fluid flow stream.

Detection sub-assembly

The detection sub-assembly includes the following elements:

- A coil (15) screwed into each boss (14),
- As an option, a coil/pre-amplifier connection cable
- As an option, a pre-amplifier enabling to increase significantly the maximum distance between the flowmeter and the electronic display and/or calculation (up to 5000 metres),
- As an option, an explosion-proof enclosure enabling the use of the flowmeter in hazardous area.

Codification

The TCX range codification is determined on 2 fields to be filled in such as: TCX x-y – 0zz

Chapter 2: Description and codification

Flowmeter diameter / Maximum flowrate

| European Designation | Diameter (mm) / Max.Flowrate (m ³ /h) | USA Designation | Diameter (in.) / Max.Flowrate (GPM) |
|----------------------|--|------------------|-------------------------------------|
| TCX 25-10-0zz | 25 (1") / 10 | TCX 1-44-0zz | 1"/44 |
| TCX 32-20-0zz | 32 (1 1/4") / 20 | TCX 1,25-88-0zz | 1 1/4"/88 |
| TCX 40-40-0zz | 40 (1 1/2") / 40 | TCX 1,5-175-0zz | 1 1/2"/175 |
| TCX 50-70-0zz | 50 (2") / 70 | TCX 2-310-0zz | 2"/310 |
| TCX 80-110-0zz | 80 (3") / 110 | TCX 3-480-0zz | 3"/480 |
| TCX 80-150-0zz | 80 (3") / 150 | TCX 3-660-0zz | 3"/660 |
| TCX 100-200-0zz | 100 (4") / 200 | TCX 4-880-0zz | 4"/880 |
| TCX 100-300-0zz | 100 (4") / 300 | TCX 4-1320-0zz | 4"/1320 |
| TCX 150-400-0zz | 150 (6") / 400 | TCX 6-1770-0zz | 6"/1770 |
| TCX 150-600-0zz | 150 (6") / 600 | TCX 6-2640-0zz | 6"/2640 |
| TCX 200-800-0zz | 200 (8") / 800 | TCX 8-3520-0zz | 8"/3520 |
| TCX 200-1000-0zz | 200 (8") / 1000 | TCX 8-4400-0zz | 8"/4400 |
| TCX 250-1200-0zz | 250 (10") / 1200 | TCX 10-5290-0zz | 10"/5290 |
| TCX 250-2000-0zz | 250 (10") / 2000 | TCX 10-8800-0zz | 10"/8800 |
| TCX 300-2400-0zz | 300 (12") / 2400 | TCX 12-10560-0zz | 12"/10560 |
| TCX 300-3000-0zz | 300 (12") / 3000 | TCX 12-13200-0zz | 12"/13200 |

Accuracy class (\pm %)

| Designation | Accuracy (\pm %) |
|-------------|---------------------|
| TCX x-y-015 | \pm 0,15 |
| TCX x-y-025 | \pm 0,25 |
| TCX x-y-050 | \pm 0,50 |



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Chapter 3: Equipment reception –storage and handling

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 documents be omitted, please contact the FAURE HERMAN After-Sales Department:

Plant La Ferté Bernard
Route de Bonnétable
72400 LA FERTE BERNARD
Tel: 33 (0) 2 43 60 28 80
Fax: 33 (0) 2 43 60 28 89
E-mail: fhservices@idexcorp.com

The flanges of the flowmeter are equipped with protection covers which must be removed only during its installation on the pipe.

Before installing 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 a clean and dry room, the measuring channel being protected, and at a temperature ranging from -20°C / $+70^{\circ}\text{C}$.



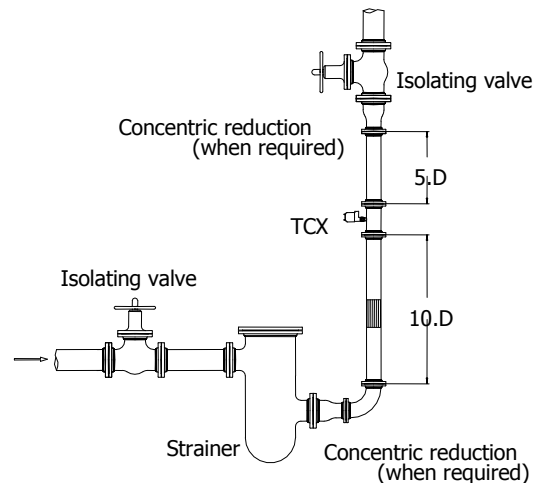
The handling must be done as follows:

- With lifting rings fitted on the flowmeter body, for equipments with a nominal size > 6" (DN 150) or with a weight > 35 kilos
- Or with straps on both sides of the flowmeter body when there are no lifting rings

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 the TCX turbine flowmeter shall adhere to a certain number of principles, to ensure the equipment reliability and to warrant long-term accurate, repeatable and stable measurements.

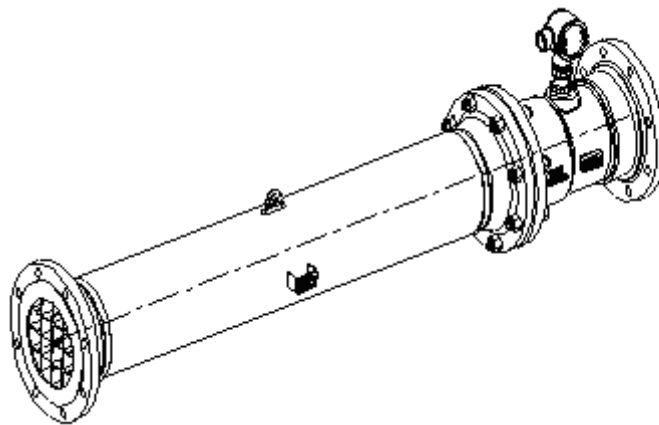


In order to warrant the measurement accuracy and repeatability, it is recommended to install upstream the flowmeter a pipe straight section of same diameter, of a length superior than or equal to 15 times this diameter.

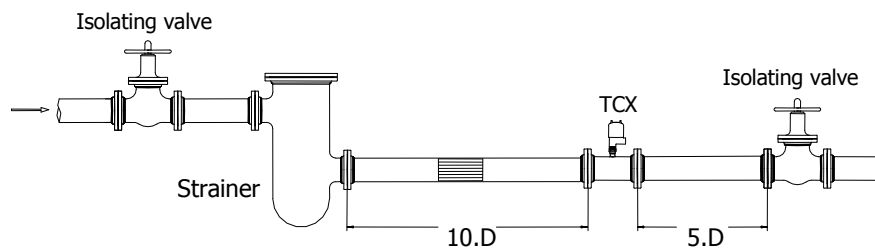
Should a flow straightener be used, this length can be reduced to 10 times the pipe diameter, the flow straightener being integrated to this length. In the same way, it is recommended to have downstream from the flowmeter a pipe straight section of same diameter, of a length superior or equal than 5 times this diameter.



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



Turbine flowmeter with associated flow straightener



Chapter 4: Installation conditions

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 can be dimensioned by means of the below table:

| TCX Type | Recommended filtration (mm) | US MESH |
|-----------|-----------------------------|---------|
| 25-y-0zz | 0.4 | 40 |
| 32-y-0zz | 0.707 | 25 |
| 40-y-0zz | 0.707 | 25 |
| 50-y-0zz | 0.841 | 20 |
| 80-y-0zz | 1.68 | 12 |
| 100-y-0zz | 1.68 | 12 |
| 150-y-0zz | 1.68 | 12 |
| 200-y-0zz | 2.38 | 8 |
| 250-y-0zz | 2.83 | 7 |
| 300-y-0zz | 2.83 | 7 |

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.

Chapter 4: Installation conditions

This minimum value can be determined by means of the following formula for stable liquids at air pressure:

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

with

| | |
|------------------|---|
| P_{min} | Minimum pressure downstream from the flowmeter |
| ΔP | Flowmeter pressure drop in the operating conditions |
| P_V | Vapour pressure of the liquid measured in the operating conditions. |

For LPG, this minimum pressure can be set at $P_V + 1$ bar.

Mechanical installation

During the flowmeter installation 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 joint faces, on the pipe side and flowmeter side.
- The flowmeter alignment with the upstream and downstream pipes in the absence of obstacles preventing the correct liquid flow (joint, ...).
- 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

TCX flowmeters are equipped with detection systems including a coil and as an option a pre-amplifier positioned inside of an explosion-proof enclosure or a weather-proof enclosure.

One of the coil body ends is threaded so as to secure its positioning and fastening into the flowmeter body.

The use of the coil alone enables to transmit signals delivered over a maximum distance of about 200 metres providing the use of shielded cables in areas of low electromagnetic interferences.

In some cases, the other end is fitted with a 2-pin connector (MS3106-10SL-4P) enabling the connection to an external system.

When delivered, the flowmeter can be equipped (according to the option selected) with a complete system, integrating the pre-amplifier. The coil / pre-amplifier connection is performed in factory and the flowmeter connection to the site cabling is achieved as described in the pre-amplifier specific technical manual.

The use of 2 or 3 shielded instrumentation cables is recommended.

Example: 01 IT 09 EG (NF M 87-202)

- 01 One unit
- IT 3 conductor-instrumentation
- 09 Unit section 0.9 mm²

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

Chapter 5: Commissioning

On completion of the flowmeter installation on the pipe and on completion of the electrical connection of pulse emitter, 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.



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Chapter 6: Maintenance

The TCX 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 sub-assembly, at least every three years. This verification may involve a replacement in workshops of the pivot system (shafts, end pieces and stops).

The TCX 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.



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Chapter 7: Dysfunction

| 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 the wiring (shielding) Check and replace when required the coil and/or the pre-amplifier. |
| 2 | Coil and/or pre-amp. defect | Check the pre-amp. adjustment and/or configuration. Replace the coil and/or pre-amp. |
| 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 upstream 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

Pre-amplifier replacement

This operation is performed out of the dangerous area and when the instrument is de-energized:

- ❑ Unscrew the explosion-proof enclosure cover,
- ❑ Disconnect the pre-amplifier from the site cabling,
- ❑ Remove both fastening screws from the pre-amplifier in the enclosure,
- ❑ Withdraw the pre-amplifier from the enclosure while avoiding to generate stress on the coil/ pre-amplifier connection cable,
- ❑ Disconnect the coil / pre-amplifier connection cable,
- ❑ Perform the same operations in the reverse order for the assembly of a new pre-amplifier

Coil replacement

This operation can only be performed after the pre-amplifier disassembly.

- ❑ Disconnect the coil / pre-amplifier connection cable,
- ❑ Withdraw the coil while unscrewing,
- ❑ Position the new coil, while ensuring the contact at the bottom of the well,
- ❑ Re-install the coil/preamplifier connection cable,
- ❑ Re-position and screw the enclosure cover.

Measuring sub-assembly replacement

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, downstream side above, on a stable and “clean” surface,



- ❑ Withdraw the downstream Vee ring.
- ❑ By means of a suitable tool, unscrew the downstream bearing support cross piece (4),
- ❑ Withdraw the impeller (2),
- ❑ Turn round the measuring line,
- ❑ By means of a suitable tool, unscrew the upstream bearing support cross piece (3),
- ❑ By means of a suitable tool, withdraw the worn bearings (5) and (6) from the upstream and downstream bearing support cross piece, then position the new ones,
- ❑ By means of a suitable tool, withdraw the worn shafts (7) and (8) from the impeller, then position the new ones with the fastening screw,
- ❑ Re-screw carefully the upstream bearing support cross piece to ensure contact in the groove bottom,
- ❑ Turn round the measuring line,
- ❑ Re-position carefully the impeller, while taking care to check the flow direction,
- ❑ Re-screw carefully the upstream bearing support cross piece to ensure contact in the groove bottom, then position the Vee ring in the groove above the thread.

Spares parts, bearing code order.

| Model | Tungsten Carbide | Graphite |
|-------|------------------|----------|
| 1" | L00056 | L00060 |
| 1.25" | L00057 | L00061 |
| 1.5" | L00058 | L00062 |
| 2" | L00059 | L00063 |
| 3" | L00036 | L00037 |
| 4" | L00038 | L00039 |
| 6" | L00040 | L00041 |
| 8" | L00042 | L00043 |
| 10" | L00044 | L00045 |
| 12" | L00046 | L00047 |

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 a component.
- The equipment design and overall dimensions comply with the state-of-the-art rules and equipment category calculation code (ASME). 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).





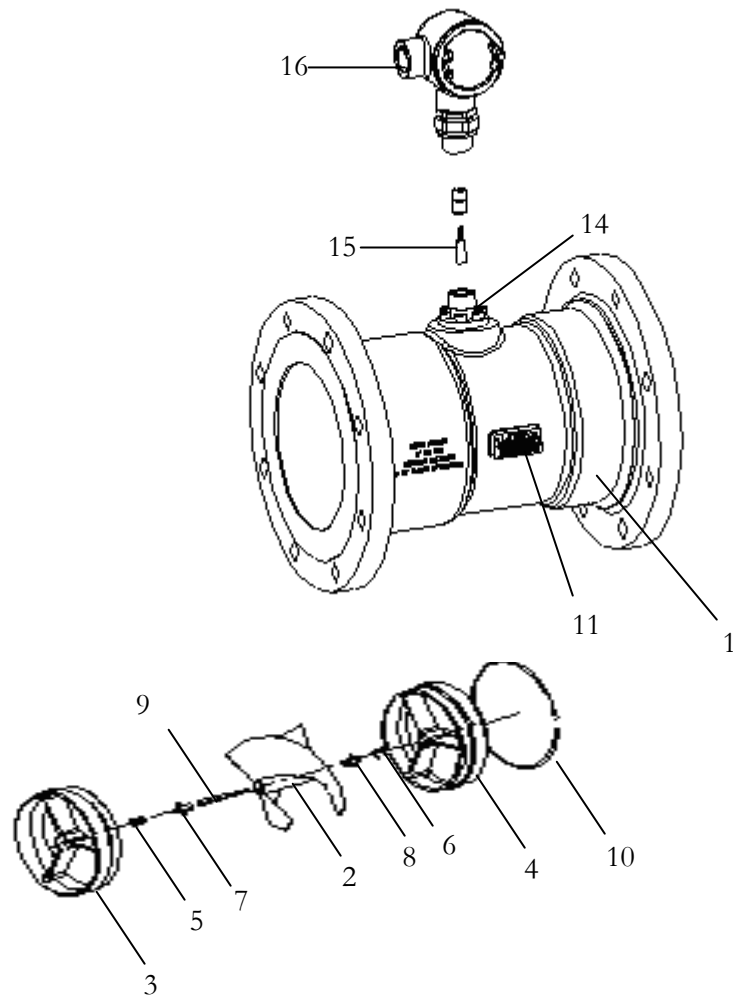
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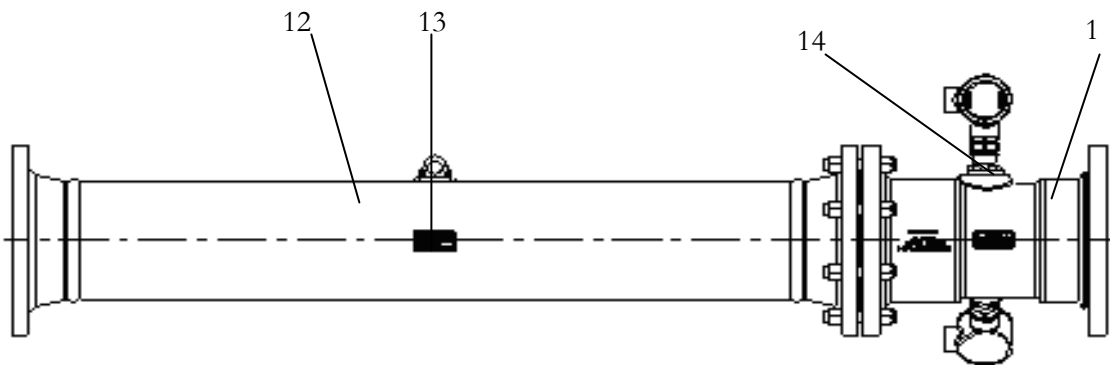
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Appendix 1

Assembly drawing and parts list – Main elements



Assembly drawing and parts list - Option with flowstraightener assembly



Assembly drawing and parts list - Parts list

| <u>Repère</u> | <u>Description</u> | <u>Quantité</u> |
|---------------|--|-----------------|
| 1 | Body | 1 |
| 2 | Impeller | 1 |
| 3 | Upstream bearing support cross piece | 1 |
| 4 | Downstream bearing support cross piece | 1 |
| 5 | Upstream bearing | 1 |
| 6 | Downstream bearing | 1 |
| 7 | Upstream shaft | 1 |
| 8 | Downstream shaft | 1 |
| 9 | Fastening screw | 1 |
| 10 | Downstream Vee ring | 1 |
| 11 | Turbine flowmeter manufacturer's nameplate | 1 |

Appendix 1

| | | |
|----|---|----------|
| 12 | Flowstraightener assembly | 1 |
| 13 | Flowstraightener manufacturer's nameplate | 1 |
| 14 | Coil well (or boss) | 1 ou 2 * |
| 15 | Coil | 1 ou 2 * |
| 16 | Enclosure | 1 ou 2 * |

*: as an option

Name plates

| | |
|--|--|
| on the meter and flowstraightener | Are indicated: Builder address – Equipment – Model – Serial number – Year – Operating pressure – Flow range – Test pressure and date – Fluid Temperature range – Danger Group – Dimension – Faure Herman's ATEX agreement number – CE logo |
| on the Faure Herman 's enclosure | Are indicated: CE logo – Faure Herman's ATEX agreement number – ATEX Product number - the mention : Don not open when energized - Model – Serial number – Year – Ambient temperature range - Address |



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Appendix 2

K-factor – Flowrate / Frequency relationship

The K-factor, expressing the number of pulses delivered by the flowmeter per unit of volume is determined during calibration.

According to the adjustments performed, allowing especially for the viscosity of the liquid measured and the number of blades, the values of the below table are given for information purposes.

| | 25-10- 0zz | 32-20- 0zz | 40-40- 0zz | 50-70- 0zz | 80-110- 0zz | 80-150- 0zz | 100-200- 0zz | 100-300- 0zz |
|---|---------------|---------------|---------------|---------------|----------------|----------------|-----------------|-----------------|
| K (p/m ³) | 89000 | 21000 | 15000 | 10000 | 4400 | 4400 | 2100 | 1700 |
| Min. linear flow rate (m ³ /h) | 1 | 2 | 4 | 7 | 11 | 15 | 20 | 30 |
| • Min. linear frequency (Hz) | 24 | 12 | 24 | 19 | 15 | 17 | 11 | 14 |
| Max. linear flowrate (m ³ /h) | 10 | 20 | 40 | 70 | 110 | 150 | 200 | 300 |
| • Max. linear frequency (Hz) | 240 | 120 | 240 | 190 | 150 | 170 | 110 | 140 |

| | 150-400- 0zz | 150-600- 0zz | 200-800 0zz | 200-1000 0zz | 250-1200- 0zz | 250-2000- 0zz | 300-2400- 0zz | 300-3000- 0zz |
|---|-----------------|-----------------|----------------|-----------------|------------------|------------------|------------------|------------------|
| K (p/m ³) | 900 | 700 | 380 | 450 | 150 | 160 | 80 | 80 |
| Min. linear flow rate (m ³ /h) | 40 | 60 | 80 | 100 | 120 | 200 | 240 | 300 |
| • Min. linear frequency (Hz) | 11 | 12 | 9 | 12 | 7 | 9 | 7 | 7 |
| Max. linear flowrate (m ³ /h) | 400 | 600 | 800 | 1000 | 1200 | 2000 | 2400 | 3000 |
| • Max. linear frequency (Hz) | 110 | 120 | 90 | 120 | 70 | 90 | 70 | 70 |



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Appendix 3

Operating restrictions – Special recommendations

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.

Remark: When the operating temperature is higher than the indicated value the maximum authorized pressure shall be reduced, in strict application of the NF EN 1092-1 and NF EN 1759-1 Standards.

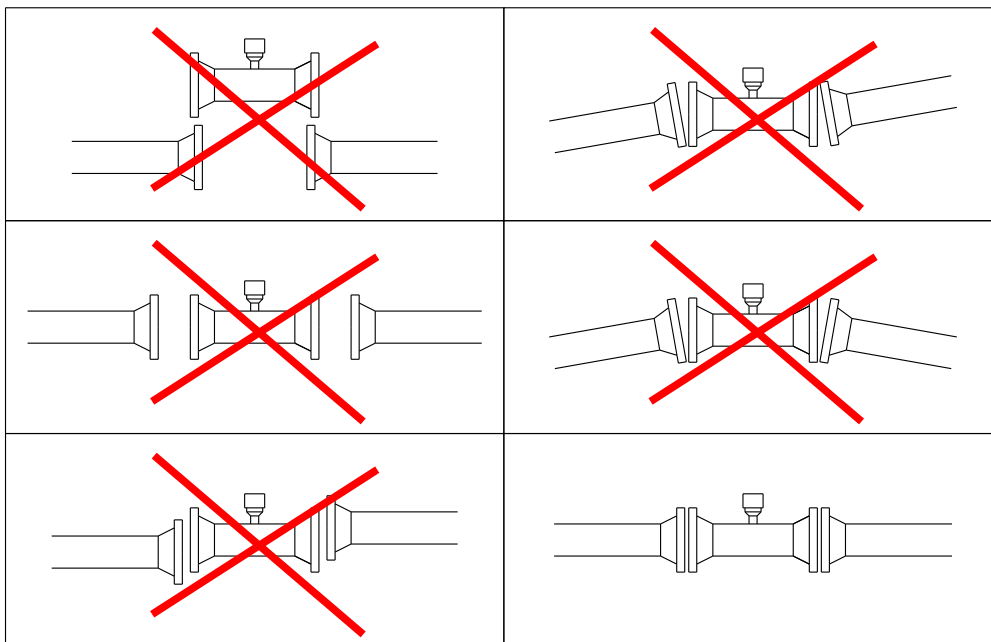
Equipment installation

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 the 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.

Appendix 3

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).



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



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Appendix 4

Gasket

The equipment shall be assembled with gaskets according to NF EN 1514 and NF EN 12560 standards and depending on flange type.

Spiral wound gaskets are forbidden for flanges rating below class 300 or PN 63.

Flange bolting

The material of flange bolting shall be chosen in ASTM A 193 B7 (rods) and ASTM A 194 2H (nuts) according to EN ISO 898-1 standard for temperature between -45°C and +480°C.

Tightening torque

Approximative tightening torque for Klinger sil gasket type

| Bolts size | Nm | Bolts size | Nm |
|------------|-----|------------|------|
| M14 | 110 | M30 | 1130 |
| M16 | 170 | M33 | 1520 |
| M20 | 330 | M36 | 1960 |
| M24 | 570 | M39 | 2525 |
| M27 | 828 | M42 | 3135 |

The link of a flowmeter equipped with a flow straightener is tightened at the factory but must be checked and retightened before commissioning. A label affixed to the flanges of this link calls attention to this requirement.





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Personal notes

Personal notes
