LUGGAGE POINT INLET STRUCTURE UPGRADE PROJECT

1.1 Background

Luggage Point Sewage Treatment Plant (STP) serves the S1 catchment that encompasses approximately half of the population of the City of Brisbane. The plant is located at 200 Main Beach Rd, Pinkenba. The plant receives flow from a combination of domestic and industrial sources but is principally treating domestic sewage.

Prior to the inlet structure upgrade project, the inlet works operated on mechanically raked bar screens. Their primary purpose was to remove coarse solids and rags from the influent stream to protect downstream equipment. The inlet screens and associated mechanical/civil structure consisted of;

- Main stilling chamber
- Four inlet channels
- Eight coarse screens (15mm aperture) with mechanically raked drives, two per inlet channel
- Four outlet penstocks
- Screenings conveyor and screenings press

A feasibility study was undertaken to assess options to address the need for better screening removal at the inlet works to prevent blockages at downstream pumps and valves and to avoid the impacts of ragging on downstream processes within the STP.

The feasibility report recommended the installation of new fine screen units to the existing inlet works structure and upgrade the inlet works for an ultimate hydraulic load of 11,600 L/s, with provision to bypass the new fine screens in the event of screen failure.

Other objectives included;

- Eliminate current WH&S issues
- Maximise the hydraulic capacity of the inlet structure, while satisfying the design criteria, for both screen flows and bypass flows.
- Improve screenings removal efficiency (for downstream operation)
- Meet fine screening requirements as per Development Approval Permit, and
- Be able to retrofit odour control (at a later date).

The inlet screen upgrade project was carried out by Stirloch Constructions Pty Ltd between December 2013 and early 2015.

1.2 OVERVIEW OF THE UPGRADED SYSTEM

The Luggage Point STP inlet screens process removes gross solids from the incoming sewage and handles the screening until it is loaded into transportable storage bins.

The inlet works consists of following main process sections:

- 8 x Inlet Screens with 8 associated Inlet and 4 associated outlet penstocks.
- 2 x transfer water sluices.
- 2 x splitter boxes.
- 3 x wash presses for de-watering of the screenings.
- 3 x storage bins for screenings storage and off-site disposal.
- 2 x drainage pumps.
- 1 x wash water pressure system.

Luggage Point STP Inlet Works is designed with a common deep receiving bay where the three pipelines from Eagle Farm Pumping Station discharge Raw Sewage. From this compartment, influent enters the fore bay or stilling area, which comprises four wide individual channels.

These four channels are then split by divider walls to make eight individual 1980mm wide channels where eight band screens are located. Each of the eight inlet channels is isolated, upstream of the screen, by a double isolation package comprising an electrically actuated penstock and a manually inserted stop board.

Each channel has an ANDRITZ AQUA SCREEN which captures and removes the rubbish and debris from the raw sewage in the inlet works. The eight screens are labelled SC-0210-001 to SC-0210-008 and are staggered to form two banks, (Bank A and Bank B). Screenings are automatically removed from the continuous perforated plates of the screens by spraying service water, which is initiated by the backwash cycle of the screens.

Channels 1 and 2, 3 and 4, 5 and 6, 7 and 8 merge downstream of the screens to make four wider channels followed by a penstock in each of these four wider channels.

There are bypass weirs downstream of the screens SC-0210-001, SC-0210-003, SC-0210-005 and SC-0210-007 cut into the divider walls. In the event of the screens become blinded or flow exceeds the screen capacity, the incoming flows overtop the bypass weirs and flow passes to the adjacent inlet channel upstream of SC-0210-002, SC-0210-004, SC-0210-006 and SC-0210-008 respectively.

The screens 1, 3, 5 and 7 (Bank A) drop their screenings onto Screenings Sluice No.1 (SL-0210-001). The spray water provided during the screen backwashing cycle transports the screenings along the sluice launder to discharge into Splitter Box No.1 (DG0210-001). The Splitter Box can direct the screenings to either Wash Press No.1 (WPR-0220-001) or alternatively to Wash Press No.3 (WPR-0220-003).

The screens 2, 4, 6 and 8 (Bank B) drop their screenings onto Screenings Sluice No.2 (SL-0210-002). The spray water provided during the screen backwashing cycle transports the screenings along the sluice launder to discharge into Splitter Box No.2 (DG0210-002). The Splitter Box can direct the screenings to either Wash Press No.2 (WPR-0220-002) or alternatively to Wash Press No.3 (WPR-0220-003).

The Wash Presses wash and compress the screenings and discharge them into an associated Storage Bin. The de-watered screenings from Wash Press 1 is transferred to Storage Bin 1 (BN-0220-001) and from Wash Press 2 to the Storage Bin 2 (BN-0220-002).

Normal operation is for the screenings from Bank A to be delivered to Wash Press 1 and for the screenings from Bank B to be delivered to Wash Press 2. Wash Press 3 and Storage Bin 3 are used as a standby storage destination for both Bank A and Bank B, while the full Storage Bins 1 or 2 are removed and replaced by empty bins.

The Splitter Boxes are arranged so that screenings from both Bank A and Bank B can be diverted to Wash Press 3 at the same time.

A pressure booster pump station is provided for effluent wash water supply to the inlet screening equipment. These pumps are controlled by VSD to maintain constant pressure in the spray and wash water line. This equipment is located remotely from the Inlet Works at the north side of Stage 1A between PST1 and Bioreactor 1.

A drain water sump with two level-controlled submersible pumps return the drain water from the wash presses and floor drains to the inlet collection chamber.

1.3 Format of the O&M Manual(s):

The O&M Manual has been split up into 6 folders/sections. Folder 1 acts as a directory for the O&M utilizing an overall index of what is contained in each section/folder.

Folder 1 provides an overall picture of the project and includes the functional specification which describes the operation of the plant.

Folders 2, 3, 4 & 5 provide specific installation, operation & maintenance documentation from specific vendors and suppliers and also include factory testing, test certificates and commissioning checksheets and procedures.

Folder 6 contains IOM documentation on free issue materials provided by QUU. This information has been included in the Stirloch manuals for the convenience of the QUU operators.

1.4 INDEX:

FOLDER 3: BOOSTER PUMP STATION O&M MANUAL (TMS832)

QUEENSLAND UrbanUtilities

FOLDER 4: WASH PRESS AND SLUICE LAUNDER O&M MANUAL (TMS833)

Section 1: Equipment Lists, Table of Contents, Commissioning Plan

Section 2: Wash Press Operating Instructions

Section 3: Wash Press Control Concept

Section 4: Motox Gearbox Operating Instructions

Section 5: Siemens Low Voltage Motors Operating Instructions

Section 6: Wash Press Solenoid Valves Operating Instructions

Section 7: Sluicing Launder

Section 8: Distribution Box - Festo Cylinder Information

Section 9: Installation and Acceptance ITP's, FAT Documents

Section 10: Drawings

FOLDER 5: MISCELLANEOUS ITEMS – VALVES, FLOWMETER, PENSTOCKS (TMS834)

Section 1: AWE Double Isolation Module O&M

Section 2: AWE Double Isolation Module Drawings

Section 3 : ABB Flowmeter Data Sheet + Calibration Certificates

Section 4: ABB Flowmeter User Guide

Section 5: ABB Flowmeter Transmitter Guide

Section 6: Swingflex Check Valve Data Sheet + IOM

Section 7: Resilient Seat Gate Valve Data Sheet + IOM

Section 8: Heavy Duty Knifegate Valve Data Sheet + IOM

Section 9: SS316 Ball Valve Data Sheet + IOM

Section 10: ARI Combination Air Valve Data Sheet + IOM

FOLDER 6: QUU SUPPLIED INFORMATION (TMS835)

Section 1-9: ANDRITZ Screens O&M Manual

Section 12-15: Spirac Bin and Retractable Chute IOM + Miscellaneous Info

Section 1: AWE Double Isolation Module O&M

OPERATION AND MAINTENANCE MANUAL

Model F35 Penstocks
Model ZW Penstocks
Model P1000 Penstocks & Stopgates

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OPERATION AND MAINTENANCE INSTRUCTIONS FOR PENSTOCKS

Prior to Operation

1. The penstock should be brushed off to clear all dirt, grit and grout particularly around the seals and gate rear and sealing faces. A high pressure wash down with clean water is also recommended.

2. Clean the stem from grit and debris. The entire threaded portion of the stem is to be adequately lubricated with grease prior to operation. Should grit or other foreign matter contaminate the grease it should be cleaned off and re-greased as necessary prior to operating.

   If the penstock has a non-metallic nut, there is no requirement to lubricate the stem.

3. Do not lubricate the seals. The seal material is of wear resistant low friction material (UHMWPE). Applying grease will only entrap grit and debris into the seals which may cause damage.

General Operation

1. Ensure the handwheel or tee key provided with the penstock is of the correct size for the operation of that penstock. Oversizing these or the use of bars etc., to gain additional leverage may result in damage to the penstock and its components.

2. Penstocks are generally clockwise closing. Refer to handwheel markings to confirm opening and closing directions.

3. The penstock should operate freely and unlaboured throughout its full travel. A sudden increase in the input effort means that the gate has reached the end of its travel or something has caused the gate to jam mid travel. Increasing input force will overstress the penstock and may result in damage.

4. Electric actuators, bevel and spur gearboxes and pneumatic and hydraulic cylinders should be operated in accordance with the manufacturer's standard instructions.

General Maintenance

1. Penstocks in frequent use require the stem and nut to be cleaned and re-greased at least on a monthly basis. It is recommended that the old grease be cleaned off before new grease is applied. Any debris should be cleaned from the threads before re-greasing. Failure to provide consistent adequate clean lubrication will result in accelerated wear of the drive nut threads.

2. Penstocks in frequent use are inherently subject to a greater wear rate on the nut threads and this should be inspected at a minimum of 3 monthly intervals. When the wear becomes excessive the nut should be replaced. A quick check is to examine the amount of backlash in the threads by rotating the handwheel back and forth noting the angle of engagement from one direction to the other.

Rev4 130121

3. Penstocks in occasional use should have stems cleaned and re-greased at 6 monthly intervals.

4. It is recommended that penstocks be washed down and cleaned from grit and debris build up at 12 monthly intervals. This opportunity should also be used to inspect seals and other components for wear and damage and check bolt tension.

5. Upon each inspection it is important to ensure that each penstock will open and close fully. Cycling the penstock through its full stroke should form part of the maintenance schedule.

6. Infrequent use of a penstock can result in stiff operation. In this case all old grease must be removed from the stem threads with a suitable solvent and re-greased accordingly.

7. Electric actuators, bevel and spur gearboxes should be maintained in accordance with the manufacturer's standard instructions.

8. The recommended grease to lubricate stem threads and thrust bearings is Castrol EPL-2 grease or equivalent.

OPERATION AND MAINTENANCE INSTRUCTIONS FOR STOPGATES

General Operation

1. Stopgates are generally made from aluminium for its lightness and easy of handling. As such, aluminium is relatively soft and care should be taken when handling so as not to knock or drop the boards resulting in damage especially to the sealing edges and surfaces. Should boards be knocked or dropped they should be inspected for burrs, scratches and dents and treated with emery cloth or hand file accordingly prior to inserting into the frame as seals can be easily damaged by sharp irregularities.

2. Under no circumstances are boards to be dragged across any surface.

3. Segmented stopgates incorporate an intermediate cross seal. These are somewhat exposed at the corners and care should be taken in the same way so as not to damage these.

4. Stopgates are bidirectional in their sealing capabilities. That is, boards may be placed in either orientation provided they spatially fit in that orientation.

5. Stopgates should be inserted and removed under balanced head conditions. Attempting to remove the board under unbalanced head conditions will require significant extra force.

6. Ensure the correct size stopgate is used for the frame. Forcing a stopgate inside an incompatible frame will result in damage to both the frame seals and the board. Equally, placing a board of insufficient width inside a frame may result in the board jamming or failure of the board under hydrostatic loading.

7. Under no circumstance are boards to be dropped into place. This may result in damage to the bottom seal.

Rev4 130121

8. Inserting and removing segmented stopgates is a two man operation and the lifting ladders supplied should be used. Lifting ladders hook onto the lifting pins located at the top corners of each segment. Segments should be inserted and removed at a steady rate whilst keeping it level. Inserting or removing one side faster or slower than the other will result in the board segment jamming in the frame.

9. Larger stopgates requiring a crane lift are provided with lifting lugs for others D-shackle and slings to attach to. Boards must be lifted straight and vertically so as not to place undue stress into the frame, seals and board.

10. Do not lubricate the seals. The seal material is of wear resistant low friction material (UHMWPE). Applying grease will only entrap grit and debris into the seals which may cause damage.

Maintenance and Storage

1. After stopgates have been used they should be washed down, cleaned and stored away in an orderly fashion. The manufacturer can provide a purpose built storage frame for this upon request.

2. Check sealing edges and faces for burrs, scratches and dents. These can generally be treated with some emery cloth or hand file. It is important that these are attended to as the seals could be damaged.

3. If a purpose built storage frame is not used, stopgates should be stored with wooden chocks underneath to protect them from damage and secured appropriately to prevent wind blowing them over.

4. Segmented stopgates with intermediate cross seals should be stored out of direct sunlight to protect the seal from UV degradation.

5. It is recommended that stopgate frames be washed down and cleaned from grit and debris build up at 12 monthly intervals. This opportunity should also be used to inspect seals for wear and damage and check bolt tension.

HAMBAKER AWE Australian Water Engineers

SGS

Issue No. 3
Date: 1st June 2012

Inspection & Test Plan – Penstocks & Stopgates

Customer: QUEENSLAND WATER ALLIANCE	**Project:** LUGGAGE POINT INLET WKS		
Job No.: 13083-01-01 B	**Product:** 1850x2200 PENSTOCK		
	Comments	**Initial**	**Date**
Welder/Assembler			
Before fabrication:			
Materials accurately cut straight and cleaned	OK		3/2/14
Identify, review welding procedures	OK		"
Correct welding wire, gas, settings	OK		"
During fabrication:			
Flatness of door < 0.5mm (No abrupt changes)	OK		10/2/14
Flatness of frame (twisting) < 1mm	OK		12/2/14
Seal joints flush	OK		14/2/14
0.05mm Feeler Gauge	OK		"
Lay flat leakage test satisfactory (<50 drips/min)	OK		"
Open/close full cycle test satisfactory	OK		"
Quality Officer			
Welding to AS1554.6/AS1665	OK		3/2/14
Passivation acceptable	OK		14/2/14
Offseat leakage test required (Yes/No)	NO		"
Offseat leakage head	NA		"
Leakage at test head (max 0.1L/min/m of seal)	NA		"
Gearbox (if applicable)	ROTORK IQ20		"
Epoxy touched up if scratched	OK		"
316ss fasteners inserted	PACKER		"

Checked and Passed : _____ (Quality Officer) 17/2/14 (Date)

HAMBAKER AWE Australian Water Engineers

SGS

Issue No. 3
Date: 1st June 2012

Inspection & Test Plan – Penstocks & Stopgates

Customer: QUEENSLAND URBAN UTILITIES	**Project:** LUGGAGE P/T INLET WKS		
Job No.: 130853-01-01 B	**Product:** 1800 x 2200 PENSTOCK		
	Comments	**Initial**	**Date**
Welder/Assembler			
Before fabrication:			
Materials accurately cut straight and cleaned	OK		3/2/14
Identify, review welding procedures	OK		〃
Correct welding wire, gas, settings	OK		〃
During fabrication:			
Flatness of door < 0.5mm (No abrupt changes)	OK		10/2/14
Flatness of frame (twisting) < 1mm	OK		12/2/14
Seal joints flush	OK		16/2/14
0.05mm Feeler Gauge	OK		〃
Lay flat leakage test satisfactory (<50 drips/min)	OK		〃
Open/close full cycle test satisfactory	OK		〃
Quality Officer			
Welding to AS1554.6/AS1665	OK		3/2/14
Passivation acceptable	OK		16/2/14
Offseat leakage test required (Yes/No)	NO		〃
Offseat leakage head	N/A		〃
Leakage at test head (max 0.1L/min/m of seal)	N/A		〃
Gearbox (if applicable)	ROTORK IQ 20		〃
Epoxy touched up if scratched	OK		〃
316ss fasteners inserted	OK PACKED		〃

Checked and Passed : _____ (Quality Officer) 17/2/14 (Date)

HAMBAKER AWE Australian Water Engineers

SGS

Issue No. 3
Date: 1st June 2012

Inspection & Test Plan – Penstocks & Stopgates

Customer: QUEENSLAND URBAN	**Project:** LUGGAGE P/T INLET WKS		
Job No.: 13083-01-01	**Product:** 1850x2200 PENSTOCKS		
	Comments	**Initial**	**Date**
Welder/Assembler			
Before fabrication:			
Materials accurately cut straight and cleaned	OK		9/1/14
Identify, review welding procedures	OK		"
Correct welding wire, gas, settings	OK		"
During fabrication:			
Flatness of door < 0.5mm (No abrupt changes)	OK		23/1/14
Flatness of frame (twisting) < 1mm	OK		"
Seal joints flush	OK		"
0.05mm Feeler Gauge	OK		"
Lay flat leakage test satisfactory (<50 drips/min)	OK		"
Open/close full cycle test satisfactory	OK		"
Quality Officer			
Welding to AS1554.6/AS1665	OK		9/1/14
Passivation acceptable			23/1/14
Offseat leakage test required (Yes/No)	YES		"
Offseat leakage head	2200		"
Leakage at test head (max 0.1L/min/m of seal)			"
Gearbox (if applicable)	ROTORK IQ 20		"
Epoxy touched up if scratched	OK		"
316ss fasteners inserted	PACKED		"

Checked and Passed : _____ (Quality Officer) 27/1/14 (Date)

HAMBAKER AWE Australian Water Engineers

SGS

Issue No. 3
Date: 1st June 2012

Inspection & Test Plan – Penstocks & Stopgates

Customer: QUEENSLAND URBAN UTILITIES	**Project:** LUGGAGE PT INLET WKS
Job No.: 13083-01-01	**Product:** 1850 x 2200 PENSTOCKS

	Comments	Initial	Date
Welder/Assembler			
Before fabrication:			
Materials accurately cut straight and cleaned	OK		9/1/14
Identify, review welding procedures	OK		"
Correct welding wire, gas, settings	OK		"
During fabrication:			
Flatness of door < 0.5mm (No abrupt changes)	OK		23/1/14
Flatness of frame (twisting) < 1mm	OK		"
Seal joints flush	OK		"
0.05mm Feeler Gauge	OK		"
Lay flat leakage test satisfactory (<50 drips/min)	OK		"
Open/close full cycle test satisfactory	OK		"
Quality Officer			
Welding to AS1554.6/AS1665	OK		9/1/14
Passivation acceptable	OK		23/1/14
Offseat leakage test required (Yes/No)	NO		"
Offseat leakage head	NA		"
Leakage at test head (max 0.1L/min/m of seal)	NA		"
Gearbox (if applicable)	ROTORK IQ20		"
Epoxy touched up if scratched	OK		"
316ss fasteners inserted	PACKED		"

Checked and Passed : _____ (Quality Officer) 27/1/14 (Date)

rotork®
Controls

IQ Range IQ3

Instructions for Safe Use, Installation, Basic Setup and Maintenance

⚠ This manual contains important safety information. Please ensure it is thoroughly read and understood before installing, operating or maintaining the equipment.

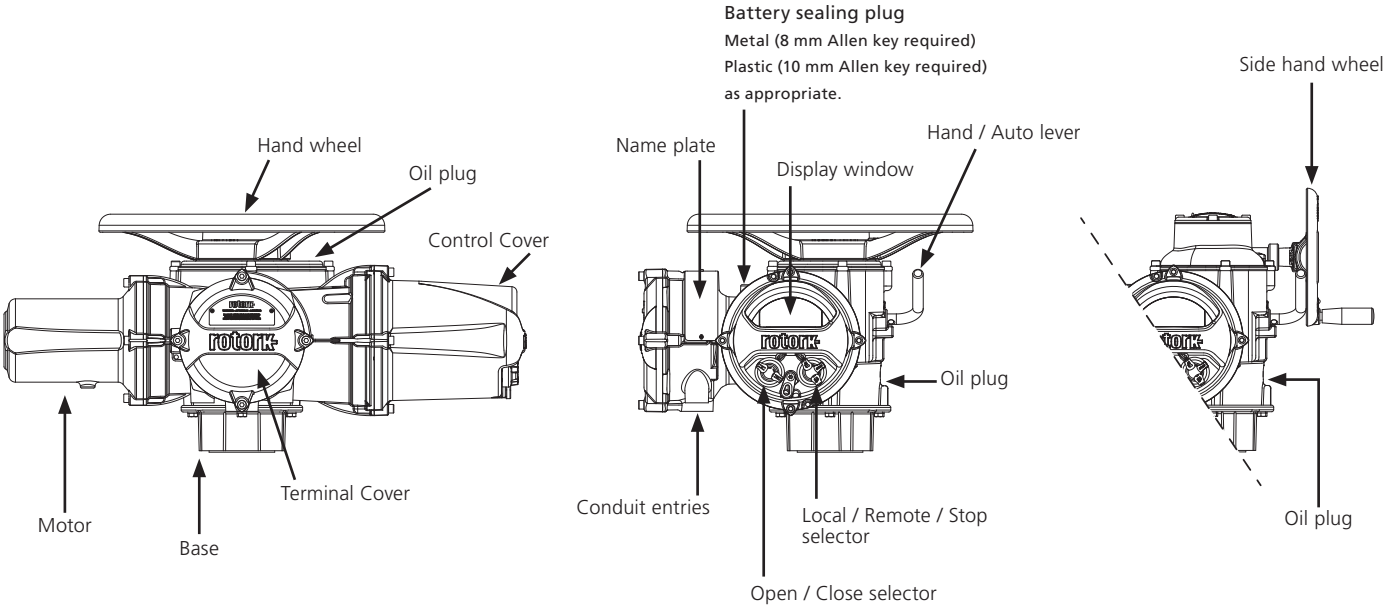
PUB002-039-00
Date of issue 07/12

CE

Table of Contents

1. Introduction

1.1 Identifying Actuator Parts



1.2 Rotork Setting Tool

The Rotork *Bluetooth*® Setting Tool Pro allows actuator control, indication and protection functions to be configured to suit site requirements. In addition, it also allows downloading of datalogger and uploading/downloading of configuration files. Files are transferred via Rotork Insight2.

It is essential that all the actuator settings are checked for compatibility with the valve, process and control system requirements before the actuator is put into service. Please read this publication.

Specification

Enclosure:

IP54

This Setting Tool *Pro* has been built in accordance with the following standards:

ATEX II I G, Ex ia IIC T4 Ga

IECEx – Ex ia IIC T4 Ga

USA - FM Int Safe Class I, Div 1, Groups A, B, C & D, T4

Canada - CSA Exia Int Safe, Class I, Div 1, Groups A, B, C & D, T4.

Temperature:

Tamb = -30 to +50 °C

The Rotork *Bluetooth*® Setting Tool Pro must only be fitted with the following types of Alkaline-Manganese or Zinc-Manganese, AAA size battery types:

Duracell, Coppertop, type MN2400

Energizer, type E92

Battery replacement must be carried out in a safe area. To replace the batteries remove the six socket head capscrews in the back of the setting tool and remove the back cover.

Operating range:

Infra-red 0.75 m.

Bluetooth up to 10 m.

The enclosure of the Rotork *Bluetooth*® Setting Tool Pro is manufactured from Polycarbonate, ABS Blend Polycarbonate and Silicon Rubber. If the Rotork *Bluetooth*® Setting Tool Pro is likely to come in contact with aggressive substances (e.g. solvents that may affect polymetric materials), then it is the responsibility of the user to ensure to take suitable precautions (e.g. regular checks as part of the routine inspections or establishing that the materials are resistant to the specific chemicals) that prevent it from being adversely affected, thus ensuring that the type of protection is not compromised.

Rotork Bluetooth® Setting Tool Pro

1.3 Introduction to this manual

This manual provides instruction on:

- Manual and electrical (local and remote) operation.
- Preparation and installation of the actuator onto the valve.
- Basic Commisioning.
- Maintenance.

Refer to Publication PUB002-045 for repair, overhaul and spare part instructions.

Refer to Publication PUB002-040 for secondary function configuration instructions.

Using the supplied Rotork *Bluetooth*® Setting Tool Pro to access the actuator set up procedures, non-intrusive setting of torque levels, position limits and all other control and indication functions can be made safely, quickly and conveniently, even in hazardous locations. The IQ allows commissioning and adjustment to be carried out with the main power supply to the actuator switched on or off.

The actuator containing the Setting Tool will be identified with a yellow label on the terminal cover.

Visit our web site at www.rotork.com for more information on the IQ, Insight2 and other Rotork actuator ranges.

2. Health and Safety

This manual is produced to enable a competent user to install, operate, adjust and inspect Rotork IQ range valve actuators. Only persons competent by virtue of their training or experience should install, maintain and repair Rotork actuators.

Work undertaken must be carried out in accordance with the instructions in this and any other relevant manuals. The user and those persons working on this equipment should be familiar with their responsibilities under any statutory provisions relating to the Health and Safety of their workplace. Due consideration of additional hazards should be taken when using the IQ range of actuators with other equipment. Should further information and guidance relating to the safe use of the Rotork IQ range of actuators be required, it will be provided on request.

The electrical installation, maintenance and use of these actuators should be carried out in accordance with the National Legislation and Statutory Provisions relating to the safe use of this equipment, applicable to the site of installation.

For the UK: Electricity at Work `Regulations 1989 and the guidance given in the applicable edition of the "IEE Wiring Regulations" should be applied. Also the user should be fully aware of his duties under the Health and Safety Act 1974. For the USA: NFPA70, National Electrical Code® is applicable.

The mechanical installation should be carried out as outlined in this manual and also in accordance with relevant standards such as British Standard Codes of Practice. If the actuator has nameplates indicating that it is suitable for installation in hazardous areas then the actuator may be installed in Zone 1, Zone 21, Zone 2 and Zone 22 (or Div 1 or Div 2, class I or Class II) classified hazardous area locations only. It should not be installed in hazardous area locations with an ignition temperature less than 135 °C, unless suitability for lower ignition temperatures has been indicated on the actuator nameplate.

It should only be installed in hazardous area locations compatible with the gas and dust groups stated on the nameplate.

The electrical installation, maintenance and the use of the actuator should be carried out in accordance with the code of practice relevant for that particular Hazardous Area certification.

No inspection or repair should be undertaken unless it conforms to the specific hazardous area certification requirements. Under no circumstances should any modification or alteration be carried out on the actuator as this could invalidate the actuators hazardous area approval certification. Access to live electrical conductors is forbidden in the hazardous area unless this is done under a special permit to work, otherwise all power should be isolated and the actuator moved to a non-hazardous area for repair or attention.

⚠ WARNING: Motor Temperature

Under normal operation the temperature of actuator's motor cover surfaces can exceed 60 °C above ambient.

⚠ WARNING: Surface Temperature

The installer/user must ensure that the actuator surface temperature rating is not influenced by external heating/ cooling effect (e.g. valve/pipeline process temperatures).

⚠ WARNING: Thermostat Bypass

If the actuator is configured to bypass the motor thermostat then the hazardous area certification will be invalidated. Additional electrical hazards may occur when using this configuration. The user should ensure that any necessary additional safety measures are considered.

⚠ WARNING: Control and Indication

Where the actuator build allows remote control and indication supplies higher than 150 VAC but below 300 VAC (refer to actuator wiring diagram), the actuator installation altitude must be restricted to less than 2,000 m as defined by BSEN 61010 or IEC 61010 (Safety Requirements For Electrical Equipment for measurement, control and laboratory use).

⚠ WARNING: Enclosure Materials

IQ Range of actuators are manufactured from aluminium alloy with stainless steel fasteners and the thrust bases are manufactured in cast iron.

The cover window is toughened glass which is retained with a 2-part silicone cement and the battery plug will be either stainless steel or PPS (Poly-Phenolyne Sulfide).

The user must ensure that the operating environment and any materials surrounding the actuator cannot lead to a reduction in the safe use of, or the protection afforded by, the actuator. Where appropriate the user must ensure the actuator is suitably protected against its operating environment.

⚠ WARNING: Operating by Hand

With respect to handwheel operation of Rotork electric actuators, refer to section 4.1.

⚠ WARNING: Actuator may start and operate when remote is selected. This will be dependent on remote control signal status and actuator configuration.

2.1 ATEX/IECFM Certified Actuators

Special Conditions

This actuator must only be located in areas where the risk of impact to the viewing window is low.

This equipment includes some exterior non-metallic parts including the protective coating. To avoid the possibility of static build up, cleaning must only be carried out with a damp cloth.

⚠ WARNING: External Enclosure Fasteners

Enclosure fasteners are stainless steel grade A4 80 except for the following sizes and when marked on the nameplate as shown. In these cases the terminal cover fasteners are carbon steel grade 12.9. If in doubt check the grade marked on the relevant fastener or contact Rotork.

Actuator Size: IQ/IQM/IQS 20 & 35 or IQ/IQM 25

Ex d IIB T4 Gb (-30°C to +70°C)

Ex d IIB T4 Gb (-40°C to +70°C)

Ex d IIB T4 Gb (-50°C to +40°C)

Certificate No: SIRA 12ATEX1123X or IECEx SIR 12.0047X

Actuator Size: IQ/IQM 20 & 25 or IQS20

Model: IQ3FM - Explosionproof, Class I, Div 1, Groups B, C, D

FM Approved

3. Storage

If your actuator cannot be installed immediately, store it in a dry place until you are ready to connect incoming cables.

If the actuator has to be installed but cannot be cabled it is recommended that the plastic transit cable entry plugs are replaced with metal plugs which are sealed with PTFE tape.

The Rotork double-sealed construction will preserve internal electrical components perfectly if left undisturbed.

It is not necessary to remove any electrical compartment covers in order to commission the IQ actuator.

Rotork cannot accept responsibility for deterioration caused on-site once the covers are removed.

Every Rotork actuator has been fully tested before leaving the factory to give years of trouble free operation, providing it is correctly commissioned, installed and sealed.

4. Operating your IQ Actuator

4.1 Operating by Hand

⚠ **WARNING**

With respect to handwheel operation of Rotork electric actuators, under no circumstances should any additional lever device such as a wheel-key or wrench be applied to the handwheel in order to develop more force when closing or opening the valve as this may cause damage to the valve and/or actuator or may cause the valve to become stuck in the seated/ backseated position.

Keep clear of the handwheel when engaging hand operation. Actuators driving valves via extension shafts may be subject to retained shaft torsion which can cause the handwheel to rotate when hand operation is engaged.

⚠ To engage handwheel drive depress the Hand/Auto lever into "Hand" position and turn the handwheel to engage the clutch. The lever can now be released where it will return to its original position. The handwheel will remain engaged until the actuator is operated electrically when it will automatically disengage and return to motor drive.

If required for local lockout purposes the Hand/Auto lever can be locked in either position using a padlock with a 6.5 mm hasp.

Locking the lever in the "hand" position prevents electrical operation of the actuator moving the valve.

4.2 Operating Electrically

Check that power supply voltage agrees with that on the actuator nameplate. Switch on power supply. It is not necessary to check phase rotation.

⚠ **Do not operate the actuator electrically without first checking, using the infra-red Setting Tool, that at least the Basic Settings have been made** *(refer to Section 8)***.**

Selecting Local/Stop/Remote Operation

The red selector enables either Local or Remote control, lockable in each position using a padlock with a 6.5 mm hasp.

When the selector is locked in the Local or Remote positions the Stop facility is still available. The selector can also be locked in the Stop position to prevent electrical operation by Local or Remote control.

Fig. 4.2.1 IQ3 Local Controls

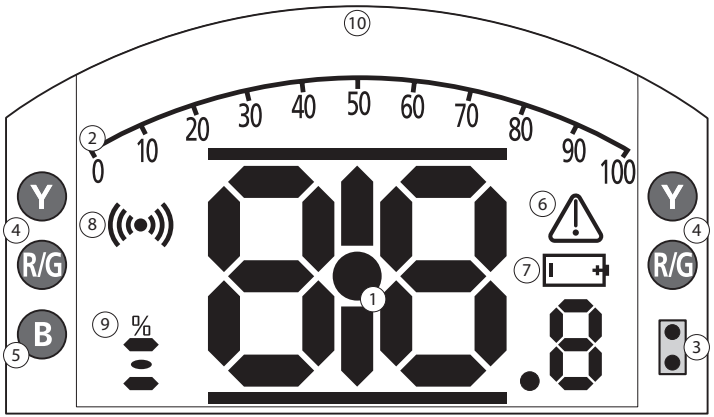
Local Control

With the red selector positioned at Local (anti-clockwise) the adjacent black knob can be turned to select Open or Close. For Stop, turn red knob clockwise.

Remote Control

Rotate the red selector to the Remote position (clockwise), this allows remote control signals to operate the actuator. Local Stop can still be used by turning the red knob anti-clockwise.

4.3 Display - Local Indication



LED INDICATION: R = RED, G = GREEN, Y = YELLOW, B = BLUE

Fig. 4.3.1 Segment Display

1. Position display

This is the main segment display for position and torque; position indication to 1 decimal place.

2. Analogue Scale

Scale 0% to 100% is used when Analogue torque (% of rated) or Positioning (% position / demand) homescreens are selected. Refer to section 4.4.

3. Infra-red LEDs

Used for older models of setting tool and to initiate a data connection using *Bluetooth* wireless technology.

4. Dual position LEDs

Consisting of 2 x Yellow for mid position and 2 x bi-colour (Red / Green) for end of travel indication.

5. *Bluetooth* indication LED

A dual intensity LED for indicating an active connection using *Bluetooth* wireless technology.

6. Alarm Icon

This will be displayed for valve, control and actuator alarms. Alarm indication is supported by fault description in the text in the line above the main display.

7. Battery Alarm Icon

This icon will be displayed when a battery is detected as low or discharged. "Battery low" or "Discharged" will also be displayed in the text display above.

8. Infra-Red Icon

This icon flashes during setting tool communication activity. LEDs will also flash when keys are pressed.

9. Percentage Open Icon

This icon will be displayed when an integer open value is displayed e.g. 57.3.

10. Dot Matrix Display

A high resolution 168x132 pixel display for displaying setup menus and datalogger graphs.

When a positional display is active, the status and active alarms will be displayed.

The LCD screen is made up of two layers; the main segment display and the dot matrix display. The displays are dual stacked so that either display can be enabled to show different information. This also allows a combination of both displays for added flexibility.

On power the LCD is backlit with a white light to enable the best viewing contrast in all lighting conditions. For additional positional indication, the LEDs at either side of the LCD are used for Closed (green), mid-travel (yellow) and Open (red) as standard. These LEDs are fully configurable in the settings menu or on request at time of order.

4.4 Display – Home screen selection

The actuator display can be set to show any one of the following home screens:

- Position indication
- Position & Digital Torque indication
- Position & Analogue Torque indication
- Position & Control Demand indication

The default home screen is Position. Home screens indicate the live conditions measured by the actuator when mains power is applied. When mains power is switched off the actuator battery powers the display and it will show the position indication display only.

The required home screens can be set by the user either as a permanent display or as a temporary display for valve or actuator operational analysis.

Temporary Home Screen display.

Using the setting tool (refer to 8.1) or arrow keys, scroll through the available home screens until the required one is displayed. The selected screen will remain displayed for approximately 5 minutes after the last setting tool command or until the actuator power is cycled.

Permanent Home Screen display.

Using the setting tool (refer to 8.1) connect to the actuator.

From the **Settings** menu, select **Indication**, **Local Display**. From the available settings, select **Home Screen**. Enter the password if requested (refer to section 8.2), select Home screen and from the dropdown list, select the required Home screen for permanent display:

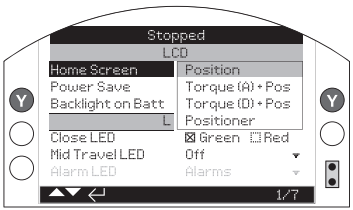


Fig. 4.4.1 Home Screen Selection

Position - Default valve position display

Torque (A) + Pos - Position with analogue torque indication

Torque (D) + Pos - Position with digital torque indication

Positioner - Position with digital and analogue position demand indication

Once selected, the set display will be the active, permanent home screen. Refer to Figs 4.4.2 to 4.4.5.

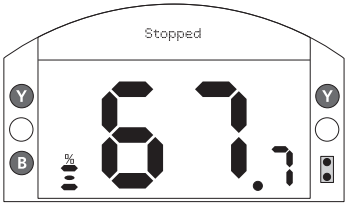


Fig. 4.4.2 Position

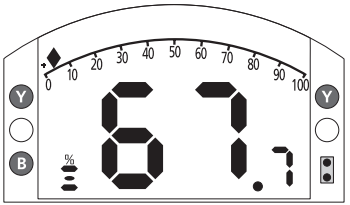


Fig. 4.4.4 Torque (A) + Position

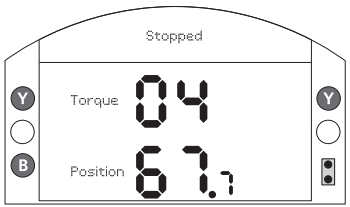


Fig. 4.4.3 Torque (D) + Position

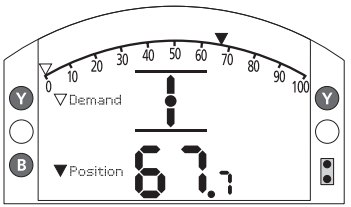


Fig. 4.4.5 Positioner

4.5 Display Status Indication – Travel

The IQ display provides real-time status indication. The top line of the text area is reserved for travel status indication.

Fig 4.5.1 shows the travel status example of **CLOSED LIMIT**

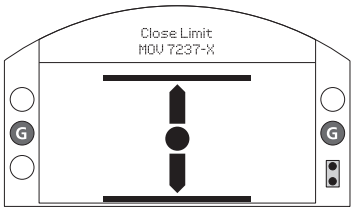


Fig. 4.5.1

4.6 Display Status Indication – Control

The bottom line of the text area is reserved for control status indication and is displayed for approximately 2 seconds after the control mode or signal is applied.

Fig 4.6.1 shows the control status example **Remote Control**.

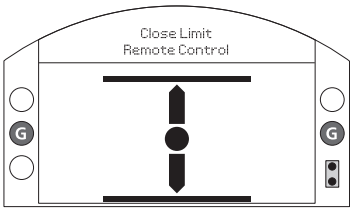


Fig. 4.6.1

4.7 Display Alarm Indication

The IQ display provides alarm indication in the form of text and alarm icons.

There are 2 alarm icons:

General Alarm:

Battery Alarm:

The general alarm icon will be supported with text in the bottom line indicating the particular alarm, or if more than one is present, each alarm will be displayed in sequence.

Fig 4.7.1 shows the status example: **TORQUE TRIP CLOSED**

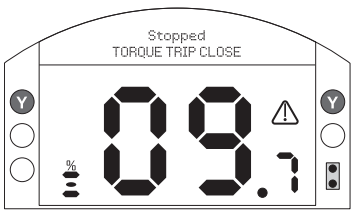


Fig. 4.7.1

4.8 Battery Alarm

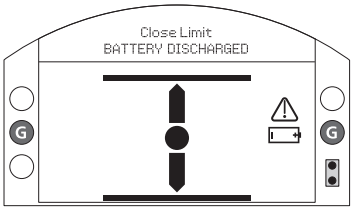


Fig. 4.8.1

The actuator checks the battery level at approximately 1 hour intervals. The battery alarm icon is displayed when the actuator detects its battery as being low and the display will indicate **BATTERY LOW**. If the battery is flat or missing the display will indicate **BATTERY DISCHARGED**.

When a low or discharged battery alarm is displayed the battery should be replaced immediately. It is essential that the correct battery type is fitted to maintain actuator certification. Refer to section 9 for details.

After replacing a battery the alarm icon will continue to be displayed until the next check and may take up to 1 hour. Cycling the power will force a battery check and clear the alarm.

5. Preparing the Drive Bush

5.1 IQ base all sizes types A and Z3

Turn actuator onto its side, remove the cap-headed screws holding retaining plate (1) onto the thrust base and pull out the drive bush (2) complete with its bearing assembly (3). Size IQ10 to 35 have 2 screws, size IQ40 to 95—F25 bases have 8 screws, and F30 have 10 screws. Before machining the drive bush the thrust bearing must be removed.

IQ10 to 18 actuators have a sealed thrust bearing located on the drive bush and retained by the split collar (4) and snap ring (5).

IQ 20 to 95 have a thrust race bearing within a steel bearing housing located on the drive bush and retained by the split collar (4) and snap ring (5). The bearing is sealed within its housing by O-rings located on the drive bush and the bearing spacer ring (6).

⚠ WARNING: Failure to remove the bearing assembly and O-rings from the drive bush prior to machining may result in damage to the bearing.

Disassembly of bearing assembly all sizes

Locate and remove the snap ring (5) using a suitable tool. Remove the split collar (4) See Fig. 5.1.1. Slide the bearing (3) off the drive bush (2).

Note Additional spacer (6) and O-rings to remove on sizes IQ20 to 95.

Keep the bearings and drive bush locating components in a safe clean place. The split collar (4) must be kept as a matched pair.

Machine the drive bush (2) to suit the valve stem, allowing a generous clearance on the screw thread for rising steam threads.

Fig. 5.1.1

Fig. 5.1.2 F10 base assembly

Fig. 5.1.3 F14 & F16 base assembly

Fig. 5.1.4 F25 & F30 base assembly

Reassembly

⚠ WARNING: Failure to fully clean and grease the drive bush and O-rings before reassembly could result in damage.

Remove all swarf from the drive bush (2) ensuring all O-rings are undamaged, clean and greased (for typical greases refer to Section 11, weights and measures).

Slide the bearing assembly (3) onto the drive bush (2) and ensure it is fitted down to the drive bush shoulder. On size IQ20 to IQ95 refit bearing spacer ring (6) into bearing assembly ensuring O-ring is fitted and greased. Grease and refit matched pair split collar (4) and snap ring (5).

Grease and refit the drive bush bearing assembly into the thrust base housing on the actuator, ensuring that the slots in the drive bush are located into the drive dogs of the hollow output shaft.

Refit the retaining plate (1) and secure with cap headed screws. For IQ40 to IQ95 tighten base retaining screws to the following torque values:

F25 / FA25 Base — 8 off / M12 cap head screws: 89 Nm / 65 lbsft

F30 / FA30 Base — 10off / M16 cap head screws: 218 Nm / 160 lbsft

5.2 Non-Thrust Base Type B

All Sizes

Undo the hex head bolts securing the base plate to the gearcase and remove the base plate.

The drive bush and its retaining clip can now be seen. The plate will vary with the size of the actuator. See Fig. 5.2.1.

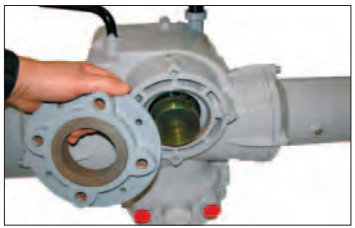


Fig. 5.2.1

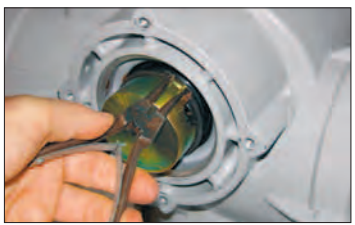


Fig. 5.2.2

Types B3 and B4 Removal

Using external circlip pliers, expand the circlip while pulling on the drive bush. The drive bush will detach from the actuator centre column with the circlip retained in its grove. Refer to Fig. 5.2.2.

Types B1 Removal

The procedure for removal and refitting of the B1 drive bush is the same as for B3 and B4, however the circlip is replaced with a custom spring circlip. The spring operates in the same manner as the B3/B4 circlip but is expanded using long nose-pliers. Refer to Fig. 5.2.3.

Fig. 5.2.3

6. Mounting the Actuator

⚠ Refer to Section 11 Weights and Measures for actuator weight.

Ensure the valve is secure before fitting the actuator as the combination may be top heavy and therefore unstable.

If it is necessary to lift the actuator using mechanical lifting equipment certified slings should be attached as indicated in Fig. 6.2.1 for vertical shafts and Fig. 6.2.2 for horizontal shafts.

At all times trained and experienced personnel should ensure safe lifting particularly when mounting actuators.

⚠ WARNING: The actuator should be fully supported until full valve shaft engagement is achieved and the actuator is secured onto the valve flange.

A suitable mounting flange confirming to ISO 5210 or USA Standard MSS SP101 must be fitted to the valve.

Actuator to valve fixing must confirm to Material specification ISO Class 8.8, yield strength 628 N/mm^2.

⚠ WARNING: Do not lift the actuator and the valve combination via the actuator. Always lift the valve/actuator assembly via the valve.

Each assembly must be assessed on an individual basis for lifting.

Fig. 6.2.1

Fig. 6.2.2

6.1 Rising Stem Valves Top Mounted

Fitting the Actuator and Base as a combined unit, all sizes.

Fit the machined drive bush into the thrust base as previously described, lower the actuator onto the threaded valve steam, engage **HAND** operation and wind the hand wheel in the open direction to engage the drive bush onto the stem. Continue winding until the actuator is firmly down onto the valve flange. Wind two further turns, fit securing bolts and tighten fully to the required torque indicated in Table B.

Fitting Thrust Base to Valve Actuator

Fit the machined drive bush into the thrust base as previously described. Remove the thrust base from the actuator, place it on the threaded valve stem with the slotted end of the drive bush uppermost and turn it in the open direction to engage the thread. Continue turning until the base is positioned onto the valve flange. Fit the securing bolts but do not tighten at this stage. Lower the actuator onto the thrust base and rotate the complete actuator until the drive dogs on the actuator output shaft engage into the drive bush. Actuator flange should now be flush with the base.

Continue to turn actuator until fixing holes align. Using bolts supplied fix actuator to thrust base and tighten down to required torque, see table A.

Open valve by two turns and firmly tighten down onto valve flange to the required torque, see table B.

Fig. 6.1.1

Size	Torque (±10%)	
	Nm	lbs. ft
M8	13.8	9.8
M12	45.9	33.8
M16	101	74

Fig. 6.1.2 Table A

Imperial Size	Torque	
	Nm	lbs. ft
1/4	12.1	9
5/16	24.3	17.9
3/8	42.3	31.2
7/16	67	49.4
1/2	103.2	76.1
9/16	147.4	108.7
5/8	205.3	151.4
3/4	363.6	268.1
7/8	585	431.5
1	877.3	647.1
Metric Size	**Torque**	
	Nm	lbs. ft
M5	6.2	4.6
M6	10.8	7.9
M8	26.1	19.3
M10	51.6	38
M12	89.2	65.8
M16	219.8	162.1
M20	430.5	317.5
M24	736.8	543.4

Fig. 6.1.3 Table B

6.2 Valve with Gearbox – Side Mounting

Check that the mounting flange is at right angles to the input shaft, and that the drive bush fits the shaft and key with adequate axial engagement. Engage **HAND**, offer up actuator to the input shaft and turn handwheel to align keyway and key. Tighten mounting bolts to the required torque indicated in Table B.

6.3 Non-Rising Stem Valves – Top Mounting

Treat as for side mounting except that when thrust is taken in the actuator, a thrust nut must be fitted above the drive bush and securely tightened.

6.4 Handwheel Sealing

Ensure that the sealing cap and O-ring is fitted securely to ensure that moisture does not pass down the centre column of the actuator. For valves with rising spindles a spindle or cover tube may be fitted, this will also be sealed with an O-ring and secured with cap screws.

Fig. 6.4.1

Fig. 6.4.2

6.5 IQM Modulating Actuators

The IQM range of actuators are suitable for modulating control duty of up to 1,200 starts per hour.

IQM have a dynamic breaking facility as standard. If mechanical overrun of the actuator and valve prove to be excessive for accurate control, the brake can be enabled. With dynamic breaking enabled, motor heating effects increase and therefore the number of starts may require reducing to prevent motor thermostat tripping.

Commissioning of the IQM range is identical to the standard IQ - refer to Section 8.

6.6 IQL & IQML Linear Drive Unit

Consists of a lead screw assembly arrangement attached to the base of the actuator in order to provide a linear output stroke between 8 mm (3/4 in) minimum and 110 mm (4 1/4 in) maximum.

The IQL/IQML actuator can be supplied with or without a yoke mounting adaptor. The adaptor consists of four pillars and a base flange to suit the valve.

Fig. 6.6.1 IQML with Yoke

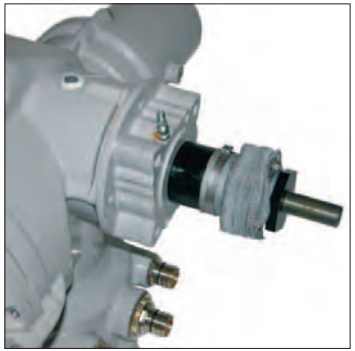


Fig. 6.6.2 IQML without Yoke

6.7 IQL & IQML Adjusting Linear Stroke

With the actuator securely fitted to the valve, but with the linear drive disconnected ensure valve is at its fully closed (down) position.

Remove cover tube from actuator handwheel, locate the down stop adjustment on the linear drive unit and with two spanners loosen the lock nut, run the lock nut and tubular down stop anti-clock wise to the end of the thread.

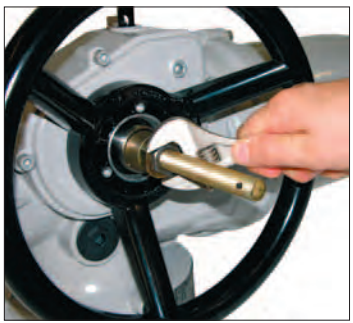


Fig. 6.7.1

Turn the actuator handwheel clockwise, the linear drive will move down towards the valve spindle and couple the linear drive to valve spindle. Turn the tubular down stop clockwise into the actuator until it comes to a mechanical stop. If the valve must close into its seat by TORQUE ACTION then back off (anticlockwise) the down stop by one third of one turn (equivalent to 1mm). Run the lock nut down onto the tubular down stop and tighten with two spanners. There is no UP STOP (open) on the linear drive unit, the mechanical stop in the valve will give this position. Refit the cover tube onto the handwheel ensuring the O-ring is fitted.

The linear drive unit is pre-packed with extreme pressure multi-purpose grease MULTIS MS2, use this or an equivalent high temperature grease.

A grease nipple is situated in the base of the actuator to enable lubrication of the lead screw.

Periodically, depending on usage and temperature, apply two pumps of the grease gun.

7. Cable Connections

⚠ WARNING: Ensure all power supplies are isolated before removing actuator covers.

Check that the supply voltage agrees with that stamped on the actuator nameplate.

A switch or circuit breaker must be included in the wiring installation or the actuator. The switch or circuit breaker must be mounted as close to the actuator as possible and shall be marked to indicate that it is the disconnect device for that particular actuator. The actuator must be protected with overcurrent protection devices rated in accordance with publication PUB002-046. Electric motor performance data for IQ range actuators.

⚠ WARNING: Actuators for use on phase to phase voltages greater than 600 V must not be used on supply systems such as floating, or earth-phase systems, where phase to earth voltages in excess of 600 VAC could exist.

7.1 Earth/Ground Connections

A lug with a 6 mm diameter hole is cast adjacent to the conduit entries for attachment of an external protective earthing strap by nut and bolt. An internal earth connection is also provided however it must not be used alone as the protective Earth Connection.

7.2 Removing Terminal Cover

Using a 6 mm Allen key loosen the four captive screws evenly. Do not attempt to lever off the cover with a screw driver this will damage the O-ring seal and may damage the flamepath on a certified unit.

Fig. 7.2.1

Actuators containing a Rotork *Bluetooth* Setting Tool Pro fitted inside of the terminal compartment are identified with a self-adhesive yellow label on the outside of the terminal compartment cover.

The wiring code card fixed in the cover is particular to each actuator and must not be interchanged with any other actuator. If in doubt check the serial number on the code card with that of the actuator.

A plastic bag in the terminal compartment contains:

- Terminal screws and washers.
- Spare cover O-ring seal.
- Wiring diagram.
- Instruction book.

Fig. 7.2.2 Actuator containing Rotork Bluetooth® Setting Tool Pro.

7.3 Cable Entry

Only appropriate certified explosion proof cable glands or conduit may be used in hazardous locations. The cable entries in the actuator are tapped M25 x 1.5p or M40 x 1.5p.

In hazardous locations, only one appropriate certified Explosion-Proof thread adaptor per entry may be used.

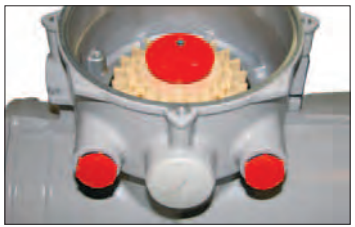


Fig. 7.3.1

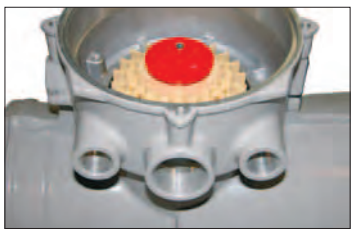


Fig. 7.3.2

Remove plastic transit plugs. Make cable entries appropriate to the cable type and size.

Ensure that threaded adaptors, cable glands or conduit are tight and fully waterproof. Seal unused cable entries with steel or brass threaded plug. In hazardous areas an appropriate certified threaded blanking plug must be installed at the cable entry without the use of an interposing thread adaptor.

7.4 Connecting to Terminals

Field wiring connections are by wire termination ring/spade tags (refer to Ex "e" enclosures below for required method) secured with the supplied 4 mm (control and indication) and 5 mm (power) pan head screws.

⚠ To ensure secure electrical connections, it is important that the requisite washers are used as shown in Figure 7.4.1. Failure to do so may result in connections working loose or screws not clamping down on wire termination tags. Spring washers must be compressed. Screw tightening torques must not exceed 1.5 Nm (1.1 lbf.ft)

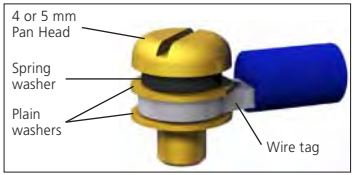


Fig. 7.4.1

⚠ On Ex "e" certified terminal enclosures, connections to the power and control terminals must be made using AMP type 160292 ring tags, for power and earth terminals and AMP type 34148 ring tabs for control terminals.

Refer to the wiring diagram inside the terminal cover to identify functions of terminals. Check the supply voltage is the same as that marked on the actuator nameplate.

Remove power terminal guard.

Begin by connecting power cables and replace guard.

When all connections are made ensure wiring diagram is replaced in the terminal compartment.

7.5 Replacing Terminal Cover

Ensure cover O-ring seal and spigot joint are in good condition and lightly greased before refitting cover.

ATTENTION: RED PLASTIC PLUGS IN CONDUIT ENTRIES ARE FOR TRANSIT ONLY. FOR LONG TERM PROTECTION FIT SUITABLE METAL PLUGS.

ATTENZIONE: I TAPPI IN PLASTICA ROSSA PER L'ENTRATA CAVI SONO SOLO TEMPORANEI. PER UNA PROTEZIONE PERMANENTE PREGO SOSTITUIRLI CON APPOSITI TAPPI METALLICI.

ATENCION: LOS TAPONES ROJOS DE PLASTICO EN LAS ENTRADAS DE CABLE SON UNICAMENTE PARA TRANSPORTE. PARA PROTECCION PERMANENTE COLOCAR TAPONES METALICOS APROPIADOS.

ACHTUNG: DIE ROTEN PLASTIKSTOPFEN SIND NUR FÜR DEN TRANSPORT GEEIGNET. FÜR DAVERHAFTEN SCHUTZ SIND DIESE GEGEN GEEIGNETE BLINDSTOPFEN AUSZÜTAUSCHEN.

ATTENTION: LES BOUCHONS PLASTIQUES ASSURENT UNE PROTECTION TEMPORAIRE. POUR UNE PROTECTION DEFINITIVE UTILISER DES BOUCHONS METALLIQUES.

注意：コンジットロの赤色プラグは、輸送用を目的としたプラグです。
長期に渡る保護の場合、適切なメタルプラグをご使用ください。

注意: 接线端红色塑料封口仅为运输途中使用。
长期正常保护时请用金属封口。

주의: 배선인입구의 빨간색 플라스틱 플러그는 오직 임시용입니다.
오래 보관하기 위해서는 규격에 맞는 금속 플러그를 사용하십시오.

8. Commisioning - Basic Settings

All actuator settings, Datalogger and asset management data is accessed using the supplied Rotork *Bluetooth*® Setting Tool Pro. Status and alarm data in addition to that shown on the home screen can also be accessed.

THE CONTROL COVER MUST NOT BE REMOVED; NO USER CONFIGURABLE SETTINGS ARE AVAILABLE WITHIN THE CONTROL ENCLOSURE. THE CONTROL COVER IS SEALED BY A QUALITY LABEL WHICH IF BROKEN MAY INVALIDATE WARRANTY.

This instruction details the basic settings that must be completed before the actuator is put into service.

ELECTRICAL OPERATION MUST NOT TAKE PLACE UNTIL THE BASIC SETTINGS HAVE BEEN MADE AND CHECKED.

The basic settings affect the correct operation of the valve by the actuator. If the actuator has been supplied with the valve, the valvemaker or supplier may have already made these settings.

⚠ Settings and operation must be verified by electric operation and function test of the actuated valve.

THIS PUBLICATION PROVIDES INSTRUCTION ON MAKING THE BASIC SETTINGS ONLY.

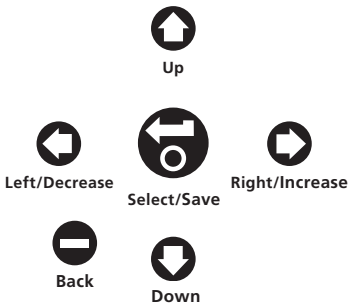
For instruction on control and indication settings and for information on diagnostics refer to PUB002-040.

8.1 Connecting to the Actuator

The Rotork Setting Tool incorporating *Bluetooth* wireless technology (Rotork *Bluetooth*® Setting Tool Pro – BTST) is shown below. It is identified by the key symbols being clear and a clear seal between the top and bottom casings.

The Infra-red only tool has filled yellow keys and a yellow seal between casings.

The Rotork *Bluetooth*® Setting Tool Pro with the relevant navigation and configuration keys is shown below.



Connecting to the actuator using *Bluetooth*

The default security set in the actuator for *Bluetooth* connection is by initiation using an infra red command. This means that the user must be in close proximity and in direct line of sight of the actuator.

Point the setting tool at the actuator display window within a range 0.25 m (10 in) and Press ⬇ key.

The screen will change to the Main Menu screen.

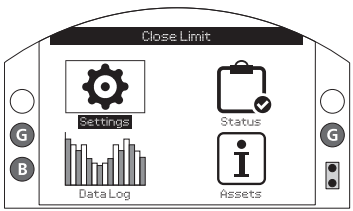


Fig. 8.1.1

The Setting Tool will automatically connect using *Bluetooth* which takes up to 5 seconds and when connected will be indicated by blue lights illuminating on the tool and in the actuator display window. Once connected, the tool can be used without pointing it at the actuator display window.

Bluetooth connection will be maintained while setting tool key commands are made. After a period of 6 minutes with no key commands, *Bluetooth* connection will be turned off and the Setting tool and display blue lights will go out. To manually turn off *Bluetooth* connection at any time, press the setting tool ⊖ and ⊕ keys together.

8.2 Security - Password

The default security level for connecting to the actuator is by infrared *Bluetooth* initiation. This requires that the user is at the actuator within 0.25 metre distance and in direct line of sight of the display. For instruction on connecting to the actuator refer to 8.1.

All actuator settings can be viewed with the actuator selected to Local, Stop or remote.

To change an actuator setting, the actuator must be selected to Local or Stop and a correct password entered.

If the actuator is selected to Remote and a setting is selected, the following warning will be displayed:

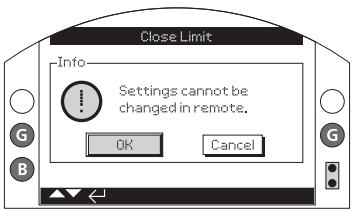


Fig. 8.2.1

Select OK to return to settings screen.

With the actuator selected to Local or Stop and when any function is selected, the Password screen will be displayed:

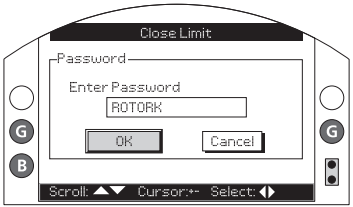


Fig. 8.2.2

The factory set default password ROTORK is displayed and the OK key is highlighted.

Press the key.

The setting screen will again be displayed. The example below shows ***Settings – Limits – Close Settings*** with the function ***Action*** highlighted:

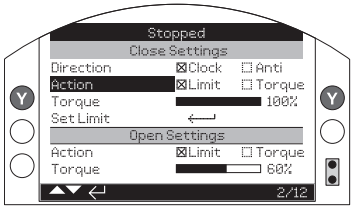


Fig. 8.2.3

Press the key to select.

The function and its setting option or range will then be highlighted:

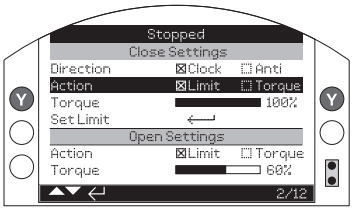


Fig. 8.2.4

If the user does not wish to change the function value, press the back button to escape without changing.

Use the ◀ or ▶ arrow keys to change the setting to the required value, the example below show a close action of ***Torque*** having been selected.

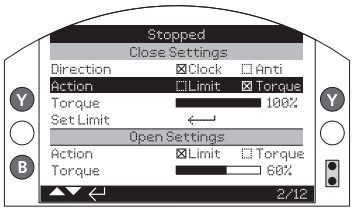


Fig. 8.2.5

Press the ● key to select.

The highlight will return to the function name only and its stored setting will be displayed:

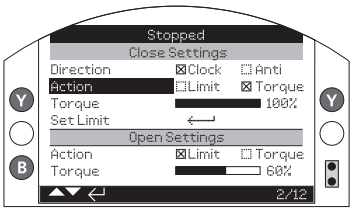
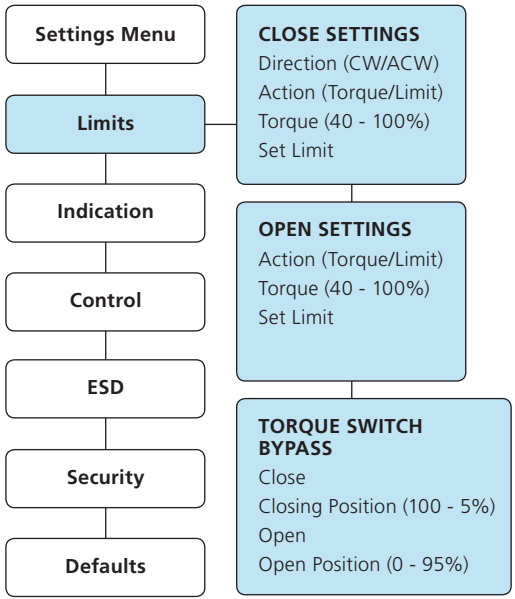


Fig. 8.2.6

The password will be requested the first time a function is selected. Once correctly entered, the password will not be required to be entered again for the duration of setting tool communication with the actuator. Other functions can be set as required.

8.3 Basic Settings Menu



8.4 Basic Settings – Limits

⚠ Settings and operation must be verified by electric operation and function test of the actuated valve.

Connect to the actuator as described in Section 8.1. From the Position display home screen press the ○ key. The main menu will be displayed.

Navigate to Settings using the ○ ○ ○ ○ keys and press ○ to select.

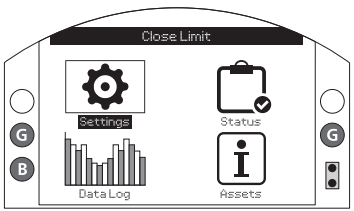


Fig. 8.4.1

The settings menu will be displayed:

Settings
Limits
Indication
Control
ESD
Security
Defaults

Navigate to Limits using the ○ ○ keys and press ○ to select.

The setting first selected to be changed will require a password to be entered – refer to section 8.2.

The limit settings are shown below with their factory default values:

	Limits				
	Close Settings				
1 / 12	Direction	☒	Clock	☐	Anti
2 / 12	Action	☒	Limit	☐	Torque
3 / 12	Torque	■■■■■			40%
4 / 12	Set Limit				
	Open Settings				
5 / 12	Action	☒	Clock	☐	Anti
6 / 12	Torque	☒	Limit	☐	Torque
7 / 12	Set Limit	■■■■■			40%
8 / 12	Turns Set	25			
	Torque Switch Bypass				
9 / 12	Opening	☐	On	☒	Off
10 / 12	OP. Bypass Pos	■			10%
11 / 12	Closing	☐	On	☒	Off
12 / 12	CL. Bypass Pos	■			90%
	▲ ▼ ↵				1 / 12

Function Close Direction (1 / 12) is shown highlighted. Use ○ ○ to scroll through functions. Functions will be highlighted in turn.

8.5 Close Settings

1 / 12. Close Direction

Function sets the direction required to close the valve. Manually operate the actuator and valve to establish closing direction.

Press to select Close Direction function. Use or to check required setting. Press to set.

2 / 12. Close Action

The actuator can be configured close on torque for seating valve types or limit for non-seating valve types.

⚠ Refer to Valve manufacturer for recommended setting. In the absence of valvemaker instruction refer to the following table.

Valve Type	Close Action	Open Action
Wedge gate	Torque	Limit
Globe	Torque	Limit
Butterfly	Limit	Limit
Through Conduit	Limit	Limit
Ball	Limit	Limit
Plug	Limit	Limit
Sluice gate	Limit	Limit
Penstock	Limit	Limit
Parallel Slide	Limit	Limit

Press to select Close Action function. Use or to check required setting. Press to set.

3 / 12. Close Torque

The value of torque available to close the valve can be set between 40% and 100% of rated. The actuator rated torque value is shown on its nameplate.

Press to select Close Torque function. Use key to decrease value and key to increase value.

Press key to set.

4 / 12 Set Close Limit

Press to select Close Limit Function. The actuator will display the following Instruction:

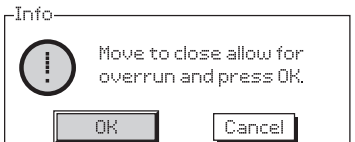


Fig. 8.5.1

Move the actuator and valve to the close position. Allow for overrun by winding the open by ½ to 1 turn.

Press to set the close limit position.

8.6 Open Settings

5 / 12. Open Action

The actuator can be configured open on torque for seating valve types or limit for non-seating valve types.

⚠ Refer to Valve manufacturer for recommended setting. In the absence of valvemaker instruction set open action to "Limit".

Press to select Open Action function. Use or to check required setting. Press to set.

6 / 12. Open Torque

The value of torque available to open the valve can be set between 40% and 100% of rated. The actuator rated torque value is shown on its nameplate.

Press to select Open Torque function. Use key to decrease value and key to increase value.

Press to set.

7 / 12. Set Open Limit

Press to select Open Limit Function. The actuator will display the following Instruction:

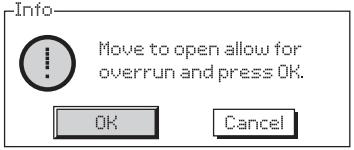


Fig. 8.6.1

Move the actuator and valve to the open position. Allow for overrun by winding close by ½ to 1 turn.

Press to set the open limit position.

8 / 12. Turns Set (not editable)

Shows the actuator output turns between the set Closed and Open limit positions.

8.7 Torque Switch Bypass

The default setting for opening and closing torque switch bypass is Off (torque protection active at all times). Bypassing the torque protection allows torque up to approximately 150% of rated to be available. The valvemaker/ integrator should be consulted to confirm the valve structure and interface components can withstand the additional torque/thrust.

9 / 12. Opening

Opening torque protection can be bypasses over a configurable portion of the opening stroke. When enabled, torque up to approximately 150% of rated torque is available for opening "sticky" valves.

Press to select Opening Torque Switch Bypass function. Use or to check required setting.

Press to set.

10 / 12. Opening Bypass position

When enabled (refer to 9 / 12), the position over the opening stroke where the torque protection is bypassed can be configured in the position range 0% (closed limit) to 95% open. Outside the bypass position, torque switch vaule will revert to that set, refer to 6 / 12.

Press to select Opening Bypass Position function. Use key to decrease value and key to increase value. Press to set.

11 / 12. Closing

Closing torque protection can be bypasses over a configurable portion of the closing stroke. When enabled, torque up to approximately 150% of rated torque is available for closing the valve. Outside the bypass position, torque switch value will revert to that set, refer to 3 / 12.

Press to select Closing Torque Switch Bypass function. Use or to check required setting.

Press to set.

12 / 12 Closing Bypass position

When enabled (refer to 11 / 12), the position over the Closing stroke where the torque protection is bypassed can be configured in the position range 100% (open limit) to 5% open.

Press to select Closing Bypass Position function. Use key to decrease value and key to increase value. Press to set.

9. Maintenance, Monitoring and Troubleshooting

Maintenance

Every Rotork actuator has been fully tested before dispatch to give years of trouble-free operation providing it is installed, sealed and commissioned in accordance with the instructions given in this publication.

The IQ actuator's unique double sealed, non-intrusive enclosure provides complete protection for the actuator components.

The IQ actuator gearing is located in an oil bath and is lubricated for life and does not need replenishing. Should the oil be removed or lost it must not be electrically operated as premature failure may result.

Covers should not be removed for routine inspection as this may be detrimental to the future reliability of the actuator.

The electrical control module cover is bonded by the Rotork quality control seal. It should not be removed as the module contains no site-serviceable components.

All electrical power supplies to the actuator must be isolated before any maintenance or inspection is carried out, except replacement of the battery.

Electrical supplies must be isolated before actuator covers are removed – refer to battery replacement instructions.

Routine maintenance should include the following:

- Check actuator to valve fixing bolts for tightness.
- Ensure valve stems and drive nuts are clean and properly lubricated.
- If the motorised valve is rarely operated, a routine operating schedule should be set up.
- Replace actuator battery every 5 years.
- Check the actuator enclosure for damage, loose or missing fasteners.
- Ensure there is not an excessive build up of dust or contaminant on the actuator.
- Check for any loss of lubricant. (refer to section 11 for lubricants).

The Actuator Battery

The battery supports the actuator valve position indication relays, datalogger and the position display (LCD) only when the main power supply is turned off. It ensures the current position is indicated and displayed when manual operation takes place.

The battery is not required to retain any actuator settings or track position changes.

With mains power switched off and without a battery fitted or when discharged, all configured settings are retained safely in EEPROM and position changes are tracked by the absolute encoder.

On power up, the correct, current position will be displayed and the actuator will operate normally.

⚠ WARNING: The battery holder in the actuator gearcase also protects the user from the hazardous live connections inside the actuator and therefore it must not be damaged. The actuator must be isolated or disconnected if the battery holder has to be removed from the actuator gearcase.

A unique circuit has been incorporated into the battery function of the IQ, effectively reducing the overall drain and significantly increasing the battery life.

In normal circumstances battery replacement interval should not exceed 5 years. Ambient temperature and plant operating conditions may affect battery life.

Battery level status is indicated by an icon on the actuator display – refer to section 4.3.

If the battery icon is displayed the battery should be replaced to ensure correct power off valve position indication.

Battery Replacement

If the actuator is located within a hazardous area permission must be obtained in the form of a "hot work permit" or other local regulation before removal and/or replacement of the battery.

Removal of the battery with the main electrical power switched off will result in stored datalogger records time reference being lost for the duration when there is no mains and battery power. It is therefore recommended that the battery is replaced with the main electrical supply to the actuator switched on.

Battery Removal

The actuator must be selected to Stop using the red selector – refer to section 4.2. Access to the battery is via a labelled sealing plug situated on the main gearcase near the handwheel hub.

Remove the sealing plug using the appropriate Allen key, ensuring the O-ring seal remains on the plug. Disconnect the battery wiring loom from the battery terminals. Using the black pull strap, lift the battery out of the rubber sealing pocket.

Fig. 9.7.1

Battery Types

For European hazardous area certified actuators (ATEX / IEC Ex) use a lithium manganese dioxide battery as stated in Fig. 9.6.2 Battery Type Table.

For FM and CSA certified enclosures use an Ultralife U9VL lithium manganese dioxide battery. Equivalent, UL recognised, batteries may be used.

For watertight (WT) actuator enclosures Rotork recommend a lithium manganese dioxide battery, however any equivalent 9V battery may be used.

If in doubt regarding the correct battery type, contact Rotork.

Enclosure Type	Battery Type	Detail
ATEX/IEC Ex - Standard Temp	Ultralife PP3 Types	U9VL or U9VL-J-P
ATEX/IEC Ex - Low/High Temp	Rotork Part Numbers:	95-462 or 95-614

Fig. 9.7.2 Battery Type Table

Fitting Replacement Battery

Fit the pull strap around the replacement battery and insert into the rubber sealing pocket. Reconnect the battery wiring loom to the battery terminals. Refit the battery sealing plug ensuring O-ring is in good condition and correctly fitted. Hand tighten the sealing plug to 8 Nm (6 lbs/ft) using the appropriate Allen key.

Oil

Unless specially ordered for extreme climatic conditions, Rotork actuators are dispatched with gearcases filled with SAE 80EP oil which is suitable for ambient temperatures ranging from

-22°F / -30°C to 160°F / 70°C.

IQ actuators do not require regular oil changes (refer to Section 11, Weights and Measures).

Torque and Position Monitoring

The IQ range of actuators incorporate real time, instantaneous Torque & Position monitoring as standard. Torque & Position can be used to monitor valve performance during operation. The effect of process changes (differential pressure etc.) can be evaluated, tight spots in valve travel can be pinpointed as well as gauging the torque developed through stroke in order to set appropriate open and closed torque switch settings.

There a two home screen displays that indicate torque and position simultaneously. Refer to section 4.4

Analogue Torque and Position indication

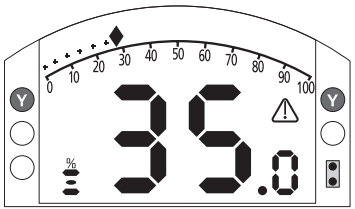


Fig. 9.7.3

Example shows that actuator at 35.0% open, producing 27% of rated torque. The warning triangle indicates the actuator has torque tripped.

Note: The torque and position values displayed are dynamic and will show the actual torque and position values currently measured. After a torque trip, the torque value tends to drop away as the internal mechanical components relax as no drive is present.

Digital Torque and Position indication

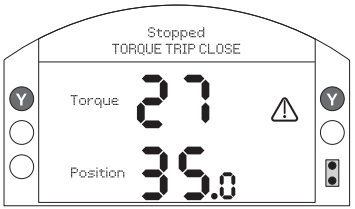


Fig. 9.7.4

Example shows that actuator at 35.0% open, producing 27% of rated torque. The status bar and warning triangle indicate that the actuator has torque tripped when closing.

Note: The actuator will torque trip and stop when the value of torque reaches that set for the open (when opening) and closing (when closing) torque switches (refer to 8.5 and 8.6). Due to the effects of inertia (variable with speed/load) and valve resilience, the torque delivered and displayed may be higher.

10. Environmental

End user advice on disposal at end of life of the product.
In all cases check local autrhority regulation before disposal.

Subject	Definition	Remarks / examples	Hazardous	Recyclable	EU Waste Code	Disposal
Batteries	Lithium	IQ battery	Yes	Yes	16 06 06	Will require special treatment before disposal, used specialist recyclers or waste disposal companies
	Alkaline	Setting tool	Yes	Yes	16 06 04	
Electrical & Electronic Equipment	Printed circuit boards	All Products	Yes	Yes	20 01 35	Use specialist recyclers
	Wire	All Products	Yes	Yes	17 04 10	
Glass	Lens/Window	IQ	No	Yes	16 01 20	Use specialist recyclers
Metals	Aluminium	Gearcases and covers	No	Yes	17 04 02	Use licensed recyclers
	Copper/Brass	Wire, IQ gears, motor windings	No	Yes	17 04 01	
	Zinc	IQ clutch Ring and associated components	No	Yes	17 04 04	
	Iron/Steel	Gears and bases	No	Yes	17 04 05	
	Mixed Metals	IQ motor rotors	No	Yes	17 04 07	
Plastics	Glass filled nylon	Covers, electronics chassis	No	No	17 02 04	Disposal as general comercial waste
	Unfilled	Gears	No	Yes	17 02 03	Use specialist recyclers
Oil /Grease	Mineral & Kerosene Mixed	Gearbox lubrication	Yes	Yes	13 07 03	Will require special treatment before disposal, use specialist recyclers or waste disposal companies
	Mineral	Gearbox lubrication	Yes	Yes	13 02 04	
	Food Grade	Gearbox lubrication	Yes	Yes	13 02 08	
	Grease	Side Handwheel / linear drive	Yes	No	13 02 08	
Rubber	Seals & Orings	Cover and shaft sealing	Yes	No	16 01 99	May require special treatment before disposal, use specialist waste disposal companies

11. Weights and Measures

Oil

Unless specially ordered for extreme climatic conditions, Rotork actuators are dispatched with gearcases filled with SAE 80EP oil suitable for ambient temperatures ranging from -22 °F to 160 °F (-30 °C to 70 °C).

Grease

Side handwheels.

Extreme pressure multipurpose grease MULTIS MS2 or equivalent. For low temperatures use a grease suitable for use at -60 °C such as Optitemp TT IEP.

Linear drive unit.

Extreme pressure multi-purpose grease MULTIS MS2 or equivalent.

Base assembly

O-rings, use either Multis EP2 / Lithoshield EP2 or equivalent for all temperature ranges between -50 °C and +70 °C.

Food grade lubricating oil is available as an alternative: contact Rotork.

*** NOTE: Excludes second stage gearbox if fitted.**

Actuator Size	Weight kg (lbs)	Oil Capacities litres (pt.-US)
IQ10	31 (68)	0.5 (1)
IQ12	31 (68)	0.5 (1)
IQ18	31 (68)	0.5 (1)
IQ20	54 (119)	1 (2.1)
IQ25	54 (119)	1 (2.1)
IQ35	75 (165)	1.5 (3.2)
IQ40	145 (320)	3 (6.3)
IQ70	145 (320)	3 (6.3)
IQ90	160 (353)	3 (6.3)
IQ91	150 (331)	3 (6.3)
IQ95	160 (353)	3 (6.3)

12. IQ Approvals

Refer to actuator nameplate for unit specific approval details.

European – Hazardous area

ATEX (94/9/EC) II 2 GD c
Ex d IIB T4 Gb T4
Ex tb IIIC T120°C Db T4, IP66 & IP68
Temperature -20°C to +70°C (-4°F to +158°F)
*Option -30°C to +70°C (-22°F to +158°F)
*Option -40°C to +70°C (-40°F to +158°F)
*Option -50°C to +40°C (-58°F to +104°F)

Ex d IIC T4 Gb T4
Ex tb IIIC T120°C Db T4, IP66 & IP68
Temperature -20°C to +70°C (-4°F to +158°F)
*Option -30°C to +70°C (-22°F to +158°F)
*Option -40°C to +70°C (-40°F to +158°F)
*Option -50°C to +40°C (-58°F to +104°F)

Ex de IIB T4 Gb T4
Ex tb IIIC T120°C Db T4, IP66 & IP68
Temperature -20 to +70°C (-4°F to +158°F)
*Option -30°C to +70°C (-22°F to +158°F)
*Option -40°C to +70°C (-40°F to +158°F)
*Option -50°C to +40°C (-58°F to +104°F)

Ex de IIC T4 Gb T4
Ex tb IIIC T120°C Db T4, IP66 & IP68
Temperature -20°C to +70°C (-4°F to +158°F)
*Option -30°C to +70°C (-22°F to +158°F)
*Option -40°C to +70°C (-40°F to +158°F)
*Option -50°C to +40°C (-58°F to +104°F)

International – Hazardous area

IECEx. IEC60079-0 & IEC600679-1
Ex d IIB T4 Gb T4
Ex tb IIIC T120°C Db T4, IP66 & IP68
Temperature -20°C to +70°C (-4°F to +158°F)
*Option -30°C to +70°C (-22°F to +158°F)
*Option -40°C to +70°C (-40°F to +158°F)
*Option -50°C to +40°C (- 58°F to +104°F)

Ex d IIC T4 Gb T4
Ex tb IIIC T120°C Db T4, IP66 & IP68
Temperature -20°C to +70°C (-4°F to +158°F)
*Option -30°C to +70°C (-22°F to +158°F)
*Option -40°C to +70°C (-40°F to +158°F)
*Option -50°C to +70°C (-58°F to +158°F)

Ex de IIB T4 Gb T4
Ex tb IIIC T120°C Db T4, IP66 & IP68
Temperature -20°C to +70°C (-4°F to +158°F)
*Option -30°C to +70°C (-22°F to +158°F)
*Option -40°C to +70°C (-40°F to +158°F)
*Option -50°C to +70°C (-58°F to +158°F)

Ex de IIB T4 Gb T4
Ex tb IIIC T120°C Db T4, IP66 & IP68
Temperature -20°C to +70°C (-4°F to +158°F)
*Option -30°C to +70°C (-22°F to +158°F)
*Option -40°C to +70°C (-40°F to +158°F)
*Option -50°C to +70°C (-58°F to +158°F)

USA – hazardous Area

FM - Explosionproof to NEC Article 500.
Class I, Division 1, Groups C & D
Class II, Division 1, Groups E, F & G
Temperature -30°C to +70°C (-22°F to +158°F)
*Option -40°C to +70°C (-40°F to +158°F)
*Option -40°C to +70°C (-58°F to +158°F)
*Option -50°C to +40°C (-58°F to +104°F).

Class I, Division 1, Groups B, C & D
Class II, Division 1, Groups E, F & G
Temperature -30°C to +70°C (-22°F to +158°F)
*Option -40°C to +70°C (-40°F to +158°F)
*Option -40°C to +70°C (-58°F to +158°F)
*Option -50°C to +40°C (-58°F to +104°F).

Canada – hazardous Area

CSA Explosionproof to C22.2 No 30
Class I, Division 1, Groups C & D
Class II, Division 1, Groups E, F & G
Temperature -30°C to +70°C (-22°F to +158°F)
*Option -40°C to +70°C (-40°F to +158°F)
*Option -50°C to +40°C (-58°F to +104°F).

Class I, Division 1, Groups B, C & D
Class II, Division 1, Groups E, F & G
Temperature -30°C to +70°C (-22°F to +158°F)
*Option -40°C to +70°C (-40°F to +158°F)
*Option -50°C to +40°C (-58°F to +104°F).

International Non hazardous

Watertight, BS EN60529
IP66 & IP68, (7 metres for 72 hours).
Temperature -30°C to +70°C (-22°F to +158°F)
*Option -40°C to +70°C (-40°F to +158°F)
*Option -50°C to +40°C (-58°F to +104°F)

US – Non hazardous

NEMA Enclosure Type 4, 4X & 6
Temperature -30°C to +70°C (-22°F to +158°F).
*Option -40°C to +70°C (-40°F to +158°F)
*Option -50°C to +40°C (-58°F to +104°F).

Canada – Non hazardous

NEMA Enclosure Type 4, 4X & 6
Temperature -30°C to +70°C (-22°F to +158°F)
*Option -40°C to +70°C (-40°F to +158°F).
*Option -50°C to +40°C (-58°F to +104°F).

Rotork can supply actuators to national standards not listed above. For details please contact Rotork.

13. Approved Fuses

FS1 = Bussman TDC11 (rating as per transformer type. See actuator wiring diagram for transformer type).

Type 1 = 250 mA anti-surge

Type 2 = 250 mA anti-surge

Type 3 = 150 mA anti-surge

FS2 (ATEX units only)

Bussman TDS 500 - 100 mA Quickblow or Littel Fuse 217 - 100 mA Quickblow

14. Vibration, Shock and Noise

Standard IQ range actuators are suitable for applications where vibration and shock severity does not exceed the following:

Type	Level
Plant induced vibration	1g rms total for all vibration within the frequency range of 10 to 1000 Hz
Shock	5g peak acceleration
Seismic	2g acceleration over a frequency range of 1 to 50 Hz if it is to operate during and after the event
Emitted noise	Independent tests have shown that at 1m generated noise does not exceed 65 db(A)

15. Conditions of Safe Use

- The following are the maximum constructional flamepath gaps for ATEX and IECEx Approved actuators.

Note: Negative sign denotes an interference fit.

Flamepath	Max. Gap (mm)	Min. Length (mm)	Actuator Type and Size
Motor Cover / Gearcase	0.15	25.00	IQ10, IQ12, IQ18, IQ20, IQ25, IQ35, IQM10, IQM12, IQM20, IQM25, IQS12, IQS20, IQS35, IQ40, IQ70, IQ90, IQ91, IQ95
Wormshaft Shroud / Gearcase	0.05	35.00	IQ10, IQ12, IQ18, IQM10, IQM12, IQS12
		38.00	IQ20, IQ25, IQM20, IQM25, IQS20
		35.00	IQ35, IQS35
Wormshaft Shroud / Gearcase	-0.04/0.00	49.75	IQ40, IQ70, IQ90, IQ91, IQ95
Wormshaft / Wormshaft Shroud	0.24	26.00	IQ10, IQ12, IQ18, IQM10, IQM12, IQS12
		26.00	IQ20, IQ25, IQM20, IQM25, IQS20
		27.00	IQ35, IQS35
Wormshaft / Wormshaft Shroud	0.25	49.75	IQ40, IQ70, IQ90, IQ91, IQ95
Terminal Bung Gearcase (IIB)	0.20	26.95	All Types and Sizes
Terminal Bung Gearcase (IIC)	0.115	26.95	All Types and Sizes
Terminal Cover / Gearcase	0.15	25.00	All Types and Sizes
Electrical Cover / Gearcase	0.15	25.00	All Types and Sizes
Encoder Shaft / Encoder Shaft Bush	0.08	25.00	All Types and Sizes
Encoder Shaft Bush / Gearcase	0.04	26.00	All Types and Sizes
Motor Loom Bush / Gearcase	0.15	28.75	IQ10, IQ12, IQ18, IQ20, IQ25, IQ35, IQM10, IQM12, IQM20, IQM25, IQS12, IQS20, IQS35
		33.25	IQ40, IQ70, IQ90, IQ91, IQ95

rotork®

Redefining Flow Control

rotork®
Controls

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www.**rotork**.com

PUB002-039-00
Date of issue 07/12

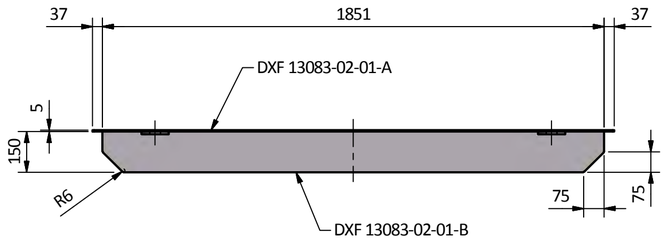
Section 2: AWE Double Isolation Module Drawings

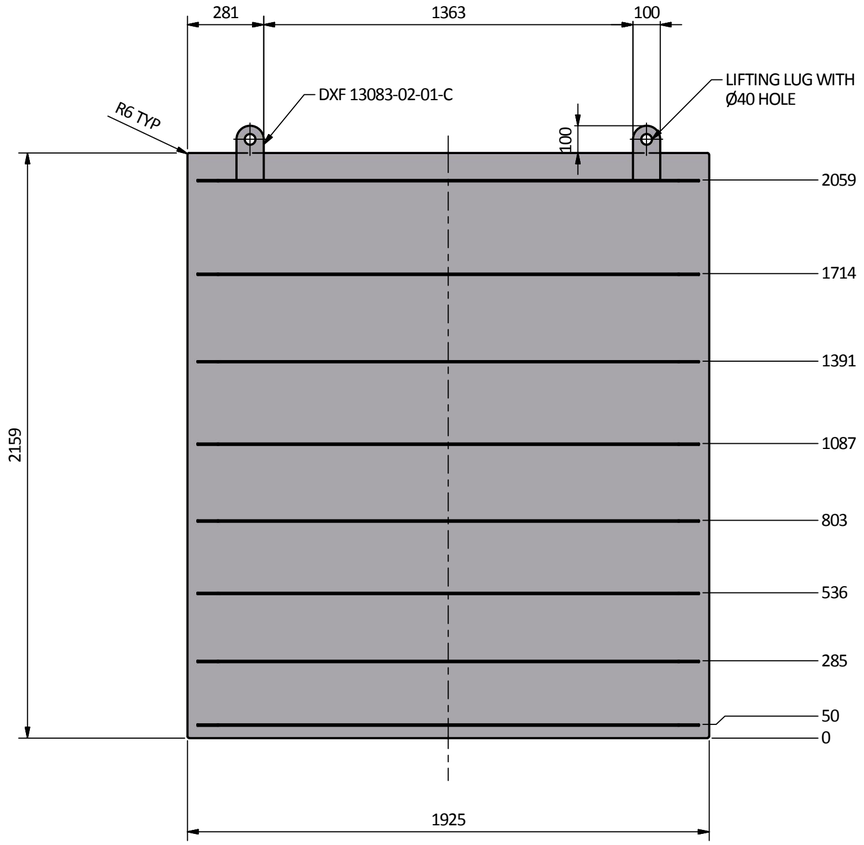
THIRD ANGLE PROJECTION

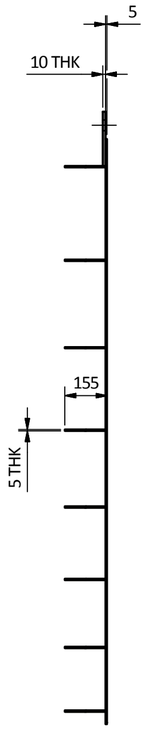
UNLESS OTHERWISE STATED GENERAL TOLERANCES ARE:

LINEAR +/– 1mm UP TO 1000mm
+/– 2mm UP TO 3000mm

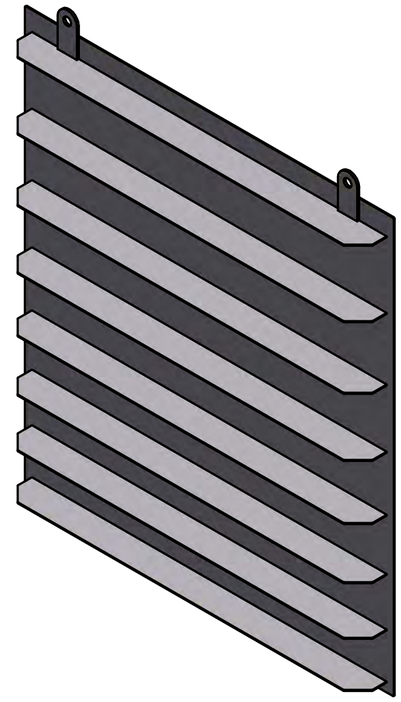
ANGULAR +/– 1°







2.2 METRES HEAD



NOTES:
1. STOPBOARD SUITABLE FOR UP TO 2.2m HEAD
2. MATERIALS: MARINE GRADE ALUMINIUM.
3. QUANTITY: 2 OFF
4. ESTIMATED WEIGHT: 86kg

REV	AMENDMENT	NAME	DATE	CHKD
0	ORIGINAL ISSUE	JKC	16/12/13	MLF

HAMBAKER AWE
AUSTRALIAN WATER ENGINEERS
18 HANSELLS PARADE
RIVERVIEW QLD 4303
AUSTRALIA
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EMAIL: info@aweng.com.au

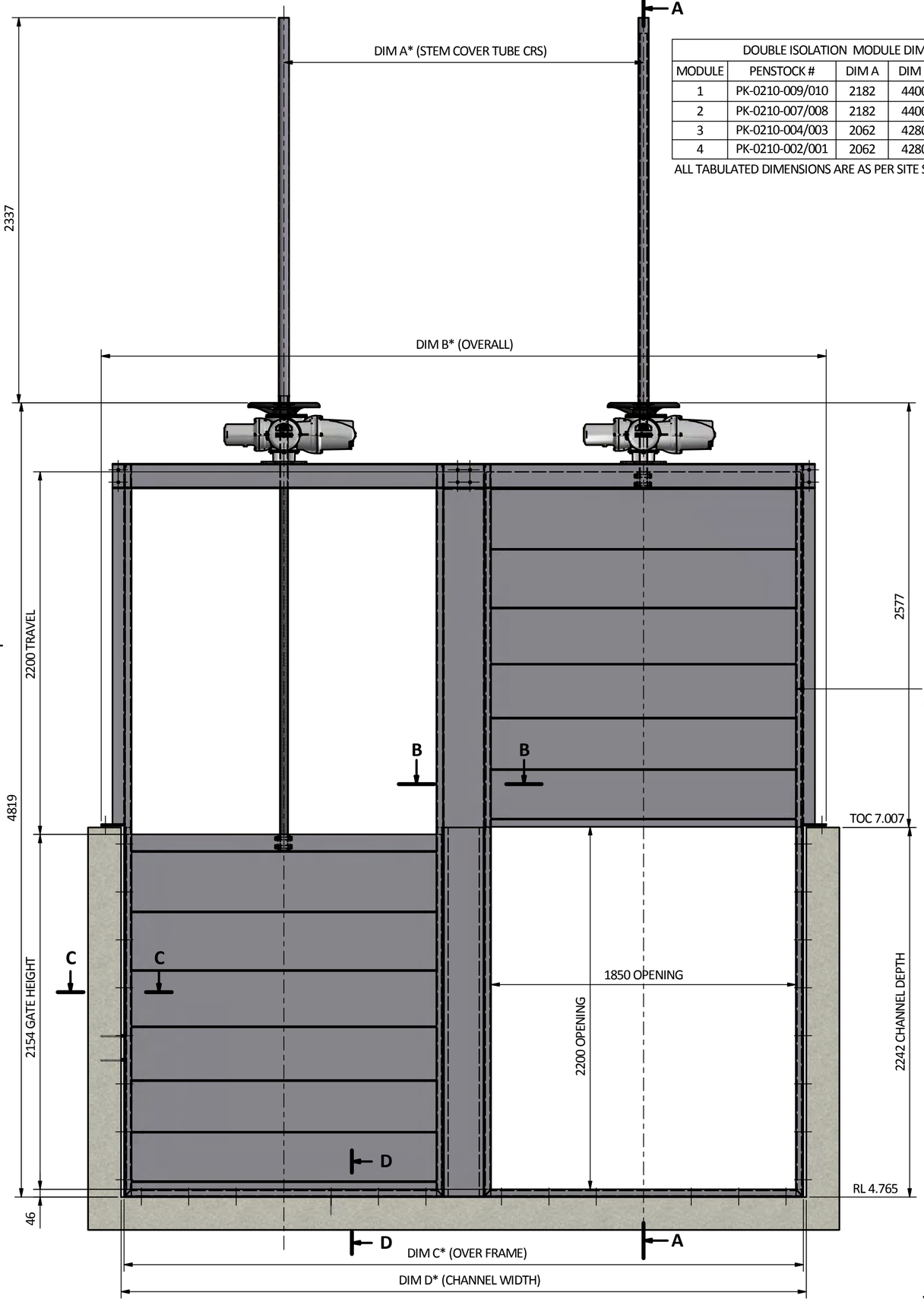
CLIENT
QUEENSLAND URBAN UTILITIES

PROJECT
LUGGAGE POINT INLET WORKS

TITLE
1850x2200 ALUMINIUM STOPBOARD
LOCATION: INLET WORKS SCREENS

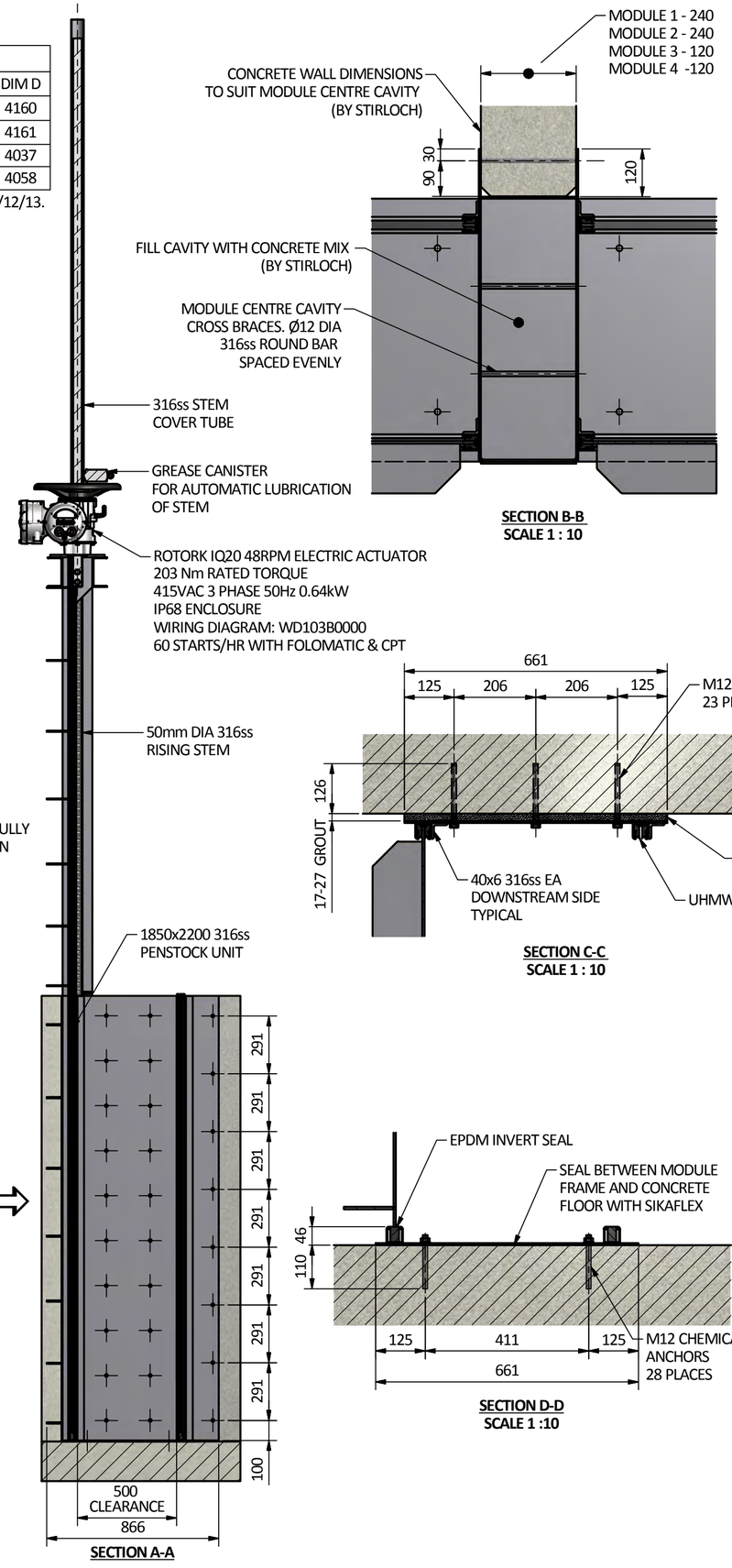
JOB No.	SCALE
13083	1:16
DRAWING NUMBER	REV
13083–02–01	0

ALL DIMENSIONS IN mm UNLESS OTHERWISE STATED
ORIGINAL DRAWING SIZE A2



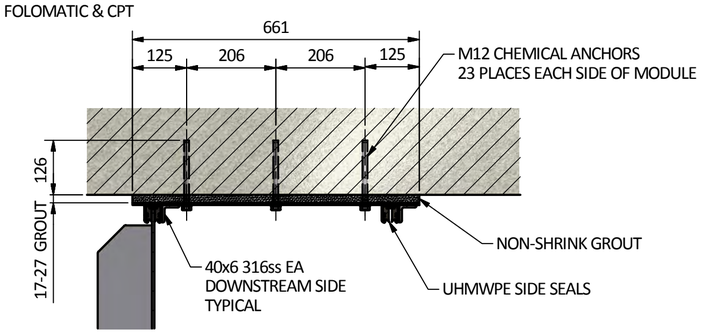
DOUBLE ISOLATION MODULE DIMENSIONS					
MODULE	PENSTOCK #	DIM A	DIM B	DIM C	DIM D
1	PK-0210-009/010	2182	4400	4124	4160
2	PK-0210-007/008	2182	4400	4124	4161
3	PK-0210-004/003	2062	4280	4004	4037
4	PK-0210-002/001	2062	4280	4004	4058

ALL TABULATED DIMENSIONS ARE AS PER SITE SURVEY ON 09/12/13.



SECTION A-A

SECTION B-B
SCALE 1 : 10



SECTION C-C
SCALE 1 : 10

SECTION D-D
SCALE 1 :10

THIRD ANGLE PROJECTION

UNLESS OTHERWISE STATED GENERAL TOLERANCES ARE:

LINEAR +/– 1mm UP TO 1000mm
+/– 2mm UP TO 3000mm

ANGULAR +/– 1°

NOTES:

1. PENSTOCK SUITABLE FOR UP TO 2.2m HEAD
2. MATERIALS:
   . FRAME STRUCTURE: 316ss
   . PENSTOCK GATES: 316ss
   . Ø50 STEM: 316ss
   . SIDE SEALS: UHMWPE
   . INVERT SEALS: EPDM
   . FASTENERS & ANCHORS: 316ss
3. QUANTITY: 4 OFF MODULES.
4. ESTIMATED WEIGHT:
   . PENSTOCK UNIT WEIGHT: 285kg
   . TOTAL MODULE WEIGHT: 1470kg
5. USE HILTI HIT-RE 500 ANCHOR ADHESIVE OR EQUIVALENT (SUPPLIED BY OTHERS)
6. USE HILT CM 651 NON-SHRINK GROUT OR EQUIVALENT (SUPPLIED BY OTHERS).
7. USE SIKA SIKALFLEX 11FC OR EQUIVALENT (SUPPLIED BY OTHERS)

REV	AMENDMENT	NAME	DATE	CHKD
1	REVISED FOR MANUFACTURE	JKC	6/12/13	MLF
0	ORIGINAL ISSUE	JKC	06/12/13	MLF

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CLIENT
QUEENSLAND URBAN UTILITIES

PROJECT
LUGGAGE POINT INLET WORKS

TITLE
1850x2200 MODEL P1000SS/P1000SA
DOUBLE ISOLATION MODULE
LOCATION: INLET WORKS SCREENS

JOB No.	SCALE
13083	1:20
DRAWING NUMBER	REV
13083–01–01	1

Section 3 : ABB Flowmeter Data Sheet + Calibration Certificates

ABB WaterMaster Service Check Sheet

Site Name:	
WaterMaster Serial Number:	
Engineer (Please Print name):	
Visit date:	
Apparent fault/problem:	

Please ✓ Tick All checks performed and any Problem areas - comment where applicable

Description	OK	Problem	Comments
Flow reading ?	☐	☐	
Totalising ?	☐	☐	
Pulse output working?	☐	☐	
mA output working?	☐	☐	

Sensor Installation:

Please show/add connections for your sensor...

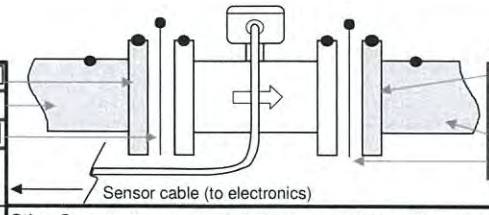
Upstream/Inlet

Flange type: Fixed ☐ Slip on ☐ Adapter ☐

Pipework material:

Fluid Contact ring?: Yes ☐ No ☐

Other Cables in the area?: (please describe)



Downstream/Outlet

Flange type: Fixed ☐ Slip on ☐ Adapter ☐

Pipework Material:

Fluid Contact ring?: Yes ☐ No ☐

Other Comments: (e.g. Installed adjacent to VSD/motor/HV cable etc.)

Active Alarms:

(Press key & Select 'Diagnostics')

Alarm Code(s): (e.g. S132.006 etc.)

Diagnostic History:

(Press key & Select 'Read Only'> Select 'Process Alarm' menu> Select 'Diagnostic History')

Alarm Code:	n:	Σt:	tn:

Signals View:

(Press key & Select 'Signals View')

Vel	m/s
E1	kΩ
E2	kΩ
E1	V
E2	V
E12	V
CDI	mA
CDR	Ω

Programming Information:

(Press key & Select 'Read Only' > Select.....

Device Info> Sensor> Sensor Size	DN250
Device Info> Sensor> Sensor Type	WM Full Bore
Device Info> Sensor> TAG & ID > SAP/ERP#	3K2200001795 3b
Device Setup> Calibration Factors> Span Ss	127.31
Device Setup> Calibration Factors> Span Sz	-0.84
Device Setup> User Span	100.0
Device Setup> User Zero	0.0
Easy Setup> Q (Flowrate) Units	l/sec
Easy Setup> Qmax	100
Easy Setup> Volume & Pulse Units	m3
Easy Setup> Pulse Width	100ms
Easy Setup> Pulses/Unit	1
Easy Setup> Damping	3sec
Easy Setup> Mains Frequency	50 Hz

WaterMaster Service Check Sheet

Issue 1 March 2010

J507183

Data sheet DS/WM–EN Rev. U

WaterMaster
Electromagnetic flowmeter

Measurement made easy

The perfect fit for all water industry applications

One solution for all your needs
— designed for use in all water and waste water applications, from sewage plants to distribution networks

State-of-the-art technology
— revolutionary data storage enables transmitter interchange and commissioning without the need for re-configuration
— self-calibrating transmitter with ultra-low temperature coefficient for highest accuracy

Versatile and simple configuration
— 'Through-the-Glass' (TTG) configuration eliminating the need to remove the cover
— smart key based functionality
— 'Easy Setup' function

VeriMaster in situ verification software option
— enables the customer to perform in situ verification of the flowmeter system

Unparalleled service ability
— fault-finding Help texts on the display
— minimized downtime with replaceable electronics cartridges

MID and OIML R49 approved with R49 self-checking
— Type-approved to accuracy Class 1 and Class 2 for any pipe orientation and bidirectional flows
— Type P-approved continuous self-checking of the sensor and transmitter to ensure the highest accuracy and long term performance

Innovative sensors for all applications
— optimized full-bore series for optimum turndown / low pressure drop, irrigation applications
— full-bore series for general-purpose water metering applications
— reduced-bore series for high turn down applications, for example, leakage
— buriable sensors eliminating the need for costly chamber construction

HART, PROFIBUS DP and MODBUS
— Full system and PLC integration

WaterMaster
Electromagnetic flowmeter

The Company

ABB is an established world force in the design and manufacture of instrumentation for industrial process control, flow measurement, gas and liquid analysis and environmental applications.

As a world leader in process automation technology our worldwide presence, comprehensive service and application-oriented know-how make ABB a leading supplier of flow measurement products.

Introduction

Setting the standard for the Water Industry

The WaterMaster range, available in sizes 10 to 2400 mm ($^3/_8$ to 96 in.), is designed specifically for use on the many diverse applications encountered in the Water and Waste-water industry. The modular design concept offers flexibility, cost-saving operation and reliability while providing a long service life and exceptionally low maintenance.

Integration into ABB asset management systems and use of the self-monitoring and diagnostic functions increase the plant availability and reduce downtimes.

VeriMaster – the verification tool

An easy-to-use utility, available through the infra red service port, it uses the advanced self-calibration and diagnostic capability of WaterMaster, coupled with fingerprinting technology, to determine the accuracy status of the WaterMaster flowmeter to within ±1 % of its original factory calibration. VeriMaster also supports printing of calibration verification records for regulatory compliance.

Diagnostic functions

Using its diagnostic functions, the flowmeter monitors both its own operability and the process. Limit values for the diagnostic parameters can be set locally. When these limits are exceeded, an alarm is tripped. In the event of an error, diagnostic-dependent help text appears on the display and this considerably simplifies and accelerates the troubleshooting procedure.

In accordance with NAMUR NE107, alarms and warnings are classified with the status of 'Maintenance Required', 'Check Function', 'Failure' and 'Out of Specification'.

Flow performance

Utilizing its advanced filtering methods, the WaterMaster improves accuracy even under difficult conditions. WaterMaster has an operating flow range with ±0.4 % accuracy as standard (±0.2 % optional) in both forward and reverse flow directions.

Easy and quick commissioning

'Fit-and-Flow' data storage inside WaterMaster eliminates the need to match sensor and transmitter in the field. On initial installation, the self-configuration sequence automatically replicates into the transmitter all calibration factors, meter size and serial numbers, as well as customer site-specific settings, eliminating the potential for error.

Intuitive, convenient navigation

The 'Easy Setup' function reliably guides unpracticed users through the menu step by step. The smart key based functionality makes handling a breeze – it's just like using a cell phone. During configuration, the permissible range of each parameter is indicated on the display and invalid entries are rejected.

Universal transmitter – powerful and flexible

The backlit display can be rotated easily without the need for tools. The contrast is adjustable and the display fully-configurable. The character size, number of lines and display resolution (number of decimal points) can be set as required. In multiplex mode, several different display options can be pre-configured and invoked one after the other.

The smart modular design of the transmitter unit enables easy disassembly without the need to unscrew cables or unplug connectors. HART is used as the standard communications protocol. Optionally, the transmitter is available with PROFIBUS DP or MODBUS communication.

Assured quality

WaterMaster is designed and manufactured in accordance with international quality procedures (ISO 9001) and all flowmeters are calibrated on nationally-traceable calibration rigs to provide the end-user with complete assurance of both quality and performance of the flowmeter.

WaterMaster
Electromagnetic flowmeter

WaterMaster – always the first choice

WaterMaster sets the standard for the water industry. The specification, features and user benefits offered by this range are based on ABB's worldwide experience in this industry and they are all targeted specifically to the industry's requirements.

Submersible and buriable

WaterMaster sensors have a rugged, robust construction to ensure a long, maintenance-free life under the arduous conditions experienced in the Water and Waste Industry. The sensors are, as standard, inherently submersible (IP68, NEMA 6P), thus ensuring suitability for installation in chambers and metering pits that are susceptible to flooding.

A unique feature of the WaterMaster sensors is that sizes DN40 to DN2400 ($1^1/_2$ to 96 in. NB) are buriable; installation simply involves excavating to the underground pipe, fitting the sensor, cabling back to the transmitter and then backfilling the hole.

The WaterMaster family

Overview of the WaterMaster

A wide range of features and user benefits are built into WaterMaster as standard:

- bi-directional flow
- unique self-calibrating transmitter (patented) for the ultimate in stability and repeatability
- OIML-type continuous self-checking, with alarms, ensures both sensor and transmitter accuracy
- true electrode and coil impedance measurement
- comprehensive simulation mode
- universal switch-mode power supply (options are available for AC and DC supplies)
- comprehensive self-diagnostics compliant with NAMUR NE107
- programmable multiple-alarm capability
- bus options: HART (4 to 20 mA), PROFIBUS DP (RS485), MODBUS (RS485)
- 3 configurable pulse / frequency and alarm outputs
- advanced infrared service port supports remote HMI, HART, cyclic data out and parameter download
- VeriMaster in situ verification software available as option
- read-only switch and ultra-secure service password for total security

WaterMaster
Electromagnetic flowmeter

OIML / MID approved

WaterMaster has been type tested and Internationally approved to the highest accuracy class 1 and 2 for cold and hot potable water meters – OIML R49-1 (Organisation Internationale de Métrologie Légale). For full details, OIML R49 is available to download from www.oiml.org. Its requirements are very similar to other International standards, such as EN14154 and ISO4064.

WaterMaster has been assessed by type approval at the National Measurement Office (NMO) to OIML R49 and passed to the very highest accuracy designations for sizes DN40 to DN200 (1½ to 8 in. NB).

The approval is for:

- Class 1 and Class 2 accuracy (calibration option)
- Environmental class T50 for water temperatures of 0.1 to 50 °C (32.18 to 122 °F)
- Electromagnetic Environment E2 (10 V/m)
- Any pipe orientation
- 5 Diameters upstream pipe
- 0 Diameters downstream pipe
- Pressure Loss Class <0.25 bar (3.62 psi)
- Integral or remote transmitter (<200 m [<656 ft.] cable)
- DN40 to DN200 (1½ to 8 in. NB), bi-directional flow

A major advance in WaterMaster is the self-checking capabilities that meet and exceed the R49 requirements and is the first electromagnetic flowmeter to be approved to OIML Type P permanent self checking during normal operation (not just at startup) and alarm indication for:

- transmitter and sensor status, with an accuracy alarm
- program ROM and RAM status
- double, independent storage of totalizer values, in both the sensor and transmitter non-volatile memories
- display test

The OIML R49-1 certificate of conformity is available from:

http://www.abb.com/product/seitp330/b42ec2377d3293cdc12573de003db93b.aspx

WaterMaster is also approved under the EU Measuring Instruments Directive (MID) 2004/22/EC, that covers putting into use water flowmeters for certain applications. MID WaterMaster is secured against tamping and is available as an option, along with fingerprinting for ABB VeriMaster in situ verification product, with certificate printout to ±1 % accuracy.

WaterMaster certificates of EC type-examination of a measuring instrument are available from:

http://www.abb.com/product/seitp330/b42ec2377d3293cdc12573de003db93b.aspx

Superior control through advanced sensor design

The innovative, patented octagonal sensor design improves flow profile and reduces up- and down-stream piping requirements for the most commonly used sizes of 40 to 200 mm (1½ to 8 in.). This optimized full bore meter provides impressive results in the most difficult of installation requirements.

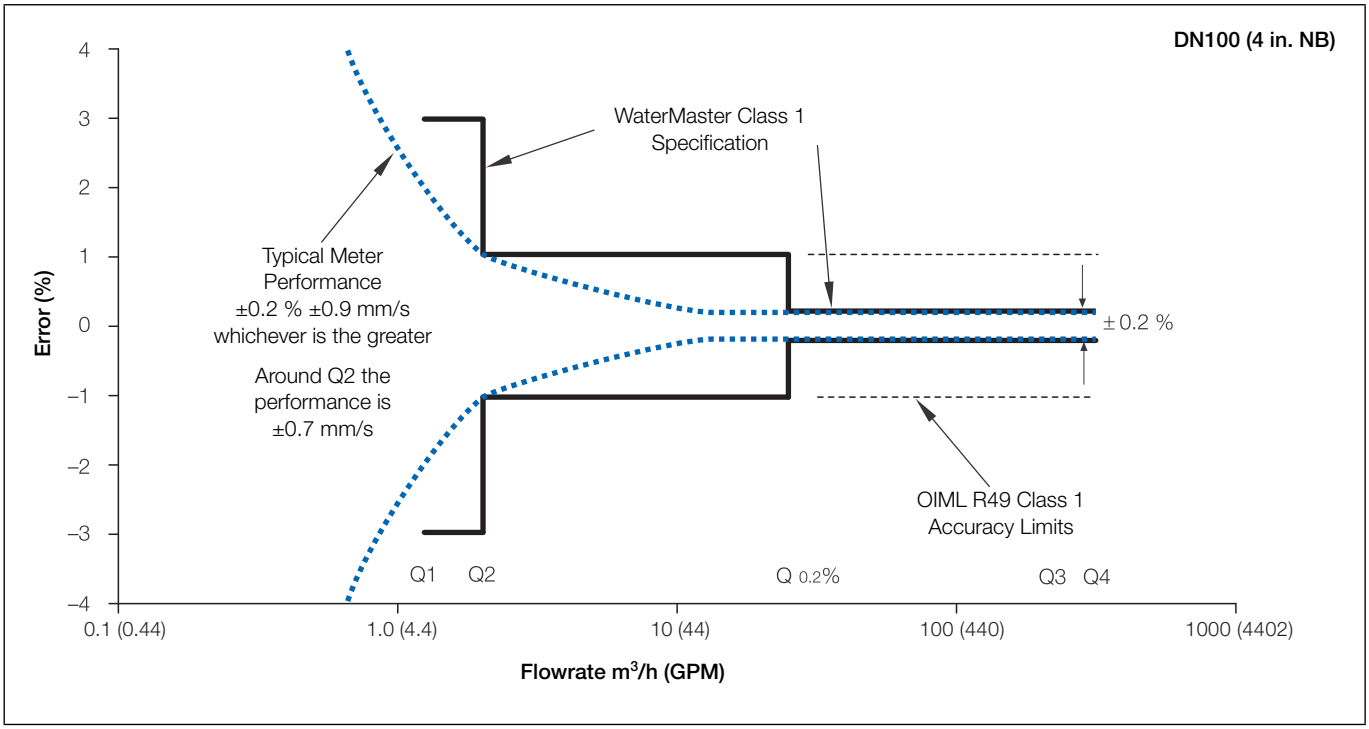
WaterMaster sensors are also available in reduced-bore geometries giving the ultimate in low-flow performance with a very high turn-down range.

The unique design of the reduced-bore sensor conditions the flow profile in the measuring section so that distortions in the flow profile, either upstream or downstream, are flattened. The result is excellent in situ flowmeter performance, even with very bad hydraulic installation conditions.

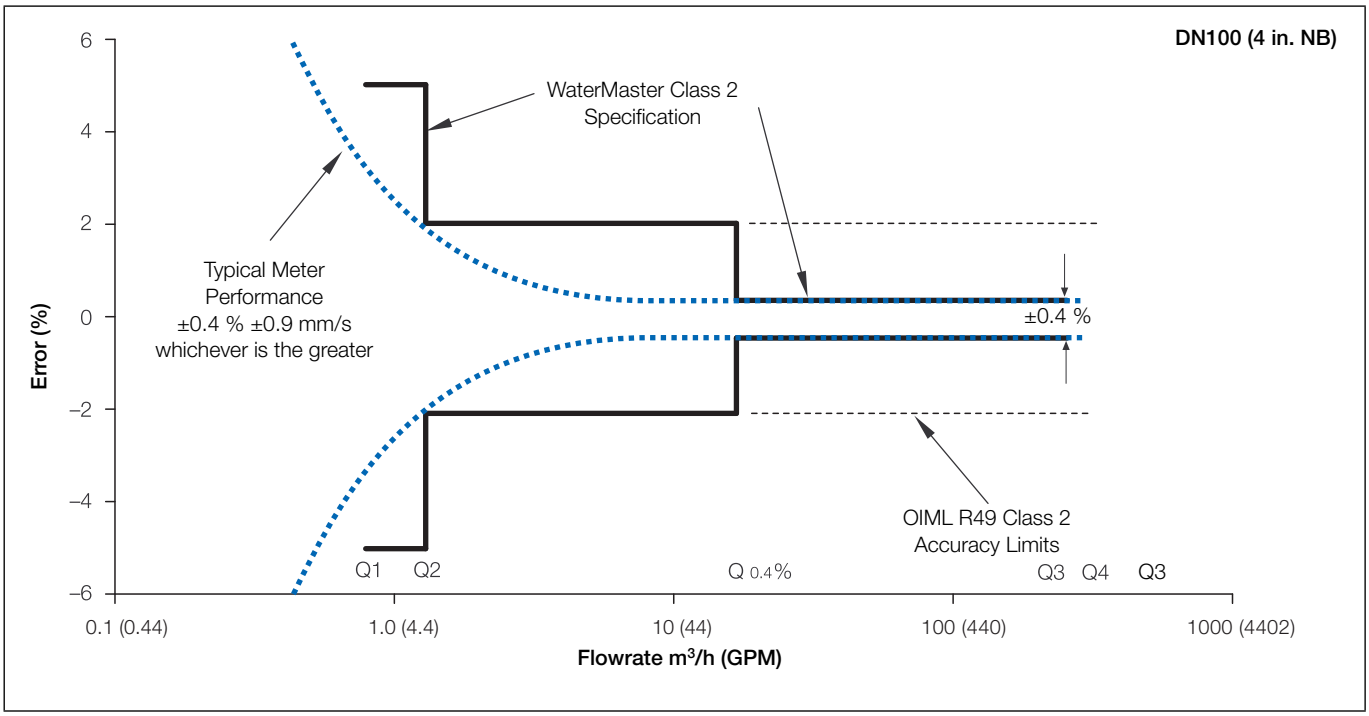
WaterMaster
Electromagnetic flowmeter

Specification

WaterMaster specification to OIML R49 Class 1



WaterMaster specification to OIML R49 Class 2



Although OIML R49 does not define the flow accuracy below Q1, WaterMaster continues to measure flow at lower flow rates down to a cutoff velocity of ±5 mm/s (±0.2 in./s). The accuracy between cutoff and Q1 is typically ±0.9 mm/s (±0.04. in./s).

WaterMaster
Electromagnetic flowmeter

WaterMaster optimized full-bore meter (FEV) / full-bore meters (FEF, FEW) flow performance – m^3/h

			Standard Calibration – 0.4 % Class 2			High Accuracy Calibration – 0.2 % Class 1		
DN	Q4	Q3	$Q_{0.4\%}$	Q2	Q1	$Q_{0.2\%}$	Q2	Q1
10	3.1	2.5	0.167	0.013	0.008	0.31	0.02	0.012
15	7.88	6.3	0.42	0.032	0.02	0.79	0.05	0.03
20	12.5	10	0.67	0.05	0.032	1.25	0.08	0.05
25	20	16	1.1	0.08	0.05	2	0.13	0.08
32	31.25	25	1.67	0.13	0.08	3	0.20	0.13
40*	50	40	4.2	0.2	0.13	6	0.32	0.2
50*	79	63	4.2	0.32	0.20	7.9	0.5	0.32
65*	125	100	6.7	0.5	0.32	12.5	0.8	0.5
80*	200	160	10.7	0.81	0.51	16	1.3	0.8
100*	313	250	16.7	1.3	0.79	25	2	1.25
125*	313	250	16.7	1.3	0.79	25	2	1.25
150*	788	630	42	3.2	2.0	63	5	3.2
200*	1,250	1,000	67	5.1	3.2	100	8	5
250	2,000	1,600	107	8.1	5.1	160	13	8
300	3,125	2,500	167	12.7	7.9	250	20	12.5
350	5,000	4,000	267	20.3	12.7	400	32	20
400	5,000	4,000	267	20.3	12.7	400	32	20
450	7,875	6,300	420	32	20	630	50	32
500	7,875	6,300	420	32	20	630	50	32
600	12,500	10,000	667	51	32	1000	80	50
700	20,000	16,000	1600	102	64	1600	160	100
750	20,000	16,000	1600	102	64	1600	160	100
30 in (760)	20,000	16,000	1600	102	64	1600	160	100
800	20,000	16,000	1600	102	64	1600	160	100
900	31,250	25,000	2500	160	100	2500	250	156
1000	31,250	25,000	2500	160	100	2500	250	156
42 in	31,250	25,000	2500	160	100	2500	250	156
1100	31,250	25,000	2500	160	100	2500	250	156
1200	50,000	40,000	4000	256	160	4000	400	250
1350	78,750	63,000	6300	403	252	6300	630	394
1400	78,750	63,000	6300	403	252	6300	630	394
1500	78,750	63,000	6300	403	252	6300	630	394
60 in (1500)	78,750	63,000	6300	403	252	6300	630	394
1600	78,750	63,000	6300	403	252	6300	630	394
1650	78,750	63,000	6300	403	252	6300	630	394
1800	125,000	100,000	10000	640	400	10000	1000	625
1950	125,000	100,000	10000	640	400	10000	1000	625
2000	125,000	100,000	10000	640	400	10000	1000	625
2200	200,000	160,000	16000	1024	640	16000	1600	1000
2400	200,000	160,000	16000	1024	640	16000	1600	1000

* OIML R49 Certificate of Conformance to Class 1 and Class 2, with OIML R49 and MID versions available.

Note. OIML R49–1 allow Class 1 only for meters with $Q_3 \geq 100$ m^3/h. Meters outside this range have been tested and conform to Class 1.

WaterMaster
Electromagnetic flowmeter

WaterMaster optimized full-bore meter (FEV) / full-bore meters (FEF, FEW) flow performance – gal/min

			Standard Calibration 0.4 % Class 2			High Accuracy Calibration 0.2 % Class 1		
NPS/NB (DN)	Q4	Q3	$Q_{0.4\%}$	Q2	Q1	$Q_{0.2\%}$	Q2	Q1
3/8 (10)	13.8	11	0.73	0.06	0.035	1.38	0.09	0.053
1/2 (15)	34.7	27.7	1.85	0.14	0.09	3.48	0.22	0.14
3/4 (20)	55	44	2.94	0.22	0.14	5.5	0.35	0.22
1 (25)	88	70.4	4.7	0.35	0.22	8.8	0.57	0.35
1 1/4 (32)	137.6	110	7.3	0.57	0.35	13.2	0.88	0.57
1 1/2 (40)	220	176	18.5	0.89	0.56	26.4	1.41	0.88
2 (50)	347	277	18.5	1.41	0.88	34.7	2.22	1.39
2 1/2 (65)	550	440	29.4	2.24	1.40	55.0	3.52	2.20
3 (80)	881	704	47.0	3.58	2.24	70.4	5.64	3.52
4 (100)	1,376	1,101	73.4	5.59	3.49	110	8.81	5.50
5 (125)	1,376	1,101	73.4	5.59	3.49	110	8.81	5.50
6 (150)	3,467	2,774	185	14.1	8.81	277	22.2	13.9
8 (200)	5,504	4,403	294	22.4	14.0	440	35.2	22.0
10 (250)	8,806	7,045	470	35.8	22.4	704	56.4	35.2
12 (300)	13,759	11,007	734	55.9	34.9	1,101	88.1	55.0
14 (350)	22,014	17,611	1,174	89.5	55.9	1,761	141	88.1
16 (400)	22,014	17,611	1,174	89.5	55.9	1,761	141	88.1
18 (450)	34,673	27,738	1,849	141	88.1	2,774	222	139
20 (500)	34,673	27,738	1,849	141	88.1	2,774	222	139
24 (600)	55,036	44,029	2,935	224	140	4,403	352	220
27/28* (700)	88,057	70,446	7,045	451	282	7,045	704	440
29 (750)	88,057	70,446	7,045	451	282	7,045	704	440
30 (760)	88,057	70,446	7,045	451	282	7,045	704	440
32 (800)	88,057	70,446	7,045	451	282	7,045	704	440
36 (900)	137,590	110,072	11,007	704	440	11,007	1,100	688
39/40* (1000)	137,590	110,072	11,007	704	440	11,007	1,100	688
42 (1050)	137,590	110,072	11,007	704	440	11,007	1,100	688
44 (1100)	137,590	110,072	11,007	704	440	11,007	1,100	688
48 (1200)	220,143	176,115	17,611	1,127	704	17,611	1,761	1,101
52 (1350)	346,726	277,381	27,738	1,775	1,110	27,738	2,773	1,733
54 (1400)	346,726	277,381	27,738	1,775	1,110	27,738	2,773	1,733
60 (1500)	346,726	277,381	27,738	1,775	1,110	27,738	2,773	1,733
66 (1600)	346,726	277,381	27,738	1,775	1,110	27,738	2,773	1,733
68 (1650)	346,726	277,381	27,738	1,775	1,110	27,738	2,773	1,733
77 (1800)	550,358	440,287	44,029	2,818	1,761	44,029	4,403	2,752
77 (1950)	550,358	440,287	44,029	2,818	1,761	44,029	4,403	2,752
78 (2000)	550,358	440,287	44,029	2,818	1,761	44,029	4,403	2,752
78 (2000)	550,358	440,287	44,029	2,818	1,761	44,029	4,403	2,752
84 (2200)	880,573	704,459	70,446	4,509	2,818	70,446	7,045	4,403
96 (2400)	880,573	704,459	70,446	4,509	2,818	70,446	7,045	4,403

*Size is dependent on flange specification

WaterMaster reduced-bore meter (FER) flow performance – m^3/h (gal/min)

				Class 2 specification				Class 1 specification			
Size		Q_4	Q_3	$Q_{0.4\ \%}$	Q_2	Q_1	R	$Q_{0.2\ \%}$	Q_2	Q_1	R
mm	in.	m^3 / h (Ugal / min)	m^3 / h (Ugal / min)	m^3 / h (Ugal / min)	m^3 / h (Ugal / min)	m^3 / h (Ugal / min)		m^3 / h (Ugal / min)	m^3 / h (Ugal / min)	m^3 / h (Ugal / min)	
40	1 1/2	31 (138)	25 (110)	0.83 (1.05)	0.063 (0.28)	0.04 (0.18)	630	1.7 (7.48)	0.1 (0.44)	0.063 (0.28)	400
50	2	50 (220)	40 (176)	1.0 (4.40)	0.1 (0.44)	0.063 (0.28)	630	2.0 (8.8)	0.16 (0.7)	0.1 (0.44)	400
65	2 1/2	79 (347)	63 (277)	1.6 (7.04)	0.16 (0.7)	0.1 (0.44)	630	3.2 (10.56)	0.25 (1.1)	0.16 (0.7)	400
80	3	125 (550)	100 (440)	2.0 (8.80)	0.25 (1.1)	0.16 (0.7)	630	4.0 (17.6)	0.4 (1.76)	0.25 (1.1)	400
100	4	200 (880)	160 (704)	3.2 (10.56)	0.41 (1.8)	0.25 (1.1)	630	6.4 (28)	0.64 (2.8)	0.4 (1.76)	400
125	5	200 (880)	160 (704)	3.2 (10.56)	0.41 (1.8)	0.25 (1.1)	630	6.4 (28)	0.64 (2.8)	0.4 (1.76)	400
150	6	500 (2200)	400 (1760)	8.0 (35.20)	1.0 (4.4)	0.63 (2.77)	630	16 (70.4)	1.6 (7)	1.0 (4.4)	400
200	8	788 (3470)	630 (2770)	13.0 (57.2)	1.6 (7.04)	1.0 (4.4)	630	25 (110)	2.5 (11)	1.6 (7)	400
250	10	1250 (5500)	1000 (4400)	20 (88)	2.5 (11.01)	1.6 (7)	630	40 (176)	4.0 (17.6)	2.5 (11)	400
300	12	2000 (8810)	1600 (7045)	32 (140.8)	4.1 (18.05)	2.5 (11)	630	64 (281.6)	6.4 (28)	4.0 (17.6)	200
350	14	2000 (8810)	1600 (7045)	32 (140.8)	6.4 (28.18)	4.0 (17.6)	400	64 (281.6)	12.8 (56)	8.0 (35.2)	200
375	15	2000 (8810)	1600 (7045)	32 (140.8)	6.4 (28.18)	4.0 (17.6)	400	64 (281.6)	12.8 (56)	8.0 (35.2)	200
400	16	3125 (13760)	2500 (11007)	50 (220)	10 (44)	6.3 (27.7)	400	100 (440)	20 (88)	12.5 (55)	200
450	18	3125 (13760)	2500 (11007)	50 (220)	10 (44)	6.3 (27.7)	400	100 (440)	20 (88)	12.5 (55)	200
500	20	5000 (22014)	4000 (17610)	80 (352)	16 (70.45)	10 (44)	400	160 (70.4)	32 (141)	20 (88)	200
600	24	7875 (34670)	6300 (27740)	126 (554.4)	25.2 (110.9)	15.8 (70)	400	252 (1108)	50.4 (222)	31.5 (138.7)	200

WaterMaster
Electromagnetic flowmeter

Specification – sensor

Functional specification

Pressure limitations

As per flange rating – non approved
PN16 for OIML R49, MID Approved

Pressure equipment directive 97/23/EC

This product is applicable in networks for the supply, distribution and discharge of water and associated equipment and is therefore exempt.

Temperature limitations

Ambient temperature
Remote transmitter –20 to 70 °C (–4 to 158 °F)
Integral transmitter –20 to 60 °C (–4 to 140 °F)

Process temperature See table below.
0.1 to 50 °C (32.2 to 122 °F) – OIML R49 T50 Approved

			Medium temperature °C (°F)	
Code	**Lining**	**Flange material**	**Minimum**	**Maximum**
FEF, FEW3	Hard rubber	Carbon steel	–10 (14)	90 (194)
		Stainless steel	–10 (14)	90 (194)
FEW1	PTFE	Carbon steel	–10 (14)	130 (266)
		Stainless steel	–25 (–13)	130 (266)
FEW3	PTFE	Carbon steel	–10 (14)	130 (266)
		Stainless steel	–10 (14)	130 (266)
FEW3	Elastomer	Carbon steel	–5 (23)	80 (176)
		Stainless steel	–5 (23)	80 (176)
FEF, FER	Elastomer	Carbon steel	–6 (21)	70 (158)
FEV	Polypropylene		–6 (21)	70 (158)

IP rating

IP68 (NEMA 6) to 7 m (20 ft.) depth
Note. Not sizes DN10 to DN32 ($^3/_8$ – $1^1/_4$ in. NB)

IP67 (NEMA 4X) – DN10 to DN32 ($^3/_8$ – $1^1/_4$ in. NB)

Buriable (sensor only)

FEV, FEF and FEW – DN450 to 2400 (18 to 96 in. NB) to 5 m (16 ft.) depth

Conductivity

>5µS cm^{-1}

Transmitter mounting

Integral (not FEF) or remote

Electrical connections

20 mm glands

$^1/_2$ in. NPT
20 mm armored glands

Sensor cable

ABB WaterMaster cable available in two forms – standard and armored
Maximum length 200 m (660 ft.)

Physical specification

Wetted parts

Electrode material

Stainless steel 316 L / 316 Ti

Super-austenitic steel

Hastelloy® C-22 and Hastelloy C4

(other electrode materials available on request)

Potential equalizing rings

Minimum of 1 recommended

Lining material / potable water approvals

			Potable Water Approvals					
Code	**Size Range**	**Liner**	**WRAS**	**WRAS 60°C**	**ACS**	**DVGW**	**NSF**	**AZ/ NZS 4020**
FEW1	DN10 – 32 ($^3/_8$ – $1^1/_4$ in. NB)	PTFE	4					
FEW3	DN10 – 600 ($^3/_8$ – 24 in. NB)	PTFE						
FEW3	DN40 – 2400 ($1^1/_2$ – 96 in. NB)	Elastomer	4					4
FEW3	DN40 – 2400 ($1^1/_2$ – 96 in. NB)	Hard rubber	4	4		4	NSF approved material	
FEV	DN40 – 200 ($1^1/_2$ – 8 in. NB)	Poly-propylene	4		4	4	NSF-61	4
FEF	DN250 – 600 (10 – 24 in. NB)	Elastomer	4		4	4	NSF-61	4
FEF	DN250 – 600 (10 – 24 in. NB)	Hard rubber	4	4		4	NSF approved material	
FER	DN40 – 600 ($1^1/_2$ – 24 in. NB)	Elastomer	4		4	4		4

*Size is dependent on flange specification

Lining protection plates

Not required

Installation conditions (recommended)

	Straight pipe requirements	
	Upstream	Downstream
FEW / FEF	5 x DN	2 x DN
FEV	5x DN	0 x DN
FER	0 x DN	0 x DN

Pressure loss

Negligible at Q3	All full bore meters
<0.25 bar (<3.62 psi) at Q3	FEV (DN40 to 200 [$1^1/_2$ to 8 in. NB])
<0.63 bar (<9.13 psi) at Q3	FER (DN40 to 600 [$1^1/_2$ to 24in. NB])

WaterMaster
Electromagnetic flowmeter

Non-wetted parts

Flange material

Carbon steel	DN20 to DN2400 (3/4 to 96 in. NB)
Stainless steel	DN10 to DN2400 (3/8 to 96 in. NB)
SG iron	FEV – DN40 to DN150 [1 1/2 to 6 in. NB) FER – DN40 to DN150 [1 1/2 to 6 in. NB)

Housing material

Carbon steel	FEV – DN40 to 200 (1 1/2 to 8 in. NB)
	FEW – DN450 to 2400 (18 to 96 in. NB)
Plastic	FEF – DN250 to 600 (10 to 24 in. NB)
Aluminium	FEW – DN10 to 400 (3/8 to 16 in. NB)

Terminal box material

Polycarbonate

Cable gland material

Plastic, brass

Paint specification

Paint coat ≥70 µm thick RAL 9002 (light grey)

WaterMaster
Electromagnetic flowmeter

Specification – transmitter

Functional specification

Power supply

Mains	85 to 265 V AC @ <7 VA
Low voltage	24 V AC +10 % /–30 % @ <7 VA
DC	24 V ±30 % @ <0.4 A

Supply voltage fluctuations within the specified range have no effect on accuracy

Digital Outputs (3)

Rating 30 V @ 220 mA, open collector, galvanically isolated *

Maximum output frequency 5250 Hz

1 off dedicated to Alarm / Logic, programmable function

2 off configurable to either Pulse / Frequency or Alarm/Logic function

Current output – HART FEX100 variant

4 to 20 mA or 4 to 12/20 mA, galvanically isolated *

Maximum loop resistance 750 Ω

HART protocol Version 5.7 (HART registered)

Signal levels compliant with NAMUR NE 43 (3.8 to 20.5 mA)

Low alarm 3.6 mA, High alarm 21.8 mA

Additional accuracy

±0.1 % of reading

Temperature coefficient: typically <±20 ppm/°C

RS485 Communications – PROFIBUS FEX100-DP variant

Registered name: FEX100-DP

RS485 (9.6kbps to 1.5Mbps), galvanically isolated

DPV0, DPV1

PA Profile 3.01

Standard idents: 9700, 9740, 9741

FEX100-DP specific ident: 3431

3 Concurrent MS2 master connections

RS485 Communications – MODBUS FEX100-MB variant

MODBUS RTU protocol

RS485 (9.6kbps to 115.2kbps), galvanically isolated

Electrical connections

20 mm glands 1/2 in. NPT, 20 mm armored glands

Temperature limitations

Ambient temperature	–20 to 60 °C (–4 to 140 °F)
Temperature coefficient	Typically <±10 ppm/°C @ Vel ≥0.5 mls

Environmental protection

Humidity: 0 to 100 %

Rating: IP67 (NEMA 4X) to 1m (3.3 ft.) depth

Tamper-proof security

Write access prevented by internal switch combined with external security seals for MID applications

Languages

English, French, German, Italian, Spanish, Polish

Infrared service port

USB adapter (accessory), USB 1.1. and 2.0 compatible

Driver software for Windows 2000, XP, 7 (32-bit) and Vista

Housing material

Powder-coated aluminium with glass window

Paint specification

Paint coat ≥70 µm thick RAL 9002 (light grey)

Transmitter vibration testing

Vibration level: 7 m/s^2

Frequency range: 20 to 150 Hz

No. of sweeps in 3 orthogonal planes: 20

Undetectable shift in transmitter span or zero performance

Hazardous approvals (HART variant only)

FM & FMc Class 1 Div 2

(FM listing NI / 1 / 2 / ABCD / T4, S / II, III / 2 / FG /T4,
Ta=60C; Type 4X, IP67 – for transmitter and integral mounting
Ta=70C, Type 6P, IP68 – for remote sensor type,
IP67 on DN10 to 32 [3/8 to 1 1/4 in.NB])

(FMc listing NI / 1 / 2 / ABCD / T4, DIP / II, III / 2 / FG /T4,
Ta=60C; Type 4X, IP67 – for transmitter and integral mounting
Ta=70C, Type 6P, IP68 – for remote sensor type, IP67 on
DN10 to 32 [3/8 to 1 1/4 in.NB])

FET, FEV, FEW and FEF DN700 to 2200 (27/28* to 84 in. NB) only

*Size is dependent on flange specification

ATEX* Zone 2, 21 & 22

II 3 G Ex nA IIC T5 Gc
II 2 D Ex tb IIIC T100°C Db
TA = –20°C to +60°C (integral transmitter)
TA = –20°C to +70°C (remote sensor)

IECEx* Zone 2, 21 & 22

Ex tb IIIC T100°C Db
Ex nA IIC T5 Gc
TA = –20°C to +60°C (integral transmitter)
TA = –20°C to +70°C (remote sensor)

*FEW, FEV, FET and FEF ≥700 (27/28 in. NB) only

Declaration of Conformance

Copies of CE certification will be available on request.

WaterMaster has OIML R49 Certificate of Conformity to accuracy class 1 and 2 (FEV DN40 to 200 [1 1/2 to 8 in.NB]). Copies of accuracy certification are available on request.

WaterMaster (FEV DN40 to 200 [1 1/2 to 8 in.NB]) has been type examined under directive MID 2004/22/EC, Annex MI-001. Copies of this certificate are available on request.

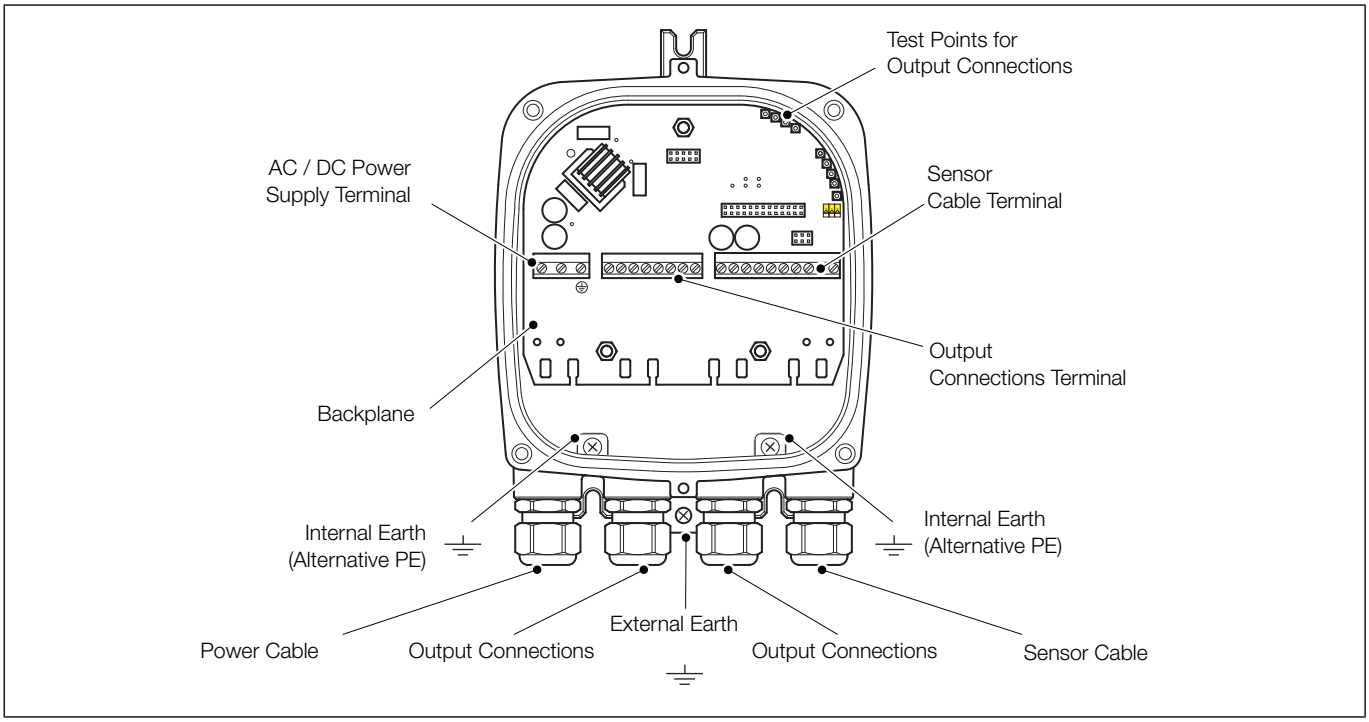
* When installed, do not leave galvanically isolated circuits (pulse and current) floating.

WaterMaster
Electromagnetic flowmeter

Transmitter connections

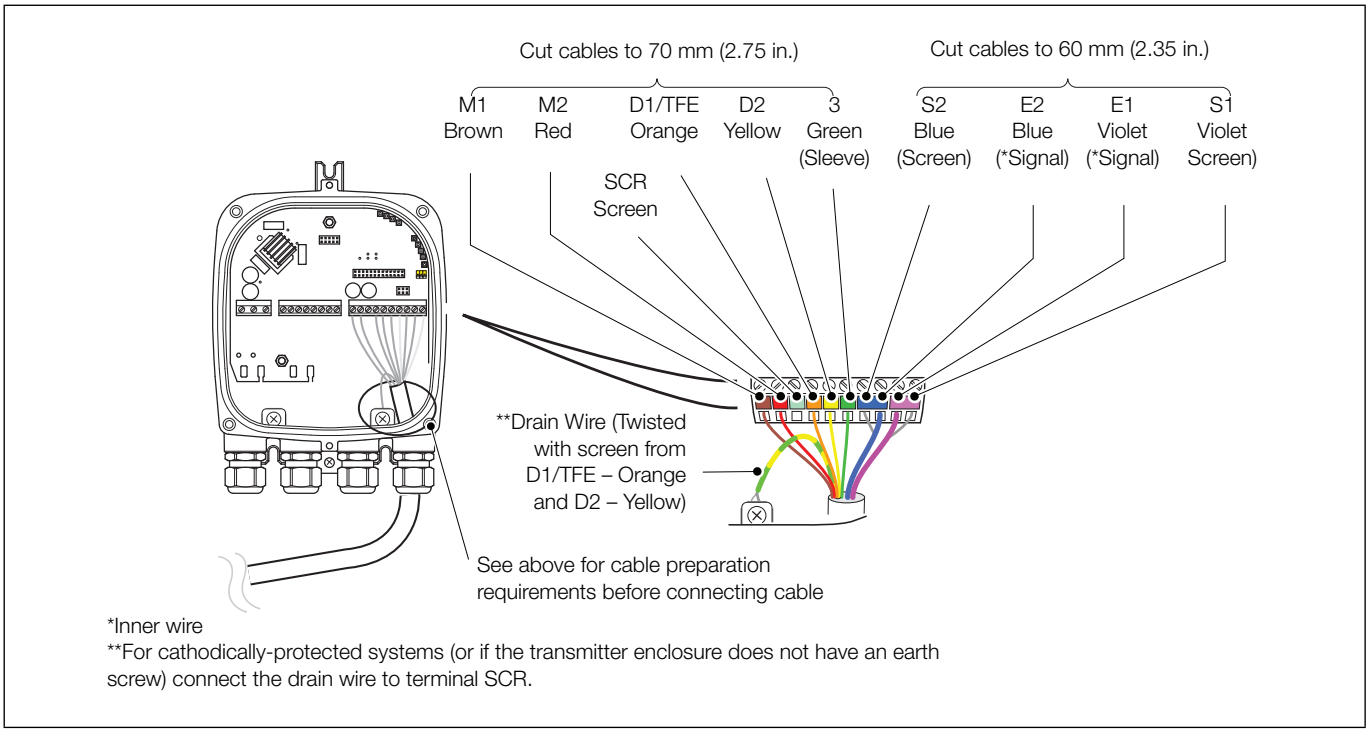
Transmitter terminal connections overview

This section is intended to give an overview of installation of a flowmeter. For Installation requirements, technical information and Health and safety precautions – refer to the User Guide OI/FET100–EN.



Cable gland / conduit entry (Remote transmitter shown)

Sensor cable terminal connections and recommended cable lengths

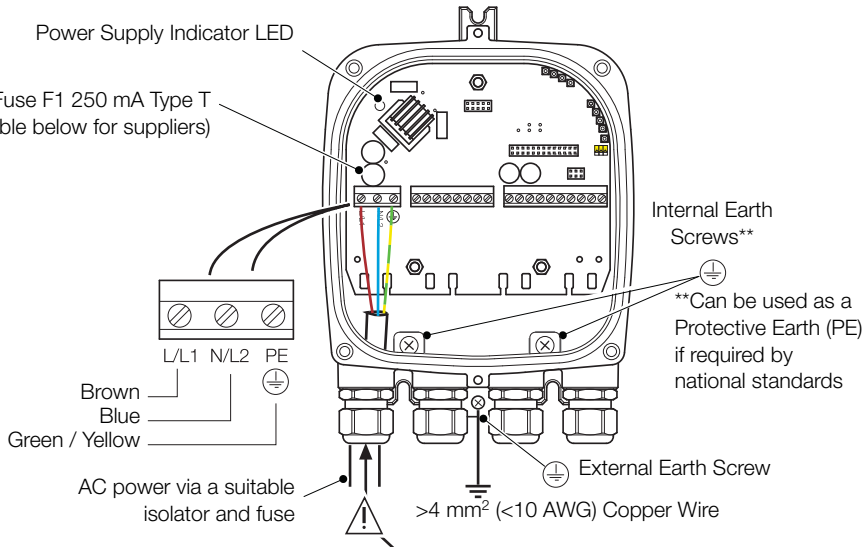


*Inner wire
**For cathodically-protected systems (or if the transmitter enclosure does not have an earth screw) connect the drain wire to terminal SCR.

Sensor cable connections at transmitter terminal block – remote transmitter

Power supply connections

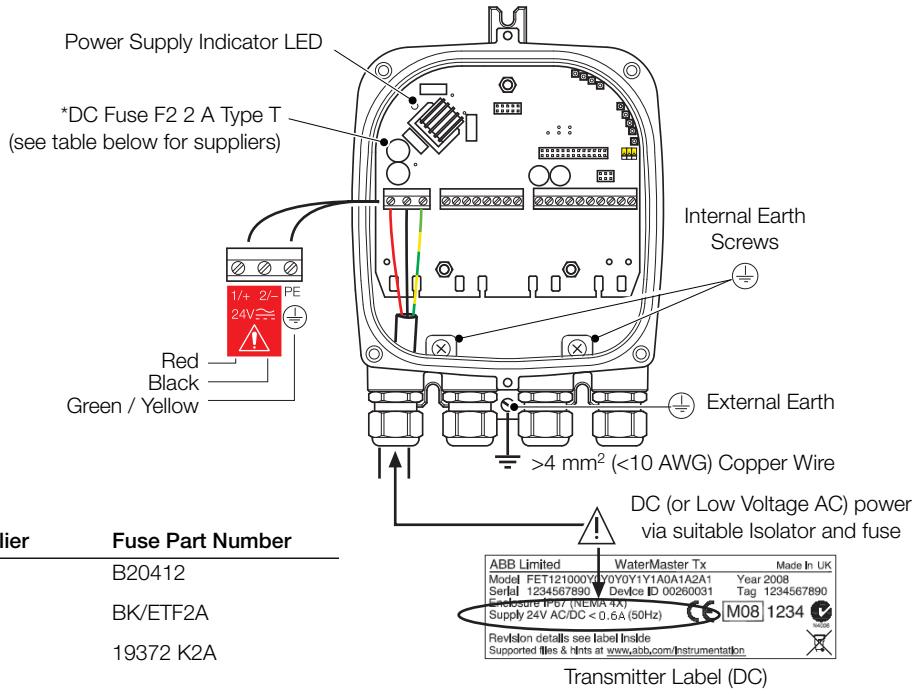
AC power supply



*Fuse Supplier	Fuse Part Number
ABB	B20411
Bussmann	BK/ETF 250 mA
Wickmann	19372 K250mA

AC power supply connections

DC (and low voltage AC) power supply



*Fuse Supplier	Fuse Part Number
ABB	B20412
Bussmann	BK/ETF2A
Wickmann	19372 K2A

DC (and low voltage AC) power supply connections

Configuration DIP switches

Three configuration DIP switches are mounted on the transmitter backplane board.

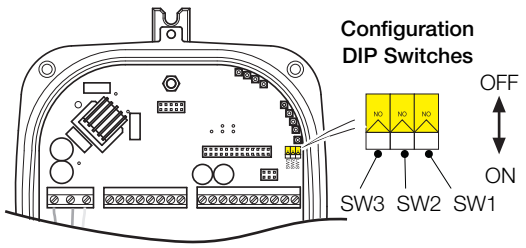
These are factory-set as follows:

- Remote transmitter – all OFF
- Integral transmitter – SW3 ON

For MID-compliant flowmeters the read-only / MID protection switch is set to 'ON' to ensure the meter is secure from tampering.

For HART software versions prior to 01.02.XX, this switch (set after commissioning) prevents login via the keypad or bus at any security level.

From HART software version 01.03.XX onwards and for all PROFIBUS software versions, on MID meters, all metrological-related parameters are locked and inaccessible at the Service level. Standard and Advanced user level parameters can still be modified via the HMI or bus.



DIP Switch Functions

SW1 – Read-only / MID Protection

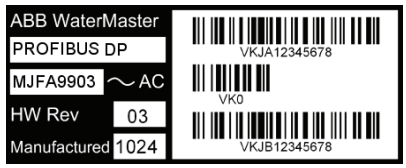
SW2 – (Future Product)

SW3 – Internal Sensor Memory

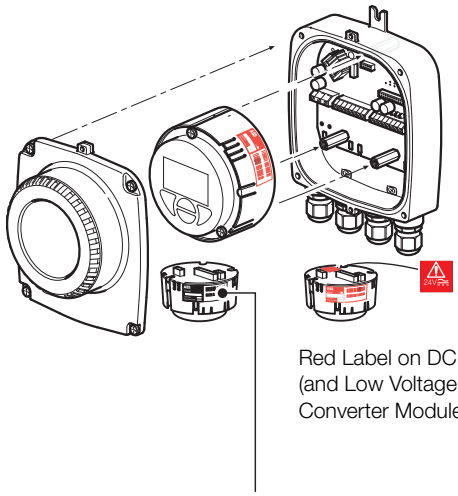
Configuration DIP switches

Transmitter module identification

Note. The communications bus type is HART FEX100 if not specified on the transmitter module label. An example of the PROFIBUS FEX100-DP variant transmitter module label is shown below.



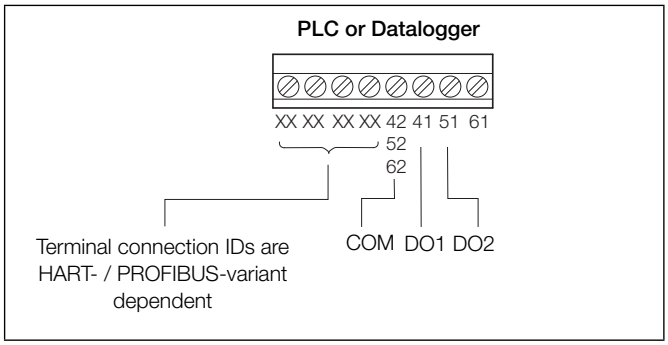
PROFIBUS FEX-100P Label



Transmitter module identification

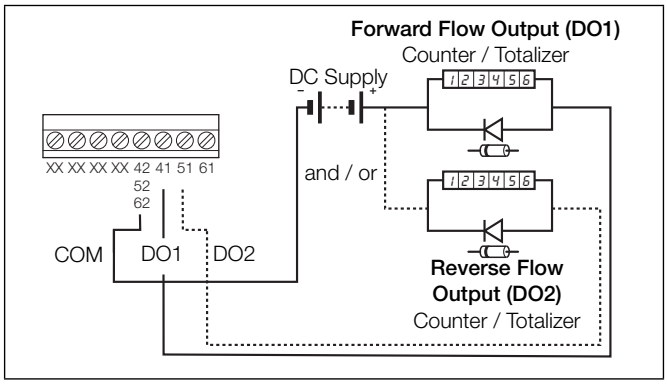
Output connections

Frequency outputs

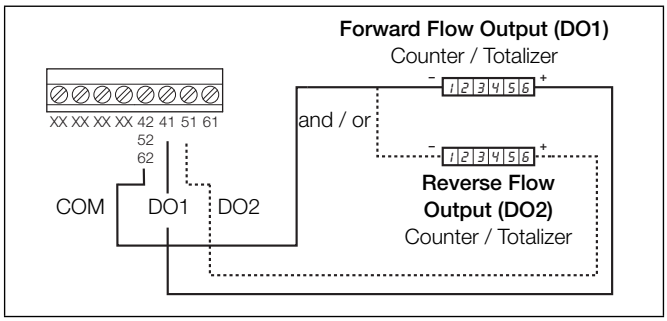


PLC / Datalogger connections

Note. Digital outputs DO1 and DO2 are polarity sensitive. The common (negative) connection for these outputs is designated 'COM'.

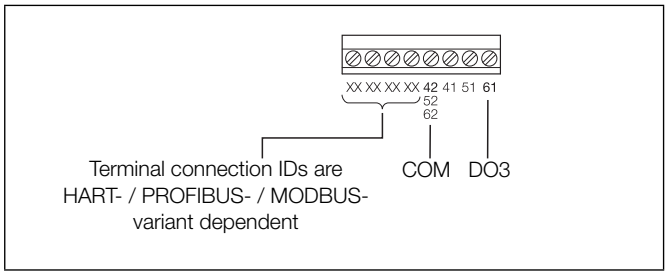


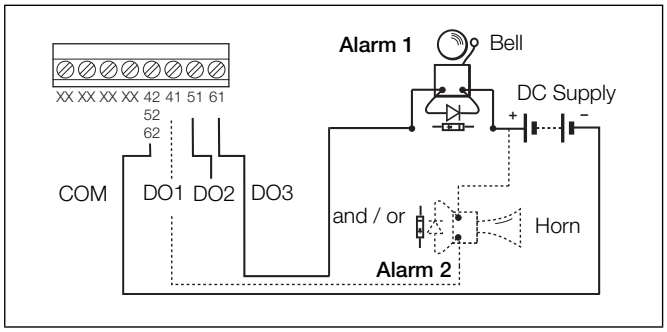
Electromechanical connections



Telemetry / Electronic counters connections

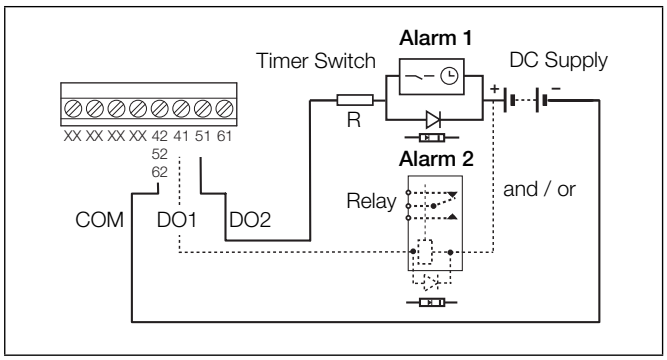
Alarm outputs





Note.

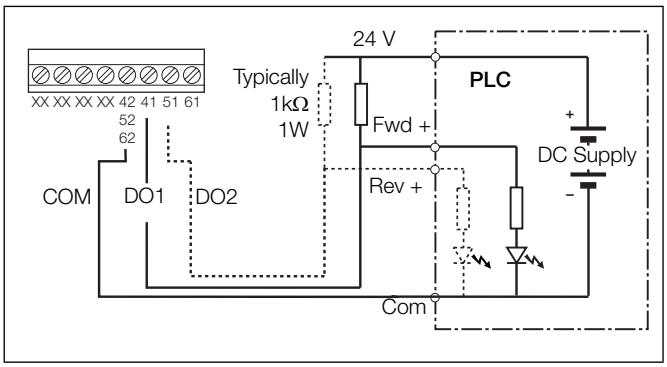
- Normal alarm / logic output is from DO3 (terminal 61). DO1 (41) and DO2 (51) can also be configured as alarms if required but are then NOT available as frequency / pulse outputs as shown in *Electromechanical connections* and *Telemetry / Electronic counters connections*, opposite.
- Bell and horn shown for example only. Any suitable alarm device may be used (for example, lamp, siren, buzzer etc.).

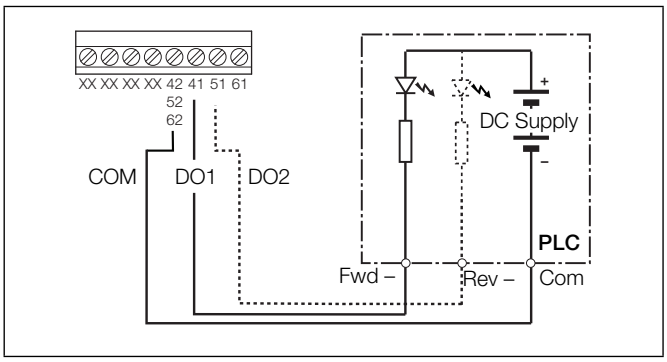


Note. Relay and timer switch shown for example only.

WaterMaster
Electromagnetic flowmeter

PLC interface

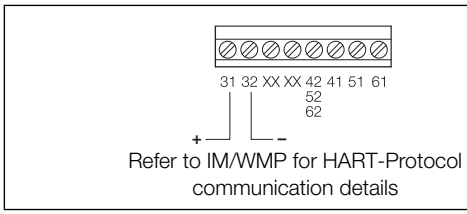




Note.

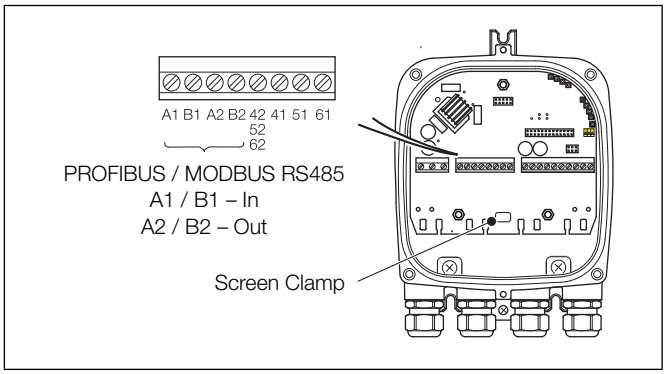
- WaterMaster digital outputs are NPN optocoupled transistors used as switches.
- Maximum allowed voltage at collector is 30 V DC
- Maximum allowed current across transistor is 220 mA.

Current output (4 to 20 ma) – HART (FEX100) variant



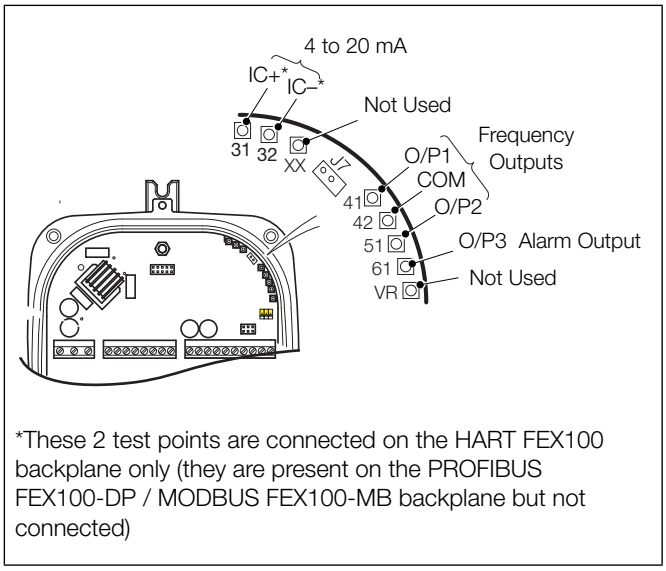
Current output (4 to 20 mA) – HART (FEX100) variant

RS485 communications – PROFIBUS (FEX100-DP) and MODBUS (FEX100-MB) variants



Test point access

Note. A typical DVM probe can access (fit) the PCB's test holes.



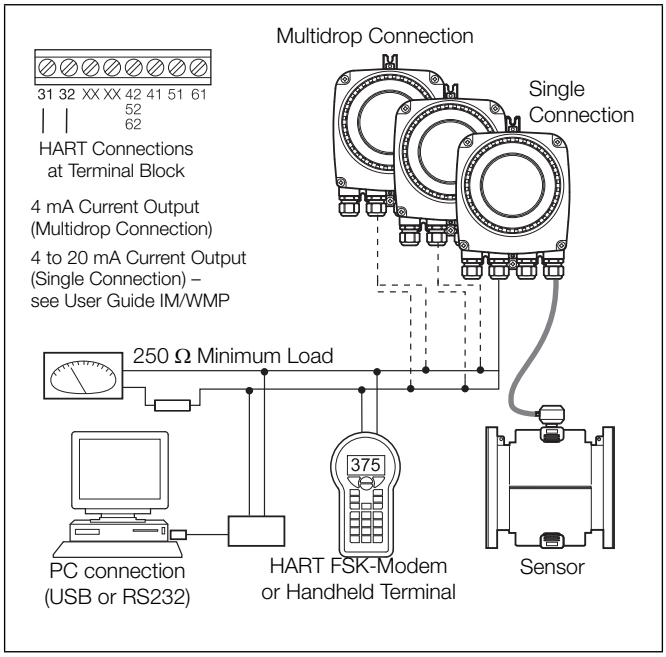
*These 2 test points are connected on the HART FEX100 backplane only (they are present on the PROFIBUS FEX100-DP / MODBUS FEX100-MB backplane but not connected)

Digital communication

The transmitter has the following options for digital communication.

HART protocol

The unit is registered with HART Communication Foundation.



HART protocol	
Configuration	Directly on the Device Software Asset Vision Basic (+ HART -DTM)
Transmission	Install a HART modem (FSK [Frequency Shift Keyed]-Modem) for HART-Communication when connecting to a PC. The HART-Modem converts the analog 4 to 20 mA signal into a digital output signal (Bell Standard 202) and connects to the PC using a USB (or RS232C) connector
Max. signal amplitude	1.2 mA
Current output load	Min. 250Ω, max. = 560Ω
Cable	AWG 24 twisted
Max. cable length	1500 m (4921 ft.)
Baud rate	1.200 baud

System integration

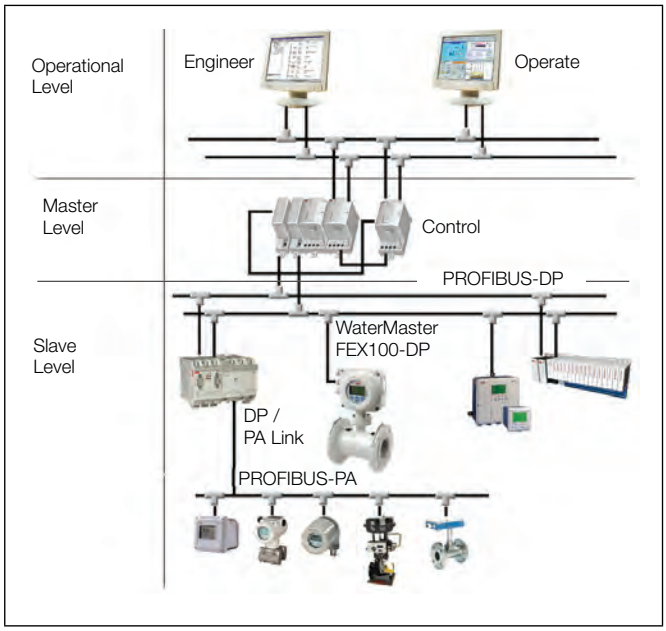
WaterMaster can be integrated into control systems and configuration devices using any Frame application, such as ABB AssetVision or similar third-party applications. ABB Device Type Managers (DTMs) for WaterMaster provide a unified structure for accessing device parameters, configuring and operating the devices and diagnosing problems. FDT (Field Device Tool) technology standardizes the communication and configuration interface between all field devices and host systems.

PROFIBUS DP protocol

PROFIBUS is a manufacturer-independent, open Fieldbus standard for a wide range of applications in manufacturing, process and building automation. Manufacturer independence and openness are ensured by the international standard EN 50170.

PROFIBUS DP ID no.	0x3431
Alternative standard ID no.	0x9701 or 0x9741
Configuration	Directly on the device Software Asset Vision Basic (+PROFIBUS DP-DTM)
Transmission signal	Accuracy to IEC 61158-2
Cable	Shielded, twisted cable (accurate to IEC 61158-2, types A or B)

All devices are connected in a bus structure ('line') as shown in below. Up to 32 stations (master or slaves) can be linked to create one 'segment', although it is recommended not to install more than 16 devices on a single segment. Each end of a segment must be terminated by an active bus terminating resistor. Both bus terminators must always be powered to ensure fault-free operation, therefore it is strongly recommended that they are connected to a back-up power supply. The use of bus amplifiers (repeaters) and segment couplers can be used to extend the network.



System integration

The GSD file for WaterMasters specifies the device-specific Ident No. 3431. It conforms to the PROFIBUS standard, providing a clear and comprehensive description of each instrument in a precisely defined format.

This enables the system configuration tool to use the information automatically when configuring a PROFIBUS bus system.

The ABB GSD file (Ident No. 3431) is divided into 2 sections:

- General specifications

  Identification of the device, together with hardware and software versions, baud rates supported and the possible time intervals for monitoring times.

- DP slave-related specifications

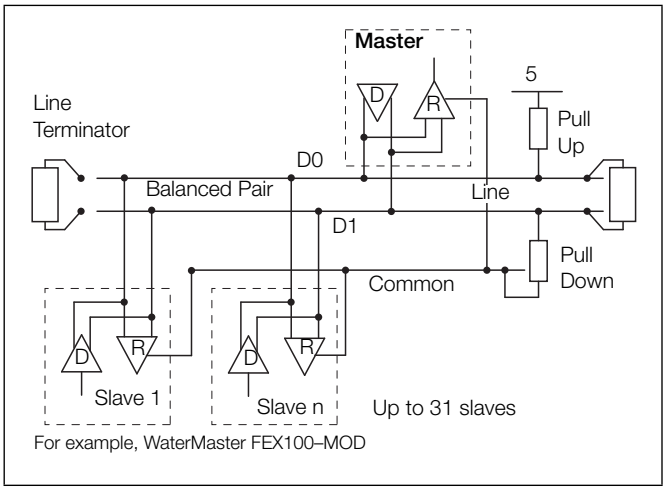
  Information about the user parameter block for device-specific configuration and modules containing details of the input and output data that can be exchanged cyclically with a PROFIBUS master.

The WaterMaster GSD file (ABB_3431.gsd) is available for download from the ABB website at: www.abb.com/fieldbus (follow the link for PROFIBUS DP field devices).

MODBUS protocol

MODBUS is an open standard that is owned and administered by an independent group of device manufacturers called the Modbus Organization (www.modbus.org).

Using the MODBUS protocol, devices from different manufacturers exchange information on the same communications bus without the need for special interface equipment. WaterMaster FEX100-MB follows the specification for Modbus Over Serial Line V1.02, using 2-wire TIA/EIA-485 (RS485) physical layer.



Cable Properties

The end-to-end length of the trunk cable must be limited. The maximum length depends on the Baud rate, the cable (gauge, capacitance or characteristic impedance), the number of loads on the daisy chain and the network configuration (2-wire or 4-wire).

For 9600 Baud rate and AWG26 (or wider) gauge, the maximum length is 1000 m (3280 ft.). Where 4-wire cabling is used as a 2-wire cabling system the maximum length must be divided by 2. The tap cables must be short, never more than 20 m (65.6 ft.). If a multi-port tap is used with n derivations, each one must have a maximum length of 40 m (131 ft.) divided by n.

The maximum serial data transmission line length for RS485 systems is 1200 m (3937 ft.). The lengths of cable that can be used are determined by the cable type, typically:

- Up to 6 m (19.7 ft.) – standard screened or twisted pair cable.
- Up to 300 m (984 ft.) – twin twisted pair with overall foil screen and an integral drain wire – for example, Belden 9502 or equivalent.
- Up to 1200 m (3937 ft.) – twin twisted pair with separate foil screens and integral drain wires – for example, Belden 9729 or equivalent.

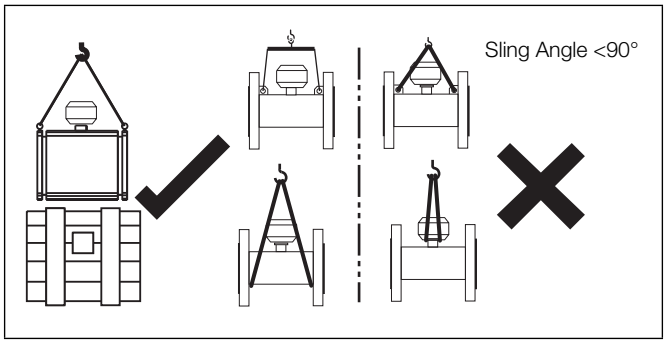
Category 5 cables may be used for RS485-MODBUS to a maximum length of 600 m (1968 ft.). For the balanced pairs used in an RS485-system, a characteristic impedance with value higher than 100Ω is preferred especially for 19200 and higher Baud rates.

Installation requirements

This section is intended to give an overview of installation of a flowmeter. For Installation requirements, technical information and Health and Safety precautions refer to User Guide OI/FEF/FEV/FEW–EN.

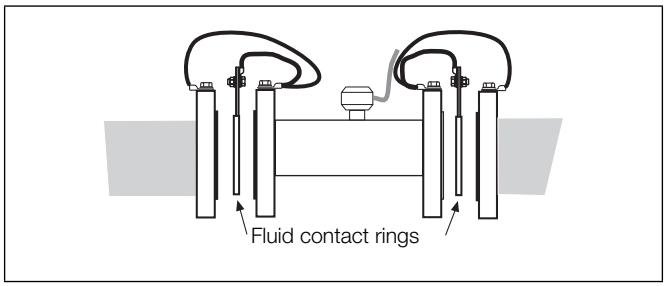
Unpacking the flowmeter

Care must be taken when lifting the flowmeter to use the lifting hooks provided or sling under the body of the meter. Never lift using the terminal connection box of the sensor cable as this will cause damage and invalidate warranty.



Grounding

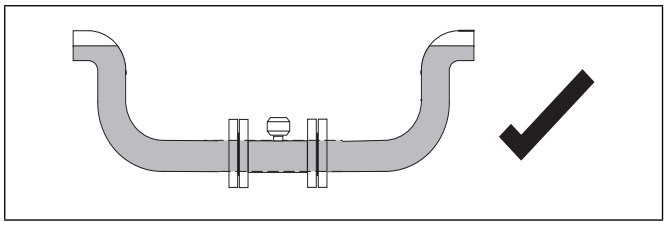
The flowmeter sensor must be cross-bonded to the upstream and downstream pipes and fluid. For technical reasons, this potential should be identical to the potential of the metering fluid. For plastic or insulated lined pipelines, the fluid is grounded by installing a minimum of 1 earthing rings. When there are stray potentials present in the pipeline, an earthing ring is recommended on both ends of the meter sensor.



Mounting

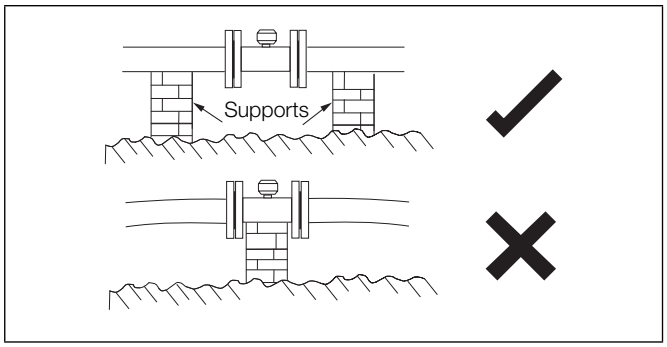
The installation conditions shown below must be observed to achieve the best operational results.

The sensor tube must always be completely full.

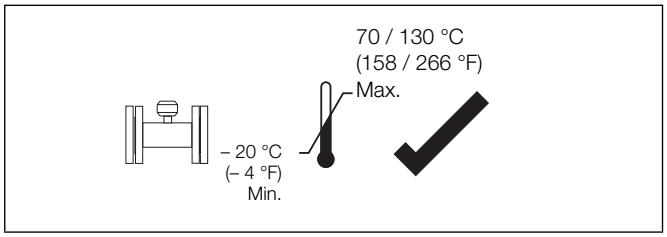


The flow direction must correspond to the identification plate. The device measures the flowrate in both directions. Forward flow is the factory setting.

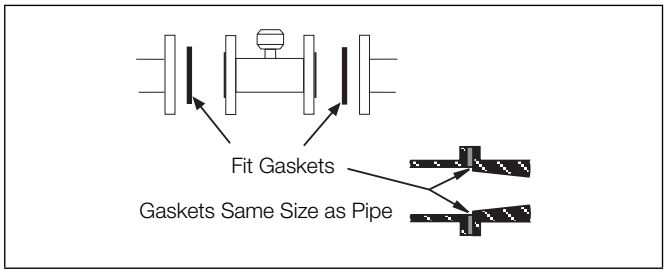
The devices must be installed without mechanical tension (torsion, bending). If required support the pipeline.



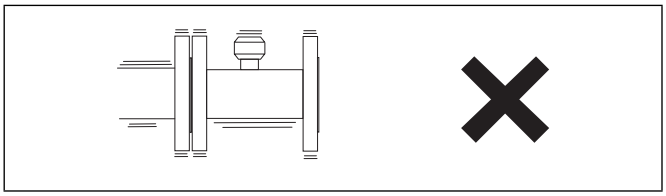
The flange seals must be made from a compatible material for the fluid and fluid temperatures if required.



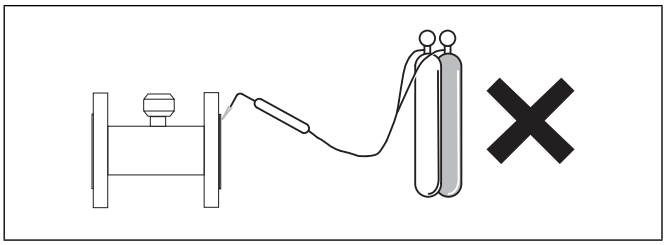
Seals must not extend into the flow area since possible turbulence could influence the device accuracy.



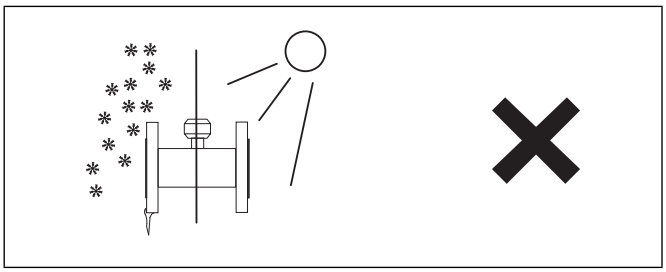
The pipeline may not exert any unallowable forces and torques on the device, such as vibration.



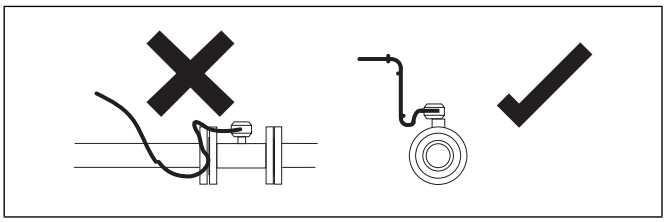
The flowmeter must not be submitted to any localized heat during installation; take care to remember this is a measuring instrument.



The flowmeter must not be exposed to direct sunlight or provide for appropriate sun protection where necessary.

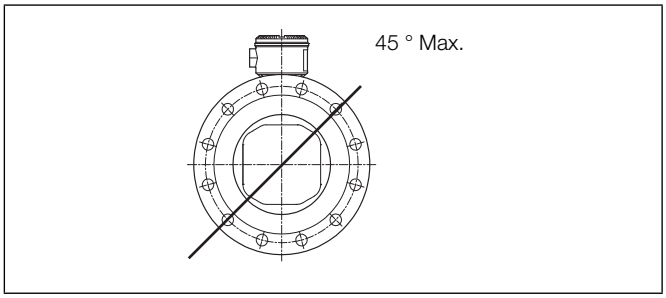


The cable to the flowmeter should be installed neatly or within a conduit, both loose or conduit should have a u shape below the terminal connection box height to allow any water run off to avoid any capillary action into the flowmeter sensor.



Electrode axis

Electrode axis should be horizontal if at all possible or no more than 45° from horizontal.



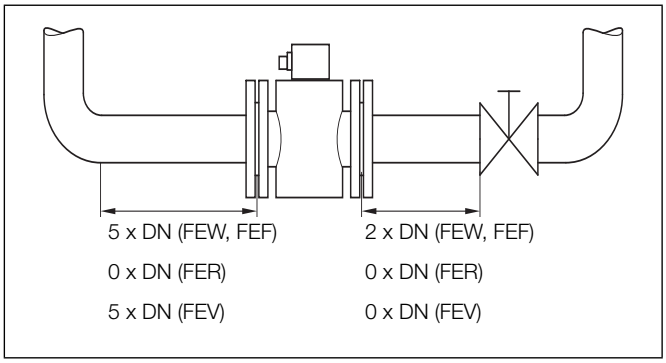
Upstream and Downstream pipe sections

The metering principle is tolerant of the flow profile.

- Wherever possible do not install fittings (for example, manifolds, valves) directly in front of the flowmeter sensor.
- Butterfly valves should be installed so that the valve plate does not extend into the flowmeter sensor.
- Valves or other turn-off components should be installed in the Downstream pipe section.

Experience has shown that, in most installations, straight upstream sections 3 x DN long and straight downstream sections 2 x DN long are normally sufficient. We would recommend conditions of 5 x DN straight upstream and 2 x DN straight downstream where possible.

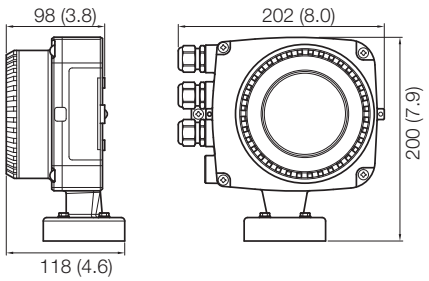
For reduced-bore meters (FER), these straight pipe sections are often not necessary.



Transmitter dimensions

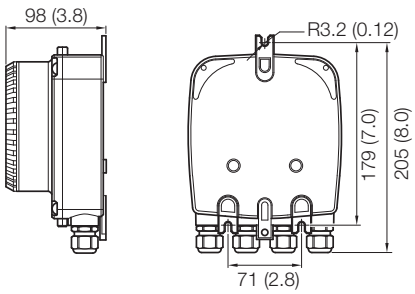
Integral transmitter

Dimensions in mm (in.)



Remote transmitter

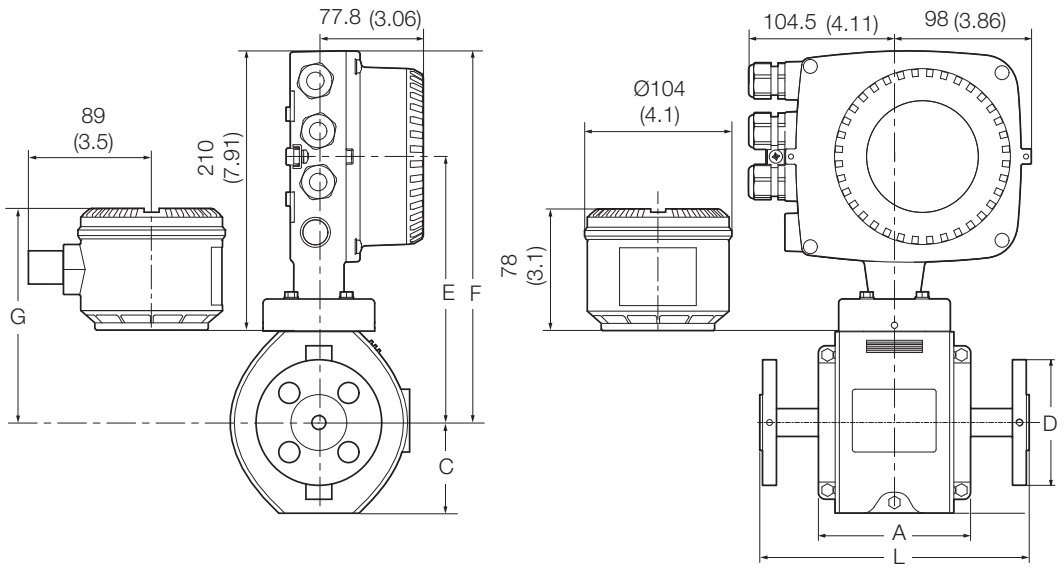
Dimensions in mm (in.)



Sensor dimensions

FEW – DN10 to 125 (3/8 to 5 in. NB)

Dimensions in mm (in.)



DN10 to 125 (3/8 to 5 in. NB) (FEW)

WaterMaster
Electromagnetic flowmeter

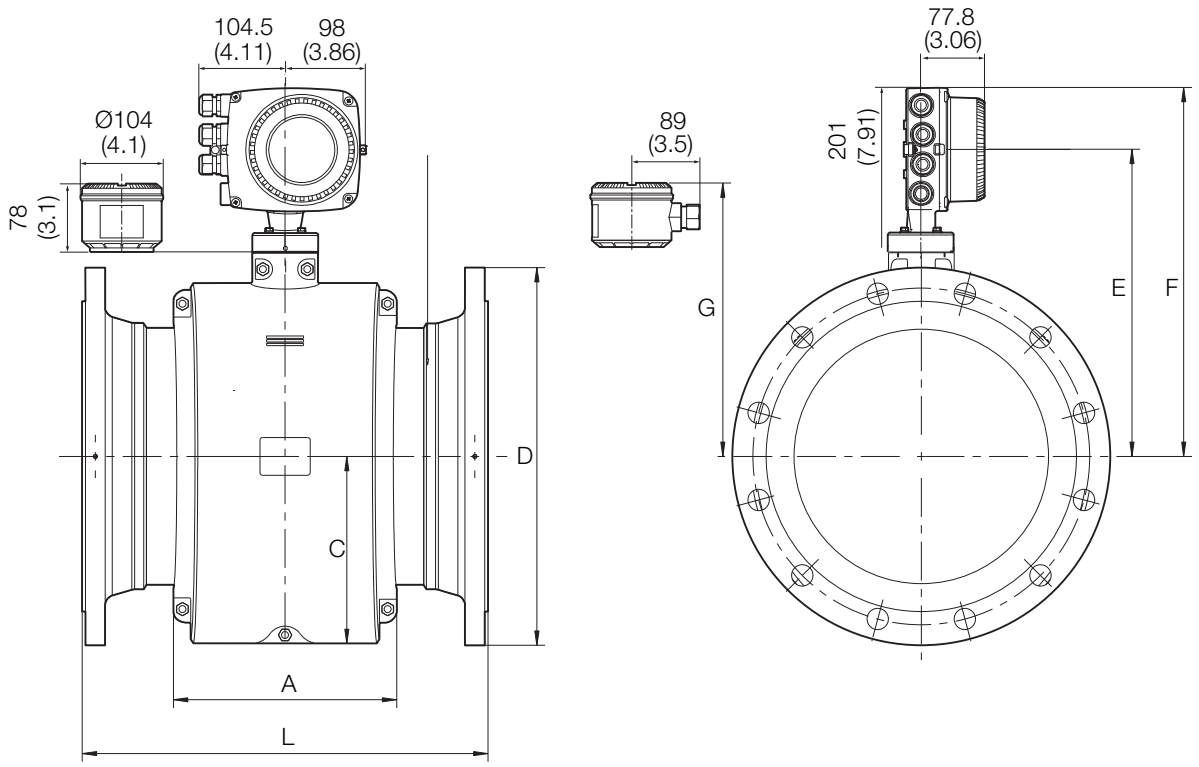
		Dimensions in mm (in.)							Approx. weight in kg (lb)	
DN	Process connection type	D	L	F	C	E	G	A	Integral	Remote
DN10 (3/8 in.)	JIS10K	90 (3.54)	200 (7.87)	268 (10.55)	82 (3.23)	193 (7.6)	148 (5.83)	113 (4.45)	6 (13)	4 (9)
	PN10 to 40	90 (3.54)								
	ASME B16.5 CL150	90 (3.54)								
	ASME B16.5 CL300	96 (3.78)								
DN15 (1/2 in.)	PN10 to 40	95 (3.74)								
	JIS5K	80 (3.15)								
	JIS10K	95 (3.74)								
	ASME B16.5 CL300	95 (3.74)								
	ASME B16.5 CL150	90 (3.54)								
DN20 (3/4 in.)	PN10 to 40	105 (4.13)							8 (18)	6 (13)
	JIS5K	85 (3.35)								
	JIS10K	100 (3.94)								
	ASME B16.5 CL300	115 (4.53)								
	ASME B16.5 CL150	98 (3.86)								
DN25 (1 in.)	PN10 to 40	115 (4.53)	200 (7.87)	268 (10.55)	82 (3.23)	193 (7.6)	148 (5.83)	113 (4.45)	9 (20)	7 (15)
	JIS5K	95 (3.74)								
	JIS10K	125 (4.88)								
	ASME B16.5 CL300	125 (4.88)								
	ASME B16.5 CL150	108 (4.25)								
DN32 (1 1/4 in.)	PN10 to 40	140 (5.51)		275 (10.83)	92 (3.62)	200 (7.87)	155 (6.10)	113 (4.45)	10 (22)	8 (18)
	JIS5K	115 (4.53)								
	JIS10K	135 (5.31)								
	ASME B16.5 CL300	135 (5.31)								
	ASME B16.5 CL150	117 (4.61)								
DN40 (1 1/2 in.)	PN10 to 40	150 (5.91)							11 (24)	9 (20)
	JIS5K	120 (4.72)								
	JIS10K	140 (5.51)								
	ASME B16.5 CL300	155 (6.10)								
	ASME B16.5 CL150	127 (5.00)								
DN50 (2 in.)	PN10 to 40	165 (6.5)		281 (11.06)	97 (3.82)	206 (8.11)	161 (6.34)	115 (4.53)	12 (26)	10 (22)
	JIS5K	130 (5.12)								
	JIS10K	155 (6.10)								
	AS4087 PN16	150 (5.91)								
	AS4087 PN35	165 (6.50)								
	ASME B16.5 CL150	152 (5.98)								
	ASME B16.5 CL300	165 (6.50)								
DN65 (2 1/2 in.)	PN10 to 40	185 (7.28)		292 (11.50)	108 (4.25)	217 (8.54)	172 (6.77)	104 (4.09)	13 (29)	11 (24)
	JIS5K	155 (6.10)								
	JIS10K	175 (6.89)								
	AS4087 PN16	165 (6.50)								
	AS4087 PN35	185 (7.28)								
	ASME B16.5 CL150	178 (7.01)								
	ASME B16.5 CL300	190 (7.48)							15 (33)	13 (29)
DN80 (3 in.)	PN10 to 40	200 (7.87)		292 (11.5)	108 (4.25)	217 (8.54)	172 (6.77)	104 (4.09)	17 (37)	15 (33)
	JIS5K	180 (7.09)								
	JIS10K	185 (7.28)								
	AS4087 PN16	185 (7.28)								
	AS4087 PN35	205 (8.07)								
	ASME B16.5 CL150	190 (7.48)								
	ASME B16.5 CL300	210 (8.28)							19 (42)	17 (37)
DN100 (4 in.)	PN10 to 16	220 (8.66)	250 (9.84)	314 (12.36)	122 (4.8)	239 (9.41)	194 (7.64)	125 (4.92)	19 (42)	17 (37)
	PN25 to 40	235 (9.25)							23 (51)	21 (46)
	JIS5K	200 (7.87)							19 (42)	17 (37)
	JIS10K	210 (8.27)								
	AS4087 PN16	215 (8.46)								
	AS4087 PN35	230 (9.06)							23 (51)	21 (46)
	ASME B16.5 CL300	255 (1.04)							30 (66)	28 (62)
	ASME B16.5 CL150	229 (9.00)							21 (51)	19 (42)
DN125 (5 in.)	PN10 to 16	250 (9.84)		324 (12.76)	130 (5.12)	249 (9.8)	204 (8.03)	125 (4.92)	22 (48)	20 (44)
	PN25 to 40	270 (10.63)							29 (64)	27 (59)
	JIS5K	235 (9.25)							22 (48)	20 (44)
	JIS10K	250 (9.84)								
	ASME B16.5 CL150	254 (10.00)								
	ASME B16.5 CL300	280 (11.02)							35 (77)	33 (73)

DN10 to 125 (3/8 to 5 in. NB) (FEW) dimensions / weights

WaterMaster
Electromagnetic flowmeter

FEW – DN150 to 400 (6 to 16 in. NB)

Dimensions in mm (in.)



DN150 to 400 (6 to 16 in. NB) (FEW)

WaterMaster
Electromagnetic flowmeter

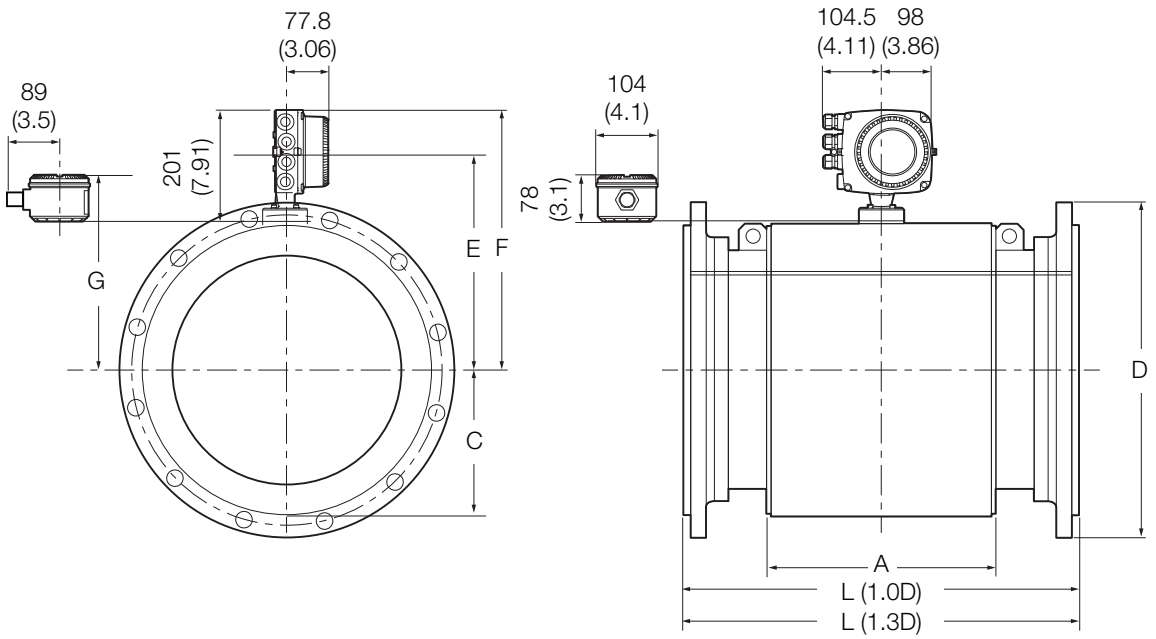
		Dimensions in mm (in.)							Approx. weight in kg (lb)	
DN	Process connection type	D	L	F	C	E	G	A	Integral	Remote
DN150 (6 in.)	PN10 to 16	285 (11.22)	300 (11.81)	371 (14.61)	146 (9.88)	296 (11.65)	251 (9.88)	166 (6.54)	33 (73)	31 (68)
	PN25 to 40	300 (11.81)							39 (86)	37 (81)
	JIS5K	265 (10.43)							33 (73)	31 (68)
	JIS10K	280 (11.02)								
	AS4087 PN16	280 (11.02)								
	AS4087 PN35	305 (11.81)							39 (86)	37 (81)
	ASME B16.5 CL300	320 (12.60)							47 (103)	45 (99)
	ASME B16.5 CL150	279 (10.98)							33 (73)	31 (68)
DN200 (8 in.)	PN10	340 (13.39)	350 (13.78)	411 (16.18)	170 (6.69)	336 (13.23)	291 (11.46)	200 (7.87)	41 (90)	39 (86)
	PN16	340 (13.39)								
	PN25	360 (14.17)							55 (121)	53 (117)
	PN40	375 (14.76)							65 (143)	63 (139)
	AS4087 PN16	335 (13.19)							41 (90)	39 (86)
	AS4087 PN35	370 (14.57)							65 (143)	63 (139)
	JIS5K	320 (12.60)							41 (90)	39 (86)
	JIS10K	330 (12.99)								
	ASME B16.5 CL300	380 (14.96)							72 (158)	70 (154)
	ASME B16.5 CL150	345 (13.58)							50 (110)	48 (106)
DN250 (10 in.)	PN10	395 (15.55)	450 (17.72)	426 (16.77)	198 (7.80)	351 (13.82)	306 (12.05)	235 (9.62)	61 (134)	59 (130)
	PN16	405 (15.94)							65 (143)	63 (139)
	PN25	425 (16.73)							84 (185)	82 (180)
	PN40	450 (17.72)							95 (209)	93 (205)
	AS4087 PN16	405 (15.94)							65 (143)	63 (139)
	AS4087 PN35	430 (16.93)							95 (209)	93 (205)
	JIS5K	385 (15.16)							65 (143)	63 (139)
	JIS10K	400 (15.75)								
	ASME B16.5 CL300	445 (17.52)							105 (231)	103 (227)
	ASME B16.5 CL150	405 (15.94)							70 (154)	68 (150)
DN300 (12 in.)	PN10	445 (17.52)	500 (19.69)	449 (17.68)	228 (8.98)	374 (14.72)	329 (12.95)	272 (10.71)	74 (163)	72 (158)
	PN16	460 (18.11)							80 (176)	78 (172)
	PN25	485 (19.09)							100 (220)	98 (216)
	JIS5K	430 (16.93)							80 (176)	78 (172)
	JIS10K	445 (17.52)								
	AS4087 PN16	455 (17.91)								
	AS4087 PN35	490 (19.29)							130 (286)	128 (282)
	ASME B16.5 CL300	520 (20.47)							150 (330)	148 (326)
	ASME B16.5 CL150	485 (19.09)							105 (231)	103 (227)
	PN40	515 (20.28)	600 (23.62)						130 (286)	128 (282)
DN350 (14 in.)	PN10	505 (19.88)	550 (21.65)	464 (18.27)	265 (10.43)	389 (15.31)	344 (13.54)	322 (12.68)	95 (209)	93 (205)
	PN16	520 (20.47)							110 (242)	108 (238)
	PN25	555 (21.85)							145 (319)	143 (315)
	JIS5K	480 (18.90)							95 (209)	93 (205)
	JIS10K	490 (19.29)								
	AS4087 PN16	525 (20.67)							130 (286)	128 (282)
	AS4087 PN35	550 (21.65)							185 (407)	183 (403)
	ASME B16.5 CL300	585 (23.03)							140 (308)	138 (304)
	ASME B16.5 CL150	535 (21.06)							105 (231)	103 (227)
	PN40	580 (22.83)	650 (25.59)						195 (429)	193 (425)
DN400 (16 in.)	PN10	565 (22.24)	600 (23.62)	506 (19.92)	265 (10.43)	431 (16.97)	386 (15.20)	322 (12.68)	103 (227)	101 (222)
	PN16	580 (22.83)							126 (277)	124 (273)
	PN25	620 (24.41)							170 (374)	168 (370)
	JIS5K	540 (21.26)							103 (227)	101 (223)
	JIS10K	560 (22.05)							116 (255)	114 (251)
	AS4087 PN16	580 (22.83)							154 (339)	152 (335)
	AS4087 PN35	610 (24.02)							302 (664)	300 (660)
	ASME B16.5 CL300	650 (25.59)							265 (583)	263 (578)
	ASME B16.5 CL150	600 (23.62)							175 (385)	173 (381)
	PN40	660 (25.98)	650 (25.59)						258 (568)	256 (564)

DN150 to 400 (6 to 5 in. NB) (FEW) dimensions / weights

WaterMaster
Electromagnetic flowmeter

FEW – DN450 to 2400 (18 to 96 in. NB)

Dimensions in mm (in.)



DN450 to 2400 (18 to 96 in. NB) (FEW)

		Dimensions in mm (in.)								Approx. weight in kg (lb)	
DN	Process connection type	D	L (1.0D)	L (1.3D)	F	C	E	G	A	Integral	Remote
DN450 (18 in.)	PN10	615 (24.21)	N/A	600 (23.62)	514 (20.24)	310 (12.20)	439 (17.28)	394 (15.51)	328 (12.91)	173 (381)	171 (377)
	PN16	640 (25.20)								188 (414)	186 (410)
	JIS5K	605 (23.82)								165 (364)	163 (359)
	JIS10K	620 (24.41)								177 (390)	175 (386)
	AS4087 PN16	640 (25.20)								232 (511)	230 (507)
	AS4087 PN35	675 (26.57)								328 (723)	326 (718)
	ASME B16.5 CL300	710 (27.95)								368 (811)	366 (807)
	ASME B16.5 CL150	635 (25.00)								250 (551)	248 (547)
	PN25	670 (26.38)	N/A	686 (27.01)						245 (540)	243 (536)
	PN40	685 (26.97)								315 (694)	313 (690)
DN500 (20 in.)	PN10	670 (26.38)	N/A	600 (23.62)	514 (20.24)	310 (12.20)	439 (17.28)	394 (15.51)	367 (14.45)	190 (418)	188 (413)
	PN16	715 (28.15)								240 (528)	238 (524)
	JIS5K	655 (25.79)								190 (418)	188 (413)
	JIS10K	675 (26.57)									
	AS4087 PN16	705 (27.76)								290 (638)	288 (634)
	AS4087 PN35	735 (28.94)								435 (957)	433 (953)
	ASME B16.5 CL150	700 (27.56)								300 (660)	298 (656)
	ASME B16.5 CL300	775 (30.51)	N/A	762						490 (1080)	488 (1076)
	PN25	730 (28.74)	N/A	700						300 (661)	298 (657)
	PN40	755 (29.72)	N/A	762						392 (864)	390 (860)
DN600 (24 in.)	PN10	780 (30.71)	N/A	800 (31.50)	565 (22.24)	361 (14.21)	490 (19.29)	445 (17.52)	469 (18.46)	284 (626)	282 (622)
	PN16	840 (33.07)								318 (700)	316 (695)
	PN25	845 (33.27)								460 (1012)	458 (1008)
	JIS5K	770 (30.31)								275 (605)	273 (600)
	JIS10K	795 (31.30)								306 (673)	304 (668)
	AS4087 PN16	825 (32.48)								382 (840)	380 (835)
	AS4087 PN35	850 (33.46)								452 (994)	450 (990)
	ASME B16.5 CL300	915 (36.02)								550 (1210)	548 (1205)
	ASME B16.5 CL150	815 (32.09)								425 (935)	423 (930)
	PN40	890 (35.04)	N/A	890						600 (1320)	598 (1316)

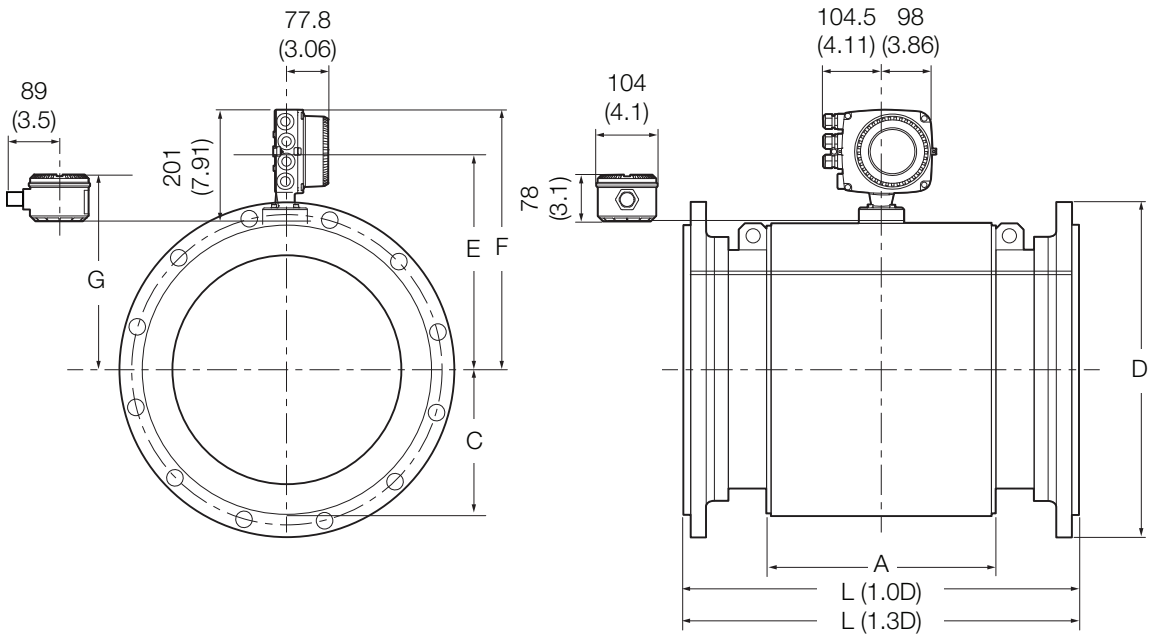
DN450 to 2400 (18 to 96 in. NB) (FEW) dimensions / weights

		Dimensions in mm (in.)								Approx. weight in kg (lb)	
DN	Process connection type	D	L (1.0D)	L (1.3D)	F	C	E	G	A	Integral	Remote
DN700 (28 in.)	JIS 5K	875 (34.45)	700 (27.56)	910 (35.83)	604 (23.77)	403 (15.87)	528 (20.79)	488 (19.21)	444 (17.48)	216 (475)	214 (471)
	JIS 10K	905 (35.63)								282 (620)	280 (616)
	PN6	860 (33.86)								225 (495)	223 (491)
	PN10	895 (35.24)								303 (667)	301 (662)
	PN16	910 (35.83)								337 (741)	335 (737)
	AWWA C207 CLASS B	927 (36.50)								249 (548)	247 (543)
	AWWA C207 CLASS D	927 (36.50)								280 (616)	278 (612)
	AS4087 PN16	910 (35.83)								359 (790)	357 (785)
	AS2129 TABLE-D	910 (35.83)								263 (579)	261 (574)
	AS2129 TABLE-E	910 (35.83)								337 (741)	335 (737)
	PN25	960 (37.80)								471 (10.36)	469 (1032)
	PN40	995 (39.17)								586 (1289)	584 (1285)
	AWWA C207 CLASS E	927 (36.50)								472 (1038)	470 (1034)
	AWWA C207 CLASS F	1035 (40.75)								715 (1573)	713 (1569)
	AS4087 PN35	935 (36.80)								539 (1186)	537 (1181)
	ASME CL150 SERIES A	925 (36.42)								503 (1107)	501 (1102)
	ASME CL150 SERIES B	835 (32.87)								323 (711)	321 (706)
	ASME CL300 SERIES B	920 (36.22)								631 (1388)	629 (1384)
DN750 (30 in.)	JIS 5K	945 (37.20)	750 (29.52)	990 (38.98)	630 (24.79)	429 (16.89)	554 (21.81)	514 (20.23)	444 (17.48)	251 (552)	249 (548)
	JIS 10K	970 (38.19)								327 (719)	325 (715)
	AWWA C207 CLASS B	984 (38.74)								273 (601)	271 (596)
	AWWA C207 CLASS D	984 (38.74)								344 (757)	342 (752)
	AS4087 PN16	995 (39.17)								467 (1027)	465 (1023)
	AS2129 TABLE-D	995 (39.17)								340 (748)	338 (744)
	AS2129 TABLE-E	995 (39.17)								454 (999)	452 (994)
	AWWA C207 CLASS E	984 (38.74)								496 (1091)	494 (1087)
	AWWA C207 CLASS F	1092 (43.99)								790 (1738)	788 (1734)
	AS4087 PN35	1015 (39.96)								663 (1459)	661 (1454)
	ASME CL150 SERIES A	985 (38.78)								544 (1197)	542 (1192)
	ASME CL150 SERIES B	885 (34.84)								320 (704)	318 (700)
	ASME CL300 SERIES B	990 (38.98)								748 (1646)	746 (1641)
DN800 (32 in.)	JIS 5K	995 (39.17)	800 (31.49)	1040 (40.04)	654 (25.74)	453 (17.83)	578 (22.76)	538 (21.18)	542 (21.34)	280 (616)	278 (612)
	JIS 10K	1020 (40.16)								364 (801)	362 (796)
	PN6	975 (38.39)								294 (647)	292 (642)
	PN10	1015 (39.96)								406 (893)	404 (889)
	PN16	1025 (40.35)								469 (1032)	467 (1027)
	AWWA C207 CLASS B	1060 (41.73)								328 (722)	326 (717)
	AWWA C207 CLASS D	1060 (41.73)								408 (898)	406 (893)
	AS4087 PN16	1060 (41.73)								530 (1166)	528 (1162)
	AS2129 TABLE-D	1060 (41.73)								386 (849)	384 (845)
	AS2129 TABLE-E	1060 (41.73)								519 (1142)	517 (1137)
	PN25	1085 (42.72)								615 (1353)	613 (1349)
	PN40	1140 (44.88)								866 (1905)	864 (1901)
	AWWA C207 CLASS E	1060 (41.73)								634 (1395)	632 (1390)
	AWWA C207 CLASS F	1150 (45.28)								897 (1973)	895 (1969)
	AS4087 PN35	1060 (41.73)								751 (1652)	749 (1648)
	ASME CL150 SERIES A	1060 (41.73)								700 (1540)	698 (1536)
	ASME CL150 SERIES B	940 (37.01)								406 (893)	404 (889)
	ASME CL300 SERIES B	1055 (41.54)								933 (2053)	931 (2048
DN900 (36 in.)	JIS 5K	1095 (43.11)	900 (35.43)	1170 (46.06)	705 (27.7()	504 (19.84)	629 (24.76)	589 (23.19)	570 (22.44)	369 812)	367 (807)
	JIS 10K	1120 (44.09)								445 (979)	443 (975)
	PN6	1075 (42.32)								390 (858)	388 (854)
	PN10	1115 (43.90)								502 (1104)	500 (1100)
	PN16	1125 (44.29)								589 (1296)	587 (1291)
	AWWA C207 CLASS B	1168 (45.98)								417 (917)	415 (913)
	AWWA C207 CLASS D	1168 (45.98)								493 (1085)	491 (1080)
	AWWA C207 CLASS E	1168 (45.98)								827 (1819)	825 (1815)
	AWWA C207 CLASS F	1270 (50.00)								1150 (2530)	1148 (2526)
	AS4087 PN16	1175 (46.26)								706 (1553)	704 (1549)
	AS2129 TABLE-D	1175 (46.26)								514 (1131)	512 (1126)
	AS2129 TABLE-E	1175 (46.26)								694 (1527)	692 (1522)
	PN25	1185 (46.65)								819 (1802)	817 (1797)
	PN40	1250 (49.21)								1158 (2548)	1156 (2543)
	AS4087 PN35	1185 (46.65)								1044 (2297)	1042 (2292)
	ASME CL150 SERIES A	1170 (46.06)								961 (2114)	959 (2110)
	ASME CL150 SERIES B	1055 (41.54)								595 (1309)	593 (1305)
	ASME CL300 SERIES B	1170 (46.06)								1147 (2523)	1145 (2519)

DN450 to 2400 (18 to 96 in. NB) (FEW) dimensions / weights (Continued)

WaterMaster
Electromagnetic flowmeter

Dimensions in mm (in.)



…DN450 to 2400 (18 to 96 in. NB) (FEW)

		Dimensions in mm (in.)								Approx. weight in kg (lb)	
DN	Process connection type	D	L (1.0D)	L (1.3D)	F	C	E	G	A	Integral	Remote
DN1000 (40 in.)	JIS 5K	1195 (47.05)	1000 (39.37)	1300 (51.18)	755 (29.71)	554 (21.81)	679 (26.73)	639 (25.16)	624 (24.57)	441 (970)	439 (966)
	JIS 10K	1235 (48.62)								572 (1258)	570 (1254)
	PN6	1175 (46.26)								466 (1025)	464 (1021)
	PN10	1230 (48.43)								674 (1483)	672 (1478)
	PN16	1255 (49.41)								879 (1934)	877 (1929)
	AWWA C207 CLASS B	1289 (50.75)								503 (1107)	501 (1102)
	AWWA C207 CLASS D	1289 (50.75)								659 (1450)	657 (1445)
	AWWA C207 CLASS E	1289 (50.75)								1028 (2262)	1026 (2257)
	AWWA C207 CLASS F	1378 (54.25)								1367 (3007)	1365 (3003)
	AS4087 PN16	1255 (49.41)								831 (1828)	829 (1824)
	AS2129 TABLE-D	1255 (49.41)								610 (1342)	608 (1338)
	AS2129 TABLE-E	1255 (49.41)								833 (1833)	831 (1028)
	PN25	1320 (51.97)								1207 (2655)	1205 (2651)
	PN40	1360 (53.54)								1413 (3109)	1411 (3104)
	AS4087 PN35	1275 (50.20)								1244 (2737)	1242 (2732)
	ASME CL150 SERIES A	1290 (50.79)								1149 (2528)	1147 (2523)
	ASME CL300 SERIES A	1240 (48.82)								1349 (2968)	1347 (2963)
	ASME CL150 SERIES B	1175 (46.26)								738 (1624)	736 (1619)
	ASME CL300 SERIES B	1275 (50.20)								1487 (3271)	1485 (3267)
DN1050 (42 in.)	AWWA C207 CLASS B	1346 (5299)	1050 (41.33)	1365 (53.74)	808 (31.82)	608 (23.92)	733 (28.84)	693 (27.28)	624 (24.57)	564 (1241)	562 (1236)
	AWWA C207 CLASS D	1346 (5299)								669 (1472)	667 (1467)
	AWWA C207 CLASS E	1346 (5299)								1143 (2515)	1141 (2510)
	AWWA C207 CLASS F	1448 (57.01)								1568 (3450)	1566 (3445)
	ASME CL150 SERIES B	1225 (48.23)								809 (1780)	807 (1775)
	ASME CL150 SERIES A	1345 (52.95)								1289 (2836)	1287 (2831)
	ASME CL300 SERIES A	1290 (50.79)								1527 (3359)	1525 (3355)
	ASME CL300 SERIES B	1335 (52.56)								1704 (3749)	1702 (3744)
DN1100 (44 in.)	JIS 5K	1305 (51.38)	1100 (43.30)	1430 (56.30)						510 (1122)	508 (1118)
	JIS 10K	1345 (52.95)								689 (1516)	687 (1511)
	AWWA C207 CLASS B	1403 (55.24)								615 (1353)	613 (1349)
	AWWA C207 CLASS D	1403 (55.24)								807 (1775)	805 (1771)
	AWWA C207 CLASS E	1404 (55.26)								1205 (2651)	1203 (2647)
	AWWA C207 CLASS F	1505 (59.25)								1719 (3782)	1717 (3777)

…DN450 to 2400 (18 to 96 in. NB) (FEW) dimensions / weights

WaterMaster
Electromagnetic flowmeter

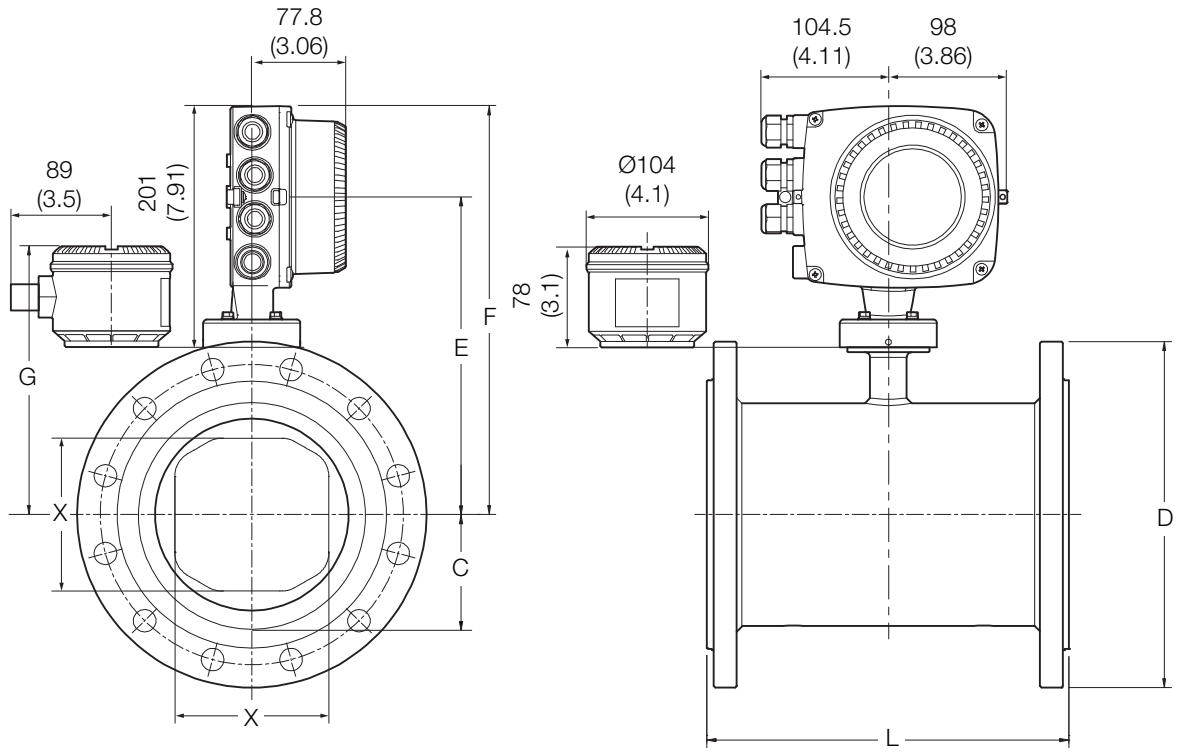
		Dimensions in mm (in.)								Approx. weight in kg (lb)	
DN	Process connection type	D	L (1.0D)	L (1.3D)	F	C	E	G	A	Integral	Remote
DN1200 (48 in.)	JIS 5K	1420 (55.91)	1200 (47.24)	1560 (61.42)	860 (33.85)	659 (25.94)	784 (30.87)	744 (29.29)	802 (31.57)	651 (1432)	649 (1428)
	JIS 10K	1465 (57.68)								967 (2127)	965 (2123)
	PN6	1405 (55.31)								710 (1562)	708 (1558)
	PN10	1455 (57.28)								1107 (2435)	1105 (2431)
	PN16	1485 (58.46)								1363 (2999)	1361 (2994)
	AWWA C207 CLASS B	1511 (59.49)								772 (1698)	770 (1694)
	AWWA C207 CLASS D	1511 (59.49)								999 (2198)	997 (2193)
	AWWA C207 CLASS E	1511 (59.49)								1458 (3208)	1456 (3203)
	AWWA C207 CLASS F	1651 (65.00)								2400 (5280)	2398 (5276)
	AS4087 PN16	1490 (58.66)								1253 (2757)	1251 (2752)
	AS2129 TABLE-D	1490 (58.66)								1023 (2251)	1021 (2246)
	AS2129 TABLE-E	1490 (58.66)								1272 (2798)	1270 (2794)
	PN25	1530 (60.24)								1559 (3430)	1557 (3425)
	PN40	1575 (62.01)								2133 (4693)	2131 (4688)
	AS4087 PN35	1530 (60.24)								2115 (4653)	2113 (4649)
	ASME CL150 SERIES A	1510 (59.45)								1707 (3755)	1705 (3751)
	ASME CL300 SERIES A	1465 (57.68)								2163 (4759)	2161 (4754)
	ASME CL150 SERIES B	1390 (54.72)								1085 (2387)	1083 (2383)
	ASME CL300 SERIES B	1510 (59.45)								2352 (5174)	2350 (5170)
DN1350 (54 in.)	AWWA C207 CLASS B	1683 (66.26)	1350 (53.15)	1755 (69.09)	955 (37.59)	754 (29.69)	879 (34.61)	839 (33.03)	902 (35.51	981 (2158)	979 (2154)
	AWWA C207 CLASS D	1683 (66.26)								1213 (2669)	1211 (2664)
	AWWA C207 CLASS E	1683 (66.26)								1942 (4272)	1940 (4268)
DN1400 (56 in.)	PN6	1630 (64.17)	1400 (55.11)	1820 (71.65)						1085 (2387)	1083 (2383)
	PN10	1675 (65.94)								1731 (3808)	1729 (3804)
	PN16	1685 (66.34)								1770 (3894)	1768 (3890)
	ASME CL150 SERIES B	1600 (62.99)								1593 (3505)	1591 (3500)
	PN25	1755 (69.09)								2368 (5210)	2366 (5205)
	PN40	1795 (70.67)								3086 (6789)	3084 (6785)
	ASME CL150 SERIES A	1745 (68.70)								2556 (5623)	2554 (5619)
	ASME CL300 SERIES A	1710 (67.32)								3376 (7427)	3374 (7423)
	ASME CL300 SERIES B	1765 (69.49)								3758 (8268)	3756 (8263)
DN1500 (60 in.)	JIS 5K	1730 (68.11)	1500 (59.05)	1950 (76.77)	1065 (41.92)	864 (34.02)	989 (38.94)	949 (37.36)	910 (35.83)	1029 (2264)	1027 (2259)
	JIS 10K	1795 (70.67)								1504 (3309)	1502 (3304)
	ASME CL150 SERIES B	1725 (67.91)								2031 (4468)	2029 (4464)
	AWWA C207 CLASS B	1854 (72.99)								1229 (2704)	1227 (2699)
	AWWA C207 CLASS D	1854 (72.99)								1514 (3331)	1512 (3326)
	AWWA C207 CLASS E	1854 (72.99)								2544 (5597)	2542 (5592)
	ASME CL150 SERIES A	1855 (73.03)								3084 (6785)	3082 (6780)
	ASME CL300 SERIES A	1810 (71.26)								3875 (8525)	3873 (8521)
	ASME CL300 SERIES B	1880 (74.02								4181 (9198)	4179 (9194)
DN1600 (64 in.)	PN6	1830 (72.05)	1600 (62.99)	2080 (81.89)	1066 (41.96)	865 (34.06)	990 (38.98)	950 (37.4)	1000 (39.37)	1434 (3155)	1432 (3150)
	PN10	1915 (75.39)								2525 (5555)	2523 (5551)
	PN25	1975 (77.76)								3201 (7042)	3199 (7038)
	PN16	1930 (75.98)								2768 (6090)	2766 (6085)
	PN40	2025 (79.72)								4375 (9625)	4373 (9621)
DN1650 (66 in.)	AWWA C207 CLASS B	2032 (80.00)	N/A	2145 (84.45)	1116 (43.94)	915 (36.02)	1040 (40.94)	1000 (39.37)	1000 (39.37)	1504 (3309)	1502 (3304)
	AWWA C207 CLASS D	2032 (80.00)								2025 (4455)	2023 (4451)
DN1800 (72 in.)	PN6	2045 (80.51)	N/A	2340 (92.13)	1181 (46.50)	980 (38.58)	1105 (43.50)	1065 (41.93)	1100 (43.31)	1853 (4077)	1851 (4072)
	PN10	2115 (83.27)								3180 (6996)	3178 (6992)
	PN16	2130 (83.86)								3657 (8045)	3655 (8041)
	PN25	2195 (86.42)								4422 (9728)	4420 (9724)
	AWWA C207 CLASS B	2197 (86.50)								1773 (3901)	1771 (3896)
	AWWA C207 CLASS D	2197 (86.50)								2387 (5251)	2385 (5247)
DN1950 (78 in.)	AWWA C207 CLASS B	2362 (92.99)	N/A	2535 (99.80)	1291 (50.81)	1090 (42.91)	1215 (47.83)	1175 (46.26)	1180 (46.46)	2309 (5080)	2307 (5075)
	AWWA C207 CLASS D	2362 (92.99)								3037 (6681)	3035 (6677)
DN2000 (80 in.)	PN6	2265 (89.17)	N/A	2600 (102.36)						2581 (5678)	2579 (5674)
	PN10	2325 (91.54)								4254 (9359)	4252 (9354)
	PN16	2345 (92.32)								4556	4554
	PN25	2425 (95.47)								5896	5894
DN2100 (84 in.)	AWWA C207 CLASS B	2534 (99.76)	N/A	2730 (107.48)	1395 (54.91)	1194 (47.01)	1319 (51.93)	1279 (50.35)	1180 (46.46)	2641 (5810)	2639 (5806)
	AWWA C207 CLASS D	2534 (99.76)								3487 (7671)	3485 (7667)
DN2200 (88 in.)	PN6	2475 (97.44)	N/A	2860 (112.60)					1330 (52.36)	3363 (7399)	3361 (7394)
	PN10	2550 (100.39)								5795	5793
DN2400 (96 in.)	PN6	2685 (105.71	N/A	3120 (122.83)	1495 (58.85)	1294 (50.94)	1419 (55.87)	1379 (54.29)	1450 (57.09)	4100 (9020)	4098 (9016)
	PN10	2760 (108.66)								6968	6966

…DN450 to 2400 (18 to 96 in. NB) (FEW) dimensions / weights (Continued)

WaterMaster
Electromagnetic flowmeter

FEV – DN40 to 200 (1½ to 8 in. NB)

Dimensions in mm (in.)



DN40 to 200 (1½ to 8 in. NB) (FEV)

		Dimensions in mm (in.)						Approx. weight in kg (lb)	
DN	Process connection type	D	L	F	E	G	X	Integral	Remote
DN40 (1½ in.)	EN1092-1 PN10, 16, 25, 40	150 (5.91)	200 (7.87)	260 (10.24)	185 (7.28)	137 (5.39)	30 (1.18)	12.8 (28.16)	11.8 (25.96)
	ASME B16.5 CLASS 150								
	AS2129 TABLE D, E, F								
DN50 (2 in.)	EN1092-1 PN10, 16, 25, 40	165 (6.50)	200 (7.87)	261 (10.28)	186 (7.32)	138 (5.43)	38 (1.5)	13.75 (30.25)	12.75 (28.05)
	ASME B16.5 CLASS 150								
DN80 (3 in.)	EN1092-1 PN10, 16, 25, 40	200 (7.87)	200 (7.87)	280 (11.04)	205.5 (8.09)	157.5 (6.2)	61 (2.4)	17.2 (37.84)	16.2 (35.64)
	ASME B16.5 CLASS 150								
	AS4087 PN16, 21								
	AS2129 TABLE D, E, F								
DN100 (4 in.)	EN1092-1 PN10, 16, 25, 40	225 (8.86)	250 (9.84)	300.5 (11.83)	225.5 (8.88)	177.5 (6.98)	70 (2.76)	19.3 (42.5)	18.3 (40.3)
	ASME B16.5 CLASS 150								
	AS4087 PN16								
DN150 (6 in.)	EN1092-1 PN10, 16, 25, 40	300 (11.81)	300 (11.81)	333.5 (13.13)	258.5 (10.18)	210.5 (8.29)	103 (4.06)	35.1 (77.2)	34.1 (75)
	ASME B16.5 CLASS 150								
	AS4087 PN16								
DN200 (8 in.)	EN1092-1 PN10, 16	375 (11.76)	350 (13.78)	358.7 (14.12)	283.7 (11.17)	235.7 (9.28)	150 (5.91)	67 (147.4)	66 (145.2)
	ASME B16.5 CLASS 150								
	AS2129 TABLE C, D, E, F								
	AS4087 PN14, 16, 21								

WaterMaster integral / remote FEV – DN40 to 200 (1½ to 8 in.) cast iron sensor dimensions / weights

WaterMaster
Electromagnetic flowmeter

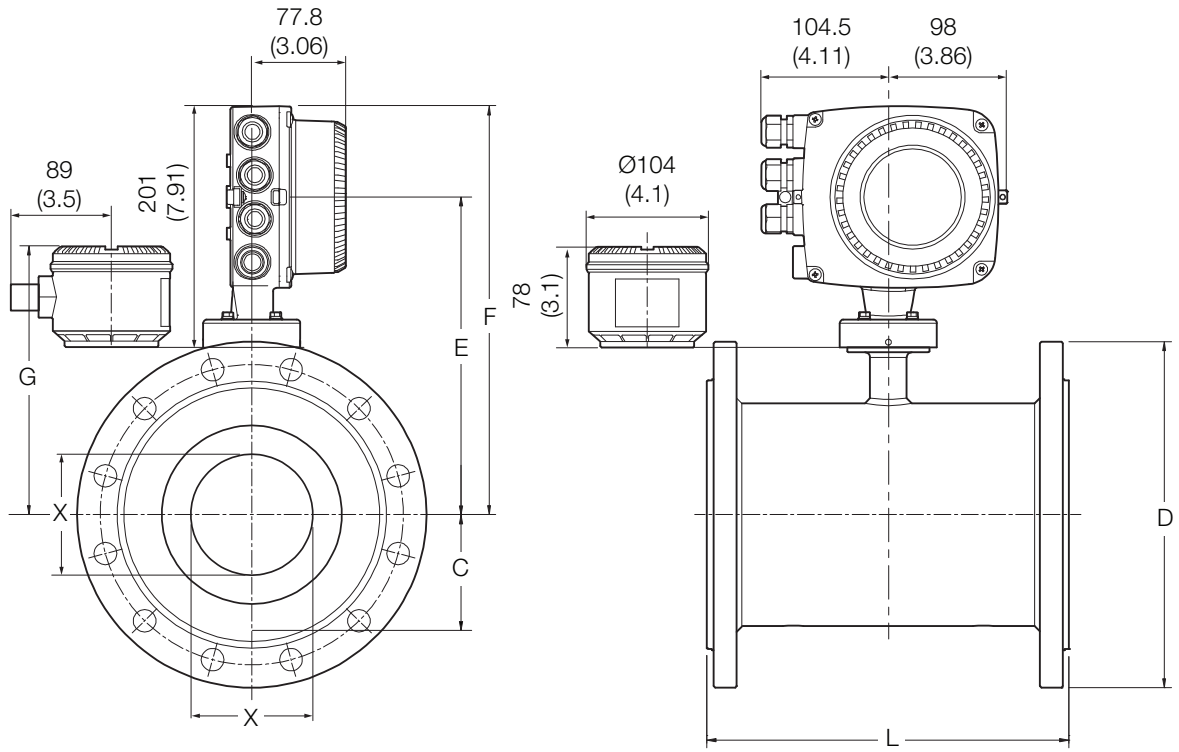
		Dimensions in mm (in.)							Approx. weight in kg (lb)	
DN	Process connection type	D	L	F	C	E	G	X	Integral	Remote
DN40 (1½ in.)	EN1092-1 PN10, PN40	150 (5.91)	200 (7.87)	260 (10.24)	30.4 (1.20)	185 (7.28)	138 (5.43)	30 (1.18)	12 (27)	11 (24)
	ASME B16.5 CLASS 150	127 (5.00)								
	JIS 10K	140 (5.51)								
	AS2129 TABLE F	140 (5.51)								
	AS2129 TABLE C D E	135 (5.31)								
	AS4087 PN14	135 (5.31)								
DN50 (2 in.)	EN1092-1 PN10, PN16	165 (6.50)	200 (7.87)	270 (10.63)	38.3 (1.51)	195 (7.68)	146 (5.75)	38 (1.50)	13 (29)	12 (27)
	ASME B16.5 CLASS 150	152.4 (6.00)								
	JIS 10K	155 (6.10)								
	AS4087 PN21	165 (6.50)								
	AS2129 TABLE F	165 (6.50)								
	AS2129 TABLE C D E	150 (5.91)								
	AS4087 PN14, PN16	150 (5.91)								
DN65 (2½ in.)	AS4087 PN14, PN16	165 (6.50)	200 (7.87)	275 (10.83)	45.2 (1.78)	200 (7.87)	152 (5.98)	48 (1.89)	15 (33)	14 (31)
	AS2129 TABLE C D E	165 (6.50)								
	EN1092-1 PN10	185 (7.28)								
	EN1092-1 PN16	185 (7.28)								
DN80 (3 in.)	EN1092-1 PN10, PN16	200 (7.87)	200 (7.87)	280 (11.02)	51.5 (2.03)	205 (8.07)	156 (6.14)	61 (2.40)	16 (36)	15 (33)
	ASME B16.5 CLASS 150	190 (7.48)								
	JIS 7.5K	211 (8.31)								
	JIS 10K	185 (7.28)								
	AS2129 TABLE C D E	185 (7.28)								
	AS4087 PN14, PN16	185 (7.28)								
	AS2129 TABLE F	205 (8.07)								
	AS4087 PN21	205 (8.07)								
DN100 (4 in.)	EN1092-1 PN10, PN16	220 (8.66)	250 (9.84)	320 (12.60)	63.75 (2.51)	245 (9.65)	196.8 (7.75)	70 (2.76)	19 (42)	18 (40)
	ASME B16.5 CLASS 150	228.6 (9.00)								
	JIS 7.5K	238 (9.37)								
	JIS 10K	210 (8.27)								
	AS2129 TABLE C D	215 (8.46)								
	AS4087 PN14, PN16	215 (8.46)								
	AS2129 TABLE E	215 (8.46)								
	AS4087 PN21	230 (9.06)								
	AS2129 TABLE F	230 (9.06)								
DN125 (5 in.)	EN1092-1 PN10, PN16	250 (9.84)	250 (9.84)	320 (12.60)	63.75 (2.51)	245 (9.65)	197 (7.76)	70 (2.76)	20 (44)	19 (42)
	ASME B16.5 CLASS 150	254 (10.00)								
	JIS 10K	250 (9.84)								
	AS2129 TABLE C D E	255 (10.04)								
	AS2129 TABLE F	280 (11.02)								
DN150 (6 in.)	EN1092 PN10, PN16	285 (11.22)	300 (11.81)	340 (13.39)	84.4 (3.32)	265 (10.43)	217 (8.54)	103 (4.06)	32 (70)	31 (68)
	ASME B16.5 CLASS 150	279 (10.98)								
	JIS 7.5k	290 (11.42)								
	JIS 10K	280 (11.02)								
	AS2129 TABLE C D	280 (11.02)								
	AS4087 PN14, PN16	280 (11.02)								
	AS2129 TABLE E	280 (11.02)								
	AS2129 TABLE F	305 (12.01)								
	AS4087 PN21	305 (12.01)								
DN200 (8 in.)	EN1092-1 PN10	340 (13.39)	350 (13.78)	365 (14.37)	109.8 (4.32)	290 (11.42)	243 (9.57)	150 (5.91)	49 (108)	48 (105)
	EN1092-1 PN16	340 (13.39)								
	ASME B16.5 CLASS 150	345 (13.58)								
	JIS 7.5K	342 (13.46)								
	JIS 10K	330 (12.99)								
	AS2129 TABLE C D	335 (13.19)								
	AS4087 PN14, PN 16	335 (13.19)								
	AS2129 TABLE E	335 (13.19)								
	AS2129 TABLE F	370 (14.57)								
	AS4087 PN21	370 (14.57)								

DN40 to 200 (1½ to 8 in. NB) (FEV) dimensions / weights

WaterMaster
Electromagnetic flowmeter

FER – DN40 to 300 (1½ to 12 in. NB)

Dimensions in mm (in.)



DN40 to 300 (1½ to 12 in. NB) (FER)

		Dimensions in mm (in.)						Approx. weight in kg (lb)	
DN	**Process connection type**	**D**	**L**	**F**	**E**	**G**	**X**	**Integral**	**Remote**
DN40 (1½ in.)	EN1092-1 PN10, 16, 25, 40	150 (5.91)	200 (7.87)	260 (10.24)	185 (7.28)	137 (5.39)	23.5 (0.93)	13.4 (29.5)	12.4 (27.3)
	ASME B16.5 CLASS 150								
	AS2129 TABLE D, E, F								
DN50 (2 in.)	EN1092-1 PN10, 16, 25, 40	165 (6.50)	200 (7.87)	261 (10.28)	186 (7.32)	138 (5.43)	29 (1.14)	14.75 (32.45)	13.75 (30.25)
	ASME B16.5 CLASS 150								
DN80 (3 in.)	EN1092-1 PN10, 16, 25, 40	200 (7.87)	200 (7.87)	280 (11.04)	205.5 (8.09)	157.5 (6.2)	47 (1.85)	21.2 (46.64)	20.2 (44.4)
	ASME B16.5 CLASS 150								
	AS4087 PN16, 21								
	AS2129 TABLE D, E, F								
DN100 (4 in.)	EN1092-1 PN10, 16, 25, 40	225 (8.86)	250 (9.84)	300.5 (11.83)	225.5 (8.88)	177.5 (6.98)	64 (2.52)	27.3 (60)	26.3 (58)
	ASME B16.5 CLASS 150								
	AS4087 PN16								
DN150 (6 in.)	EN1092-1 PN10, 16, 25, 40	300 (11.81)	300 (11.81)	333.5 (13.13)	258.5 (10.18)	210.5 (8.29)	100.2 (3.94)	27.3 (60)	26.3 (58)
	ASME B16.5 CLASS 150								
	AS4087 PN16								
DN200 (8 in.)	EN1092-1 PN10, 16	375 (11.76)	350 (13.78)	358.7 (14.12)	283.7 (11.17)	235.7 (9.28)	126.7 (5.00)	68 (150)	67 (147.4)
	ASME B16.5 CLASS 150								
	AS2129 TABLE C, D, E, F								
	AS4087 PN14, 16, 21								

DN40 to 200 (1½ to 8 in.) (FER) cast iron sensor dimensions / weights

WaterMaster
Electromagnetic flowmeter

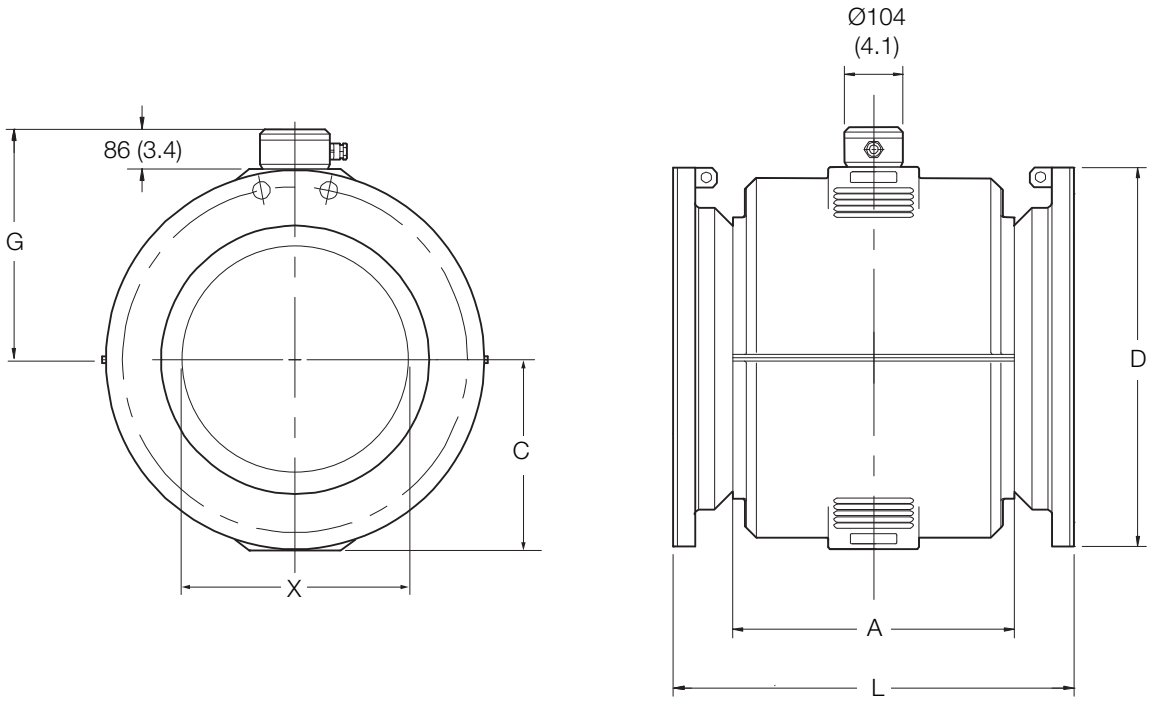
		Dimensions in mm (in.)							Approx. weight in kg (lb)	
DN	Process connection type	D	L	F	C	E	G	X	Integral	Remote
DN40 (1½ in.)	EN1092-1 PN10, 16, 25, 40	150 (5.91)	200 (7.87)	260 (10.24)	30.4 (1.20)	185 (7.28)	138 (5.43)	23.5 (0.93)	13 (29)	11 (24)
	ASME B16.5 CLASS 150	127 (5.00)								
	JIS 10K	140 (5.51)								
	AS2129 TABLE C D E	135 (5.31)								
	AS2129 TABLE F	140 (5.51)								
	AS4087 PN14	135 (5.31)								
DN50 (2 in.)	EN1092-1 PN10, 16, 25, 40	165 (6.50)	200 (7.87)	270 (10.63)	38.3 (1.51)	195 (7.68)	146 (5.75)	29 (1.14)	14 (31)	12 (27)
	ASME B16.5 CLASS 150	152.4 (6.00)								
	JIS 10K	155 (6.10)								
	AS4087 PN21	165 (6.50)								
	AS2129 TABLE F	165 (6.50)								
	AS2129 TABLE C D E	150 (5.91)								
	AS4087 PN14, PN16	150 (5.91)								
DN65 (2½ in.)	EN1092-1 PN10, 16, 25, 40	185 (7.28)	200 (7.87)	275 (10.83)	45.2 (1.78)	200 (7.87)	152 (5.98)	37 (1.46)	15 (33)	13 (29)
	ASME B16.5 CLASS 150	178 (7.00)								
	JIS10K	175 (6.89)								
	AS2129 TABLE C D E	165 (6.50)								
	AS2129 TABLE F	185 (7.28)								
	AS4087 PN14, 16	165 (6.50)								
	AS4087 PN21	185 (7.28)								
DN80 (3 in.)	EN1092-1 PN10, 16, 25, 40	200 (7.87)	200 (7.87)	280 (11.02)	51.5 (2.03)	205 (8.07)	156 (6.14)	47 (1.85)	20 (44)	18 (40)
	ASME B16.5 CLASS 150	190 (7.48)								
	JIS 10K	185 (7.28)								
	AS2129 TABLE C D E	185 (7.28)								
	AS4087 PN14, 16	185 (7.28)								
	AS2129 TABLE F	205 (8.07)								
	AS4087 PN21	205 (8.07)								
DN100 (4 in.)	EN1092-1 PN10, 16	220 (8.66)	250 (9.84)	320 (12.60)	63.75 (2.51)	245 (9.65)	196.8 (7.75)	64 (2.52)	27 (59)	25 (55)
	EN1092-1 PN25, 40	235 (9.25)								
	ASME B16.5 CLASS 150	228.6 (9.00)								
	JIS 7.5K	238 (9.37)								
	JIS 10K	210 (8.27)								
	AS2129 TABLE C D	215 (8.46)								
	AS4087 PN14, 16	215 (8.46)								
	AS4087 PN21	230 (9.06)								
DN125 (5 in.)	EN1092-1 PN10, 16	250 (9.84)	250 (9.84)	320 (12.60)	63.75 (2.51)	245 (9.65)	197 (7.76)	64 (2.52)	27 (59)	25 (55)
	EN1092-1 PN25, 40	270 (10.63)								
	ASME B16.5 CLASS 150	254 (10.00)								
	JIS 10K	250 (9.84)								
	AS2129 TABLE C D	255 (10.04)								
DN150 (6 in.)	EN1092 PN10, 16	285 (11.22)	300 (11.81)	340 (13.39)	84.4 (3.32)	265 (10.43)	217 (8.54)	100.2 (3.94)	33 (72)	31 (68)
	EN1092 PN25, 40	300 (11.81)								
	ASME B16.5 CLASS 150	279 (10.98)								
	JIS 7.5k	290 (11.42)								
	JIS 10K	280 (11.02)								
	AS2129 TABLE C D	280 (11.02)								
	AS4087 PN14, 16	280 (11.02)								
	AS4087 PN21	305 (12.01)								
DN200 (8 in.)	EN1092-1 PN10, 16	340 (13.39)	350 (13.78)	365 (14.37)	109.8 (4.32)	290 (11.42)	243 (9.57)	126.7 (4.99)	50 (110)	48 (106)
	EN1092-1 PN25, 40	360 (14.17)								
	ASME B16.5 CLASS 150	345 (13.58)								
	JIS 7.5K	342 (13.46)								
	JIS 10K	330 (12.99)								
	AS2129 TABLE C D	335 (13.19)								
	AS4087 PN14, 16	335 (13.19)								
	AS4087 PN21	370 (14.57)								
DN250 (10 in.)	EN1092-1 PN10	395 (15.55)	450 (17.72)	389 (15.31)	136.8 (5.39)	313 (12.33)	268 (10.55)	153.5 (6.04)	77 (169)	75 (165)
	EN1092-1 PN16	405 (15.94)								
	EN1092-1 PN25	425 (16.73)								
	ASME B16.5 CLASS 150	405 (15.94)								
	JIS 7.5K	400 (15.75)								
	JIS 10K	400 (15.75)								
	AS2129 TABLE C D	405 (15.94)								
	AS4087 PN14, 16	405 (15.94)								
	AS4087 PN21	430 (16.93)								
DN300 (12 in.)	EN1092-1 PN10	445 (17.52)	500 (19.69)	414 (16.30)	162.2 (6.39)	338.6 (13.33)	294 (1157)	203.5 (8.01)	114 (251)	112 (247)
	EN1092-1 PN16	460 (18.11)								
	EN1092-1 PN25	485 (19.09)								
	ASME B16.5 CLASS 150	485 (19.09)								
	JIS 10K	445 (17.52)								
	AS2129 TABLE C D	455 (17.91)								
	AS4087 PN14, 16	455 (17.91)								
	AS4087 PN21	490 (19.29)								

DN40 to 300 (1½ to 12 in. NB) (FER) dimensions / weights

WaterMaster
Electromagnetic flowmeter

FER – DN350 to 600 (14 to 24 in. NB) remote sensor

Dimensions in mm (in.)



DN350 to 600 (14 to 24 in. NB) (FER) remote sensor

WaterMaster
Electromagnetic flowmeter

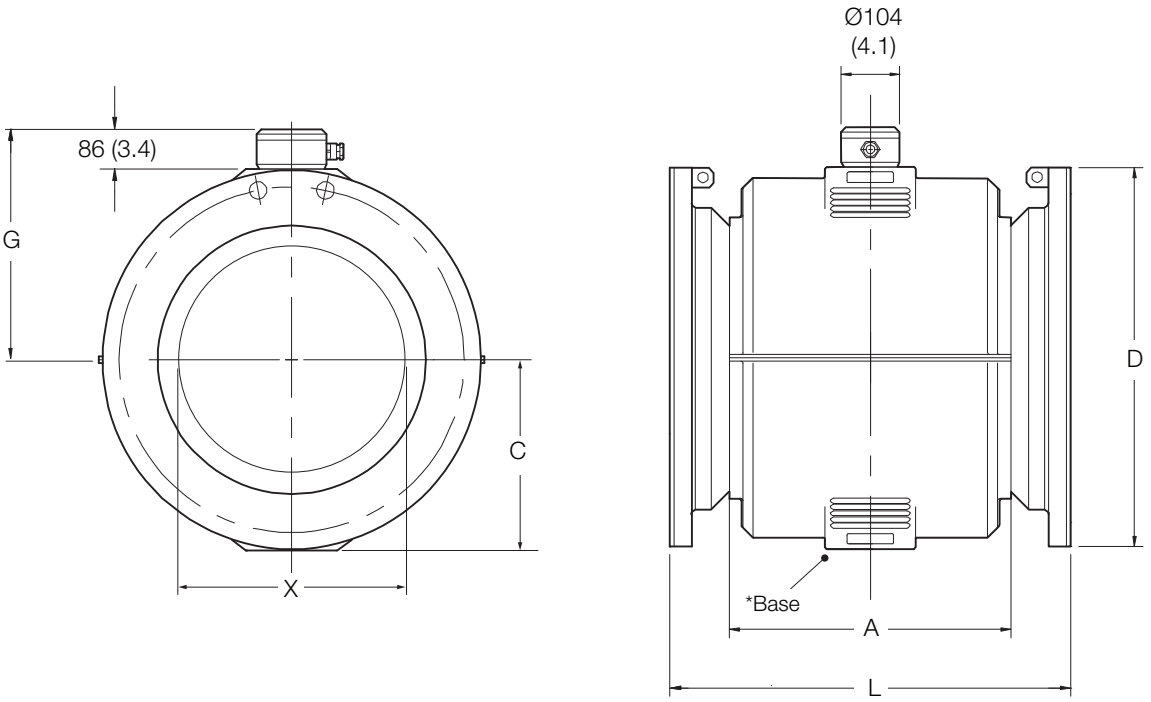
		Dimensions in mm (in.)								Approx. weight in kg (lb)
DN	Process connection type	D	L	F	C	E	G	A	X	Remote
DN350 (14 in.)	EN1092-1 PN10	505 (19.88)	550 (21.65)	472 (18.58)	231 (9.09)	402 (15.83)	325 (12.80)	376 (14.80)	340 (13.39)	100 (220)
	EN1092-1 PN16	520 (20.47)								
	EN1092-1 PN25	555 (21.85)								
	EN1092-1 PN40	580 (22.83)								
	JIS 5K	480 (18.90)								
	JIS 10K	490 (19.29)								
	AS2129 TABLE C D E	525 (20.67)								
	AS2129 TABLE F	550 (21.65)								
	AS4087 PN14, PN16	525 (20.67)								
	AS4087 PN21	550 (21.65)								
DN400 (16 in.)	EN1092-1 PN10	565 (22.24)	600 (23.62)	502 (19.76)	257.5 (10.14)	432 (17.01)	355 (13.98)	420 (16.54)	390 (15.35)	115 (253)
	EN1092-1 PN16	580 (22.83)								
	EN1092-1 PN25	620 (24.41)								
	EN1092-1 PN40	660 (25.98)								
	JIS 5K	540 (21.26)								
	JIS 10K	560 (22.05)								
	AS2129 TABLE C D E	580 (22.83)								
	AS2129 TABLE F	610 (24.02)								
	AS4087 PN14, PN16	580 (22.83)								
	AS4087 PN21	610 (24.02)								
DN450 (18 in.)	EN1092-1 PN10	615 (24.21)	700 (27.56)	537 (21.14)	285 (11.22)	467 (18.39)	390 (15.35)	480 (18.90)	440 (17.32)	160 (352)
	EN1092-1 PN16	640 (25.20)								
	EN1092-1 PN25	670 (26.38)								
	EN1092-1 PN40	685 (26.97)								
	JIS 5K	605 (23.82)								
	JIS 10K	620 (24.41)								
	AS2129 TABLE C D E	640 (25.20)								
	AS2129 TABLE F	675 (26.57)								
	AS4087 PN14, PN16	640 (25.20)								
	AS4087 PN21	675 (26.57)								
DN500 (20 in.)	EN1092-1 PN10	670 (26.38)	770 (30.31)	557 (21.93)	317.5 (12.50)	487 (19.17)	410 (16.14)	520 (20.47)	490 (19.29)	217 (477)
	EN1092-1 PN16	715 (28.15)								
	EN1092-1 PN25	730 (28.74)								
	EN1092-1 PN40	755 (29.72)								
	JIS 5K	655 (25.79)								
	JIS 10K	675 (26.57)								
	AS2129 TABLE C D E	705 (27.76)								
	AS2129 TABLE F	735 (28.94)								
	AS4087 PN14, PN16	705 (27.76)								
	AS4087 PN21	735 (28.94)								
DN600 (24 in.)	EN1092-1 PN10	780 (30.71)	920 (36.22)	602 (23.70)	345 (13.58)	532 (20.94)	455 (17.91)	610 (24.02)	591 (23.27)	315 (693)
	EN1092-1 PN16	840 (33.07)								
	EN1092-1 PN25	845 (33.27)								
	EN1092-1 PN40	890 (35.04)								
	JIS 5K	770 (30.31)								
	JIS 10K	795 (31.30)								
	AS2129 TABLE C D E	825 (32.48)								
	AS2129 TABLE F	850 (33.46)								
	AS4087 PN14, PN16	825 (32.48)								
	AS4087 PN21	850 (33.46)								

DN350 to 600 (14 to 24 in. NB) (FER) remote sensor dimensions / weights

WaterMaster
Electromagnetic flowmeter

FEF – DN250 to 600 (10 to 24 in. NB)

Dimensions in mm (in.)



*Dimension C = centre line to base of flowmeter body

DN250 to 600 (10 to 24 in. NB) (FEF)

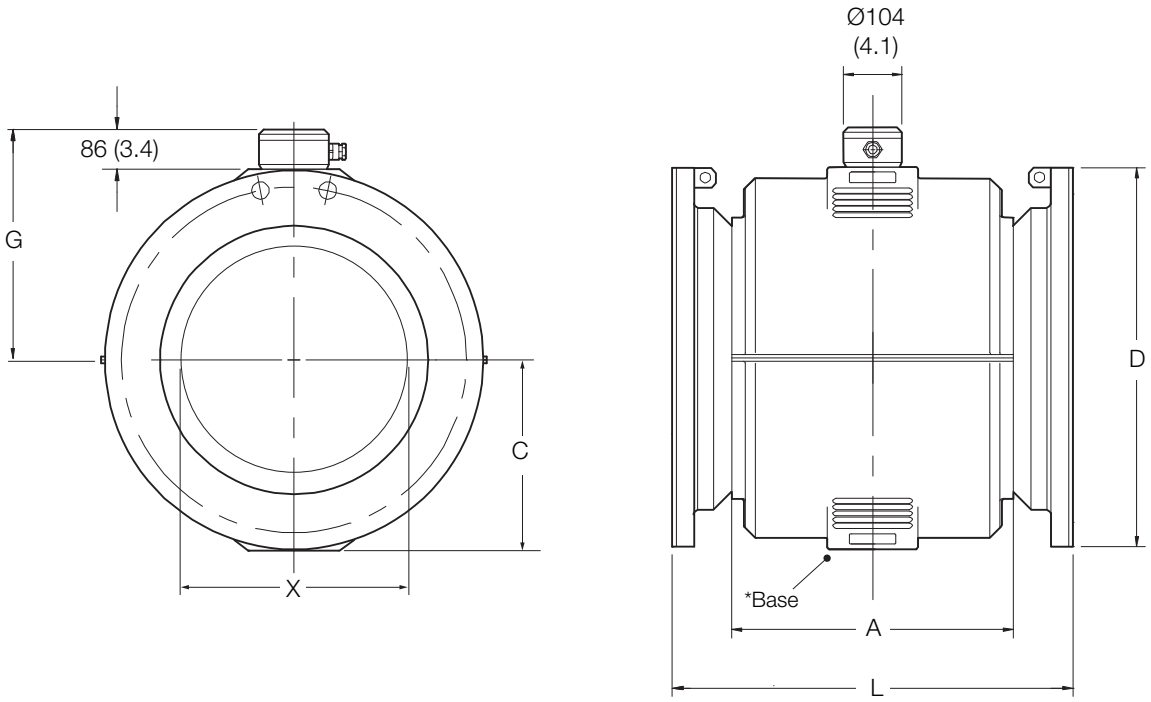
WaterMaster
Electromagnetic flowmeter

		Dimensions in mm (in.)						
DN	Process connection type	D	L	C	G	A	X	Approx. weight in kg (lb)
DN250 (10 in.)	ASME B16.5 CLASS 150	405 (15.94)	450 (17.72)	215 (8.46)	301 (11.85)	300 (11.81)	250 (9.84)	88 (194)
	ASME B16.5 CLASS 300	445 (17.52)	490 (19.29)					
	EN1092 -1 PN10	395 (15.55)	450 (17.72)					
	EN1092 – 1 PN16	405 (15.94)						
	EN1092 – 1 PN25	425 (16.73)	490 (19.29)					
	EN1092 – 1 PN40	450 (17.72)						
	JIS 5K	385 (15.16)	450 (17.72)					
	JIS 10K	400 (15.75)						
	AS4087 PN14, PN16	405 (15.94)						
	AS2129 TABLE C D							
	AS2129 TABLE E							
	AS4087 PN21	430 (16.93)						
	AS2129 TABLE F							
DN300 (12 in.)	ASME B16.5 CLASS 150	485 (19.09)	500 (19.69)	231 (9.09)	317 (12.48)	352 (13.86)	300 (11.81)	128 (282)
	ASME B16.5 CLASS 300	520 (20.47)	540 (21.26)					
	EN1092 – 1 PN10	445 (17.52)	500 (19.69)					
	EN1092 – 1 PN16	460 (18.11)	500 (19.69)					
	EN1092 – 1 PN25	485 (19.09)	540 (21.26)					
	EN1092 – 1 PN40	515 (20.28)	540 (21.26)					
	JIS 5K	430 (16.93)	500 (19.69)					
	JIS 10K	445 (17.52)	500 (19.69)					
	AS4087 PN14, PN16	455 (17.91)	500 (19.69)					
	AS2129 TABLE TABLE C D	455 (17.91)	500 (19.69)					
	AS2129 TABLE E	455 (17.91)	500 (19.69)					
	AS4087 PN21	490 (19.29)	500 (19.69)					
	AS2129 TABLE F	490 (19.29)	500 (19.69)					
DN350 (14 in.)	ASME B16.5 CLASS 150	535 (21.06)	550 (21.65)	257.5 (10.14)	346 (13.62)	376 (14.80)	350 (13.78)	100 (220)
	ASME B16.5 CLASS 300	585 (23.03)	570 (22.44)					
	EN1092 – 1 PN10	505 (19.88)	550 (21.65)					
	EN1092 – 1 PN16	520 (20.47)	550 (21.65)					
	EN1092 – 1 PN25	555 (21.85)	570 (22.44)					
	EN1092 – 1 PN40	580 (22.83)	570 (22.44)					
	JIS 5K	480 (18.90)	550 (21.65)					
	JIS 7.5K	530 (20.87)	550 (21.65)					
	JIS 10K	490 (19.29)	550 (21.65)					
	AS4087 PN14, PN16	525 (20.67)	550 (21.65)					
	AS2129 TABLE C D E	525 (20.67)	550 (21.65)					
	AS4087 PN21	550 (21.65)	550 (21.65)					
	AS2129 TABLE F	550 (21.65)	550 (21.65)					
	AS4087 PN35	550 (21.65)	570 (22.44)					
	AS2129 TABLE H	550 (21.65)	570 (22.44)					
DN375 (15 in.)	AS4087 PN14, PN16	550 (21.65)	550 (21.65)	257.5 (10.14)	346 (13.62)	376 (14.80)	350 (13.78)	115 (253)
	AS2129 TABLE C	550 (21.65)	550 (21.65)					
	AS4087 PN35	580 (22.83)	570 (22.44)					
DN400 (16 in.)	ASME B16.5 CLASS 150	600 (23.62)	600 (23.62)	285 (11.22)	371 (14.61)	420 (16.54)	400 (15.75)	115 (253)
	ASME B16.5 CLASS 300	650 (25.59)	620 (24.41)					
	EN1092 – 1 PN10	565 (22.24)	600 (23.62)					
	EN1092 – 1 PN16	580 (22.83)	600 (23.62)					
	EN1092 – 1 PN25	620 (24.41)	620 (24.41)					
	EN1092 – 1 PN40	660 (25.98)	620 (24.41)					
	JIS 5K	540 (21.26)	600 (23.62)					
	JIS 7.5K	582 (22.91)	600 (23.62)					
	JIS 10K	560 (22.05)	600 (23.62)					
	AS4087 PN14, PN16	580 (22.83)	600 (23.62)					
	AS2129 TABLE C D E	580 (22.83)	600 (23.62)					
	AS4087 PN21	610 (24.02)	600 (23.62)					
	AS2129 TABLE F	610 (24.02)	600 (23.62)					
	AS4087 PN35	610 (24.02)	620 (24.41)					
	AS2129 TABLE H	610 (24.02)	620 (24.41)					

DN250 to 600 (10 to 24 in. NB) (FEF) dimensions / weights

WaterMaster
Electromagnetic flowmeter

Dimensions in mm (in.)



*Dimension C = centre line to base of flowmeter body

…DN250 to 600 (10 to 24 in. NB) (FEF)

		Dimensions in mm (in.)						
DN	Process connection type	D	L	C	G	A	X	Approx. weight in kg (lb)
DN450 (18 in.)	ASME B16.5 CLASS 150	635 (25.00)	700 (27.56)	317.5 (12.50)	402 (15.83)	480 (18.90)	450 (17.72)	160 (352)
	ASME B16.5 CLASS 300	710 (27.95)						
	EN1092 – 1 PN10	615 (24.21)						
	EN1092 – 1 PN16	640 (25.20)						
	EN1092 – 1 PN25	670 (26.38)						
	EN1092 – 1 PN40	685 (26.97)						
	JIS 5K	605 (23.82)						
	JIS 7.5K	652 (25.67)						
	JIS 10K	620 (24.41)						
	AS4087 PN14, PN16	640 (25.20)						
	AS2129 TABLE C D	640 (25.20)						
	AS2129 TABLE E	640 (25.20)						
	AS4087 PN21	675 (26.57)						
	AS2129 TABLE F	675 (26.57)						
	AS4087 PN35	675 (26.57)						
	AS2129 TABLE H	675 (26.57)						
DN500 (20 in.)	ASME B16.5 CLASS 150	700 (27.56)	770 (30.31)	345 (13.58)	429 (16.89)	520 (20.47)	500 (19.69)	217 (455)
	ASME B16.5 CLASS 300	775 (30.51)						
	EN1092 – 1 PN10	670 (26.38)						
	EN1092 – 1 PN16	715 (28.15)						
	EN1092 – 1 PN25	730 (28.74)						
	EN1092 – 1 PN40	755 (29.72)						
	JIS 5K	655 (25.79)						
	JIS 7.5K	706 (27.80)						
	JIS 10K	675 (26.57)						
	AS4087 PN 14, PN16	705 (27.76)						
	AS2129 TABLE C D E	705 (27.76)						
	AS4087 PN21	735 (28.94)						
	AS2129 TABLE F	735 (28.94)						
	AS4087 PN35	735 (28.94)						
	AS2129 TABLE H	735 (28.94)						
DN600 (24 in.)	ASME B16.5 CLASS 150	815 (32.09)	920 (36.22)	387.5 (15.25)	472 (18.58)	610 (24.02)	600 (23.62)	315 (693)
	ASME B16.5 CLASS 300	915 (36.02)						
	EN1092 – 1 PN10	780 (30.71)						
	EN1092 – 1 PN16	840 (33.07)						
	EN1092 – 1 PN25	845 (33.27)						
	EN1092 – 1 PN40	890 (35.04)						
	JIS 5K	770 (30.31)						
	JIS 7.5K	810 (31.89)						
	JIS 10K	795 (31.30)						
	AS4087 PN14, PN16	825 (32.48)						
	AS2129 TABLE C D	825 (32.48)						
	AS2129 TABLE E	825 (32.48)						
	AS4087 PN21	850 (33.46)						
	AS2129 TABLE F	850 (33.46)						
	AS4087 PN35	850 (33.46)						
	AS2129 TABLE H	850 (33.46)						

…DN250 to 600 (10 to 24 in. NB) (FEF) dimensions / weights

Ordering information

Electromagnetic flowmeter WaterMaster – FEW11, FEW12 and FEW18

Product coding field number	1 … 5	6	7 … 9	10	11	12	13	14, 15	16	17	18	19	20	21	22	23	24	25	26	27	Options
Flowmeter system – full bore, integral mount (DN10 to DN32 only)	**FEW11**																				
Flowmeter system – full bore, remote mount	**FEW12**	X	XXX	X	X	X	X	XX	X	X	X	X	X	X	X	X	X	X	X	X	
Full bore sensor only – for use with WaterMaster transmitter / remote	**FEW18**																				
Design																					
Non-hazardous areas		1																			
Hazardous areas		5																			
Bore diameter																					
DN10 (3/8 in.)			010																		
DN15 (1/2 in.)			015																		
DN20 (3/4 in.)			020																		
DN25 (1 in.)			025																		
DN32 (1 1/4 in.)			032																		
Liner material																					
PTFE – DN10 to 32 (3/8 to 1 1/4 in. NB)				A																	
Electrode design																					
Standard					1																
Other					9																
Measuring electrodes material																					
Hastelloy® C-4 (2.4610)						D															
Grounding accessories																					
Not required							0														
One potential equalizing ring (stainless steel)							3														
Two potential equalizing rings (stainless steel)							4														
Other							9														
Process connection type (refer to pages 21 and 20)																					
ASME B16.5 B class 150								A1													
ASME B16.5 B class 300								A3													
ISO / EN PN40								S4													
DIN PN40								D4													
Other								Z9													
Process connection material																					
Carbon steel flanges – DN20 to 32 (3/4 to 1 1/4 in. NB)									B												
Stainless steel flange 1.4571 (316 Ti) – DN10 to 15 (3/8 to 1/2 in. NB)									D												
Other									Z												
Usage certifications																					
Standard (without PED)										1											
Other										9											
Calibration type																					
Class 2 calibration – standard accuracy 0.4 %											A										
Class 1 calibration – high accuracy 0.2 %											B										
Extended range, class 1 calibration – high accuracy 0.2 %											N										
Extended range, class 2 calibration – standard accuracy 0.4 %											P										
Temperature range installation / ambient temperature range																					
Standard design / –20 … 60 °C (–4 … 140 °F)												1									
Nameplate																					
Adhesive													A								
Signal cable length and type																					
Without signal cable														0							
5 m (15 ft.) cable														1							
10 m (30 ft.) cable														2							
20 m (60 ft.) cable														3							
30 m (100 ft.) cable														4							
50 m (165 ft.) cable														5							
80 m (260 ft.) cable														6							
100 m (325 ft.) cable														7							
150 m (490 ft.) cable														8							
Special length or cable type														9							
Explosion protection certification																					
General purpose (non-Ex design)															A						
FM Class 1 Div. 2															G						
usFMc Class 1 Div. 2															P						
ATEX / IECEx Zone 2, 21 & 22															M						

Continued on next page…

WaterMaster
Electromagnetic flowmeter

Product coding field number	1 … 5	6	7 … 9	10	11	12	13	14, 15	16	17	18	19	20	21	22	23	24	25	26	27	Options
Flowmeter system – full bore, integral mount (DN10 to DN32 only)	**FEW11**																				
Flowmeter system – full bore, remote mount	**FEW12**	**X**	**XXX**	**X**	**X**	**X**	**X**	**XX**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	
Full bore sensor only – for use with WaterMaster transmitter / remote	**FEW18**																				

Protection class transmitter / protection class sensor

IP67 (NEMA 4X) / IP67 (NEMA 4X) – cable not fitted and potted to sensor	1
IP67 (NEMA 4X) / IP67 (NEMA 4X) – cable fitted and potted to sensor	7

Cable conduits*

M20 x 1.5 (plastic)	A
NPT ½ in. (blanked when cable not fitted)	B
M20 SWA (armored)	D
M20 SWA sensor, M20 x 1.5 (plastic) power / output	F
Without	Y

Power supply

Without	0
100... 230 V AC, 50 Hz	1
24 V AC or 24 V DC, 50 Hz	2
100... 230 V AC, 60 Hz	3
24 V AC or 24 V DC, 60 Hz	4

Input and output signal type

HART + 20 mA + pulse + contact output	A
PROFIBUS DP RS485 physical layer + pulse + contact output (general-purpose design only)	G
MODBUS RTU RS485 physical layer + pulse + contact output (general-purpose design only)	M
Without	Y

Configuration type / diagnostics type

Not required	0
Factory default/ standard	1

Options**

Accessories

Configuration lead	AC

Documentation language

German	M1	Chinese	M6
Italian	M2	Swedish	M7
Spanish	M3	Finnish	M8
French	M4	Portuguese	MA
English	M5 (default)	Danish	MF
		Norwegian	MN

Verification type

Without fingerprint	V0
VeriMaster	V3

Potable water approval

WRAS cold water approval	CWA
Without	CWY

Power supply frequency (FEW 18 only)

50 Hz	F5
60 Hz	F6

Number of testpoints (FEW 10 to 32 only)

1 Point	T1
3 Points	T3

* For FM or FMC Approved versions, NPT only permitted.
** Add codes for options.

Electromagnetic flowmeter WaterMaster FEV11, FEV12 and FEV18

Product coding field number	1 … 5	6	7 … 9	10	11	12	13	14, 15	16	17	18	19	20	21	22	23	24	25	26	27	Options
Flowmeter system, optimized full bore, integral mount	**FEV11**																				
Flowmeter system, optimized full bore, remote mount	**FEV12**	X	XXX	X	X	X	X	XX	X	X	X	X	X	X	X	X	X	X	X	X	
Optimized full bore sensor only, for use with WaterMaster transmitter / remote	**FEV18**																				
Design																					
Non-hazardous areas		1																			
Hazardous areas		5																			
Bore diameter																					
DN40 (1 1/2 in.)			040																		
DN50 (2 in.)			050																		
DN65 (2 1/2 in.)			065																		
DN80 (3 in.)			080																		
DN100 (4 in.)			100																		
DN125 (5 in.)			125																		
DN150 (6 in.)			150																		
DN200 (8 in.)			200																		
Liner material																					
Polypropylene – DN40 to 200 (1 1/2 to 8 in. NB)				V																	
Electrode design																					
Standard					1																
Measuring electrodes material																					
Stainless steel 316						S															
Hastelloy® C-22						C															
Super-austenitic steel						U															
Grounding accessories																					
Standard							1														
One potential equalizing ring (stainless steel)							3														
Two potential equalizing rings (stainless steel)							4														
Process connection type (refer to pages 29 and 28)																					
Flanges ASME B16.5 class 150								A1													
Flanges AS 4087 PN21 (≥ DN50 [2 in. NB])								E0													
Flanges AS 4087 PN16 (≥ DN50 [2 in. NB])								E1													
Flanges AS 4087 PN14								E2													
Flanges AS 2129 Table F								E3													
Flanges AS 2129 Table E								E4													
Flanges AS 2129 Table D								E5													
Flanges AS 2129 Table C								E6													
Flanges JIS G5527 7.5K (³ DN100 [4 in. NB])								J0													
Flanges JIS B2220 10K								J1													
ISO/EN PN10								S1													
ISO / EN PN16 (≥ DN50 [2 in. NB])								S2													
ISO / EN PN40 (DN40 [1 1/2 in. NB] only) 16 bar rated								S4													
Process connection material																					
Carbon steel flanges									B												
Usage certifications																					
Standard										1											
Calibration type																					
Class 2 Calibration – standard accuracy 0.4 %											A										
Class 1 Calibration – high accuracy 0.2 %											B										
Extended range, class 1 calibration – high accuracy 0.2 %											N										
Extended range, class 2 calibration – standard accuracy 0.4 %											P										

Continued on next page…

WaterMaster
Electromagnetic flowmeter

Product coding field number	1 … 5	6	7 … 9	10	11	12	13	14, 15	16	17	18	19	20	21	22	23	24	25	26	27	Options
Flowmeter system, optimized full bore, integral mount	**FEV11**	X	XXX	X	X	X	X	XX	X	X	X	X	X	X	X	X	X	X	X	X	
Flowmeter system, optimized full bore, remote mount	**FEV12**																				
Optimized full bore sensor only, for use with WaterMaster transmitter / remote	**FEV18**																				
Temperature range installation / ambient temperature range																					
Standard design / –20 … 60 °C (–4 … 140 °F)												1									
Nameplate																					
Adhesive													A								
Signal cable length and type*																					
Without signal cable														0							
5 m (15 ft.) cable														1							
10 m (30 ft.) cable														2							
20 m (60 ft.) cable														3							
30 m (100 ft.) cable														4							
50 m (165 ft.) cable														5							
80 m (260 ft.) cable														6							
100 m (325 ft.) cable														7							
150 m (490 ft.) cable														8							
Special length > 150 m (> 490 ft.)														9							
Explosion protection certification																					
General purpose (non-Ex design)															A						
FM Class 1 Div. 2															G						
usFMc Class 1 Div. 2															P						
ATEX / IECEx Zone 2, 21 & 22															M						
Protection class transmitter / protection class sensor																					
IP67 (NEMA 4X) / IP67 (NEMA 4X) – integral																1					
IP67 (NEMA 4X) / IP68 (NEMA 6P) – cable not fitted and not potted																2					
IP67 (NEMA 4X) / IP68 (NEMA 6P) – cable fitted and potted																3					
Cable conduits *																					
M20 x 1.5 (plastic)																	A				
NPT 1/2 in. (blanked when cable not fitted)																	B				
M20 SWA (armored)																	D				
M20 SWA sensor, M20 x 1.5 (plastic) power / output																	F				
Without																	Y				
Power supply																					
Without																		0			
100... 230 V AC, 50 Hz																		1			
24 V AC or 24 V DC, 50 Hz																		2			
100... 230 V AC, 60 Hz																		3			
24 V AC or 24 V DC, 60 Hz																		4			
Others																		9			
Input and output signal type																					
HART + 20 mA + pulse + contact output																			A		
PROFIBUS DP RS485 physical layer + pulse + contact output (general-purpose design only)																			G		
MODBUS RTU RS485 physical layer + pulse + contact output (general-purpose design only)																			M		
Without																			Y		
Configuration type / diagnostics type																					
Without																				0	
Factory defaults / standard diagnostics																				1	

Continued on next page…

* The type of signal cable supplied (standard or armored) depends on the type of cable conduit (variant digit number 24) ordered.
For FM or FMC Approved versions, NPT only permitted.

WaterMaster
Electromagnetic flowmeter

Product coding field number	1 … 5	6	7 … 9	10	11	12	13	14, 15	16	17	18	19	20	21	22	23	24	25	26	27	Options
Flowmeter system, optimized full bore, integral mount	**FEV11**	X	XXX	X	X	X	X	XX	X	X	X	X	X	X	X	X	X	X	X	X	
Flowmeter system, optimized full bore, remote mount	**FEV12**																				
Optimized full bore sensor only, for use with WaterMaster transmitter / remote	**FEV18**																				

Options**

Accessories

Configuration lead	AC

Documentation language

German	M1	Chinese	M6
Italian	M2	Swedish	M7
Spanish	M3	Finnish	M8
French	M4	Portuguese	MA
English	M5 (default)	Danish	MF
		Norwegian	MN

Other usage certifications

Measuring Instruments Directive (MID)	CM1
OIML R49 Calibration	CM2

Verification type

Without fingerprint	V0
VeriMaster	V3

Potable water approval

WRAS cold water approval	CWA
NSF 61 meter approval	CWC
DVGW	CWD
ACS	CWF
Without	CWY

Power supply frequency (sensor FEV18 only)

50 Hz	F5
60 Hz	F6

Number of testpoints

1 Point	T1
3 Points	T3

**Add codes for options.

WaterMaster
Electromagnetic flowmeter

Electromagnetic flowmeter WaterMaster FEF12 and FEF18

Product coding field number	1 … 5	6	7 … 9	10	11	12	13	14, 15	16	17	18	19	20	21	22	23	24	25	26	27	Options
Flowmeter system, full bore, remote mount	**FEF12**	X	XXX	X	X	X	X	XX	X	X	X	X	X	X	X	X	X	X	X	X	
Full bore sensor only, for use with WaterMaster transmitter / remote	**FEF18**																				
Design																					
Non-hazardous areas		1																			
Hazardous areas (DN≥700 [27 in. NB])		5																			
Bore diameter																					
DN250 (10 in.)			250																		
DN300 (12 in.)			300																		
DN350 (14 in.)			350																		
DN375 (15 in.)			375																		
DN400 (16 in.)			400																		
DN450 (18 in.)			450																		
DN500 (20 in.)			500																		
DN600 (24 in.)			600																		
Others			999																		
Liner material																					
Elastomer – DN250 to 600 (10 to 24 in. NB)				K																	
Hard rubber – DN250 to 600 (10 to 24 in. NB)				H																	
Other				Z																	
Electrode design																					
Standard					1																
Others					9																
Measuring electrodes material																					
Stainless steel 316						S															
Hastelloy® C-22						C															
Super-austenitic steel (DN250 to 600 [10 to 24 in. NB])						U															
Others						Z															
Grounding accessories																					
Standard							1														
One potential equalizing ring (stainless steel)							3														
Two potential equalizing rings (stainless steel)							4														
Others							9														
Process connection type (refer to pages 35 to 33)																					
Flanges ASME B16.5 class 150								A1													
Flanges ASME B16.5 class 300								A3													
Flanges AWWA C207 class B								C1													
Flanges AWWA C207 class D								C2													
Flanges AS 4087 PN21								E0													
Flanges AS 4087 PN16								E1													
Flanges AS 4087 PN14								E2													
Flanges AS 2129 Table F								E3													
Flanges AS 2129 Table E								E4													
Flanges AS 2129 Table D								E5													
Flanges AS 2129 Table C								E6													
Flanges AS 2129 Table H								E7													
Flanges AS 4087 PN35								E8													
Flanges JIS G5527 7.5K								J0													
Flanges JIS B2220 10K								J1													
Flanges JIS B2220 5K								J2													
Flanges ISO / EN PN6								S0													
Flanges ISO / EN PN10								S1													
Flanges ISO / EN PN16								S2													
Flanges ISO / EN PN25								S3													
Flanges ISO / EN PN40								S4													
Others								Z9													
Note. DN80 to 200 (3 to 10 in. NB) available only with PN16																					
Process connection material																					
Carbon steel flanges									B												
Others									Z												
Usage certifications																					
Standard										1											
Calibration type																					
Class 2 calibration – standard accuracy 0.4 %											A										
Class 1 calibration – high accuracy 0.2 %											B										
Extended range, class 1 calibration – high accuracy 0.2 %											N										
Extended range, class 2 calibration – standard accuracy 0.4 %											P										

Continued on next page …

WaterMaster
Electromagnetic flowmeter

Product coding field number	1 … 5	6	7 … 9	10	11	12	13	14, 15	16	17	18	19	20	21	22	23	24	25	26	27	Options
Flowmeter system, full bore, remote mount	FEF12	X	XXX	X	X	X	X	XX	X	X	X	X	X	X	X	X	X	X	X	X	
Full bore sensor only, for use with WaterMaster transmitter / remote	FEF18																				
Temperature range installation / ambient temperature range																					
Standard design / –20 … 60 °C (–4 … 140 °F)												1									
Nameplate																					
Adhesive													A								
Signal cable length and type*																					
Without signal cable														0							
5 m (15 ft.) cable														1							
10 m (30 ft.) cable														2							
20 m (60 ft.) cable														3							
30 m (100 ft.) cable														4							
50 m (165 ft.) cable														5							
80 m (260 ft.) cable														6							
100 m (325 ft.) cable														7							
150 m (490 ft.) cable														8							
Special Length > 150 m (> 490 ft.) (and / or armored cable)														9							
Explosion protection certification																					
General purpose (non-Ex design)															A						
Protection class transmitter / protection class sensor																					
IP67 (NEMA 4X) / IP68 (NEMA 6P) – cable not fitted and not potted																2					
IP67 (NEMA 4X) / IP68 (NEMA 6P) – cable fitted and potted																3					
Cable conduits**																					
M20 x 1.5 (plastic)																	A				
NPT ½ in. (blanked when cable not fitted)																	B				
M20 SWA (armored)																	D				
M20 SWA sensor, M20 x 1.5 (plastic) power / output																	F				
Without																	Y				
Power supply																					
Without																		0			
100... 230 V AC (50 Hz)																		1			
24 V AC or 24 V DC (50 Hz)																		2			
100... 230 V AC (60 Hz)																		3			
24 V AC or 24 V DC (60 Hz)																		4			
Input and output signal type																					
HART + 20 mA + pulse + contact output																			A		
PROFIBUS DP RS485 physical layer + pulse + contact output (general-purpose design only)																			G		
MODBUS RTU RS485 physical layer + pulse + contact output (general-purpose design only)																			M		
Without																			Y		
Configuration type / diagnostics type																					
Without																				0	
Factory defaults / standard diagnostics																				1	

Options***

Accessories

Configuration lead	AC

Documentation language

German	M1	Chinese	M6
Italian	M2	Swedish	M7
Spanish	M3	Finnish	M8
French	M4	Portuguese	MA
English	M5 (default)	Danish	MF
		Norwegian	MN

Verification type

Without fingerprint	V0
VeriMaster	V3

Potable water approvals

WRAS cold water approval	CWA
NSF 61 meter approval	CWC
DVGW	CWD
ACS	CWF
WRAS 60 °C (140 °F) water approval	CWK
Without	CWY

Power supply frequency (sensor FEF 18 only)

50 Hz	F5
60 Hz	F6

Number of testpoints

1 Point	T1
3 Points	T3

*Size is dependent on flange specification
**The type of signal cable supplied (standard or armored) depends on the type of cable conduit (variant digit number 24) ordered – for FM or FMC Approved versions, NPT only permitted.
***Add codes for options.

Electromagnetic flowmeter WaterMaster – FEW31, FEW32 and FEW38

Product coding field number	1 … 5	6	7 … 9	10	11	12	13	14, 15	16	17	18	19	20	21	22	23	24	25	26	27	Options
Flowmeter system – full bore, integral mount	**FEW31**																				
Flowmeter system – full bore, remote mount	**FEW32**	X	XXX	X	X	X	X	XX	X	X	X	X	X	X	X	X	X	X	X	X	
Full bore sensor only – for use with WaterMaster transmitter / remote	**FEW38**																				
Design																					
Non-hazardous areas		1																			
Hazardous areas		5																			
Bore diameter																					
DN10 (3/8 in.)			010																		
DN15 (1/2 in.)			015																		
DN20 (3/4 in.)			020																		
DN25 (1 in.)			025																		
DN32 (1 1/4 in.)			032																		
DN40 (1 1/2 in.)			040																		
DN50 (2 in.)			050																		
DN65 (2 1/2 in.)			065																		
DN80 (3 in.)			080																		
DN100 (4 in.)			100																		
DN125 (5 in.)			125																		
DN150 (6 in.)			150																		
DN200 (8 in.)			200																		
DN250 (10 in.)			250																		
DN300 (12 in.)			300																		
DN350 (14 in.)			350																		
DN400 (16 in.)			400																		
DN450 (18 in.)			450																		
DN500 (20 in.)			500																		
DN600 (24 in.)			600																		
DN700 (28 in.)			700																		
DN750 (29 in.)			750																		
DN760 (30 in.)			760																		
DN800 (32 in.)			800																		
DN900 (36 in.)			900																		
DN1000 (40 in.)			001																		
DN1050 (42 in.)			051																		
DN1100 (44 in.)			101																		
DN1200 (48 in.)			201																		
DN1350 (54 in.)			351																		
DN1400 (56 in.)			401																		
DN1500 (60 in.)			501																		
DN1600 (64 in.)			601																		
DN1650 (66 in.)			651																		
DN1800 (72 in.)			801																		
DN1950 (78 in.)			951																		
DN2000 (80 in.)			002																		
DN2100 (84 in.)			102																		
DN2200 (88 in.)			202																		
DN2400 (96 in.)			402																		
Others			999																		
Liner material																					
PTFE – DN10 to 600 (3/8 to 24 in. NB)				A																	
Hard rubber – DN40 to 2400 (1 1/2 to 96 in. NB)				H																	
Elastomer – DN40 to 2400 (1 1/2 to 96 in. NB)				K																	
Electrode design																					
Standard					1																
Other					9																
Measuring electrodes material																					
Hastelloy® C-4 (2.4610)						D															
Stainless steel 316Ti/316L						S															
Hastelloy C-22						C															
Grounding accessories																					
Not required							0														
Standard							1														
One potential equalizing ring (stainless steel)							3														
Two potential equalizing rings (stainless steel)							4														

Continued on next page…

WaterMaster
Electromagnetic flowmeter

Product coding field number	1 … 5	6	7 … 9	10	11	12	13	14, 15	16	17	18	19	20	21	22	23	24	25	26	27	Options
Flowmeter system – full bore, integral mount	**FEW31**	x	xxx	x	x	x	x	xx	x	x	x	x	x	x	x	x	x	x	x	x	
Flowmeter system – full bore, remote mount	**FEW32**																				
Full bore sensor only – for use with WaterMaster transmitter / remote	**FEW38**																				
Process connection type (refer to pages 21 to 26)																					
Flanges ASME B16.47 series B / B16.5 Class 150								A1													
Flanges ASME B16.47 series B / B16.5 Class 300								A3													
Flanges ASME B16.47 series A Class 150								B1													
Flanges ASME B16.47 series A Class 300								B3													
Flanges AWWA C207 Class B								C1													
Flanges AWWA C207 Class D								C2													
Flanges AWWA C207 Class E								C3													
Flanges AWWA C207 Class F								C4													
Flanges JIS 10K								J1													
Flanges JIS 5K								J2													
Flanges AS 4087 PN 16								E1													
Flanges AS 2129 Table E								E4													
Flanges AS 2129 Table D								E5													
Flanges AS 4087 PN 35								E8													
ISO 7005, DIN, EN 1092-1 PN6								S0													
ISO 7005, DIN, EN 1092-1 PN10								S1													
ISO 7005, DIN, EN 1092-1 PN16								S2													
ISO 7005, DIN, EN 1092-1 PN25								S3													
ISO 7005, DIN, EN 1092-1 PN40								S4													
Process connection material																					
Carbon steel flanges									B												
Stainless steel flange									D												
Usage certifications																					
Standard (without PED)										1											
Calibration type																					
Class 2 calibration – standard accuracy 0.4 %											A										
Class 1 calibration – high accuracy 0.2 %											B										
Temperature range installation / ambient temperature range																					
Standard design/ –20 … 60 °C (–4 … 140 °F)												1									
Nameplate																					
Adhesive													A								
Signal cable length and type																					
Without signal cable														0							
5 m (15 ft.) cable														1							
10 m (30 ft.) cable														2							
20 m (60 ft.) cable														3							
30 m (100 ft.) cable														4							
50 m (165 ft.) cable														5							
80 m (260 ft.) cable														6							
100 m (325 ft.) cable														7							
150 m (490 ft.) cable														8							
Special length or cable type														9							
Explosion protection certification*																					
General purpose (non-Ex design)															A						
FM Class 1 Div. 2															G						
usFMc Class 1 Div. 2															P						
ATEX / IECEx Zone 2, 21 & 22															M						

Continued on next page…

WaterMaster
Electromagnetic flowmeter

Product coding field number	1 … 5	6	7 … 9	10	11	12	13	14, 15	16	17	18	19	20	21	22	23	24	25	26	27	Options
Flowmeter system – full bore, integral mount	**FEW31**	X	XXX	X	X	X	X	XX	X	X	X	X	X	X	X	X	X	X	X	X	
Flowmeter system – full bore, remote mount	**FEW32**																				
Full bore sensor only – for use with WaterMaster transmitter / remote	**FEW38**																				

Protection class transmitter / protection class sensor

IP67 (NEMA 4X) / IP67 (NEMA 4X) – cable not fitted and not potted to sensor	1
IP 67 (NEMA 4x) / IP68 (NEMA 6P) – cable not fitted and not potted to sensor	2
IP 67 (NEMA 4x) / IP68 (NEMA 6P) – cable fitted and potted to sensor	3

Cable conduits **

M20 x 1.5 (plastic)	A
NPT ½ in. (blanked when cable not fitted)	B
M20 SWA (armored)	D
M20 SWA sensor, M20 x 1.5 (plastic) power / output	F
Without	Y

Power supply

Without	0
108.. 230 V AC, 50 Hz	1
24 V AC or 24 V DC, 50 Hz	2
100 ... 230 V AC, 60 Hz	3
24 V AC or 24 V DC, 60 Hz	4

Input and output signal type

HART + 20 mA + pulse + contact output	A
PROFIBUS DP RS485 physical layer + pulse + contact output (general-purpose design only)	G
MODBUS RTU RS485 physical layer + pulse + contact output (general-purpose design only)	M
Without	Y

Configuration type / diagnostics type

Not required	0
Factory default / Standard	1

Options***

Accessories

Configuration lead	AC

Documentation language

German	M1	Chinese	M6
Italian	M2	Swedish	M7
Spanish	M3	Finnish	M8
French	M4	Portuguese	MA
English	M5 (default)	Danish	MF
		Norwegian	MN

Lay length

ISO length – DN10 to 600 (⅜ to 24 in.) and 1.25D DN1800 to 2400 (72 to 96 in.)	JB
1.3D DN700 to 2400 (28 to 96 in.) – see dimensional pages 25, 26, 27	JK
1.0D DN700 to 1600 (28 to 64 in.) – see dimensional pages 25, 26, 27	JH

Verification type

Without fingerprint	V0
VeriMaster	V3

Potable water approval

WRAS cold water approval	CWA
DVGW	CWD
WRAS 60 °C (140 °F) water approval	CWK
NSF material approval	CWM
Without	CWY

Power supply frequency (sensor FEW38 only)

50 Hz	F5
60 Hz	F6

* FM approval in process. FEF product still available with full FM approval

** The type of signal cable supplied (standard or armored) depends on the type of cable conduit (variant digit number 24) ordered. For FM or FMC Approved versions, NPT only permitted.

*** Add codes for options.

WaterMaster
Electromagnetic flowmeter

WaterMaster FER reduced-bore sensor flowmeter series

Product coding field number	1 … 6	7 … 9	10	11	12	13	14,15	16	17	18	19	20	21	22	23	24	25	26	27	Options
WaterMaster system. Reduced-bore sensor with remote mounted transmitter	**FER121**																			
WaterMaster system. Reduced-bore sensor with integral transmitter	**FER111**	**XXX**	**X**	**X**	**X**	**X**	**XX**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	
WaterMaster reduced-bore sensor only, remote mount, without transmitter	**FER181**																			
Bore diameter																				
DN 40 (1½ in.)		040																		
DN 50 (2 in.)		050																		
DN 65 (2½ in.)		065																		
DN 80 (3 in.)		080																		
DN 100 (4 in.)		100																		
DN 125 (5 in.)		125																		
DN 150 (6 in.)		150																		
DN 200 (8 in.)		200																		
DN 250 (10 in.)		250																		
DN 300 (12 in.)		300																		
DN 350 (14 in.)		350																		
DN 375 (15 in.)		375																		
DN 400 (16 in.)		400																		
DN 450 (18 in.)		450																		
DN 500 (20 in.)		500																		
DN 600 (24 in.)		600																		
Liner material																				
Elastomer – DN40 to 600 (1½ to 24 in. NB)			K																	
Electrode design																				
Standard				1																
Measuring electrodes material																				
Stainless steel 316					S															
Super austenitic steel (1.4529)					U															
Grounding accessories																				
1 x Stainless steel equalizing ring						3														
2 x Stainless steel equalizing rings						4														
Process connection type (refer to pages 30 and 30)																				
Flanges ANSI / ASME B16.5 / 16.47 series B Class 150	(40 / 50 / 80 / 100 / 150 … 300)						A1													
Flanges AWWA C207 Class E	(40 / 50 / 80)						C3													
Flanges JIS 7.5K	(100 / 150 … 300)						J0													
Flanges JIS 10K	(40 / 50 / 80 / 100 / 150 … 300)						J1													
Flanges AS 4087 PN 21	(50 / 80 / 100 / 150 … 600)						E0													
Flanges AS 4087 PN 16	(50 / 80 / 100 / 150 … 350 / 450 … 600)						E1													
Flanges AS 4087 PN 14	(40 / 50 / 80 / 100 / 150 … 600)						E2													
Flanges AS 2129 Table F	(40 / 50 / 80 / 100 / 150 … 600)						E3													
Flanges AS 2129 Table E	(40 / 50 / 80 / 100 / 125 / 150 … 600)						E4													
Flanges AS 2129 Table D	(40 / 50 / 80 / 100 / 150 … 300)						E5													
Flanges AS 2129 Table C	(40 / 50 / 80 / 100 / 150 … 300)						E6													
ISO 7005 PN 10 EN 1092-1	(40 … 600)						S1													
ISO 7005 PN 16 EN 1092-1	(40 … 600)						S2													
ISO 7005 PN 40 EN 1092-1	(40)						S4													
Process connection material																				
Carbon steel								B												
Usage certifications																				
Standard									1											

Continued on next page…

WaterMaster
Electromagnetic flowmeter

Product coding field number	1 … 6	7 … 9	10	11	12	13	14,15	16	17	18	19	20	21	22	23	24	25	26	27	Options
WaterMaster system. Reduced-bore sensor with remote mounted transmitter	**FER121**																			
WaterMaster system. Reduced-bore sensor with integral transmitter	**FER111**	**XXX**	**X**	**X**	**X**	**X**	**XX**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	
WaterMaster reduced-bore sensor only, remote mount, without transmitter	**FER181**																			

See previous page

Calibration type

Class 2 calibration – standard accuracy 0.4 %	A
Class 1 calibration – high accuracy 0.2	B
Extended range, class 1 calibration – high accuracy 0.2 %	N
Extended range, class 2 calibration – standard accuracy 0.4 %	P

Installation temperature range / ambient temperature range

Standard design –20 … 60 °C (–4 … 140 °F)	1

Name plate

Adhesive label	A

Signal cable length and type

Without signal cable	0
5 m (16.4 ft)	1
10 m (32.8 ft)	2
20 m (65.6 ft)	3
30 m (98.4 ft)	4
50 m (164.0 ft)	5
80 m (262.5 ft)	6
100 m (325 ft)	7
150 m (490 ft)	8
Others	9

Explosion protection certification

General purpose (non-Ex design)	A

Protection class transmitter / protection class sensor

IP67 (NEMA 4X) / IP68 (NEMA 6P) – cable not fitted and not potted	2
IP67 (NEMA 4X) / IP68 (NEMA 6P) – cable fitted and potted	3

Cable conduits*

M20 x 1.5	A
NPT ½ in (blanked when cable not fitted)	B
M20 SWA armored (FEV121 and FEV181 only)	D
M20 SWA sensor, output and power connector (FEV121 and FEV181 only)	F

Power supply

Without (FEV18 only)	0
100... 230 V AC, 50 Hz	1
24 V AC or 24 V DC, 50 Hz	2
100... 230 V AC, 60 Hz	3
24 V AC or 24 V DC, 60 Hz	4

Input and output signal type

HART + 20 mA + pulse + contact output	A
PROFIBUS DP RS485 physical layer + pulse + contact output (FEV111 and FEV121 only)	G
MODBUS RTU RS485 physical layer + pulse + contact output (FEV111 and FEV121 only)	M
Without (FEV181 only)	Y

Configuration type / diagnostics type

Without (FEV18 only)	0
Factory defaults / standard diagnostics (FEV11 and FEV12 only)	1

Options**

Documentation language

German	M1	Chinese	M6
Italian	M2	Portuguese	MA
Spanish	M3	Russian	MB
French	M4	Danish	MF
English	M5 (default)		

Verification type

Without fingerprint	V0
VeriMaster	V3

Potable water approval

WRAS cold water approval	CWA
DVGW	CWD
ACS	CWF

Power supply frequency (sensor FER18 only)

50 Hz	F5
60 Hz	F6

* The type of signal cable supplied (standard or armored) depends on the type of cable conduit (variant digit number 24) ordered.
For FM or FMC Approved versions, NPT only permitted.
**Add codes for options.

WaterMaster
Electromagnetic flowmeter

Electromagnetic flowmeter transmitter for WaterMaster FET10 and FET12

Product coding field number	1 … 5	6	7	8	9	10	11	12	13	14	15	Options
Transmitter module	**FET10**											
Remote transmitter	**FET12**		X	X	X	X	X	X	X	X	X	
Design												
Non-hazardous area		1										
Hazardous area		5										
Temperature range installation / ambient temperature range												
Standard design / –20 … 60 °C (–4 … 140 °F)			1									
Nameplate												
Adhesive				A								
Signal cable length												
Without signal cable					0							
Explosion protection												
Without (transmitter only)						Y						
FM Class 1 Div. 2						G						
usFMc Class 1 Div. 2						P						
ATEX / IECEx Zone 2, 21 & 22						M						
Protection class transmitter / protection class sensor												
IP67 (NEMA 4X) / IP67 (NEMA 4X)							1					
Cable conduits												
M20 x 1.5 (plastic)								A				
NPT ½ in. (blanked when cable not fitted)								B				
M20 SWA (armored)								D				
M20 SWA sensor, M20 x 1.5 (plastic) power / output								F				
Without								Y				
Power supply												
100... 230 V AC									1			
24 V AC or 24 V DC									2			
Input and output												
HART + 20 mA + pulse + contact output										A		
PROFIBUS DP RS485 physical layer + pulse + contact output (general-purpose design only)										G		
MODBUS RTU RS485 physical layer + pulse + contact output (general-purpose design only)										M		
Configuration type / diagnostics type												
Factory defaults / standard diagnostics											1	

Options**

Accessories

Configuration lead	AC

Documentation

German	M1	Chinese	M6
Italian	M2	Swedish	M7
Spanish	M3	Finnish	M8
French	M4	Portuguese	MA
English	M5 (default)	Danish	MF
		Norwegian	MN

Other usage

Measuring Instruments Directive (MID)	CM1

*The transmitter converter module Input and Output Signal Type must match the transmitter backplane output configuration (HART or PROFIBUS) – see OI/FET100-EN.
**Add codes for options.

Common accessories

Accessory	Item Number
WaterMaster AC Fuse F1 Type T 250 mA A/S TR5	B20411
WaterMaster DC Fuse F2 Type T 2 A A/S TR5	B20412
WaterMaster Infra Red Comms Pack	MJBX9932
WaterMaster Backplane PCB Board (STD)	WATX2505
WaterMaster Sensor PCB Board	WATX2506
WaterMaster Comms Cable	WEBC2500
Signal cable for remote WaterMaster transmitter 5 m (15 ft.) 10 m (30 ft.) 20 m (60 ft.) 30 m (100 ft.) 50 m (165 ft.) 80 m (260 ft.) 100 m (325 ft.) 150 m (490 ft.) 500 m (1650 ft.)	 STT4500/05 STT4500/10 STT4500/20 STT4500/30 STT4500/50 STT4500/80 STT4500/100 STT4500/150 STT4500/500
Armored signal cable for remote WaterMaster transmitter 5 m (15 ft.) 10 m (30 ft.) 20 m (60 ft.) 30 m (100 ft.) 50 m (165 ft.) 80 m (260 ft.) 100 m (325 ft.) 150 m (490 ft.) 500 m (1650 ft.)	 STT4501/05 STT4501/10 STT4501/20 STT4501/30 STT4501/50 STT4501/80 STT4501/100 STT4501/150 STT4501/500

Acknowledgements

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3KXF211101R1001

Sales

Service

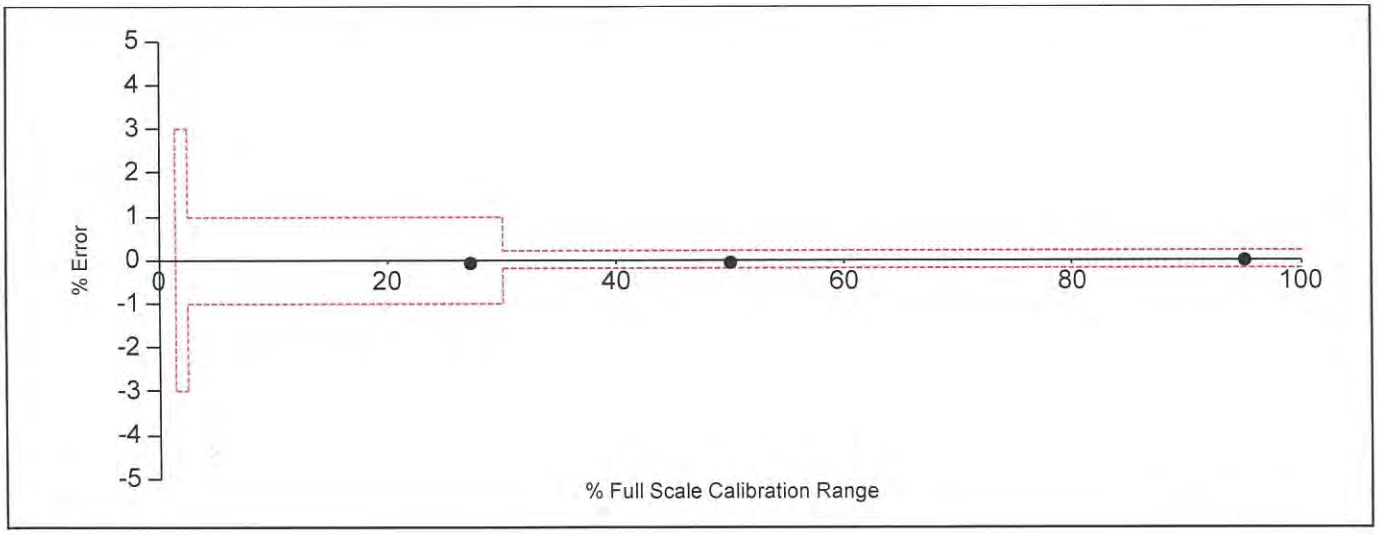
Software

DS/WM-EN Rev. U 10.2013

CERTIFICATE OF CALIBRATION

Customer Name:	ABB Australia Pty Ltd - AUABB	**Certificate Number:**	13/1/7/001828
Customer Ref:	3161143827	**Accreditation Number:**	
Tag Number:	FEF-WRS-250	**Calibration Date:**	10 Jun 2013
Serial No:	3K220000179536	**Calibration Location:**	ABB Stonehouse U.K.
ABB Order Ref:	0000440907	**Test Rig:**	Rig 7
Meter Type:	WaterMaster	**Fluid:**	Water
Meter Code:	FEF181250K1S4E1B1B1A0A2A0Y0	**Calibration Range:**	533.33 m3/hr
Meter Options:	.F5.M5.V3.CWA	**Calibration Type:**	Comparison
Meter Bore:	250 mm	**Sensor Factor Ss:**	127.3054
		Sensor Factor Ss(t):	0.0000
		Sensor Factor Sz:	-0.8437
		Sensor Factor Sz(b):	0.0000
		Accuracy Specification:	Class 1

			Reference					*Meter Under Test*		
Test Run number	*Run Time sec*	*Water Temp ° C*	*Stream 1 m3/hr*	*Stream 2 m3/hr*	*Stream 3 m3/hr*	*Stream 4 m3/hr*	*Ref-Lab Flow m3/hr*	*Test Meter Flowrate m3/hr*	*% Cal. Range*	*% Error*
1	180.000	23.000	145.457	0.000	0.000	0.000	145.457	145.349	27.253	-0.07
2	100.000	23.000	133.387	0.000	133.689	0.000	267.077	266.911	50.046	-0.06
3	100.000	23.000	173.286	0.000	175.198	158.779	507.262	507.193	95.099	-0.01



This flowmeter has been wet calibrated at ABB Stonehouse Calibration Facility and is traceable to some/all of the International Standards detailed below
ISO 4185, ISO 7278 Part 2, ISO 8316 and ISO 17025
Note, these are the main calibration standards, but due to the complex nature of fluid flow calibration, other standards will apply to parts of the system

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Section 4: ABB Flowmeter User Guide

User Guide OI/FEF/FEV/FEW–EN Rev. B

F, V, W Series
Electromagnetic flowmeter
Full-bore flow sensors

The perfect fit for all water industry applications

Introduction

ABB's full-bore FEF, FEV and FEW electromagnetic flowmeter sensors are available with either an AquaMaster 3 or a WaterMaster transmitter.

AquaMaster 3 and WaterMaster are a range of high performance electromagnetic flowmeters for the measurement of electrically conductive fluids and are supplied as factory-configured and calibrated systems.

This User Guide provides end-user details for installation and connection.

This User Guide should be used in conjunction with the following publications:

– AquaMaster 3 FET200 electromagnetic flowmeter transmitter User Guide (OI/FET200–EN)

– WaterMaster FET100 electromagnetic flowmeter transmitter User Guide (OI/FET100–EN)

The Company

We are an established world force in the design and manufacture of instrumentation for industrial process control, flow measurement, gas and liquid analysis and environmental applications.

As a part of ABB, a world leader in process automation technology, we offer customers application expertise, service and support worldwide.

We are committed to teamwork, high quality manufacturing, advanced technology and unrivalled service and support.

The quality, accuracy and performance of the Company's products result from over 100 years experience, combined with a continuous program of innovative design and development to incorporate the latest technology.

Quality Control

The UKAS Calibration Laboratory No. 0255 is just one of the ten flow calibration plants operated by the Company and is indicative of our dedication to quality and accuracy.

UKAS CALIBRATION
0255

UKAS Calibration Laboratory No. 0255

1 Safety

Information in this manual is intended only to assist our customers in the efficient operation of our equipment. Use of this manual for any other purpose is specifically prohibited and its contents are not to be reproduced in full or part without prior approval of the Technical Publications Department.

1.1 Electrical Safety

This equipment complies with the requirements of CEI/IEC 61010-1:2001-2 'Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use' and complies with NIST and OSHA.

If the equipment is used in a manner NOT specified by the Company, the protection provided by the equipment may be impaired.

1.2 Symbols

One or more of the following symbols may appear on the equipment labelling:

	**Warning** – Refer to the manual for instructions
	**Caution** – Risk of electric shock
	Protective earth (ground) terminal
	Earth (ground) terminal

	Direct current supply only
	Alternating current supply only
	Both direct and alternating current supply
	The equipment is protected through double insulation

1.3 Health & Safety

Health and Safety

To ensure that our products are safe and without risk to health, the following points must be noted:

- The safety requirements of this equipment, any associated equipment and the local environment must be taken into consideration during installation.
- Install and use this equipment and any associated equipment in accordance with the relevant national and local standards.
- The relevant sections of these instructions must be read carefully before proceeding.
- Warning labels on containers and packages must be observed.
- Installation, operation, maintenance and servicing must only be carried out by suitably trained personnel and in accordance with the information given.
- Normal safety precautions must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and / or temperature.
- Chemicals must be stored away from heat, protected from temperature extremes and powders kept dry. Normal safe handling procedures must be used.
- When disposing of chemicals ensure that no two chemicals are mixed.
- Product liability – advice and assistance provided without charge is given in good faith but without liability.

Safety advice concerning the use of the equipment described in this manual or any relevant hazard data sheets (where applicable) may be obtained from the Company address on the back cover, together with servicing and spares information.

Warning.

- System configuration must be carried out only by users or personnel with approved access rights (user privileges).
- Read all relevant sections of this guide before configuring the system or modifying system parameters.
- Install and use associated equipment in accordance with the relevant national and local standards.

2 Mechanical Installation

2.1 Unpacking

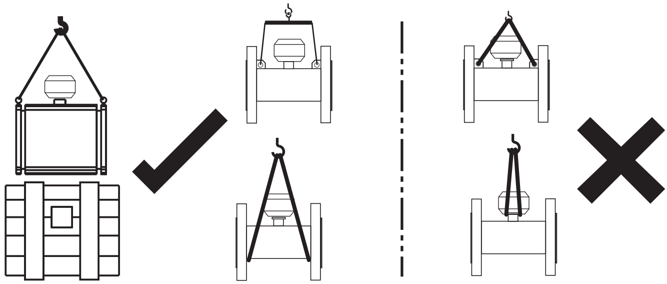


Fig. 2.1 Unpacking

Caution.

- Inspect the flowmeter for damage before installation. Do NOT install a damaged or faulty flowmeter.
- When lifting the flowmeter, use the lifting hooks provided or sling under the body of the meter. NEVER lift the flowmeter by the sensor cable terminal connection box – this will damage the terminal connection box and invalidate the warranty.

2.2 Installation Conditions

Caution. Do NOT exceed the maximum working pressure marked on the flowmeter.

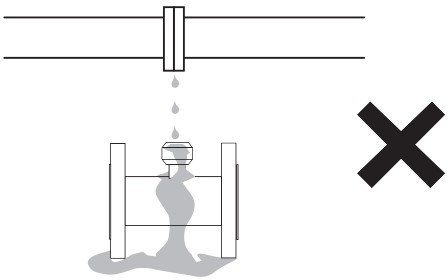


Fig. 2.2 Spillage

Caution. Do NOT install the flowmeter in an area where a spillage of any substance could damage the flowmeter.

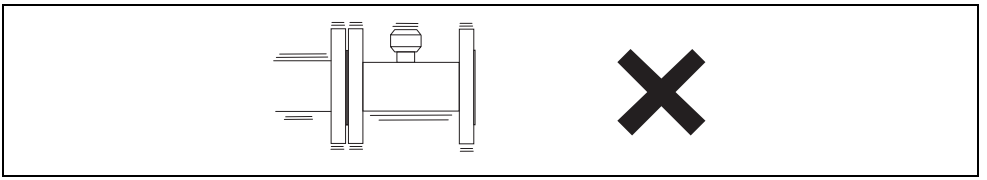


Fig. 2.3 Vibration

Caution. Do NOT install the flowmeter in a pipeline that may exert excessive movement and twisting forces on the flowmeter, for example, vibration.

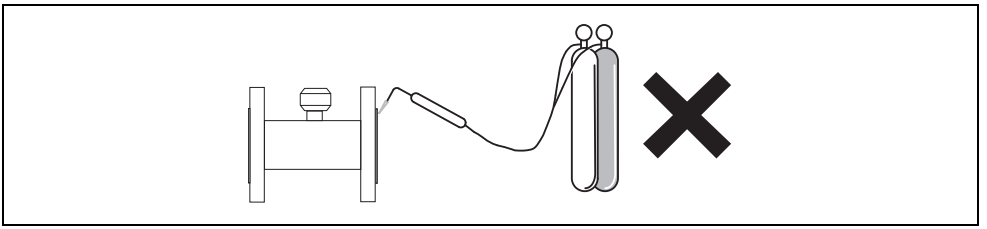


Fig. 2.4 Localized Heat

Caution. Do NOT subject the flowmeter to localized heat during installation. Remember – the flowmeter is a measuring instrument.

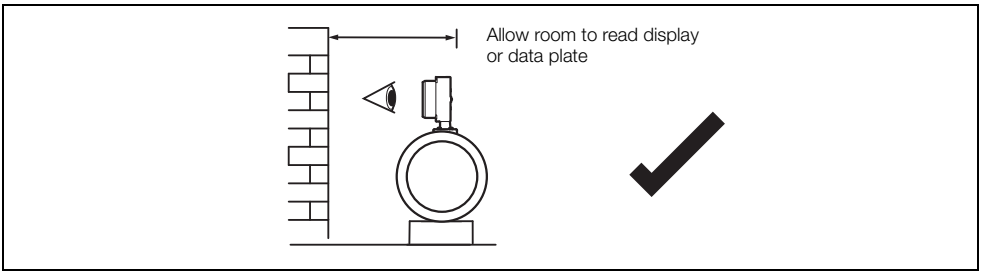


Fig. 2.5 Siting

Note. When installing an integral flowmeter, allow enough room to read the transmitter's display and data label.

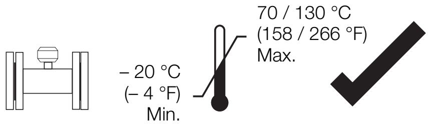


Fig. 2.6 Within Temperature Limits

Caution. Ensure the flowmeter is operated within its specified temperature limits. Use flange seals made from a material that is compatible with the fluid and fluid temperatures as required.

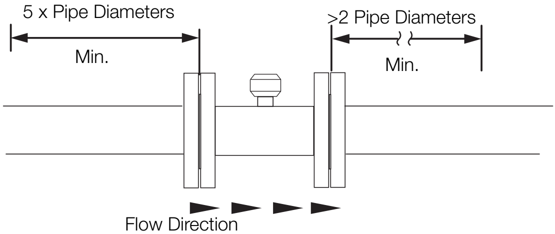


Fig. 2.7 Straight Pipe Requirements

Note. Ensure the flow direction in the pipeline corresponds to the identification plate. The flowmeter measures the flowrate in both directions. Forward flow is the factory setting. Experience has shown that, in most installations, a straight upstream section 3 x pipe diameters in length and a straight downstream section 2 x pipe diameters in length are sufficient. However, wherever possible, straight upstream and downstream sections 5 x 2 pipe diameters in length are recommended.

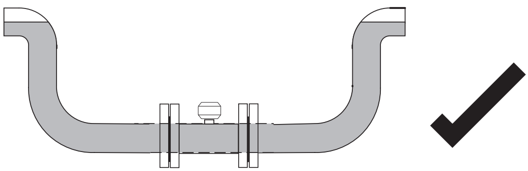


Fig. 2.8 Fluid Level

Note. For accurate and reliable operation, install the flowmeter sensor in a position where it will be completely full when in operation. The flowmeter will operate when not full, but indicated readings will not be accurate.

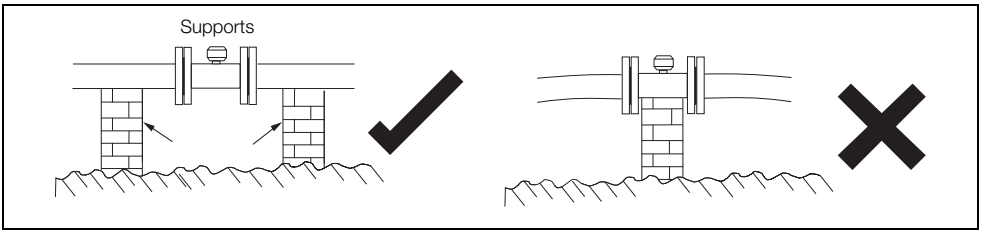


Fig. 2.9 Above Ground

Caution. Do NOT install the flowmeter in a manner that will subject it to mechanical tension (torsion, bending). If required, support the pipeline. Remember – the flowmeter is a measuring instrument.

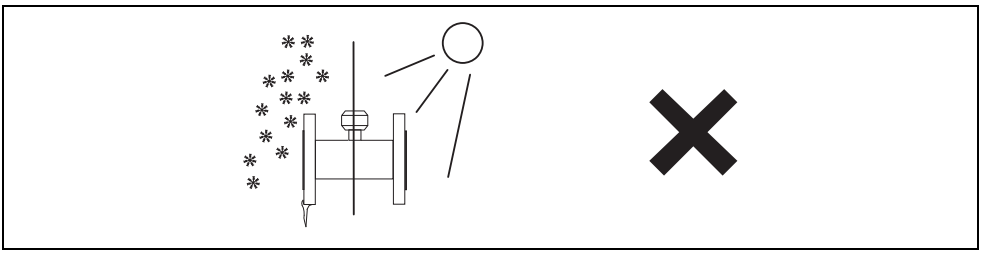


Fig. 2.10 Temperature Difference

Caution. Do NOT install the flowmeter in a position that will expose it to direct sunlight. Provide appropriate sun protection if required.

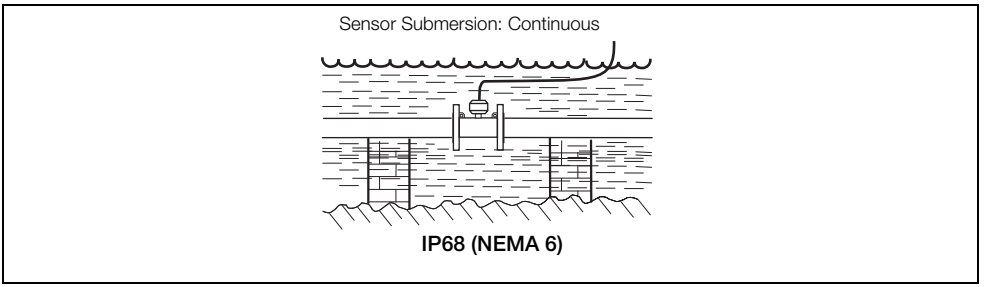


Fig. 2.11 Within Environmental Rating

Caution. Ensure the level of IP rating is correct for the required meter installation application. IP68 (NEMA 6) rated meters can be continuously submerged.

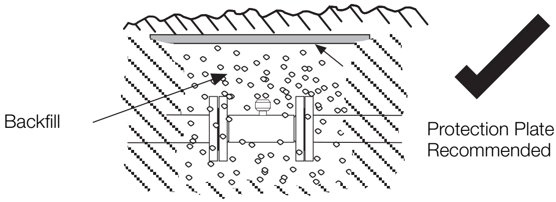


Fig. 2.12 Underground

Caution. When burying a flowmeter, ensure it can be found easily if required (for example, mark the installation position with a post). Installing a protection plate above the meter is also recommended.

Note. For further advice when burying flowmeters, contact the ABB Service Organization.

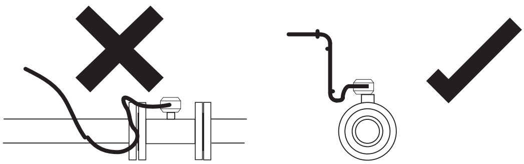


Fig. 2.13 Cable Routing

Caution. Install all flowmeter cabling neatly. Installation within a conduit is recommended. Install the cabling or conduit with a U-bend below the terminal connection box height to prevent water ingress into the flowmeter sensor by capillary action.

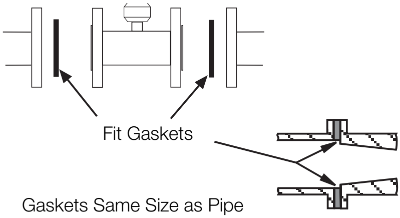


Fig. 2.14 Gasket Fitting

Caution. Use correctly sized gaskets. Do NOT fit gaskets that will extend into the flow area – the turbulence caused will adversely affect flowmeter accuracy.

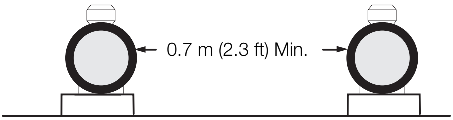


Fig. 2.15 Separation of Sensors

Caution. If flowmeters are installed in adjacent pipelines, ensure they are **at least** 0.7 m (2.3 ft.) apart to prevent the electromagnetic field from one meter affecting the other.

3 Electrical Installation

3.1 Grounding

Caution. For safety reasons and optimum performance, the flowmeter, pipelines and medium must be correctly bonded and grounded according to regulations.

Do not ground cathodically-protected pipelines to an external earth.

Note.

- The flow sensor must not be connected to a ground spike.
- For bonding connections use ^{3} 4mm^2 (< 10AWG) cable.

Arrangement	Number of Fluid Contact Rings
AquaMaster 3 Transmitter	2
WaterMaster Transmitter	1 minimum
Insulating Pipe	2

Table 3.1 Fluid Contact Rings

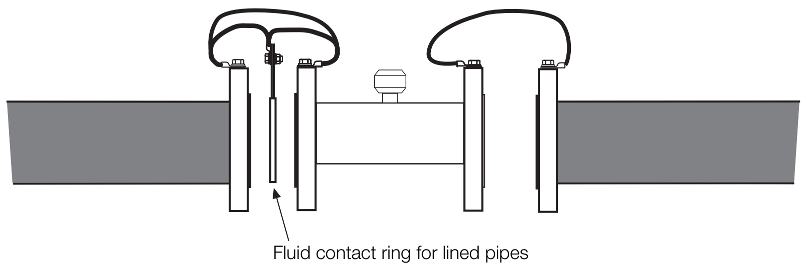


Fig. 3.1 All Metal Pipe (Including Lined Metal Pipe)

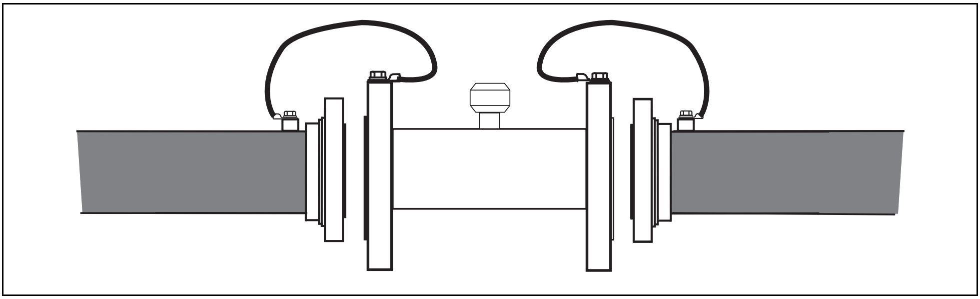


Fig. 3.2 Metal Pipe with Flange Adaptor

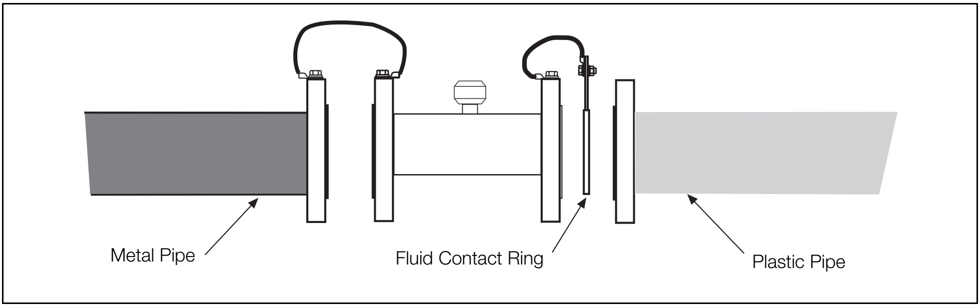


Fig. 3.3 Flanged Metal Pipe to Plastic Pipe

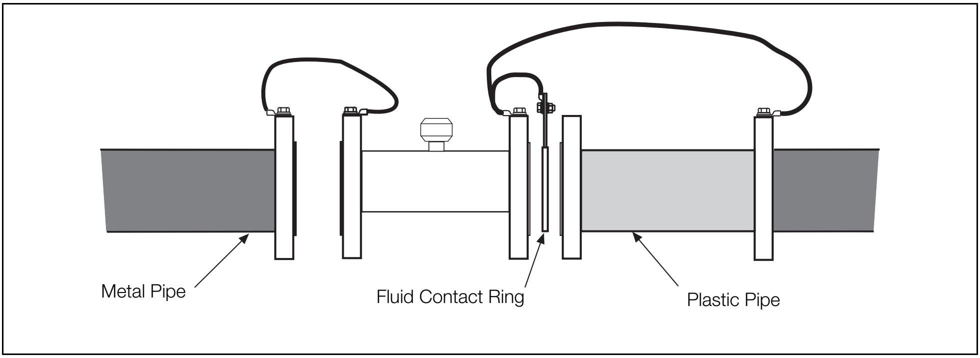


Fig. 3.4 Metal Pipe with Plastic Make-up Insert

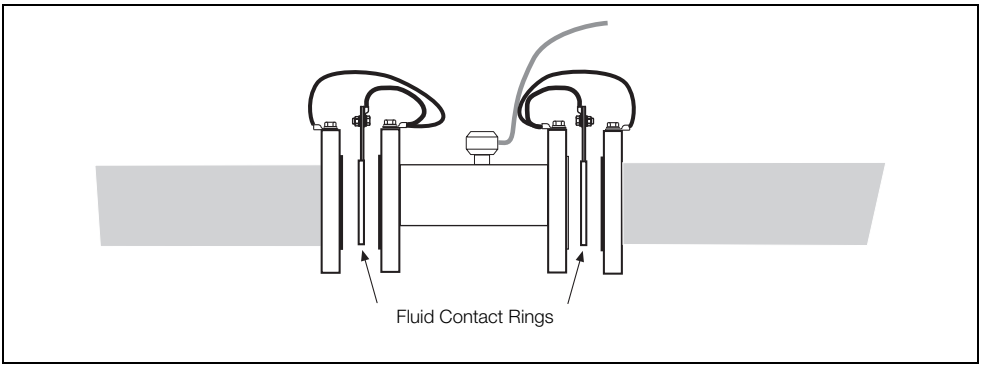


Fig. 3.5 All-plastic Pipe

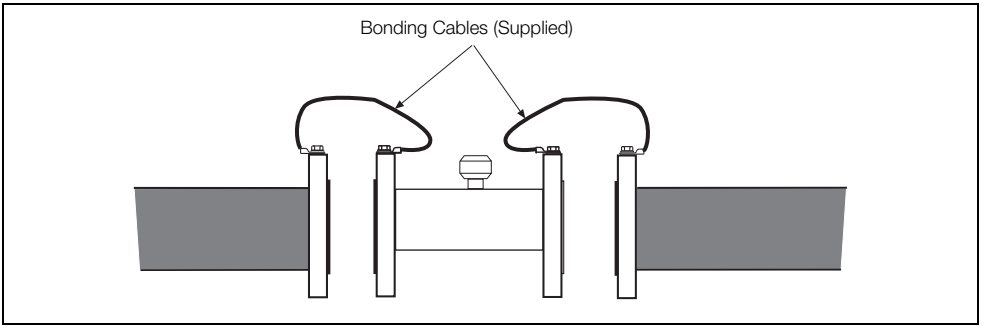


Fig. 3.6 Pipelines with Cathodic Protection

Caution. Do NOT ground cathodically-protected systems.

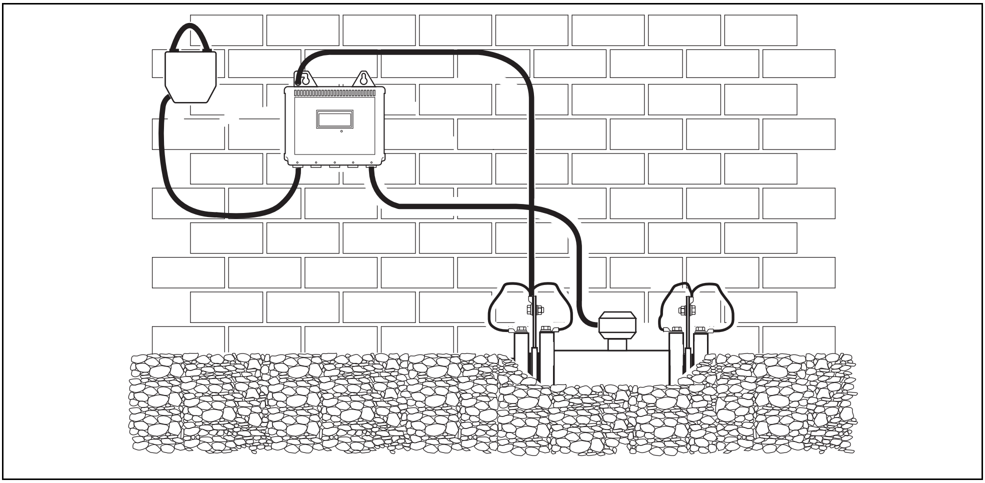


Fig. 3.7 AquaMaster 3 Transmitter Mounted in a Chamber (Battery Version Shown)

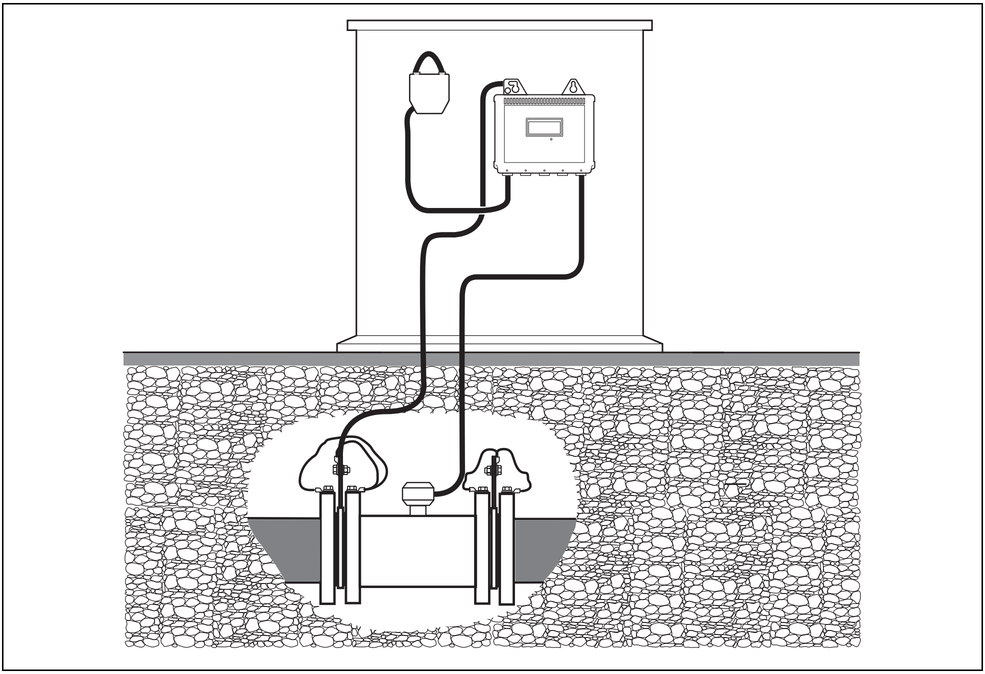


Fig. 3.8 AquaMaster 3 Transmitter Mounted in a Cabinet (Battery Version Shown)

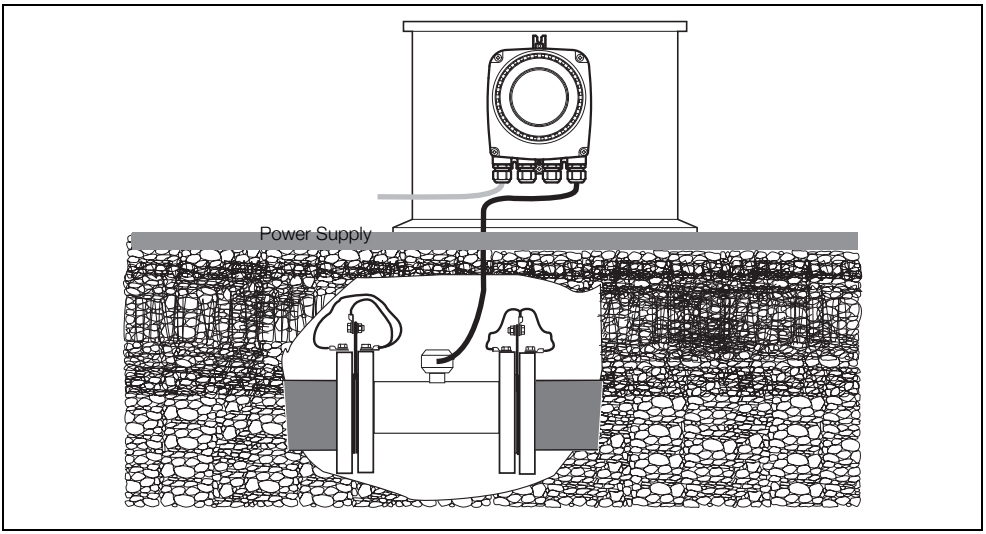


Fig. 3.9 WaterMaster Remote Transmitter Mounted in a Roadside Cabinet

3.2 Cable Preparation (Remote Transmitter Only)

Caution. Maintain Environmental Protection at all times – See Section 3.3, page 17.

To prepare the cable for connection at the transmitter and sensor terminal blocks:

1. Remove the outer cable insulation and Mylar® wrap.
2. Ensure the drain wire is sleeved.
3. Cut the cable connection wires to the lengths shown.

3.2.1 Sensor Cable Connections (Remote WaterMaster Transmitter Only)

Caution.

- Make connections only as shown.
- Twist the screen wire of D1 / TFE + D2 with the outer screen drain wire and sleeve them green / yellow.
- Ensure the seal and mating surfaces are clean to maintain environmental rating.
- Conduit connections must provide cable entry sealing.
- Ensure cable glands are tightened after wiring. Do not overtighten the plastic cable glands to avoid destroying their sealing properties. Initially, tighten finger-tight, then a further 1/2 to 3/4 turn using a suitable spanner or wrench.

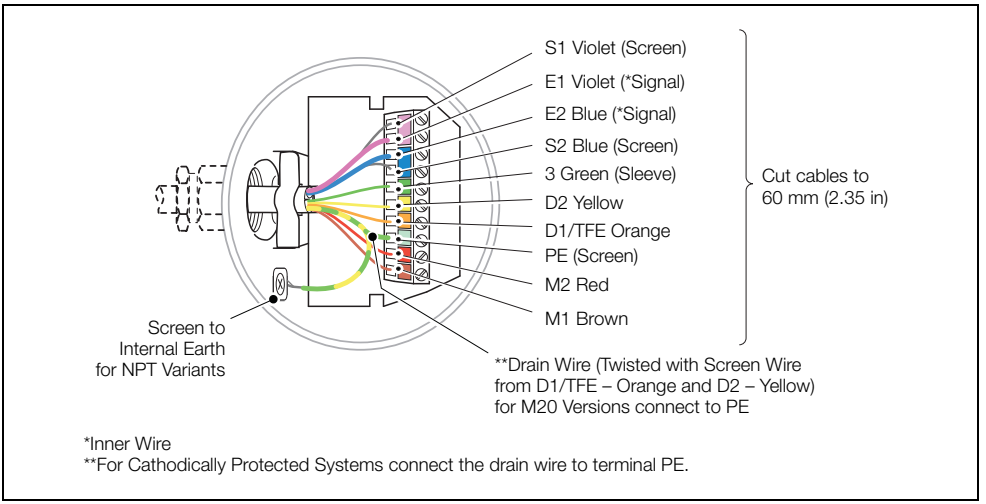


Fig. 3.10 Sensor Cable Connections – WaterMaster Transmitter

3.2.2 Sensor Cable Connections (Remote AquaMaster 3 Transmitter Only)

Caution.

- Twist the three screen wires together and sleeve them.
- Keep cable pairs twisted.
- Make connections only as shown.
- Maintain Environmental Protection at all times.
- Conduit connections must provide cable entry sealing.

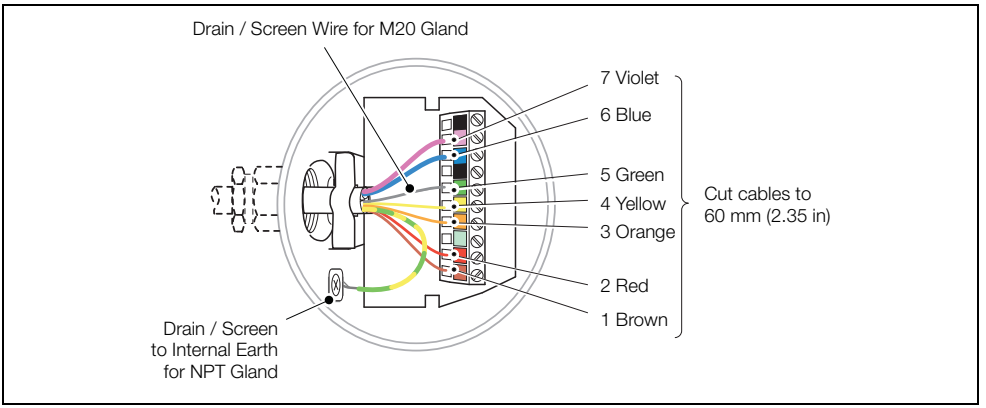


Fig. 3.11 Sensor Cable Connections – AquaMaster 3 Transmitter

3.3 Environmental Protection

Fig. 3.12 Potting the Sensor Terminal Box

Warning.

- Potting materials are toxic. Read the manufacturers' instructions carefully before preparing the potting material and use suitable safety precautions.
- Power up and check all connections before potting.
- The remote sensor terminal box connections must be potted immediately on completion to prevent the ingress of moisture.
- Do not overfill or allow the potting material to come into contact with 'O' rings or grooves.
- Do not let potting material enter conduit (if used).

4 Specification

WaterMaster optimized full-bore meter / full-bore meters flow performance (m^3/h)

			Standard Calibration – 0.4 % Class 2			High Accuracy Calibration – 0.2 % Class 1		
DN	Q4	Q3	$Q_{0.4\%}$	Q2	Q1	$Q_{0.2\%}$	Q2	Q1
10	3.1	2.5	0.167	0.013	0.008	0.31	0.02	0.012
15	7.88	6.3	0.42	0.032	0.02	0.79	0.05	0.03
20	12.5	10	0.67	0.05	0.032	1.25	0.08	0.05
25	20	16	1.1	0.08	0.05	2	0.13	0.08
32	31.25	25	1.67	0.13	0.08	3	0.20	0.13
40*	50	40	4.2	0.2	0.13	6	0.32	0.2
50*	79	63	4.2	0.32	0.20	7.9	0.5	0.32
65*	125	100	6.7	0.5	0.32	12.5	0.8	0.5
80*	200	160	10.7	0.81	0.51	16	1.3	0.8
100*	313	250	16.7	1.3	0.79	25	2	1.25
125*	313	250	16.7	1.3	0.79	25	2	1.25
150*	788	630	42	3.2	2.0	63	5	3.2
200*	1,250	1,000	67	5.1	3.2	100	8	5
250	2,000	1,600	107	8.1	5.1	160	13	8
300	3,125	2,500	167	12.7	7.9	250	20	12.5
350	5,000	4,000	267	20.3	12.7	400	32	20
400	5,000	4,000	267	20.3	12.7	400	32	20
450	7,875	6,300	420	32	20	630	50	32
500	7,875	6,300	420	32	20	630	50	32
600	12,500	10,000	667	51	32	1000	80	50
700	20,000	16,000	1600	102	64	1600	160	100
750	20,000	16,000	1600	102	64	1600	160	100
30 in (760)	20,000	16,000	1600	102	64	1600	160	100
800	20,000	16,000	1600	102	64	1600	160	100
900	31,250	25,000	2500	160	100	2500	250	156
1000	31,250	25,000	2500	160	100	2500	250	156
42 in	31,250	25,000	2500	160	100	2500	250	156
1100	31,250	25,000	2500	160	100	2500	250	156
1200	50,000	40,000	4000	256	160	4000	400	250
1350	78,750	63,000	6300	403	252	6300	630	394
1400	78,750	63,000	6300	403	252	6300	630	394
1500	78,750	63,000	6300	403	252	6300	630	394
60 in (1500)	78,750	63,000	6300	403	252	6300	630	394
1600	78,750	63,000	6300	403	252	6300	630	394
1650	78,750	63,000	6300	403	252	6300	630	394
1800	125,000	100,000	10000	640	400	10000	1000	625
1950	125,000	100,000	10000	640	400	10000	1000	625
2000	125,000	100,000	10000	640	400	10000	1000	625
2200	200,000	160,000	16000	1024	640	16000	1600	1000
2400	200,000	160,000	16000	1024	640	16000	1600	1000

* OIML R49 Certificate of Conformance to Class 1 and Class 2, with OIML R49 and MID versions available.

Note. OIML R49–1 allows Class 1 only for meters with $Q_3 \geq 100$ m^3/h. Meters outside this range have been tested and conform to Class 1.

WaterMaster optimized full-bore meter / full-bore meters flow performance (GPM)

			Standard Calibration 0.4 % Class 2			High Accuracy Calibration 0.2 % Class 1		
NPS/NB (DN)	Q4	Q3	$Q_{0.4\%}$	Q2	Q1	$Q_{0.2\%}$	Q2	Q1
3/8 (10)	13.8	11	0.73	0.06	0.035	1.38	0.09	0.053
1/2 (15)	34.7	27.7	1.85	0.14	0.09	3.48	0.22	0.14
3/4 (20)	55	44	2.94	0.22	0.14	5.5	0.35	0.22
1 (25)	88	70.4	4.7	0.35	0.22	8.8	0.57	0.35
1 1/4 (32)	137.6	110	7.3	0.57	0.35	13.2	0.88	0.57
1 1/2 (40)	220	176	18.5	0.89	0.56	26.4	1.41	0.88
2 (50)	347	277	18.5	1.41	0.88	34.7	2.22	1.39
2 1/2 (65)	550	440	29.4	2.24	1.40	55.0	3.52	2.20
3 (80)	881	704	47.0	3.58	2.24	70.4	5.64	3.52
4 (100)	1,376	1,101	73.4	5.59	3.49	110	8.81	5.50
5 (125)	1,376	1,101	73.4	5.59	3.49	110	8.81	5.50
6 (150)	3,467	2,774	185	14.1	8.81	277	22.2	13.9
8 (200)	5,504	4,403	294	22.4	14.0	440	35.2	22.0
10 (250)	8,806	7,045	470	35.8	22.4	704	56.4	35.2
12 (300)	13,759	11,007	734	55.9	34.9	1,101	88.1	55.0
14 (350)	22,014	17,611	1,174	89.5	55.9	1,761	141	88.1
16 (400)	22,014	17,611	1,174	89.5	55.9	1,761	141	88.1
18 (450)	34,673	27,738	1,849	141	88.1	2,774	222	139
20 (500)	34,673	27,738	1,849	141	88.1	2,774	222	139
24 (600)	55,036	44,029	2,935	224	140	4,403	352	220
27/28* (700)	88,057	70,446	7,045	451	282	7,045	704	440
29 (750)	88,057	70,446	7,045	451	282	7,045	704	440
30 (760)	88,057	70,446	7,045	451	282	7,045	704	440
32 (800)	88,057	70,446	7,045	451	282	7,045	704	440
36 (900)	137,590	110,072	11,007	704	440	11,007	1,100	688
39/40* (1000)	137,590	110,072	11,007	704	440	11,007	1,100	688
42 (1050)	137,590	110,072	11,007	704	440	11,007	1,100	688
44 (1100)	137,590	110,072	11,007	704	440	11,007	1,100	688
48 (1200)	220,143	176,115	17,611	1,127	704	17,611	1,761	1,101
52 (1350)	346,726	277,381	27,738	1,775	1,110	27,738	2,773	1,733
54 (1400)	346,726	277,381	27,738	1,775	1,110	27,738	2,773	1,733
60 (1500)	346,726	277,381	27,738	1,775	1,110	27,738	2,773	1,733
66 (1600)	346,726	277,381	27,738	1,775	1,110	27,738	2,773	1,733
68 (1650)	346,726	277,381	27,738	1,775	1,110	27,738	2,773	1,733
77 (1950)	550,358	440,287	44,029	2,818	1,761	44,029	4,403	2,752
78 (2000)	550,358	440,287	44,029	2,818	1,761	44,029	4,403	2,752
78 (2000)	550,358	440,287	44,029	2,818	1,761	44,029	4,403	2,752
84 (2200)	880,573	704,459	70,446	4,509	2,818	70,446	7,045	4,403
96 (2400)	880,573	704,459	70,446	4,509	2,818	70,446	7,045	4,403

*Size is dependent on flange specification

AquaMaster 3 FEV2, FEF2 AC-powered Full-bore Sensors – Flow Performance

Size		Q_4	Q_3	$Q_{(0.5\%)}$	Class 2 specification Q_2	Class 2 specification Q_1	Class 2 specification R	Class 1 specification Q_2	Class 1 specification Q_1	Class 1 specification R
mm	in.	m^3 / h (GPM)	m^3 / h (GPM)	m^3 / h (GPM)	m^3 / h (GPM)	m^3 / h (GPM)		m^3 / h (GPM)	m^3 / h (GPM)	
40	1 1/2	50 (220)	40 (176)	4 (18)	0.20 (0.88)	0.13 (0.57)	315	0.32 (1.40)	0.20 (0.88)	200
50	2	79 (247)	63 (277)	6.3 (28)	0.32 (1.41)	0.20 (0.88)	315	0.50 (2.20)	0.32 (1.41)	200
65	2 1/2	125 (550)	100 (440)	10 (44)	0.50 (2.20)	0.32 (1.41)	315	0.80 (3.52)	0.50 (2.20)	200
80	3	200 (880)	160 (700)	16 (70)	0.81 (3.56)	0.51 (2.24)	315	1.30 (5.72)	0.8 (3.52)	200
100	4	313 (1377)	250 (1100)	25 (110)	1.3 (5.72)	0.79 (3.47)	315	2.00 (8.80)	1.25 (5.5)	200
125	5	313 (1377)	250 (1100)	25 (110)	1.3 (5.72)	0.79 (3.47)	315	2.00 (8.80)	1.25 (5.5)	200
150	6	788 (3470)	630 (2770)	63 (277)	3.2 (14.08)	2.00 (8.80)	315	5.00 (22.00)	3.2 (14.08)	200
200	8	1250 (5500)	1000 (4400)	100 (440)	5.1 (22.44)	3.2 (14.08)	315	8.0 (35.20)	5.0 (22.00)	200
250	10	2000 (8800)	1600 (7040)	160 (700)	8.1 (35.64)	5.1 (22.44)	315	13.0 (57.20)	8.0 (35.20)	200
300	12	3125 (13750)	2500 (11007)	250 (1100)	12.7 (55.88)	7.9 (34.76)	315	20.0 (88.00)	12.5 (55.00)	200
350	14	5000 (22000)	4000 (17610)	400 (1760)	20.3 (89.32)	12.7 (55.88)	315	32.0 (14.08)	20.0 (88.00)	200
400	16	5000 (22000)	4000 (17610)	400 (1760)	20.3 (89.32)	12.7 (55.88)	315	32.0 (14.08)	20.0 (88.00)	200
450	18	7875 (34760)	6300 (27740)	630 (2770)	32.0 (140.8)	20.0 (88.00)	315	50.0 (220.00)	32.0 (140.8)	200
500	20	7875 (34650)	6300 (27740)	630 (2770)	32.0 (140.8)	20.0 (88.00)	315	50.0 (220.00)	32.0 (140.8)	200
600	24	12500 (55000)	10000 (44000)	1000 (4400)	51.0 (224.4)	32.0 (140.8)	315	80.0 (352.0)	50.0 (220.0)	200

AquaMaster 3 FEV2, FEF2 Battery / Renewable Energy Full-bore Sensors – Flow Performance

Size		Q_4	Q_3	$Q_{(0.25\%)}$	Class 2 specification Q_2	Class 2 specification Q_1	Class 2 specification R	Class 1 specification Q_2	Class 1 specification Q_1	Class 1 specification R
mm	in.	m^3 / h (GPM)	m^3 / h (GPM)	m^3 / h (GPM)	m^3 / h (GPM)	m^3 / h (GPM)		m^3 / h (GPM)	m^3 / h (GPM)	
40	1 1/2	50 (220)	40 (176)	2.7 (11.8)	0.4 (1.8)	0.25 (1.1)	160	0.64 (2.8)	0.4 (1.8)	100
50	2	79 (247)	63 (277)	4.2 (18.5)	0.63 (2.8)	0.39 (1.71)	160	1.0 (4.4)	0.63 (2.8)	100
65	2 1/2	125 (550)	100 (440)	6.7 (29.5)	1.0 (4.4)	0.6 (1.41)	160	1.6 (7.0)	1.0 (4.4)	100
80	3	200 (880)	160 (700)	10.7 (47.0)	1.6 (7.0)	1.0 (4.4)	160	2.6 (11.4)	1.6 (7.0)	100
100	4	313 (1377)	250 (1100)	16.7 (73.5)	2.5 (11.0)	1.6 (7.0)	160	4.0 (17.6)	2.5 (11.0)	100
125	5	313 (1377)	250 (1100)	16.7 (73.5)	2.5 (11.0)	1.6 (7.0)	160	4.0 (17.6)	2.5 (11.0)	100
150	6	788 (3470)	630 (2770)	42.0 (184.8)	6.3 (27.7)	3.9 (17.1)	160	10.0 (44.0)	6.3 (27.7)	100
200	8	1250 (5500)	1000 (4400)	67.0 (294.8)	10.0 (44.0)	6.0 (26.4)	160	16.0 (70.0)	10.0 (44.0)	100
250	10	2000 (8800)	1600 (7040)	107.0 (470.8)	16.0 (70.0)	10.0 (44.0)	160	26.0 (110.4)	16.0 (70.0)	100
300	12	3125 (13750)	2500 (11007)	167.0 (734.8)	25.0 (110.0)	15.6 (68.6)	160	40.0 (176.0)	25.0 (110.0)	100
350	14	5000 (22000)	4000 (17610)	267.0 (1174.8)	40.0 (176.0)	25.0 (110.0)	160	64.0 (281.6)	40.0 (176.0)	100
400	16	5000 (22000)	4000 (17610)	267.0 (1174.8)	40.0 (176.0)	25.0 (110.0)	160	64.0 (281.6)	40.0 (176.0)	100
450	18	7875 (34760)	6300 (27740)	420.0 (184.8)	63.0 (277.0)	39.0 (171.6)	160	101.0 (444.4)	63.0 (277.0)	100
500	20	7875 (34650)	6300 (27740)	420.0 (184.8)	63.0 (277.0)	39.0 (171.6)	160	101.0 (444.4)	63.0 (277.0)	100
600	24	12500 (55000)	10000 (44000)	667.0 (2934.8)	100.0 (440.0)	63.0 (277.0)	160	160.0 (704.0)	100.0 (440.0)	100

Functional Specification

Pressure limitations

As per flange rating – non approved
PN16 for OIML R49, MID Approved

Pressure equipment directive 97/23/EC

This product is applicable in networks for the supply, distribution and discharge of water and associated equipment and is therefore exempt.

Temperature limitations

Ambient temperature
Remote transmitter –20 to 70 °C (–4 to 158 °F)
Integral transmitter –20 to 60 °C (–4 to 140 °F)

Process temperature See table below.
0.1 to 50 °C (32.2 to 122 °F) – OIML R49 T50 Approved

			Medium temperature °C (°F)	
Code	**Lining**	**Flange material**	**Minimum**	**Maximum**
FEF, FEW3	Hard rubber	Carbon steel	–5 (23)	80 (176)
		Stainless steel	–5 (23)	80 (176)
FEW1	PTFE	Carbon steel	–10 (14)	130 (266)
		Stainless steel	–25 (–13)	130 (266)
FEW3	PTFE	Carbon steel	–10 (14)	130 (266)
		Stainless steel	–10 (14)	130 (266)
FEW3	Elastomer	Carbon steel	–5 (23)	80 (176)
		Stainless steel	–5 (23)	80 (176)
FEF, FER	Elastomer	Carbon steel	–6 (21)	70 (158)
FEV	Polypropylene		–6 (21)	70 (158)
FEW3	Linatex	Carbon steel	–10 (14)	70 (158)
		Stainless steel	–20 (–4)	70 (158)

IP rating

IP68 (NEMA 6) to 7 m (20 ft.) depth
Note. Not sizes DN10 to DN32 ($^3/_8$ – $1^1/_4$ in. NB)

IP67 (NEMA 4X) – DN10 to DN32 ($^3/_8$ – $1^1/_4$ in. NB)

Buriable (sensor only)

FEV, FEF and FEW – DN450 to 2400 (18 to 96 in. NB) to 5 m (16 ft.) depth

Conductivity

>5µS cm^{-1}

Transmitter mounting

Integral (not FEF) or remote

Electrical connections

20 mm glands

$^1/_2$ in. NPT
20 mm armored glands

Sensor cable

ABB WaterMaster cable available in two forms – standard and armored
Maximum length 200 m (660 ft.)

Physical Specification

Wetted parts

Electrode material

Stainless steel 316 L / 316 Ti

Super-austenitic steel

Hastelloy® C-22 and Hastelloy C4

(other electrode materials available on request)

Potential equalizing rings

Minimum of 1 recommended

Lining material / potable water approvals

			Potable Water Approvals					
Code	**Size Range**	**Liner**	**WRAS**	**WRAS 60°C**	**ACS**	**DVGW**	**NSF**	**AZ/NZS 4020**
FEW1	DN10 – 32 (3/8 – 1 1/4 in. NB)	PTFE	✔					
FEW3	DN10 – 600 (3/8 – 24 in. NB)	PTFE						
FEW3	DN50 – 600 (2 – 24 in. NB)	Linatex						
FEW3	DN40 – 2400 (1 1/2 – 96 in. NB)	Elastomer	✔					Pending
FEW3	DN40 – 2400 (1 1/2 – 96 in. NB)	Hard rubber	✔	✔		✔	NSF approved material	
FEV	DN40 – 200 (1 1/2 – 8 in. NB)	Polypropylene	✔				NSF-61	✔
FEF	DN80 –600 (3 – 24 in. NB)	Elastomer	✔		✔	✔	NSF-61	✔
FEF	DN80 –600 (3 – 24 in. NB)	Hard rubber	✔	✔		✔	NSF approved material	
FER	DN40 – 600 (1 1/2 – 24 in. NB)	Elastomer	✔		✔	✔		✔

*Size is dependent on flange specification

Lining protection plates

Not required

Installation conditions (recommended)

Upstream ≥ 5D (not FER ≥ OD (FER)

Downstream ≥ 2D (not FER ≥ OD (FER)

Pressure loss

Negligible at Q3	All full bore meters
<0.25 bar (<3.62 psi) at Q3	FEV (DN40 to 200 [1 1/2 to 8 in. NB])
<0.63 bar (<9.13 psi) at Q3	FER (DN40 to 600 [1 1/2 to 24in. NB])

Non-wetted parts

Flange material

Carbon steel	DN20 to DN2400 ($^3/_4$ to 96 in. NB)
Stainless steel	DN10 to DN2400 ($^3/_8$ to 96 in. NB)
SG iron	FEV – DN40 to DN150 [1 $^1/_2$ to 6 in. NB)
	FER – DN40 to DN150 [1 $^1/_2$ to 6 in. NB)

Housing material

Carbon steel	FEV – DN40 to 200 (1$^1/_2$ to 8 in. NB)
	FEW – DN450 to 2400 (18 to 96 in. NB)
Plastic	FEF – DN80 to 600 (3 to 24 in. NB)
Aluminium	FEW – DN10 to 400 ($^3/_8$ to 16 in. NB)

Terminal box material
Polycarbonate

Cable gland material
Plastic, brass

Paint specification
Paint coat ≥70 µm thick RAL 9002 (light grey)

DS/WM–EN Rev. N

5 Sensor dimensions

5.1 FEW – DN10 to 125 (3/8 to 5 in. NB)

Dimensions in mm (in.)

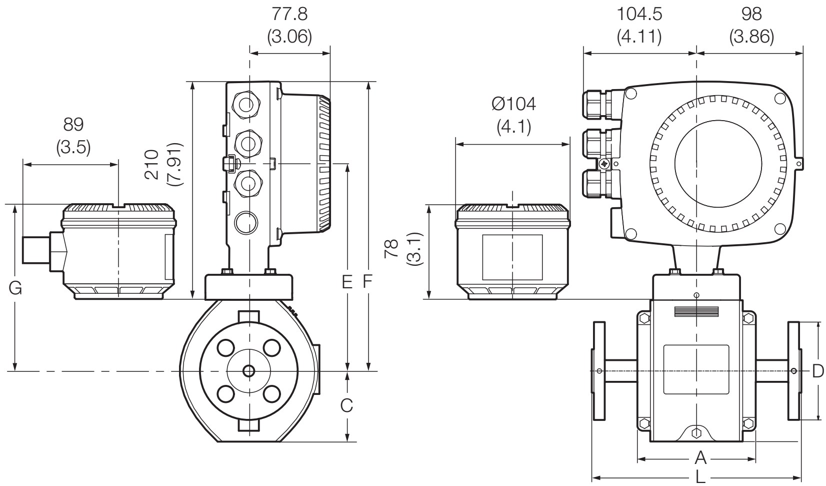


Fig. 5.1 DN10 to 125 (3/8 to 5 In. NB) (FEW)

		Dimensions in mm (in.)							Approx. weight in kg (lb)	
DN	**Mating flange type**	**D**	**L**	**F**	**C**	**E**	**G**	**A**	**Integral**	**Remote**
DN10 (3/8 in.)	JIS10K	90 (3.54)	200 (7.87)	268 (10.55)	82 (3.23)	193 (7.6)	148 (5.83)	113 (4.45)	6 (13)	4 (9)
	PN10 to 40	90 (3.54)								
	ASME B16.5 CL150	90 (3.54)								
	ASME B16.5 CL300	96 (3.78)								
DN15 (1/2 in.)	PN10 to 40	95 (3.74)								
	JIS5K	80 (3.15)								
	JIS10K	95 (3.74)								
	ASME B16.5 CL300	95 (3.74)								
	ASME B16.5 CL150	90 (3.54)								
DN20 (3/4 in.)	PN10 to 40	105 (4.13)							8 (18)	6 (13)
	JIS5K	85 (3.35)								
	JIS10K	100 (3.94)								
	ASME B16.5 CL300	115 (4.53)								
	ASME B16.5 CL150	98 (3.86)								

Table 5.1 DN10 to 125 (3/8 to 5 in. NB) (FEW) dimensions / weights

		Dimensions in mm (in.)							Approx. weight in kg (lb)	
DN	Mating flange type	D	L	F	C	E	G	A	Integral	Remote
DN25 (1 in.)	PN10 to 40	115 (4.53)	200 (7.87)	268 (10.55)	82 (3.23)	193 (7.6)	148 (5.83)	113 (4.45)	9 (20)	7 (15)
	JIS5K	95 (3.74)								
	JIS10K	125 (4.88)								
	ASME B16.5 CL300	125 (4.88)								
	ASME B16.5 CL150	108 (4.25)								
DN32 (1 1/4 in.)	PN10 to 40	140 (5.51)		275 (10.83)	92 (3.62)	200 (7.87)	155 (6.10)	113 (4.45)	10 (22)	8 (18)
	JIS5K	115 (4.53)								
	JIS10K	135 (5.31)								
	ASME B16.5 CL300	135 (5.31)								
	ASME B16.5 CL150	117 (4.61)								
DN40 (1 1/2 in.)	PN10 to 40	150 (5.91)							11 (24)	9 (20)
	JIS5K	120 (4.72)								
	JIS10K	140 (5.51)								
	ASME B16.5 CL300	155 (6.10)								
	ASME B16.5 CL150	127 (5.00)								
DN50 (2 in.)	PN10 to 40	165 (6.5)		281 (11.06)	97 (3.82)	206 (8.11)	161 (6.34)	115 (4.53)	12 (26)	10 (22)
	JIS5K	130 (5.12)								
	JIS10K	155 (6.10)								
	AS4087 PN16	150 (5.91)								
	AS4087 PN35	165 (6.50)								
	ASME B16.5 CL150	152 (5.98)								
	ASME B16.5 CL300	165 (6.50)								
DN65 (2 1/2 in.)	PN10 to 40	185 (7.28)		292 (11.50)	108 (4.25)	217 (8.54)	172 (6.77)	104 (4.09)	13 (29)	11 (24)
	JIS5K	155 (6.10)								
	JIS10K	175 (6.89)								
	AS4087 PN16	165 (6.50)								
	AS4087 PN35	185 (7.28)								
	ASME B16.5 CL150	178 (7.01)								
	ASME B16.5 CL300	190 (7.48)							15 (33)	13 (29)
DN80 (3 in.)	PN10 to 40	200 (7.87)		292 (11.5)	108 (4.25)	217 (8.54)	172 (6.77)	104 (4.09)	17 (37)	15 (33)
	JIS5K	180 (7.09)								
	JIS10K	185 (7.28)								
	AS4087 PN16	185 (7.28)								
	AS4087 PN35	205 (8.07)								
	ASME B16.5 CL150	190 (7.48)								
	ASME B16.5 CL300	210 (8.28)							19 (42)	17 (37)

Table 5.1 DN10 to 125 (3/8 to 5 in. NB) (FEW) dimensions / weights (Continued)

		Dimensions in mm (in.)							Approx. weight in kg (lb)	
DN	Mating flange type	D	L	F	C	E	G	A	Integral	Remote
DN100 (4 in.)	PN10 to 16	220 (8.66)	250 (9.84)	314 (12.36)	122 (4.8)	239 (9.41)	194 (7.64)	125 (4.92)	19 (42)	17 (37)
	PN25 to 40	235 (9.25)							23 (51)	21 (46)
	JIS5K	200 (7.87)							19 (42)	17 (37)
	JIS10K	210 (8.27)								
	AS4087 PN16	215 (8.46)								
	AS4087 PN35	230 (9.06)							23 (51)	21 (46)
	ASME B16.5 CL300	255 (1.04)							30 (66)	28 (62)
	ASME B16.5 CL150	229 (9.00)							21 (51)	19 (42)
DN125 (5 in.)	PN10 to 16	250 (9.84)		324 (12.76)	130 (5.12)	249 (9.8)	204 (8.03)	125 (4.92)	22 (48)	20 (44)
	PN25 to 40	270 (10.63)							29 (64)	27 (59)
	JIS5K	235 (9.25)							22 (48)	20 (44)
	JIS10K	250 (9.84)								
	ASME B16.5 CL150	254 (10.00)								
	ASME B16.5 CL300	280 (11.02)							35 (77)	33 (73)

Table 5.1 DN10 to 125 (3/8 to 5 in. NB) (FEW) dimensions / weights (Continued)

5.2 FEW – DN150 to 400 (6 to 16 in. NB)

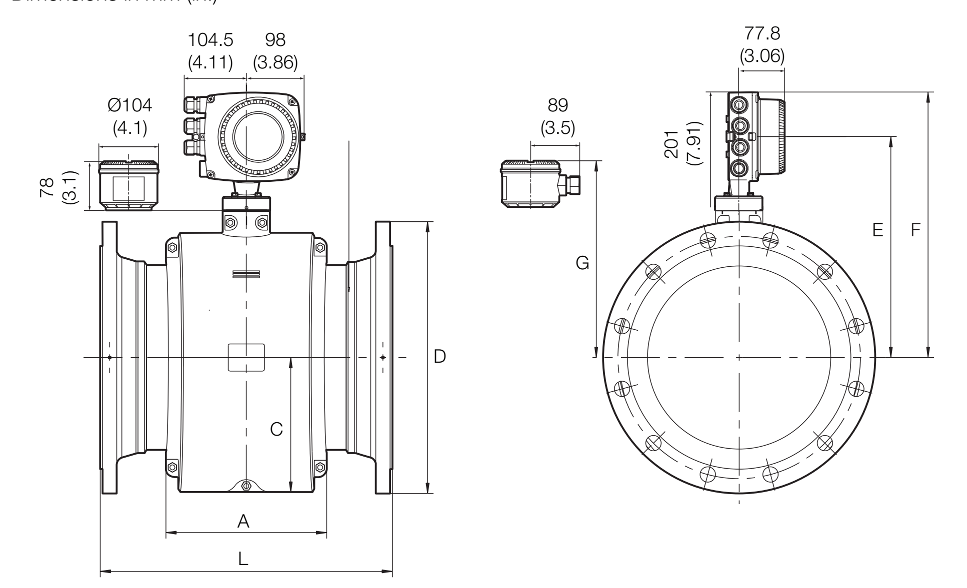


Fig. 5.2 DN150 to 400 (6 to 16 in. NB) (FEW)

		Dimensions in mm (in.)							Approx. weight in kg (lb)	
DN	Mating flange type	D	L	F	C	E	G	A	Integral	Remote
DN150 (6 in.)	PN10 to 16	285 (11.22)	300 (11.81)	371 (14.61)	146 (9.88)	296 (11.65)	251 (9.88)	166 (6.54)	33 (73)	31 (68)
	PN25 to 40	300 (11.81)							39 (86)	37 (81)
	JIS5K	265 (10.43)							33 (73)	31 (68)
	JIS10K	280 (11.02)								
	AS4087 PN16	280 (11.02)								
	AS4087 PN35	305 (11.81)							39 (86)	37 (81)
	ASME B16.5 CL300	320 (12.60)							47 (103)	45 (99)
	ASME B16.5 CL150	279 (10.98)							33 (73)	31 (68)
DN200 (8 in.)	PN10	340 (13.39)	350 (13.78)	411 (16.18)	170 (6.69)	336 (13.23)	291 (11.46)	200 (7.87)	41 (90)	39 (86)
	PN16	340 (13.39)								
	PN25	360 (14.17)							55 (121)	53 (117)
	PN40	375 (14.76)							65 (143)	63 (139)
	AS4087 PN16	335 (13.19)							41 (90)	39 (86)
	AS4087 PN35	370 (14.57)							65 (143)	63 (139)
	JIS5K	320 (12.60)							41 (90)	39 (86)
	JIS10K	330 (12.99)								
	ASME B16.5 CL300	380 (14.96)							72 (158)	70 (154)
	ASME B16.5 CL150	345 (13.58)							50 (110)	48 (106)

Table 5.2 DN150 to 400 (6 to 5 in. NB) (FEW) dimensions / weights

		Dimensions in mm (in.)							Approx. weight in kg (lb)	
DN	Mating flange type	D	L	F	C	E	G	A	Integral	Remote
DN250 (10 in.)	PN10	395 (15.55)	450 (17.72)	426 (16.77)	198 (7.80)	351 (13.82)	306 (12.05)	235 (9.62)	61 (134)	59 (130)
	PN16	405 (15.94)							65 (143)	63 (139)
	PN25	425 (16.73)							84 (185)	82 (180)
	PN40	450 (17.72)							95 (209)	93 (205)
	AS4087 PN16	405 (15.94)							65 (143)	63 (139)
	AS4087 PN35	430 (16.93)							95 (209)	93 (205)
	JIS5K	385 (15.16)							65 (143)	63 (139)
	JIS10K	400 (15.75)								
	ASME B16.5 CL300	445 (17.52)							105 (231)	103 (227)
	ASME B16.5 CL150	405 (15.94)							70 (154)	68 (150)
DN300 (12 in.)	PN10	445 (17.52)	500 (19.69)	449 (17.68)	449 (17.68)	449 (17.68)	449 (17.68)	449 (17.68)	74 (163)	72 (158)
	PN16	460 (18.11)							80 (176)	78 (172)
	PN25	485 (19.09)							100 (220)	98 (216)
	JIS5K	430 (16.93)							80 (176)	78 (172)
	JIS10K	445 (17.52)								
	AS4087 PN16	455 (17.91)								
	AS4087 PN35	490 (19.29)							130 (286)	128 (282)
	ASME B16.5 CL300	520 (20.47)							150 (330)	148 (326)
	ASME B16.5 CL150	485 (19.09)							105 (231)	103 (227)
	PN40	515 (20.28)	600 (23.62)						130 (286)	128 (282)
DN350 (14 in.)	PN10	505 (19.88)	550 (21.65)	464 (18.27)	265 (10.43)	389 (15.31)	344 (13.54)	322 (12.68)	95 (209)	93 (205)
	PN16	520 (20.47)							110 (242)	108 (238)
	PN25	555 (21.85)							145 (319)	143 (315)
	JIS5K	480 (18.90)							95 (209)	93 (205)
	JIS10K	490 (19.29)								
	AS4087 PN16	525 (20.67)							130 (286)	128 (282)
	AS4087 PN35	550 (21.65)							185 (407)	183 (403)
	ASME B16.5 CL300	585 (23.03)							140 (308)	138 (304)
	ASME B16.5 CL150	535 (21.06)							105 (231)	103 (227)
	PN40	580 (22.83)	650 (25.59)						195 (429)	193 (425)
DN400 (16 in.)	PN10	565 (22.24)	600 (23.62)	506 (19.92)	265 (10.43)	431 (16.97)	386 (15.20)	322 (12.68)	103 (227)	101 (222)
	PN16	580 (22.83)							126 (277)	124 (273)
	PN25	620 (24.41)							170 (374)	168 (370)
	JIS5K	540 (21.26)							103 (227)	101 (223)
	JIS10K	560 (22.05)							116 (255)	114 (251)
	AS4087 PN16	580 (22.83)							154 (339)	152 (335)
	AS4087 PN35	610 (24.02)							302 (664)	300 (660)
	ASME B16.5 CL300	650 (25.59)							265 (583)	263 (578)
	ASME B16.5 CL150	600 (23.62)							175 (385)	173 (381)
	PN40	660 (25.98)	650 (25.59)						258 (568)	256 (564)

Table 5.2 DN150 to 400 (6 to 5 in. NB) (FEW) dimensions / weights (Continued)

5.3 FEW – DN450 to 2400 (18 to 96 in. NB)

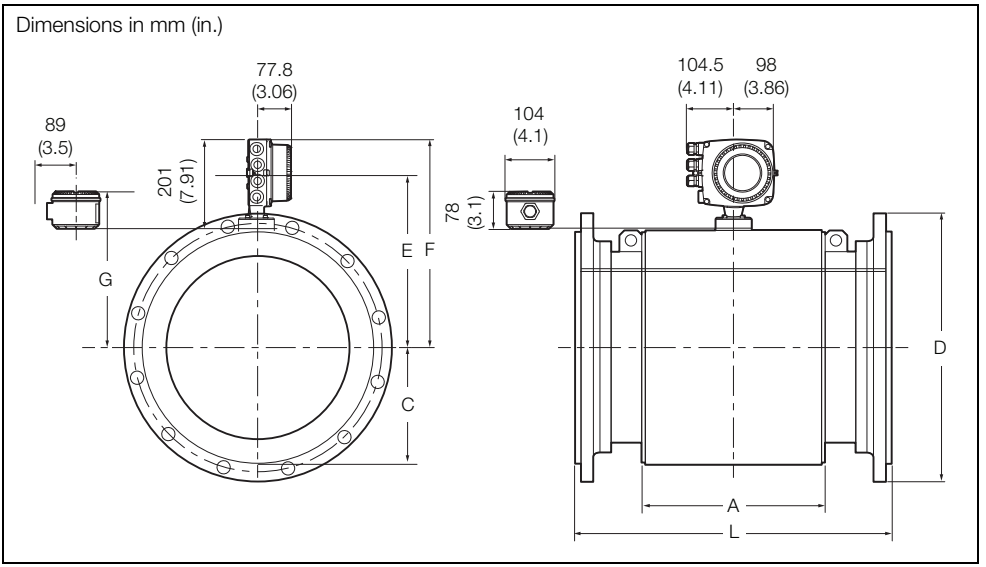


Fig. 5.3 DN450 to 2400 (18 to 96 in. NB) (FEW)

		Dimensions in mm (in.)							Approx. weight in kg (lb)	
DN	Mating flange type	D	L	F	C	E	G	A	Integral	Remote
DN450 (18 in.)	PN10	615 (24.21)	600 (23.62)	514 (20.24)	310 (12.20)	439 (17.28)	394 (15.51)	328 (12.91)	320 (704)	318 (700)
	PN16	640 (25.20)							335 (737)	333 (732)
	JIS5K	605 (23.82)							320 (704)	318 (700)
	JIS10K	620 (24.41)							333 (733)	331 (728)
	AS4087 PN16	640 (25.20)							380 (836)	378 (832)
	AS4087 PN35	675 (26.57)							480 (1056)	478 (1051)
	ASME B16.5 CL300	710 (27.95)							380 (836)	378 (832)
	ASME B16.5 CL150	635 (25.00)							260 (572)	258 (568)
	PN25	670 (26.38)	686 (27.01)						393 (865)	391 (860)
	PN40	685 (26.97)							463 (1019)	461 (1015)
DN500 (20 in.)	PN10	670 (26.38)	600 (23.62)	514 (20.24)	310 (12.20)	439 (17.28)	394 (15.51)	367 (14.45)	190 (418)	188 (413)
	PN16	715 (28.15)							240 (528)	238 (524)
	JIS5K	655 (25.79)							190 (418)	188 (413)
	JIS10K	675 (26.57)								
	AS4087 PN16	705 (27.76)							290 (638)	288 (634)
	AS4087 PN35	735 (28.94)							435 (957)	433 (953)
	ASME B16.5 CL150	700 (27.56)							300 (660)	298 (656)
	ASME B16.5 CL300	775 (30.51)	762 (30.00)						490 (1078)	488 (1074)
	PN25	730 (28.74)	700 (27.56)						300 (660)	298 (665)
	PN40	755 (29.72)	762 (30.00)						400 (880)	398 (876)

Table 5.3 DN450 to 2400 (18 to 96 in. NB) (FEW) dimensions / weights

		Dimensions in mm (in.)							Approx. weight in kg (lb)	
DN	Mating flange type	D	L	F	C	E	G	A	Integral	Remote
DN600 (24 in.)	PN10	780 (30.71)	800 (31.50)	565 (22.24)	361 (14.21)	490 (19.29)	445 (17.52)	469 (18.46)	246 (541)	244 (536)
	PN16	840 (33.07)							318 (700)	316 (695)
	PN25	845 (33.27)							460 (1012)	458 (1008)
	JIS5K	770 (30.31)							275 (605)	273 (600)
	JIS10K	795 (31.30)							306 (673)	304 (668)
	AS4087 PN16	825 (32.48)							382 (840)	380 (835)
	AS4087 PN35	850 (33.46)							452 (994)	450 (990)
	ASME B16.5 CL300	915 (36.02)							550 (1210)	548 (1205)
	ASME B16.5 CL150	815 (32.09)							425 (935)	423 (930)
	PN40	890 (35.04)	890 (35.04)						600 (1320)	598 (1316)
DN700 (28 in.)	JIS 5K	875 (34.45)	910 (35.83)	604 (23.77)	403 (15.87)	528 (20.79)	530 (20.87)	444 (17.48)	216 (475)	214 (471)
	JIS 10K	905 (35.63)							282 (620)	280 (616)
	PN6	860 (33.86)							225 (495)	223 (491)
	PN10	895 (35.24)							303 (667)	301 (662)
	PN16	910 (35.83)							337 (741)	335 (737)
	AWWA C207 CLASS B	927 (36.50)							249 (548)	247 (543)
	AWWA C207 CLASS D	927 (36.50)							280 (616)	278 (612)
	AS4087 PN16	910 (35.83)							359 (790)	357 (785)
	AS2129 TABLE-D	910 (35.83)							263 (579)	261 (574)
	AS2129 TABLE-E	910 (35.83)							337 (741)	335 (737)
	PN25	960 (37.80)							471 (10.36)	469 (1032)
	PN40	995 (39.17)							586 (1289)	584 (1285)
	AWWA C207 CLASS E	927 (36.50)							472 (1038)	470 (1034)
	AWWA C207 CLASS F	1035 (40.75)							715 (1573)	713 (1569)
	AS4087 PN35	935 (36.80)							539 (1186)	537 (1181)
	ASME CL150 SERIES A	925 (36.42)							503 (1107)	501 (1102)
	ASME CL150 SERIES B	835 (32.87)							323 (711)	321 (706)
	ASME CL300 SERIES B	920 (36.22)							631 (1388)	629 (1384)
DN750 (30 in.)	JIS 5K	945 (37.20)	990 (38.98)	630 (24.79)	429 (16.89)	554 (21.81)	556 (21.89)	444 (17.48)	251 (552)	249 (548)
	JIS 10K	970 (38.19)							327 (719)	325 (715)
	AWWA C207 CLASS B	984 (38.74)							273 (601)	271 (596)
	AWWA C207 CLASS D	984 (38.74)							344 (757)	342 (752)
	AS4087 PN16	995 (39.17)							467 (1027)	465 (1023)
	AS2129 TABLE-D	995 (39.17)							340 (748)	338 (744)
	AS2129 TABLE-E	995 (39.17)							454 (999)	452 (994)
	AWWA C207 CLASS E	984 (38.74)							496 (1091)	494 (1087)
	AWWA C207 CLASS F	1092 (43.99)							790 (1738)	788 (1734)
	AS4087 PN35	1015 (39.96)							663 (1459)	661 (1454)
	ASME CL150 SERIES A	985 (38.78)							544 (1197)	542 (1192)
	ASME CL150 SERIES B	885 (34.84)							320 (704)	318 (700)
	ASME CL300 SERIES B	990 (38.98)							748 (1646)	746 (1641)

Table 5.3 DN450 to 2400 (18 to 96 in. NB) (FEW) dimensions / weights (Continued)

		Dimensions in mm (in.)							Approx. weight in kg (lb)	
DN	Mating flange type	D	L	F	C	E	G	A	Integral	Remote
DN800 (32 in.)	JIS 5K	995 (39.17)	1040 (40.04)	654 (25.74)	453 (17.83)	578 (22.76)	580 (22.83)	542 (21.34)	280 (616)	278 (612)
	JIS 10K	1020 (40.16)							364 (801)	362 (796)
	PN6	975 (38.39)							294 (647)	292 (642)
	PN10	1015 (39.96)							406 (893)	404 (889)
	PN16	1025 (40.35)							469 (1032)	467 (1027)
	AWWA C207 CLASS B	1060 (41.73)							328 (722)	326 (717)
	AWWA C207 CLASS D	1060 (41.73)							408 (898)	406 (893)
	AS4087 PN16	1060 (41.73)							530 (1166)	528 (1162)
	AS2129 TABLE-D	1060 (41.73)							386 (849)	384 (845)
	AS2129 TABLE-E	1060 (41.73)							519 (1142)	517 (1137)
	PN25	1085 (42.72)							615 (1353)	613 (1349)
	PN40	1140 (44.88)							866 (1905)	864 (1901)
	AWWA C207 CLASS E	1060 (41.73)							634 (1395)	632 (1390)
	AWWA C207 CLASS F	1150 (45.28)							897 (1973)	895 (1969)
	AS4087 PN35	1060 (41.73)							751 (1652)	749 (1648)
	ASME CL150 SERIES A	1060 (41.73)							700 (1540)	698 (1536)
	ASME CL150 SERIES B	940 (37.01)							406 (893)	404 (889)
	ASME CL300 SERIES B	1055 (41.54)							933 (2053)	931 (2048
DN900 (36 in.)	JIS 5K	1095 (43.11)	1170 (46.06)	705 (27.7()	504 (19.84)	629 (24.76)	631 (24.84)	570 (22.44)	369 812)	367 (807)
	JIS 10K	1120 (44.09)							445 (979)	443 (975)
	PN6	1075 (42.32)							390 (858)	388 (854)
	PN10	1115 (43.90)							502 (1104)	500 (1100)
	PN16	1125 (44.29)							589 (1296)	587 (1291)
	AWWA C207 CLASS B	1168 (45.98)							417 (917)	415 (913)
	AWWA C207 CLASS D	1168 (45.98)							493 (1085)	491 (1080)
	AWWA C207 CLASS E	1168 (45.98)							827 (1819)	825 (1815)
	AWWA C207 CLASS F	1270 (50.00)							1150 (2530)	1148 (2526)
	AS4087 PN16	1175 (46.26)							706 (1553)	704 (1549)
	AS2129 TABLE-D	1175 (46.26)							514 (1131)	512 (1126)
	AS2129 TABLE-E	1175 (46.26)							694 (1527)	692 (1522)
	PN25	1185 (46.65)							819 (1802)	817 (1797)
	PN40	1250 (49.21)							1158 (2548)	1156 (2543)
	AS4087 PN35	1185 (46.65)							1044 (2297)	1042 (2292)
	ASME CL150 SERIES A	1170 (46.06)							961 (2114)	959 (2110)
	ASME CL150 SERIES B	1055 (41.54)							595 (1309)	593 (1305)
	ASME CL300 SERIES B	1170 (46.06)							1147 (2523)	1145 (2519)

Table 5.3 DN450 to 2400 (18 to 96 in. NB) (FEW) dimensions / weights (Continued)

		Dimensions in mm (in.)							Approx. weight in kg (lb)	
DN	Mating flange type	D	L	F	C	E	G	A	Integral	Remote
DN1000 (40 in.)	JIS 5K	1195 (47.05)	1300 (51.18)	755 (29.71)	554 (21.81)	679 (26.73)	681 (26.81)	624 (24.57)	441 (970)	439 (966)
	JIS 10K	1235 (48.62)							572 (1258)	570 (1254)
	PN6	1175 (46.26)							466 (1025)	464 (1021)
	PN10	1230 (48.43)							674 (1483)	672 (1478)
	PN16	1255 (49.41)							879 (1934)	877 (1929)
	AWWA C207 CLASS B	1289 (50.75)							503 (1107)	501 (1102)
	AWWA C207 CLASS D	1289 (50.75)							659 (1450)	657 (1445)
	AWWA C207 CLASS E	1289 (50.75)							1028 (2262)	1026 (2257)
	AWWA C207 CLASS F	1378 (54.25)							1367 (3007)	1365 (3003)
	AS4087 PN16	1255 (49.41)							831 (1828)	829 (1824)
	AS2129 TABLE-D	1255 (49.41)							610 (1342)	608 (1338)
	AS2129 TABLE-E	1255 (49.41)							833 (1833)	831 (1028)
	PN25	1320 (51.97)							1207 (2655)	1205 (2651)
	PN40	1360 (53.54)							1413 (3109)	1411 (3104)
	AS4087 PN35	1275 (50.20)							1244 (2737)	1242 (2732)
	ASME CL150 SERIES A	1290 (50.79)							1149 (2528)	1147 (2523)
	ASME CL300 SERIES A	1240 (48.82)							1349 (2968)	1347 (2963)
	ASME CL150 SERIES B	1175 (46.26)							738 (1624)	736 (1619)
	ASME CL300 SERIES B	1275 (50.20)							1487 (3271)	1485 (3267)
DN1050 (42 in.)	AWWA C207 CLASS B	1346 (5299)	1365 (53.74)	808 (31.82)	608 (23.92)	733 (28.84)	735 (28.92)	624 (24.57)	564 (1241)	562 (1236)
	AWWA C207 CLASS D	1346 (5299)							669 (1472)	667 (1467)
	AWWA C207 CLASS E	1346 (5299)							1143 (2515)	1141 (2510)
	AWWA C207 CLASS F	1448 (57.01)							1568 (3450)	1566 (3445)
	ASME CL150 SERIES B	1225 (48.23)							809 (1780)	807 (1775)
	ASME CL150 SERIES A	1345 (52.95)							1289 (2836)	1287 (2831)
	ASME CL300 SERIES A	1290 (50.79)							1527 (3359)	1525 (3355)
	ASME CL300 SERIES B	1335 (52.56)							1704 (3749)	1702 (3744)
DN1100 (44 in.)	JIS 5K	1305 (51.38)	1430 (56.30)						510 (1122)	508 (1118)
	JIS 10K	1345 (52.95)							689 (1516)	687 (1511)
	AWWA C207 CLASS B	1403 (55.24)							615 (1353)	613 (1349)
	AWWA C207 CLASS D	1403 (55.24)							807 (1775)	805 (1771)
	AWWA C207 CLASS E	1404 (55.26)							1205 (2651)	1203 (2647)
	AWWA C207 CLASS F	1505 (59.25)							1719 (3782)	1717 (3777)

Table 5.3 DN450 to 2400 (18 to 96 in. NB) (FEW) dimensions / weights (Continued)

		Dimensions in mm (in.)							Approx. weight in kg (lb)	
DN	Mating flange type	D	L	F	C	E	G	A	Integral	Remote
DN1200 (48 in.)	JIS 5K	1420 (55.91)	1560 (61.42)	860 (33.85)	659 (25.94)	784 (30.87)	786 (30.94)	802 (31.57)	651 (1432)	649 (1428)
	JIS 10K	1465 (57.68)							967 (2127)	965 (2123)
	PN6	1405 (55.31)							710 (1562)	708 (1558)
	PN10	1455 (57.28)							1107 (2435)	1105 (2431)
	PN16	1485 (58.46)							1363 (2999)	1361 (2994)
	AWWA C207 CLASS B	1511 (59.49)							772 (1698)	770 (1694)
	AWWA C207 CLASS D	1511 (59.49)							999 (2198)	997 (2193)
	AWWA C207 CLASS E	1511 (59.49)							1458 (3208)	1456 (3203)
	AWWA C207 CLASS F	1651 (65.00)							2400 (5280)	2398 (5276)
	AS4087 PN16	1490 (58.66)							1253 (2757)	1251 (2752)
	AS2129 TABLE-D	1490 (58.66)							1023 (2251)	1021 (2246)
	AS2129 TABLE-E	1490 (58.66)							1272 (2798)	1270 (2794)
	PN25	1530 (60.24)							1559 (3430)	1557 (3425)
	PN40	1575 (62.01)							2133 (4693)	2131 (4688)
	AS4087 PN35	1530 (60.24)							2115 (4653)	2113 (4649)
	ASME CL150 SERIES A	1510 (59.45)							1707 (3755)	1705 (3751)
	ASME CL300 SERIES A	1465 (57.68)							2163 (4759)	2161 (4754)
	ASME CL150 SERIES B	1390 (54.72)							1085 (2387)	1083 (2383)
	ASME CL300 SERIES B	1510 (59.45)							2352 (5174)	2350 (5170)
DN1350 (54 in.)	AWWA C207 CLASS B	1683 (66.26)	1755 (69.09)	955 (37.59)	754 (29.69)	879 (34.61)	881 (34.69)	902 (35.51	981 (2158)	979 (2154)
	AWWA C207 CLASS D	1683 (66.26)							1213 (2669)	1211 (2664)
	AWWA C207 CLASS E	1683 (66.26)							1942 (4272)	1940 (4268)
DN1400 (56 in.)	PN6	1630 (64.17)	1820 (71.65)						1085 (2387)	1083 (2383)
	PN10	1675 (65.94)							1731 (3808)	1729 (3804)
	PN16	1685 (66.34)							1770 (3894)	1768 (3890)
	ASME CL150 SERIES B	1600 (62.99)							1593 (3505)	1591 (3500)
	PN25	1755 (69.09)							2368 (5210)	2366 (5205)
	PN40	1795 (70.67)							3086 (6789)	3084 (6785)
	ASME CL150 SERIES A	1745 (68.70)							2556 (5623)	2554 (5619)
	ASME CL300 SERIES A	1710 (67.32)							3376 (7427)	3374 (7423)
	ASME CL300 SERIES B	1765 (69.49)							3758 (8268)	3756 (8263)
DN1500 (60 in.)	JIS 5K	1730 (68.11)	1950 (76.77)	1065 (41.92)	864 (34.02)	989 (38.94)	991 (39.02)	910 (35.83)	1029 (2264)	1027 (2259)
	JIS 10K	1795 (70.67)							1504 (3309)	1502 (3304)
	ASME CL150 SERIES B	1725 (67.91)							2031 (4468)	2029 (4464)
	AWWA C207 CLASS B	1854 (72.99)							1229 (2704)	1227 (2699)
	AWWA C207 CLASS D	1854 (72.99)							1514 (3331)	1512 (3326)
	AWWA C207 CLASS E	1854 (72.99)							2544 (5597)	2542 (5592)
	ASME CL150 SERIES A	1855 (73.03)							3084 (6785)	3082 (6780)
	ASME CL300 SERIES A	1810 (71.26)							3875 (8525)	3873 (8521)
	ASME CL300 SERIES B	1880 (74.02							4181 (9198)	4179 (9194)

Table 5.3 DN450 to 2400 (18 to 96 in. NB) (FEW) dimensions / weights (Continued)

		Dimensions in mm (in.)							Approx. weight in kg (lb)	
DN	Mating flange type	D	L	F	C	E	G	A	Integral	Remote
DN1600 (64 in.)	PN6	1830 (72.05)	2080 (81.89)	1066 (41.96)	865 (34.06)	990 (38.98)	992 (39.06)	1000 (39.37)	1434 (3155)	1432 (3150)
	PN10	1915 (75.39)							2525 (5555)	2523 (5551)
	PN25	1975 (77.76)							3201 (7042)	3199 (7038)
	PN16	1930 (75.98)							2768 (6090)	2766 (6085)
	PN40	2025 (79.72)							4375 (9625)	4373 (9621)
DN1650 (66 in.)	AWWA C207 CLASS B	2032 (80.00)	2145 (84.45)	1116 (43.94)	915 (36.02)	1040 (40.94)	1042 (41.02)	1000 (39.37)	1504 (3309)	1502 (3304)
	AWWA C207 CLASS D	2032 (80.00)							2025 (4455)	2023 (4451)
DN1800 (72 in.)	PN6	2045 (80.51)	2340 (92.13)	1181 (46.50)	980 (38.58)	1105 (43.50)	1107 (43.48)	1100 (43.31)	1853 (4077)	1851 (4072)
	PN10	2115 (83.27)							3180 (6996)	3178 (6992)
	PN16	2130 (83.86)							3657 (8045)	3655 (8041)
	PN25	2195 (86.42)							4422 (9728)	4420 (9724)
	AWWA C207 CLASS B	2197 (86.50)							1773 (3901)	1771 (3896)
	AWWA C207 CLASS D	2197 (86.50)							2387 (5251)	2385 (5247)
DN1950 (78 in.)	AWWA C207 CLASS B	2362 (92.99)	2535 (99.80)	1291 (50.81)	1090 (42.91)	1215 (47.83)	1217 (47.91)	1180 (46.46)	2309 (5080)	2307 (5075)
	AWWA C207 CLASS D	2362 (92.99)							3037 (6681)	3035 (6677)
DN2000 (80 in.)	PN6	2265 (89.17)	2600 (102.36)						2581 (5678)	2579 (5674)
	PN10	2325 (91.54)							4254 (9359)	4252 (9354)
	PN16	2345 (92.32)							4556 (10023)	4554 (10019)
	PN25	2425 (95.47)							5896 (12971)	5894 (12967)
DN2100 (84 in.)	AWWA C207 CLASS B	2534 (99.76)	2730 (107.48)	1395 (54.91)	1194 (47.01)	1319 (51.93)	1321 (52.01)	1180 (46.46)	2641 (5810)	2639 (5806)
	AWWA C207 CLASS D	2534 (99.76)							3487 (7671)	3485 (7667)
DN2200 (88 in.)	PN6	2475 (97.44)	2860 (112.60)					1330 (52.36)	3363 (7399)	3361 (7394)
	PN10	2550 (100.39)							5795 (12749)	5793 (12745)
DN2400 (96 in.)	PN6	2685 (105.71	3120 (122.83)	1495 (58.85)	1294 (50.94)	1419 (55.87)	1421 (55.94)	1450 (57.09)	4100 (9020)	4098 (9016)
	PN10	2760 (108.66)							6968 (15330)	6966 (15325)

Table 5.3 DN450 to 2400 (18 to 96 in. NB) (FEW) dimensions / weights (Continued)

5.4 FEV – DN40 to 200 (1½ to 8 in. NB)

Dimensions in mm (in.)

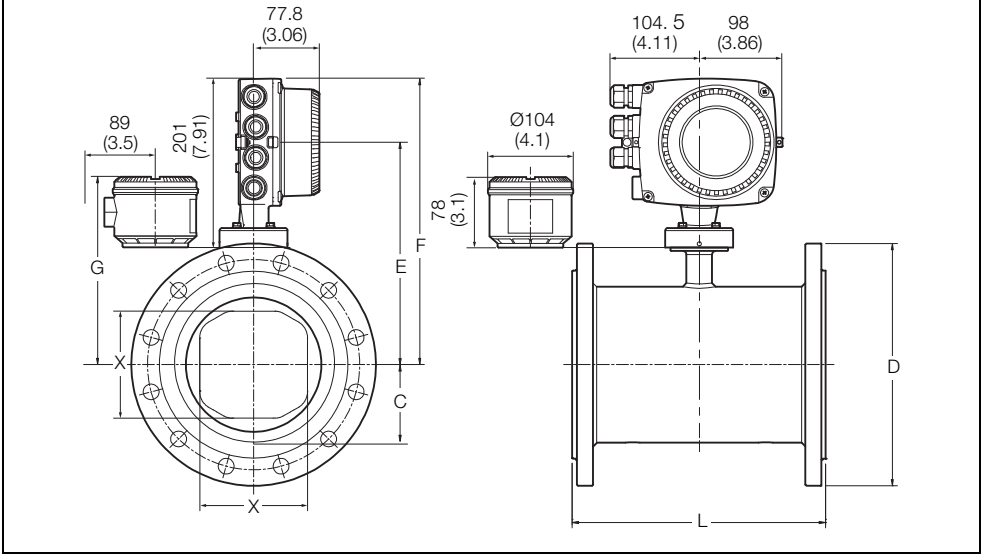


Fig. 5.4 DN40 to 200 (1½ to 8 in. NB) (FEV)

		Dimensions in mm (in.)							Approx. weight in kg (lb)	
DN	Mating flange type	D	L	F	C	E	G	X	Integral	Remote
DN40 (1½ in.)	EN1092-1 PN10, PN40	150 (5.91)	200 (7.87)	260 (10.24)	30.4 (1.20)	185 (7.28)	138 (5.43)	30 (1.18)	12 (27)	11 (24)
	ASME B16.5 CLASS 150	127 (5.00)								
	JIS 10K	140 (5.51)								
	AS2129 TABLE F	140 (5.51)								
	AS2129 TABLE C D E	135 (5.31)								
	AS4087 PN14	135 (5.31)								
DN50 (2 in.)	EN1092-1 PN10, PN16	165 (6.50)	200 (7.87)	270 (10.63)	38.3 (1.51)	195 (7.68)	146 (5.75)	38 (1.50)	13 (29)	12 (27)
	ASME B16.5 CLASS 150	152.4 (6.00)								
	JIS 10K	155 (6.10)								
	AS4087 PN21	165 (6.50)								
	AS2129 TABLE F	165 (6.50)								
	AS2129 TABLE C D E	150 (5.91)								
	AS4087 PN14, PN16	150 (5.91)								
DN65 (2½ in.)	AS4087 PN14, PN16	165 (6.50)	200 (7.87)	275 (10.83)	45.2 (1.78)	200 (7.87)	152 (5.98)	48 (1.89)	15 (33)	14 (31)
	AS2129 TABLE C D E	165 (6.50)								
	EN1092-1 PN10	185 (7.28)								
	EN1092-1 PN16	185 (7.28)								

Table 5.4 DN40 to 200 (1½ to 8 in. NB) (FEV) dimensions / weights

		Dimensions in mm (in.)							Approx. weight in kg (lb)	
DN	Mating flange type	D	L	F	C	E	G	X	Integral	Remote
DN80 (3 in.)	EN1092-1 PN10, PN16	200 (7.87)	200 (7.87)	280 (11.02)	51.5 (2.03)	205 (8.07)	156 (6.14)	61 (2.40)	16 (36)	15 (33)
	ASME B16.5 CLASS 150	190 (7.48)								
	JIS 7.5K	211 (8.31)								
	JIS 10K	185 (7.28)								
	AS2129 TABLE C D E	185 (7.28)								
	AS4087 PN14, PN16	185 (7.28)								
	AS2129 TABLE F	205 (8.07)								
	AS4087 PN21	205 (8.07)								
DN100 (4 in.)	EN1092-1 PN10, PN16	220 (8.66)	250 (9.84)	320 (12.60)	63.75 (2.51)	245 (9.65)	196.8 (7.75)	70 (2.76)	19 (42)	18 (40)
	ASME B16.5 CLASS 150	228.6 (9.00)								
	JIS 7.5K	238 (9.37)								
	JIS 10K	210 (8.27)								
	AS2129 TABLE C D	215 (8.46)								
	AS4087 PN14, PN16	215 (8.46)								
	AS2129 TABLE E	215 (8.46)								
	AS4087 PN21	230 (9.06)								
	AS2129 TABLE F	230 (9.06)								
DN125 (5 in.)	EN1092-1 PN10, PN16	250 (9.84)	250 (9.84)	320 (12.60)	63.75 (2.51)	245 (9.65)	197 (7.76)	70 (2.76)	20 (44)	19 (42)
	ASME B16.5 CLASS 150	254 (10.00)								
	JIS 10K	250 (9.84)								
	AS2129 TABLE C D E	255 (10.04)								
	AS2129 TABLE F	280 (11.02)								
DN150 (6 in.)	EN1092 PN10, PN16	285 (11.22)	300 (11.81)	340 (13.39)	84.4 (3.32)	265 (10.43)	217 (8.54)	103 (4.06)	32 (70)	31 (68)
	ASME B16.5 CLASS 150	279 (10.98)								
	JIS 7.5k	290 (11.42)								
	JIS 10K	280 (11.02)								
	AS2129 TABLE C D	280 (11.02)								
	AS4087 PN14, PN16	280 (11.02)								
	AS2129 TABLE E	280 (11.02)								
	AS2129 TABLE F	305 (12.01)								
	AS4087 PN21	305 (12.01)								
DN200 (8 in.)	EN1092-1 PN10	340 (13.39)	350 (13.78)	365 (14.37)	109.8 (4.32)	290 (11.42)	243 (9.57)	150 (5.91)	49 (108)	48 (105)
	EN1092-1 PN16	340 (13.39)								
	ASME B16.5 CLASS 150	345 (13.58)								
	JIS 7.5K	342 (13.46)								
	JIS 10K	330 (12.99)								
	AS2129 TABLE C D	335 (13.19)								
	AS4087 PN14, PN 16	335 (13.19)								
	AS2129 TABLE E	335 (13.19)								
	AS2129 TABLE F	370 (14.57)								
	AS4087 PN21	370 (14.57)								

Table 5.4 DN40 to 200 (1½ to 8 in. NB) (FEV) dimensions / weights (Continued)

5.5 FER – DN40 to 300 (1½ to 12 in. NB)

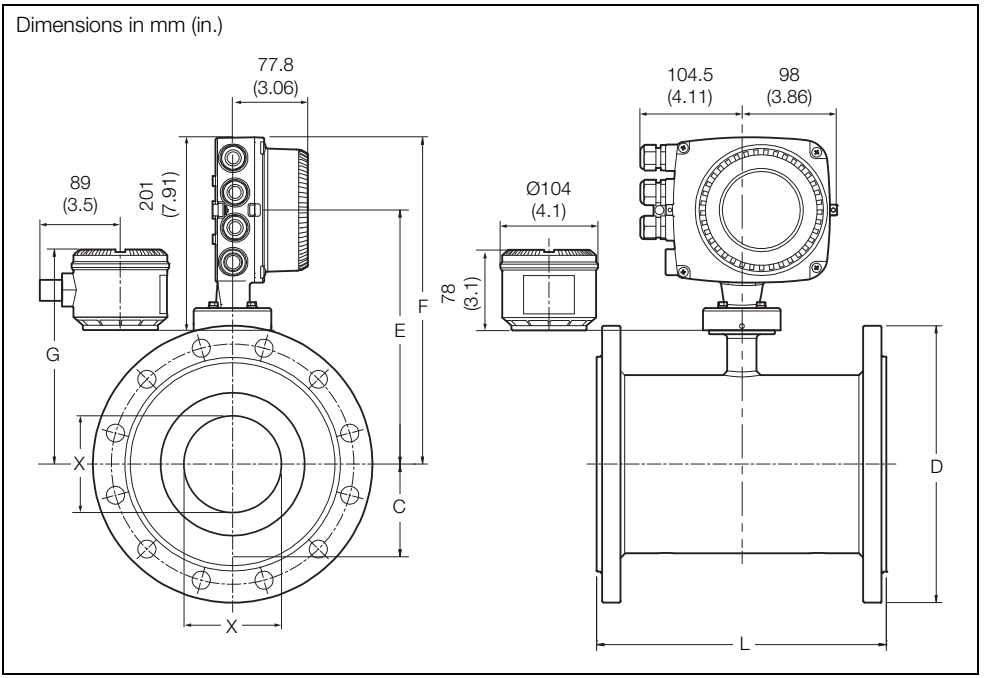


Fig. 5.5 DN40 to 300 (1½ to 12 in. NB) (FER)

		Dimensions in mm (in.)							Approx. weight in kg (lb)	
DN	Mating flange type	D	L	F	C	E	G	X	Integral	Remote
DN40 (1½ in.)	EN1092-1, PN10, 16, 25, 40	150 (5.91)	200 (7.87)	260 (10.24)	30.4 (1.20)	185 (7.28)	138 (5.43)	60.7 (2.39)	13 (29)	11 (24)
	ASME B16.5 CLASS 150	127 (5.00)								
	JIS 10K	140 (5.51)								
	AS2129 TABLE C D E	135 (5.31)								
	AS2129 TABLE F	140 (5.51)								
	AS4087 PN14	135 (5.31)								
DN50 (2 in.)	EN1092-1 PN10, 16, 25, 40	165 (6.50)	200 (7.87)	270 (10.63)	38.3 (1.51)	195 (7.68)	146 (5.75)	78 (3.07)	14 (31)	12 (27)
	ASME B16.5 CLASS 150	152.4 (6.00)								
	JIS 10K	155 (6.10)								
	AS4087 PN21	165 (6.50)								
	AS2129 TABLE F	165 (6.50)								
	AS2129 TABLE C D E	150 (5.91)								
	AS4087 PN14, PN16	150 (5.91)								

Table 5.5 DN40 to 300 (1½ to 12 in. NB) (FER) dimensions / weights

		Dimensions in mm (in.)							Approx. weight in kg (lb)	
DN	Mating flange type	D	L	F	C	E	G	X	Integral	Remote
DN65 (2½ in.)	EN1092-1 PN10, 16, 25, 40	185 (7.28)	200 (7.87)	275 (10.83)	45.2 (1.78)	200 (7.87)	152 (5.98)	90 (3.54)	15 (33)	13 (29)
	ASME B16.5 CLASS 150	178 (7.00)								
	JIS10K	175 (6.89)								
	AS2129 TABLE C D E	165 (6.50)								
	AS2129 TABLE F	185 (7.28)								
	AS4087 PN14, 16	165 (6.50)								
	AS4087 PN21	185 (7.28)								
DN80 (3 in.)	EN1092-1 PN10, 16, 25, 40	200 (7.87)	200 (7.87)	280 (11.02)	51.5 (2.03)	205 (8.07)	156 (6.14)	103 (4.06)	20 (44)	18 (40)
	ASME B16.5 CLASS 150	190 (7.48)								
	JIS 10K	185 (7.28)								
	AS2129 TABLE C D E	185 (7.28)								
	AS4087 PN14, 16	185 (7.28)								
	AS2129 TABLE F	205 (8.07)								
	AS4087 PN21	205 (8.07)								
DN100 (4 in.)	EN1092-1 PN10, 16	220 (8.66)	250 (9.84)	320 (12.60)	63.75 (2.51)	245 (9.65)	196.8 (7.75)	128 (5.04)	27 (59)	25 (55)
	EN1092-1 PN25, 40	235 (9.25)								
	ASME B16.5 CLASS 150	228.6 (9.00)								
	JIS 7.5K	238 (9.37)								
	JIS 10K	210 (8.27)								
	AS2129 TABLE C D	215 (8.46)								
	AS4087 PN14, 16	215 (8.46)								
	AS4087 PN21	230 (9.06)								
DN125 (5 in.)	EN1092-1 PN10, 16	250 (9.84)	250 (9.84)	320 (12.60)	63.75 (2.51)	245 (9.65)	197 (7.76)	128 (5.04)	27 (59)	25 (55)
	EN1092-1 PN25, 40	270 (10.63)								
	ASME B16.5 CLASS 150	254 (10.00)								
	JIS 10K	250 (9.84)								
	AS2129 TABLE C D	255 (10.04)								
DN150 (6 in.)	EN1092 PN10, 16	285 (11.22)	300 (11.81)	340 (13.39)	84.4 (3.32)	265 (10.43)	217 (8.54)	170 (6.69)	33 (72)	31 (68)
	EN1092 PN25, 40	300 (11.81)								
	ASME B16.5 CLASS 150	279 (10.98)								
	JIS 7.5k	290 (11.42)								
	JIS 10K	280 (11.02)								
	AS2129 TABLE C D	280 (11.02)								
	AS4087 PN14, 16	280 (11.02)								
	AS4087 PN21	305 (12.01)								
DN200 (8 in.)	EN1092-1 PN10, 16	340 (13.39)	350 (13.78)	365 (14.37)	109.8 (4.32)	290 (11.42)	243 (9.57)	221 (8.70)	50 (110)	48 (106)
	EN1092-1 PN25, 40	360 (14.17)								
	ASME B16.5 CLASS 150	345 (13.58)								
	JIS 7.5K	342 (13.46)								
	JIS 10K	330 (12.99)								
	AS2129 TABLE C D	335 (13.19)								
	AS4087 PN14, 16	335 (13.19)								
	AS4087 PN21	370 (14.57)								

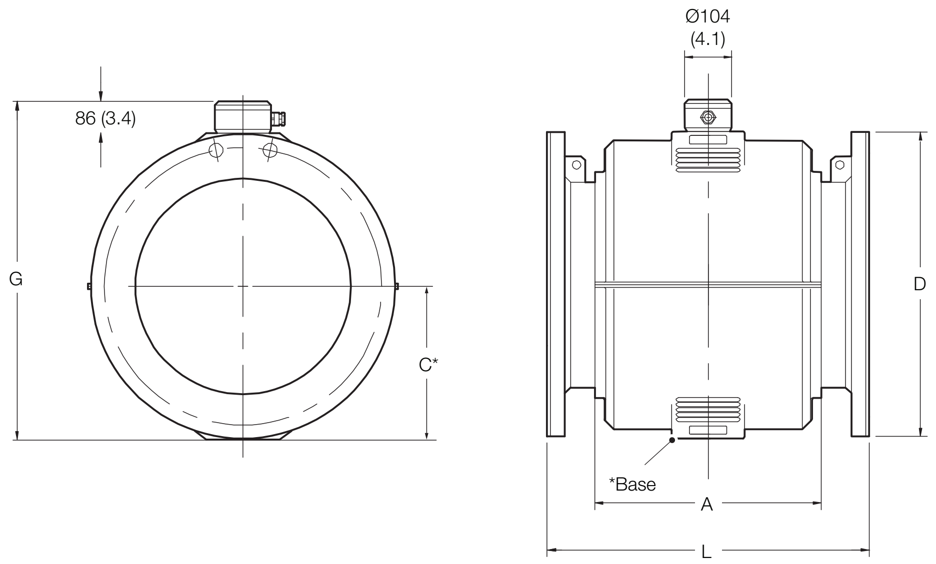
Table 5.5 DN40 to 300 (1½ to 12 in. NB) (FER) dimensions / weights (Continued)

		Dimensions in mm (in.)							Approx. weight in kg (lb)	
DN	Mating flange type	D	L	F	C	E	G	X	Integral	Remote
DN250 (10 in.)	EN1092-1 PN10	395 (15.55)	450 (17.72)	389 (15.31)	136.8 (5.39)	313 (12.33)	268 (10.55)	276 (10.87)	77 (169)	75 (165)
	EN1092-1 PN16	405 (15.94)								
	EN1092-1 PN25	425 (16.73)								
	ASME B16.5 CLASS 150	405 (15.94)								
	JIS 7.5K	400 (15.75)								
	JIS 10K	400 (15.75)								
	AS2129 TABLE C D	405 (15.94)								
	AS4087 PN14, 16	405 (15.94)								
	AS4087 PN21	430 (16.93)								
DN300 (12 in.)	EN1092-1 PN10	445 (17.52)	500 (19.69)	414 (16.30)	162.2 (6.39)	338.6 (13.33)	294 (1157)	337 (12.87)	114 (251)	112 (247)
	EN1092-1 PN16	460 (18.11)								
	EN1092-1 PN25	485 (19.09)								
	ASME B16.5 CLASS 150	485 (19.09)								
	JIS 10K	445 (17.52)								
	AS2129 TABLE C D	455 (17.91)								
	AS4087 PN14, 16	455 (17.91)								
	AS4087 PN21	490 (19.29)								

Table 5.5 DN40 to 300 (1½ to 12 in. NB) (FER) dimensions / weights (Continued)

5.6 FEF – DN80 to 600 (3 to 24 in. NB)

Dimensions in mm (in.)



*Dimension C = centre line to base of flowmeter body

Fig. 5.6 DN80 to 600 (3 to 24 in. NB) (FEF)

		Dimensions in mm (in.)					
DN	Mating flange type	D	L	C	G	A	Approx. weight in kg (lb)
DN80 (3 in.)	EN1092-1 PN16	200 (7.90)	200 (7.90)	86 (3.40)	258 (10.20)	113 (4.50)	18 (40)
DN100 (4 in.)	EN1092-1 PN16	220 (8.70)	250 (9.80)	106 (4.20)	298 (11.70)	140 (5.50)	24 (54)
DN150 (6 in.)	EN1092-1 PN16	285 (11.20)	300 (11.80)	138 (5.40)	362 (14.30)	178 (7.00)	38 (84)
DN200 (8 in.)	EN1092-1 PN16	340 (13.40)	350 (13.80)	161 (6.30)	408 (16.10)	203 (8.00)	55 (121)
DN250 (10 in.)	ASME B16.5 CLASS 150	405 (15.94)	450 (17.72)	215 (8.46)	301 (11.85)	300 (11.81)	88 (194)
	ASME B16.5 CLASS 300	445 (17.52)	490 (19.29)				
	EN1092 -1 PN10	395 (15.55)	450 (17.72)				
	EN1092 – 1 PN16	405 (15.94)					
	EN1092 – 1 PN25	425 (16.73)	490 (19.29)				
	EN1092 – 1 PN40	450 (17.72)					
	JIS 5K	385 (15.16)	450 (17.72)				
	JIS 10K	400 (15.75)					
	AS4087 PN14, PN16	405 (15.94)					
	AS2129 TABLE C D						
	AS2129 TABLE E						
	AS4087 PN21	430 (16.93)					
	AS2129 TABLE F						

Table 5.6 DN80 to 600 (3 to 24 in. NB) (FEF) dimensions / weights

		Dimensions in mm (in.)					
DN	Mating flange type	D	L	C	G	A	Approx. weight in kg (lb)
DN300 (12 in.)	ASME B16.5 CLASS 150	485 (19.09)	500 (19.69)	231 (9.09)	317 (12.48)	352 (13.86)	128 (282)
	ASME B16.5 CLASS 300	520 (20.47)	540 (21.26)				
	EN1092 – 1 PN10	445 (17.52)	500 (19.69)				
	EN1092 – 1 PN16	460 (18.11)	500 (19.69)				
	EN1092 – 1 PN25	485 (19.09)	540 (21.26)				
	EN1092 – 1 PN40	515 (20.28)	540 (21.26)				
	JIS 5K	430 (16.93)	500 (19.69)				
	JIS 10K	445 (17.52)	500 (19.69)				
	AS4087 PN14, PN16	455 (17.91)	500 (19.69)				
	AS2129 TABLE TABLE C D	455 (17.91)	500 (19.69)				
	AS2129 TABLE E	455 (17.91)	500 (19.69)				
	AS4087 PN21	490 (19.29)	500 (19.69)				
	AS2129 TABLE F	490 (19.29)	500 (19.69)				
DN350 (14 in.)	ASME B16.5 CLASS 150	535 (21.06)	550 (21.65)	257.5 (10.14)	346 (13.62)	376 (14.80)	100 (220)
	ASME B16.5 CLASS 300	585 (23.03)	570 (22.44)				
	EN1092 – 1 PN10	505 (19.88)	550 (21.65)				
	EN1092 – 1 PN16	520 (20.47)	550 (21.65)				
	EN1092 – 1 PN25	555 (21.85)	570 (22.44)				
	EN1092 – 1 PN40	580 (22.83)	570 (22.44)				
	JIS 5K	480 (18.90)	550 (21.65)				
	JIS 7.5K	530 (20.87)	550 (21.65)				
	JIS 10K	490 (19.29)	550 (21.65)				
	AS4087 PN14, PN16	525 (20.67)	550 (21.65)				
	AS2129 TABLE C D E	525 (20.67)	550 (21.65)				
	AS4087 PN21	550 (21.65)	550 (21.65)				
	AS2129 TABLE F	550 (21.65)	550 (21.65)				
	AS4087 PN35	550 (21.65)	570 (22.44)				
	AS2129 TABLE H	550 (21.65)	570 (22.44)				
DN375 (15 in.)	AS4087 PN14, PN16	550 (21.65)	550 (21.65)	257.5 (10.14)	346 (13.62)	376 (14.80)	115 (253)
	AS2129 TABLE C	550 (21.65)	550 (21.65)				
	AS4087 PN35	580 (22.83)	570 (22.44)				
DN400 (16 in.)	ASME B16.5 CLASS 150	600 (23.62)	600 (23.62)	285 (11.22)	371 (14.61)	420 (16.54)	115 (253)
	ASME B16.5 CLASS 300	650 (25.59)	620 (24.41)				
	EN1092 – 1 PN10	565 (22.24)	600 (23.62)				
	EN1092 – 1 PN16	580 (22.83)	600 (23.62)				
	EN1092 – 1 PN25	620 (24.41)	620 (24.41)				
	EN1092 – 1 PN40	660 (25.98)	620 (24.41)				
	JIS 5K	540 (21.26)	600 (23.62)				
	JIS 7.5K	582 (22.91)	600 (23.62)				
	JIS 10K	560 (22.05)	600 (23.62)				
	AS4087 PN14, PN16	580 (22.83)	600 (23.62)				
	AS2129 TABLE C D E	580 (22.83)	600 (23.62)				
	AS4087 PN21	610 (24.02)	600 (23.62)				
	AS2129 TABLE F	610 (24.02)	600 (23.62)				
	AS4087 PN35	610 (24.02)	620 (24.41)				
	AS2129 TABLE H	610 (24.02)	620 (24.41)				

Table 5.6 DN80 to 600 (3 to 24 in. NB) (FEF) dimensions / weights (Continued)

		Dimensions in mm (in.)					
DN	Mating flange type	D	L	C	G	A	Approx. weight in kg (lb)
DN450 (18 in.)	ASME B16.5 CLASS 150	635 (25.00)	700 (27.56)	317.5 (12.50)	402 (15.83)	480 (18.90)	160 (352)
	ASME B16.5 CLASS 300	710 (27.95)					
	EN1092 – 1 PN10	615 (24.21)					
	EN1092 – 1 PN16	640 (25.20)					
	EN1092 – 1 PN25	670 (26.38)					
	EN1092 – 1 PN40	685 (26.97)					
	JIS 5K	605 (23.82)					
	JIS 7.5K	652 (25.67)					
	JIS 10K	620 (24.41)					
	AS4087 PN14, PN16	640 (25.20)					
	AS2129 TABLE C D	640 (25.20)					
	AS2129 TABLE E	640 (25.20)					
	AS4087 PN21	675 (26.57)					
	AS2129 TABLE F	675 (26.57)					
	AS4087 PN35	675 (26.57)					
	AS2129 TABLE H	675 (26.57)					
DN500 (20 in.)	ASME B16.5 CLASS 150	700 (27.56)	770 (30.31)	345 (13.58)	429 (16.89)	520 (20.47)	217 (455)
	ASME B16.5 CLASS 300	775 (30.51)					
	EN1092 – 1 PN10	670 (26.38)					
	EN1092 – 1 PN16	715 (28.15)					
	EN1092 – 1 PN25	730 (28.74)					
	EN1092 – 1 PN40	755 (29.72)					
	JIS 5K	655 (25.79)					
	JIS 7.5K	706 (27.80)					
	JIS 10K	675 (26.57)					
	AS4087 PN 14, PN16	705 (27.76)					
	AS2129 TABLE C D E	705 (27.76)					
	AS4087 PN21	735 (28.94)					
	AS2129 TABLE F	735 (28.94)					
	AS4087 PN35	735 (28.94)					
	AS2129 TABLE H	735 (28.94)					
DN600 (24 in.)	ASME B16.5 CLASS 150	815 (32.09)	920 (36.22)	387.5 (15.25)	472 (18.58)	610 (24.02)	315 (693)
	ASME B16.5 CLASS 300	915 (36.02)					
	EN1092 – 1 PN10	780 (30.71)					
	EN1092 – 1 PN16	840 (33.07)					
	EN1092 – 1 PN25	845 (33.27)					
	EN1092 – 1 PN40	890 (35.04)					
	JIS 5K	770 (30.31)					
	JIS 7.5K	810 (31.89)					
	JIS 10K	795 (31.30)					
	AS4087 PN14, PN16	825 (32.48)					
	AS2129 TABLE C D	825 (32.48)					
	AS2129 TABLE E	825 (32.48)					
	AS4087 PN21	850 (33.46)					
	AS2129 TABLE F	850 (33.46)					
	AS4087 PN35	850 (33.46)					
	AS2129 TABLE H	850 (33.46)					

Table 5.6 DN80 to 600 (3 to 24 in. NB) (FEF) dimensions / weights (Continued)

6 Common accessories

Accessory	Item Number
WaterMaster AC Fuse F1 Type T 250 mA A/S TR5	B20411
WaterMaster DC Fuse F2 Type T 2 A A/S TR5	B20412
WaterMaster Infra Red Comms Pack	MJBX9932
WaterMaster Backplane PCB Board (STD)	WATX2505
WaterMaster Sensor PCB Board	WATX2506
WaterMaster Comms Cable	WEBC2500
Signal cable for remote WaterMaster transmitter	
5 m (15 ft.)	STT4500/05
10 m (30 ft.)	STT4500/10
20 m (60 ft.)	STT4500/20
30 m (100 ft.)	STT4500/30
50 m (165 ft.)	STT4500/50
80 m (260 ft.)	STT4500/80
100 m (325 ft.)	STT4500/100
150 m (490 ft.)	STT4500/150
500 m (1650 ft.)	STT4500/500
Armored signal cable for remote WaterMaster transmitter	
5 m (15 ft.)	STT4501/05
10 m (30 ft.)	STT4501/10
20 m (60 ft.)	STT4501/20
30 m (100 ft.)	STT4501/30
50 m (165 ft.)	STT4501/50
80 m (260 ft.)	STT4501/80
100 m (325 ft.)	STT4501/100
150 m (490 ft.)	STT4501/150
500 m (1650 ft.)	STT4501/500

Products and customer support

Automation Systems
For the following industries:
— Chemical & Pharmaceutical
— Food & Beverage
— Manufacturing
— Metals and Minerals
— Oil, Gas & Petrochemical
— Pulp and Paper

Drives and Motors
— AC and 6 Drives, AC and DC Machines, AC Motors to 1kV
— Drive Systems
— Force Measurement
— Servo Drives

Controllers & Recorders
— Single and Multi-loop Controllers
— Circular Chart and Strip Chart Recorders
— Paperless Recorders
— Process Indicators

Flexible Automation
— Industrial Robots and Robot Systems

Flow Measurement
— Electromagnetic Flowmeters
— Mass Flowmeters
— Turbine Flowmeters
— Wedge Flow Elements

Marine Systems & Turbochargers
— Electrical Systems
— Marine Equipment
— Offshore Retrofit and Refurbishment

Process Analytics
— Process Gas Analysis
— Systems Integration

Transmitters
— Pressure
— Temperature
— Level
— Interface Modules

Valves, Actuators and Positioners
— Control Valves
— Actuators
— Positioners

Water, Gas & Industrial Analytics Instrumentation
— pH, Conductivity and Dissolved Oxygen Transmitters and Sensors
— Ammonia, Nitrate, Phosphate, Silica, Sodium, Chloride, Fluoride, Dissolved Oxygen and Hydrazine Analyzers
— Zirconia Oxygen Analyzers, Katharometers, Hydrogen Purity and Purge-gas Monitors, Thermal Conductivity

Customer support
We provide a comprehensive after sales service via a Worldwide Service Organization. Contact one of the following offices for details on your nearest Service and Repair Centre.

UK
ABB Limited
Tel: +44 (0)1453 826661
Fax: +44 (0)1453 829671

USA
ABB Inc.
Tel: +1 215 674 6000
Fax: +1 215 674 7183

Client Warranty
Prior to installation, the equipment referred to in this manual must be stored in a clean, dry environment, in accordance with the Company's published specification.
Periodic checks must be made on the equipment's condition. In the event of a failure under warranty, the following documentation must be provided as substantiation:
— A listing evidencing process operation and alarm logs at time of failure.
— Copies of all storage, installation, operating and maintenance records relating to the alleged faulty unit.

Contact us

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OI/FEF/FEV/FEW-EN Rev. B 12.2012

Section 5: ABB Flowmeter Transmitter Guide

User Guide OI/FET100–EN Rev. D

WaterMaster FET100
Electromagnetic flowmeter Transmitter

The perfect fit for all water industry applications

Introduction

WaterMaster™ is a range of high performance electromagnetic flowmeters for the measurement of electrically-conductive fluids and systems are normally supplied factory-configured and calibrated.

This User Guide provides installation, connection, security, start-up and basic setup details. For programming and configuration information refer to the Programming Guide – IM/WMP.

For a comprehensive overview of publications available for the WaterMaster transmitter, refer to the inside cover of this publication. Web links, QR code and reference numbers are also included.

The Company

We are an established world force in the design and manufacture of instrumentation for industrial process control, flow measurement, gas and liquid analysis and environmental applications.

As a part of ABB, a world leader in process automation technology, we offer customers application expertise, service and support worldwide.

We are committed to teamwork, high quality manufacturing, advanced technology and unrivalled service and support.

The quality, accuracy and performance of the Company's products result from over 100 years experience, combined with a continuous program of innovative design and development to incorporate the latest technology.

Quality Control

The UKAS Calibration Laboratory No. 0255 is just one of the ten flow calibration plants operated by the Company and is indicative of our dedication to quality and accuracy.

UKAS CALIBRATION
0255

UKAS Calibration Laboratory No. 0255

For more information…

Further publications for the WaterMaster transmitter are available for free download from www.abb.com/flow (see links and reference numbers below) or by scanning this code:

	search for or click on:
Programming Guide	IM/WMP
User Guide Supplement, PROFIBUS RS485 Physical Layer (FEX100–DP)	IM/WMPBS–EN
User Guide Supplement, PROFIBUS FEX100-DP Parameter Tables	IM/WMPBST–EN
User Guide Supplement, MODBUS RS485 Physical Layer (FEX100–MB)	COI/FEX100/MOD–EN
User Guide Supplement, MODBUS Tables	COI/FEX100/MOD/TBL–EN

1 Safety

Information in this manual is intended only to assist our customers in the efficient operation of our equipment. Use of this manual for any other purpose is specifically prohibited and its contents are not to be reproduced in full or part without prior approval of the Technical Publications Department.

1.1 Electrical Safety

This equipment follows, obeys the requirements of CEI/IEC 61010-1:2001-2 'Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use' and follows, obeys NIST and OSHA.

If the equipment is used in a manner NOT specified by the Company, the protection provided by the equipment may be impaired.

1.2 Symbols

One or more of the following symbols may appear on the equipment labeling:

	Warning – Refer to the manual for instructions
	Caution – Risk of electric shock
	Protective earth (ground) terminal
	Earth (ground) terminal

	Direct current supply only
	Alternating current supply only
	Both direct and alternating current supply
	The equipment is protected through double insulation

1.3 Health & Safety

Health and Safety

To ensure that our products are safe and without risk to health, the following points must be noted:

- The safety requirements of this equipment, any associated equipment and the local environment must be taken into consideration during installation.
- Install and use this equipment and any associated equipment in accordance with the relevant national and local standards.
- The relevant sections of these instructions must be read carefully before proceeding.
- Warning labels on containers and packages must be observed.
- Installation, operation, maintenance and servicing must only be carried out by suitably trained personnel and in accordance with the information given.
- Normal safety precautions must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and / or temperature.
- Chemicals must be stored away from heat, protected from temperature extremes and powders kept dry. Normal safe handling procedures must be used.
- When disposing of chemicals ensure that no two chemicals are mixed.
- Product liability – advice and assistance provided without charge is given in good faith but without liability.

Safety advice concerning the use of the equipment described in this manual or any relevant hazard data sheets (where applicable) may be obtained from the Company address on the back cover, together with servicing and spares information.

Warning.

- System configuration must be carried out only by users or personnel with approved access rights (user privileges).
- Read all relevant sections of this guide before configuring the system or modifying system parameters.
- Install and use associated equipment in accordance with the relevant national and local standards.

2 Mechanical Installation

2.1 Installation Conditions

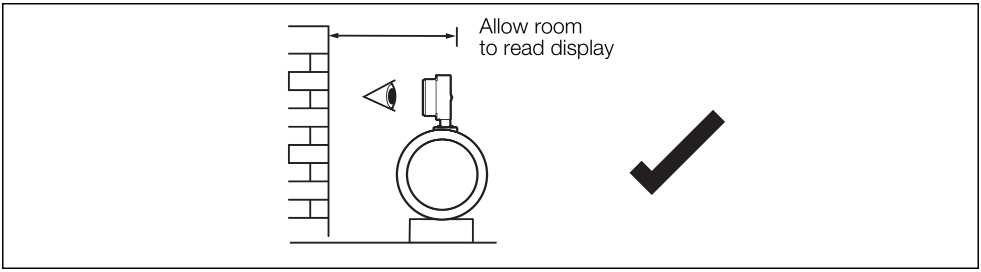


Fig. 2.1 Siting

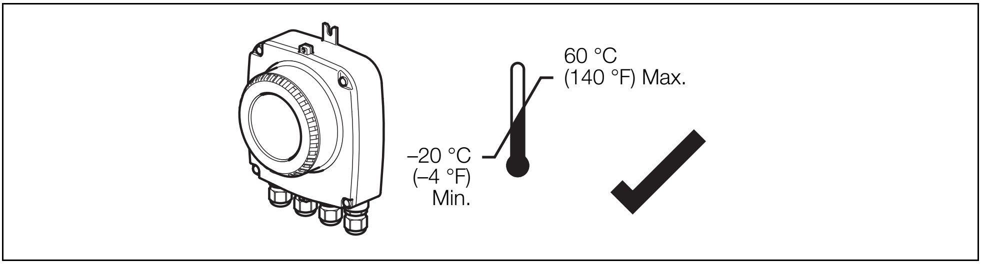


Fig. 2.2 Within Temperature Limits

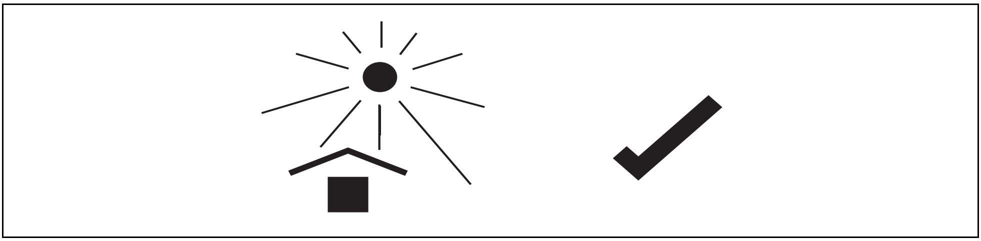


Fig. 2.3 Shade

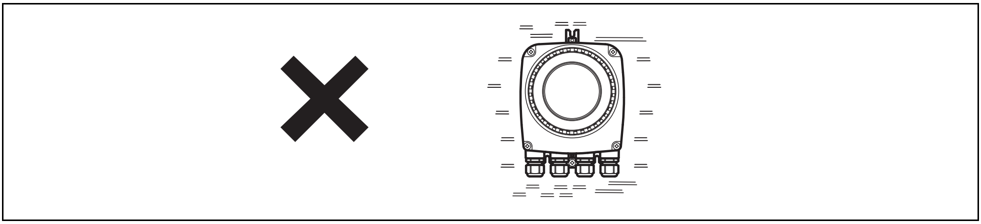


Fig. 2.4 Vibration

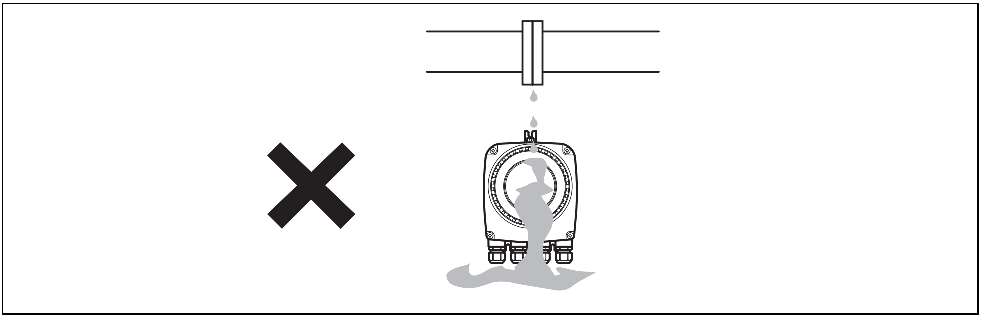


Fig. 2.5 Spillage

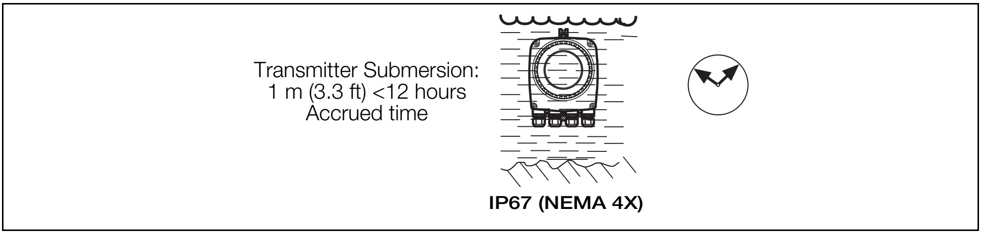


Fig. 2.6 Within Environmental Rating

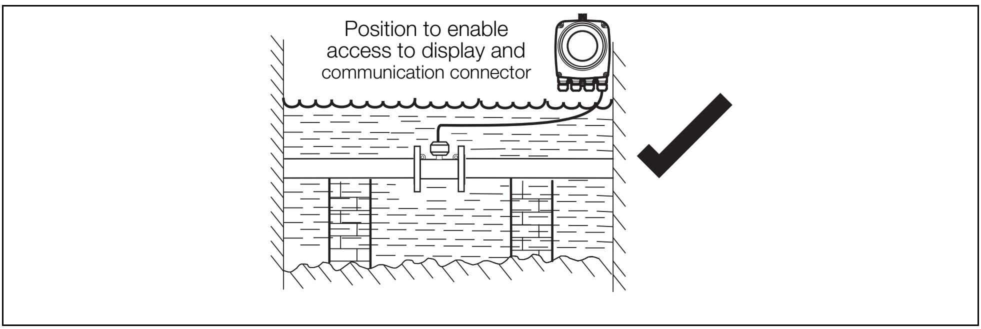


Fig. 2.7 Access to Transmitter

2.2 Dimensions

Dimensions in mm (in).

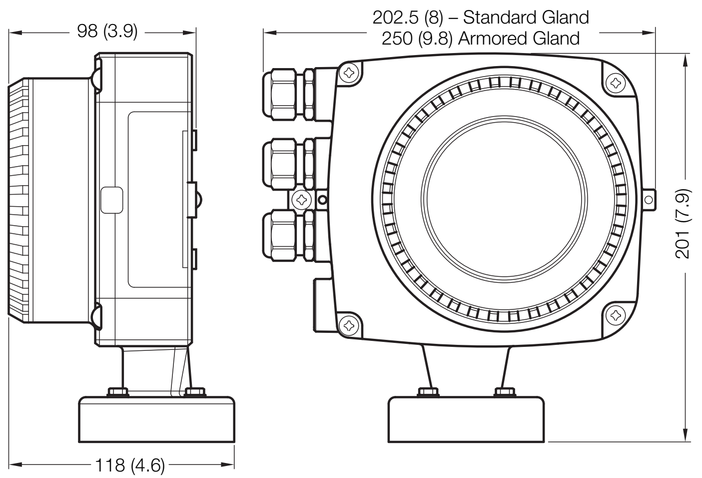


Fig. 2.8 Integral Transmitter Dimensions (Standard Gland Shown)

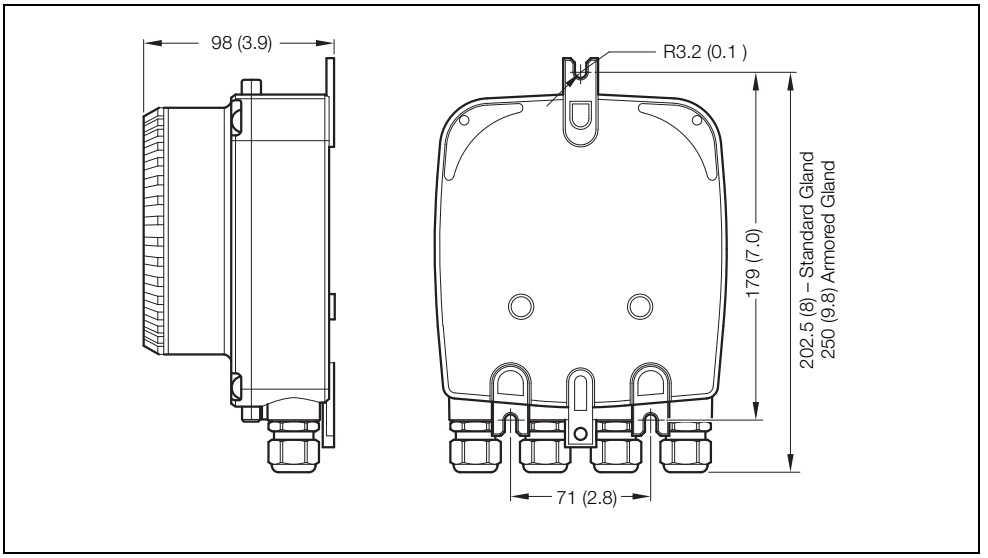


Fig. 2.9 Remote Transmitter Dimensions (Standard Gland Shown)

Note. Fix remote transmitter to a secure surface using 3 x M5 screws (not supplied).

3 Electrical Installation

3.1 Remote Transmitter / Sensor Arrangement

Note. For bonding connections use ≥ 4mm^2 (< 10AWG) cable.

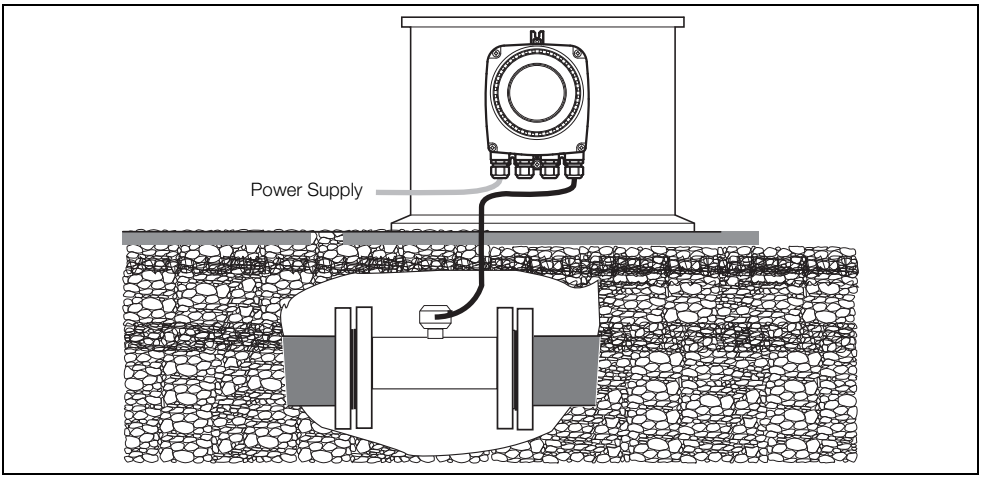


Fig. 3.1 Remote Transmitter in Roadside Cabinet – Flanged Sensor

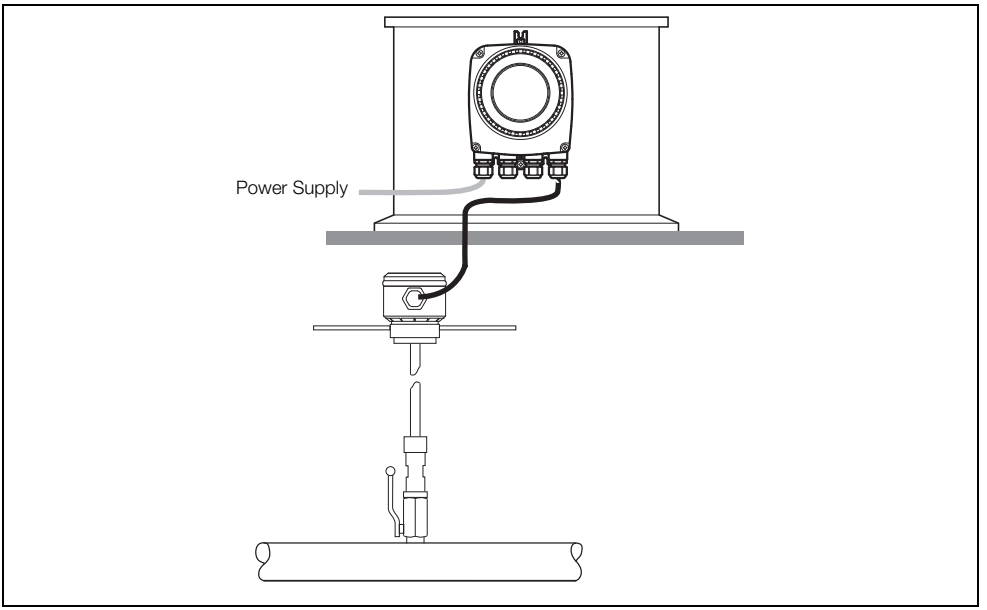


Fig. 3.2 Remote Transmitter in Roadside Cabinet – Probe Sensor

3.2 Transmitter Terminal Connections

Warning. Isolate the transmitter from power supplies before removing the cover.

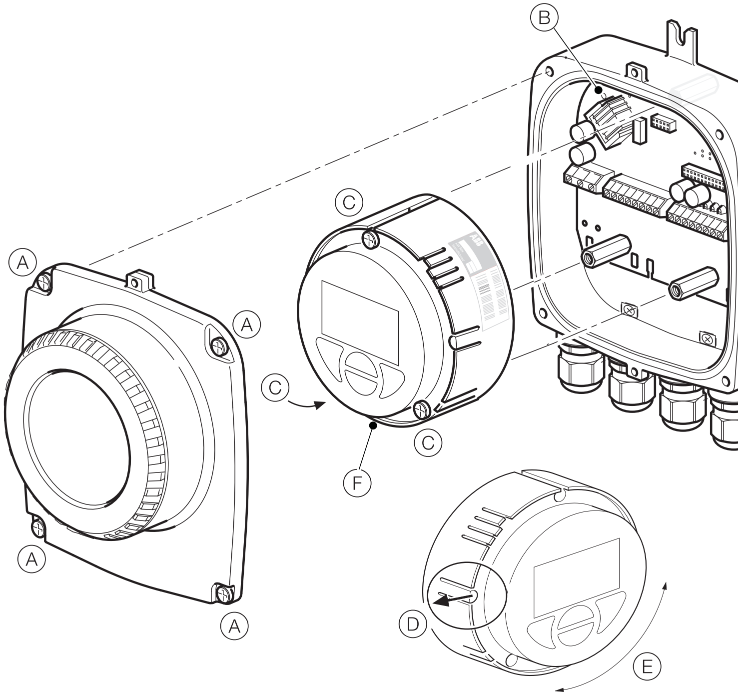


Fig. 3.3 Accessing the Transmitter Terminals

Referring to Fig. 3.3:

1. Slacken (but do not remove) the four transmitter cover screws Ⓐ.
2. Remove the transmitter cover.
3. Check that the power indicator LED Ⓑ on the backplane is **not** lit.

Warning. If the power indicator LED Ⓑ is lit, the transmitter is still powered up. Before continuing, isolate the transmitter power supply.

4. If screws Ⓒ are not visible, access them by gently pulling the rotation lock Ⓓ back and rotating the cartridge Ⓔ until the cartridge screw access holes align with the cartridge screw heads.
5. Slacken the three cartridge screws and lift the cartridge Ⓕ away from the housing.

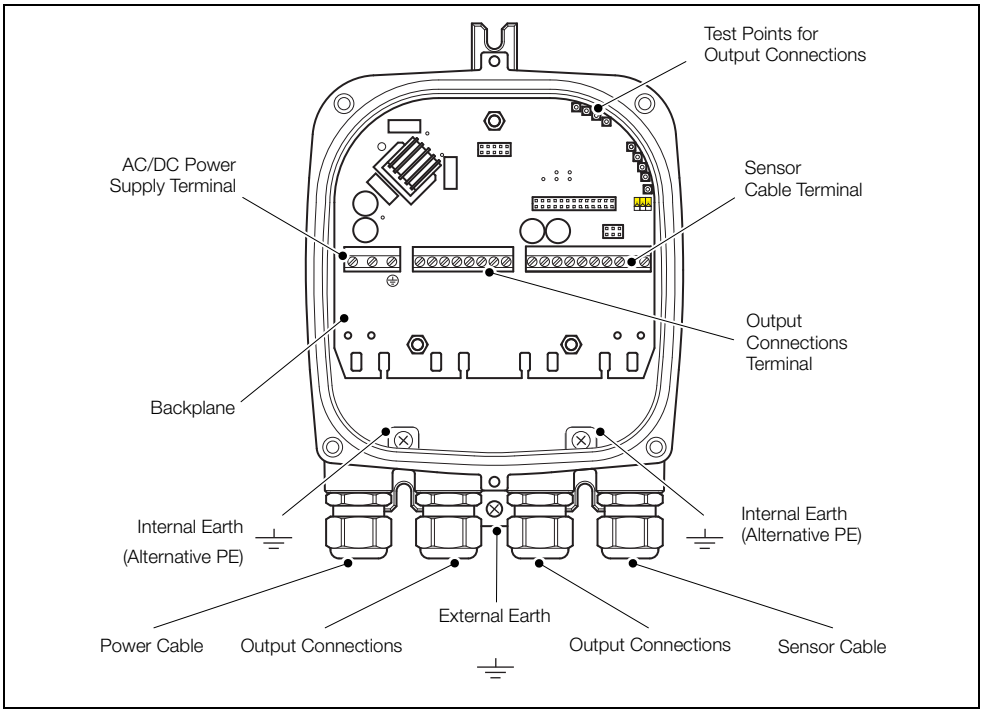


Fig. 3.4 Cable Gland / Conduit Entry (Remote Transmitter Shown)

3.3 Cable Preparation (Remote Systems Only)

To prepare the cable for connection at the transmitter and sensor terminal blocks:

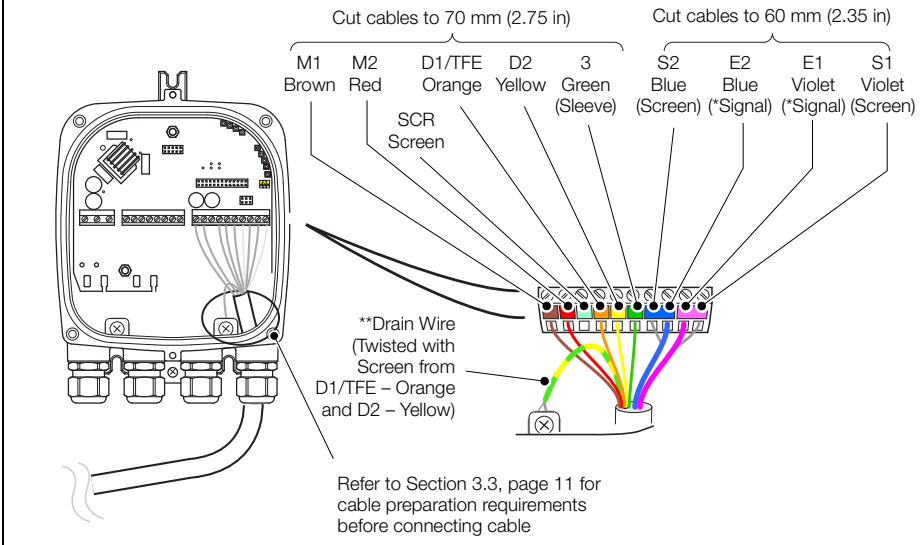
1. Remove the outer cable insulation and Mylar® wrap.
2. Ensure the drain wire is sleeved.
3. Cut the cable connection wires to the lengths shown in Fig 3.5, page 12.

3.4 Transmitter / Sensor Cable Connections

Caution.

- Make connections only as shown.
- Twist the screen wire of D1 / TFE + D2 with the outer screen drain wire and sleeve them.
- For standard (non-cathodically protected) systems, connect the drain wire to the earth screw.
- For cathodically protected systems, connect the drain wire to terminal SCR, ensuring no braid or wires touch the exposed copper areas within the transmitter sensor cable wiring area.
- If an earth screw is not available at the transmitter enclosure, connect the drain wire to terminal SCR.
- Ensure the seal and mating surfaces are clean to maintain environmental rating.
- Conduit connections must provide cable entry sealing.
- Ensure cable glands are tightened after wiring. Do not overtighten the plastic cable glands to avoid destroying their sealing properties. Initially, tighten finger-tight, then a further $^{1}/_{2}$ to $^{3}/_{4}$ turn using a suitable spanner or wrench.
- Fit blanking plugs where required.

3.4.1 Sensor Cable Terminal Connections and Recommended Cable Lengths



*Inner wire
**For cathodically protected systems (or if the transmitter enclosure does not have an earth screw) connect the drain wire to terminal SCR.

Fig. 3.5 Sensor Cable Connections at Transmitter Terminal Block – Standard System

3.5 Output Connections

Caution.

- Inductive loads must be suppressed or clamped to limit voltage swings.
- Operation of outputs is programmable.
- External isolators are not normally required as the pulse and alarm circuit is electrically separated from all other WaterMaster connections.

3.5.1 Frequency Outputs

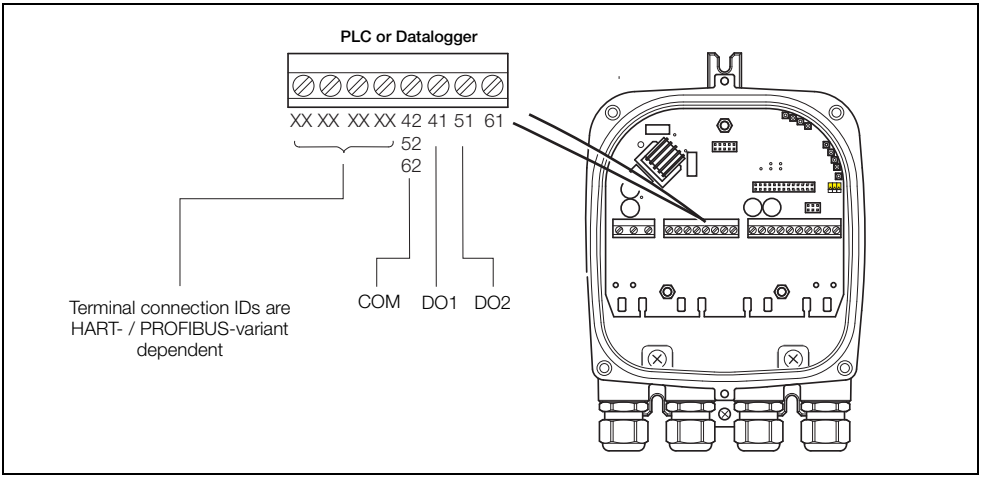


Fig. 3.6 PLC / Datalogger Connections

Note. Digital outputs DO1 and DO2 are polarity sensitive. The common (negative) connection for these outputs is designated 'COM'.

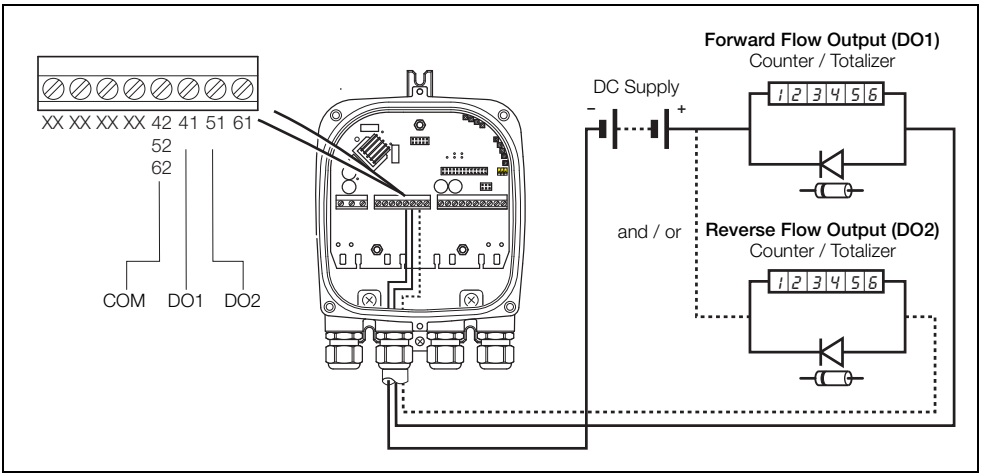


Fig. 3.7 Electromechanical Connections

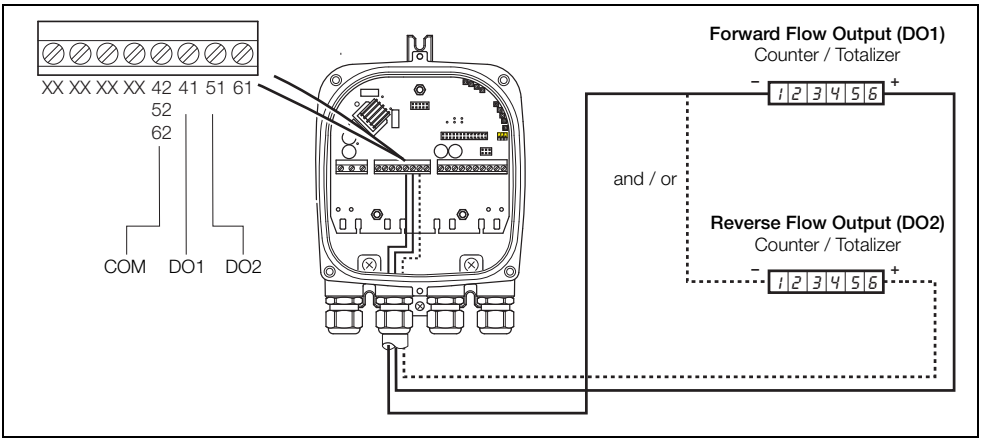


Fig. 3.8 Telemetry / Electronic Counters (etc.) Connections

3.5.2 Alarm Outputs

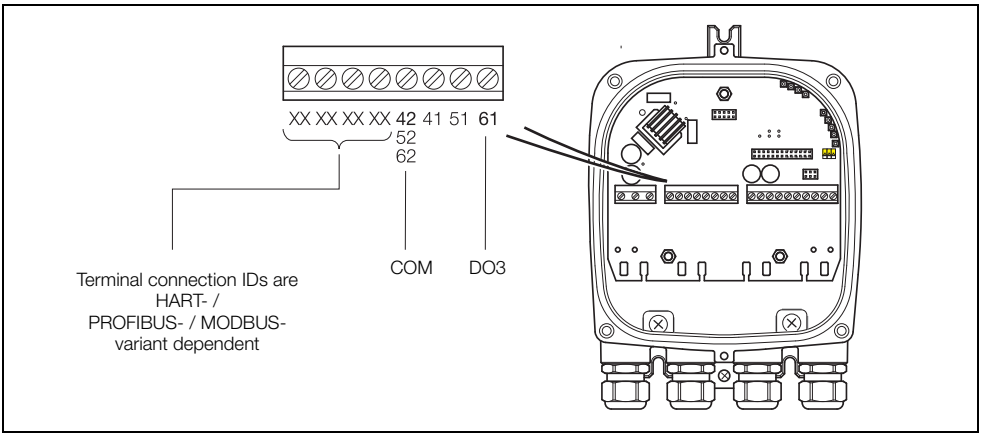


Fig. 3.9 Alarm Output Connections

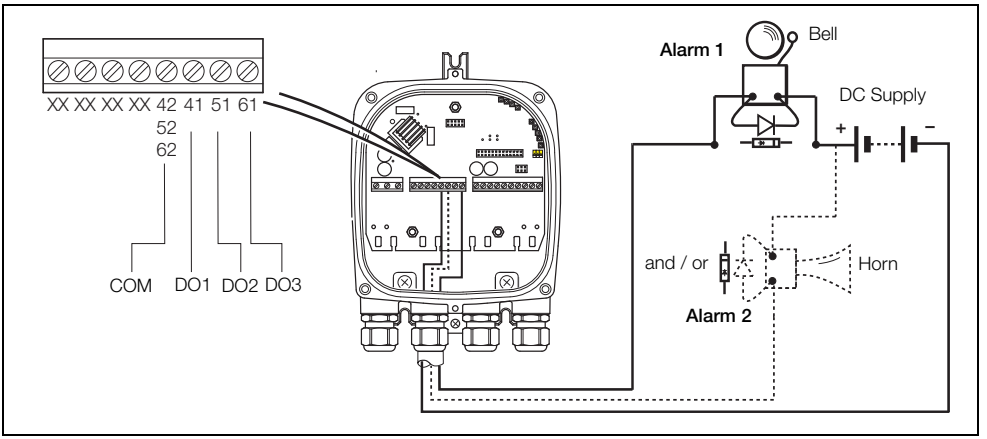


Fig. 3.10 Alarm Output Connections

Note.

- Normal alarm / logic output is from DO3 (terminal 61). DO1 (41) and DO2 (51) can also be configured as alarms if required but are then NOT available as frequency / pulse outputs as shown in Figs 3.7 and 3.8).
- Bell and horn shown for example only. Any suitable alarm device may be used (for example, lamp, siren, buzzer etc.).

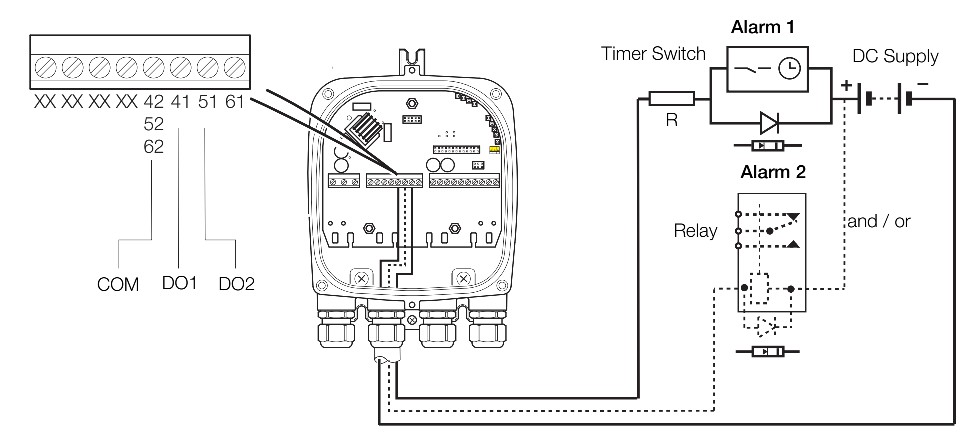


Fig. 3.11 Relay and Timers Output Connections

Note. Relay and timer switch shown for example only. Connect as required.

3.5.3 Contact Input

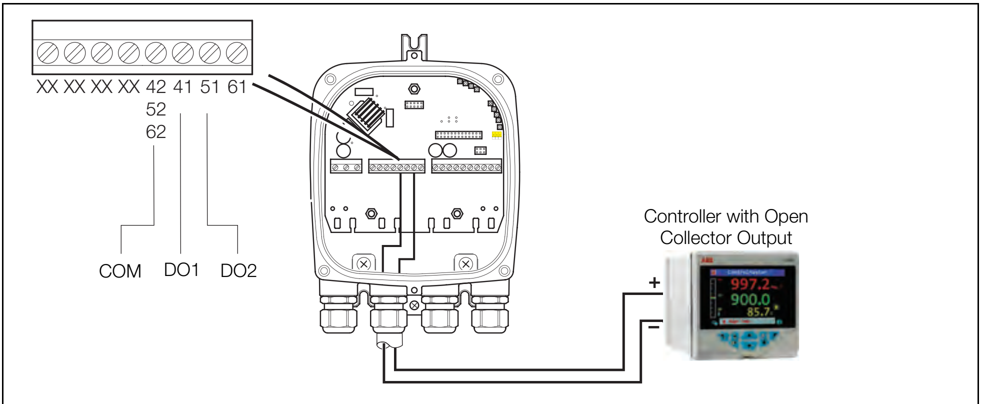


Fig. 3.12 Open Collector (or Grounded Contact) Connections

3.5.4 PLC Interface

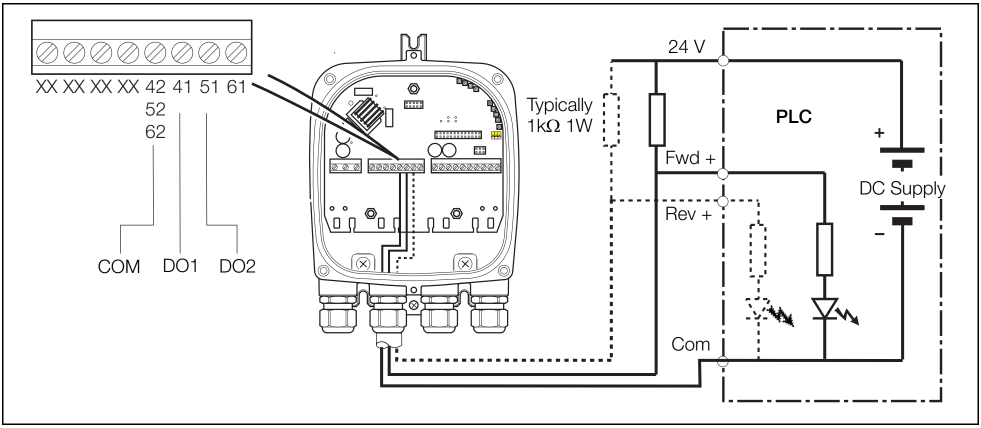


Fig. 3.13 PLC – Common –ve Connections

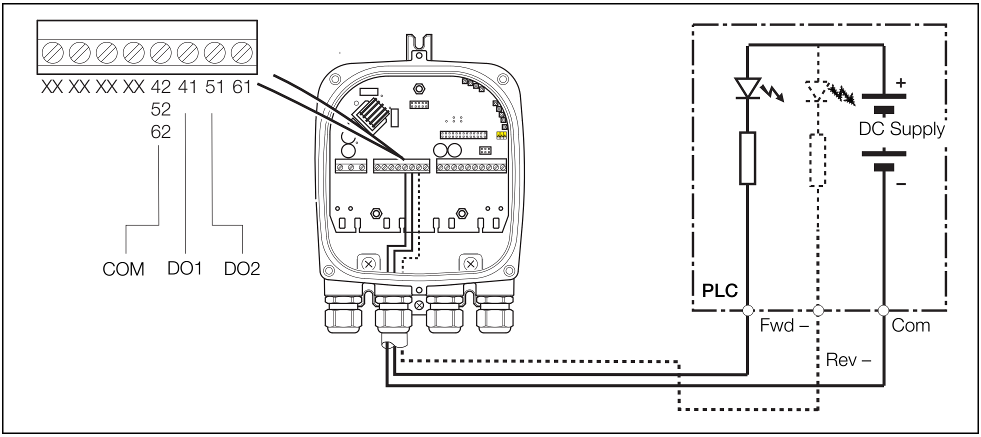


Fig. 3.14 PLC – Common +ve Connections

Note.

- WaterMaster digital outputs are NPN optocoupled transistors used as switches.
- Maximum allowed voltage at collector is 30 V DC
- Maximum allowed current across transistor is 220 mA.

3.5.5 Current Output (4 to 20 mA) – HART (FEX100) Variant

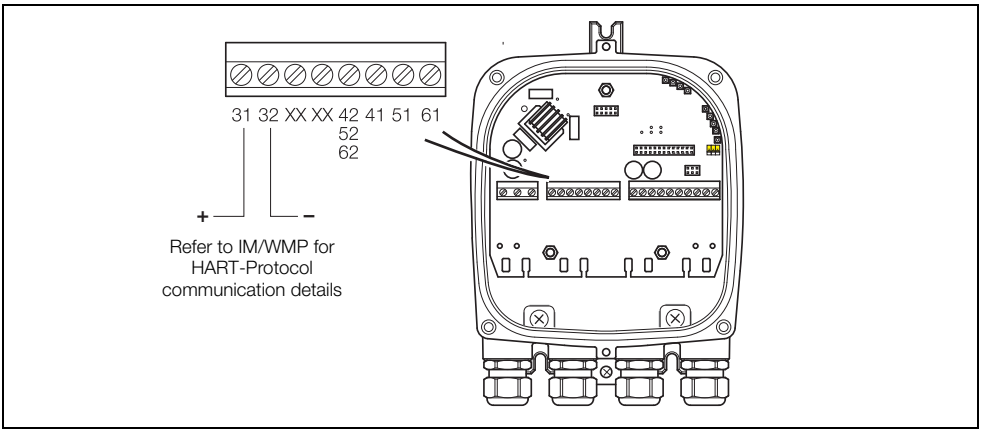


Fig. 3.15 Current Output (4 to 20 mA) – HART (FEX100) Variant

3.5.6 RS485 Communications – PROFIBUS (FEX100-DP) and MODBUS (FEX100-MB) Variants

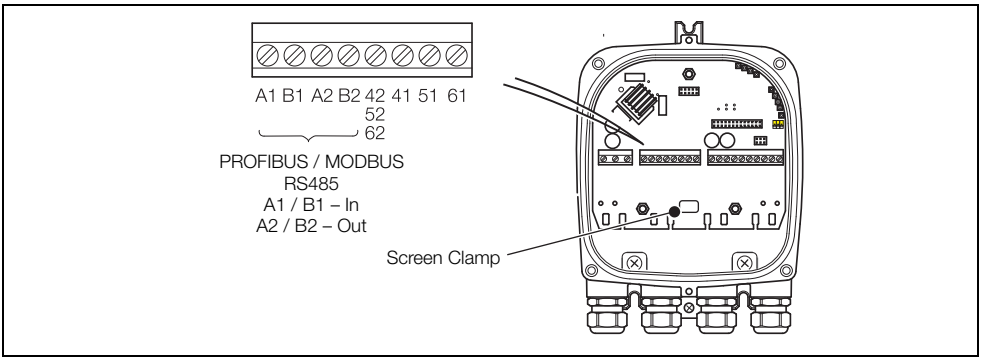
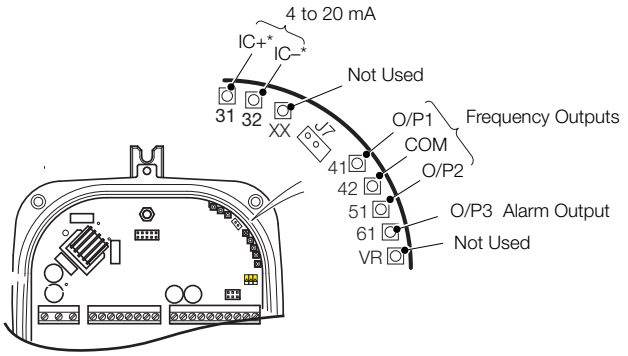


Fig. 3.16 WaterMaster RS485 Backplane Connections to PROFIBUS / MODBUS Networks

3.5.7 Test Point Access

Note. A typical DVM probe can access (fit) the PCB's test holes.



*These 2 test points are connected on the HART FEX100 backplane only
(they are present on the PROFIBUS FEX100-DP / MODBUS FEX100-MB backplane but are not connected)

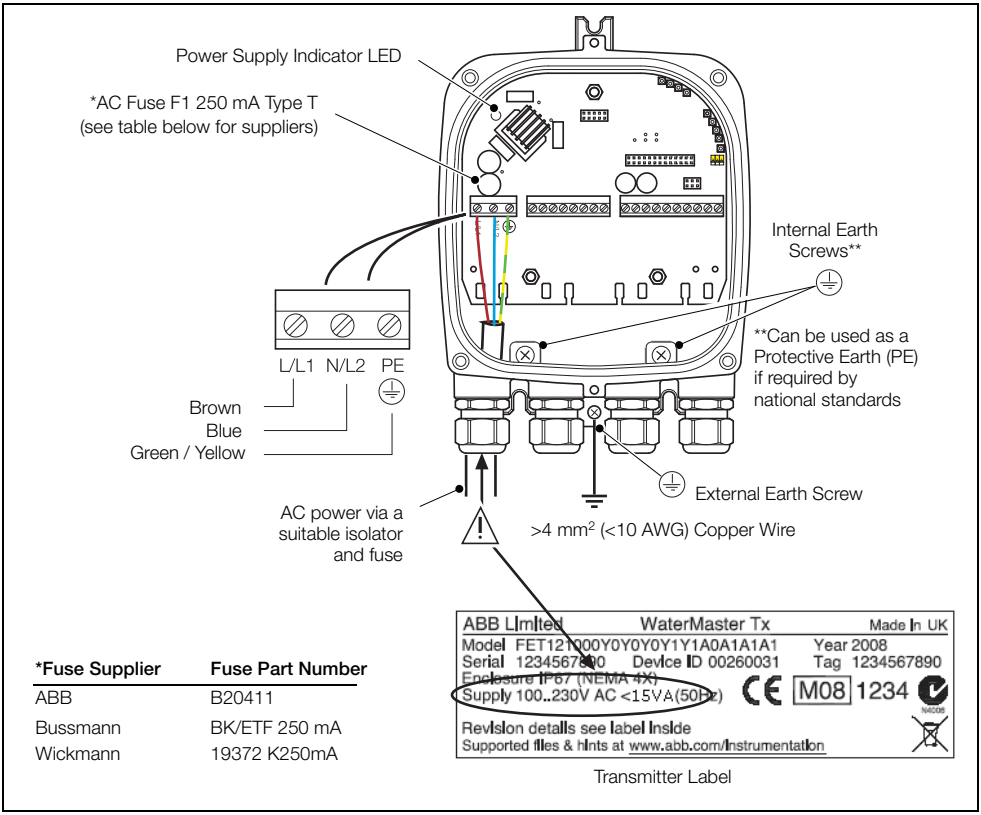
Fig. 3.17 Transmitter PCB Board Test Point Access

3.6 Power Supply Connections

Warning.

- Electrical installation and earthing (grounding) must be in accordance with relevant national and local standards.
- Power must be connected via a suitable isolator and fused in accordance with relevant standards.
- When changing fuses F1 or F2, isolate the power supply and wait 20 seconds before opening the enclosure.
- Replace fuses with the correct part – see Fig 3.18 (AC power) and 3.19, page 21 (DC power).

3.6.1 AC Power Supply

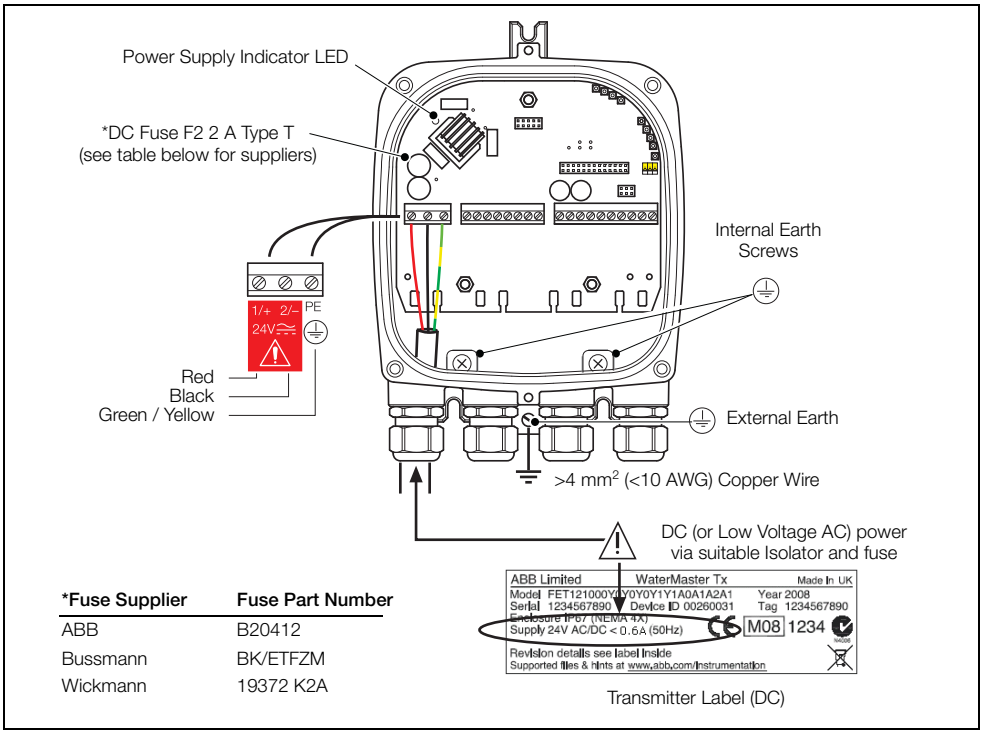


*Fuse Supplier	Fuse Part Number
ABB	B20411
Bussmann	BK/ETF 250 mA
Wickmann	19372 K250mA

Transmitter Label

Fig. 3.18 AC Power Supply Connections

3.6.2 DC (and Low Voltage AC) Power Supply



*Fuse Supplier	Fuse Part Number
ABB	B20412
Bussmann	BK/ETFZM
Wickmann	19372 K2A

Fig. 3.19 DC (and Low Voltage AC) Power Supply Connections

3.6.3 Configuration DIP Switches

Three configuration DIP switches are mounted on the transmitter backplane board.

These are factory-set as follows:

- Remote transmitter – all OFF
- Integral transmitter – SW3 ON

For MID-compliant flowmeters set the read-only / MID protection switch to 'ON' to ensure the meter is secure from tampering.

For HART software versions prior to 01.02.XX, this switch (set after commissioning) prevents login via the keypad or bus at any security level.

From HART software version 01.03.XX onwards and for all PROFIBUS software versions, on MID meters, all metrological-related parameters are locked and inaccessible at the Service level. Standard and Advanced user level parameters can still be modified via the HMI or bus.

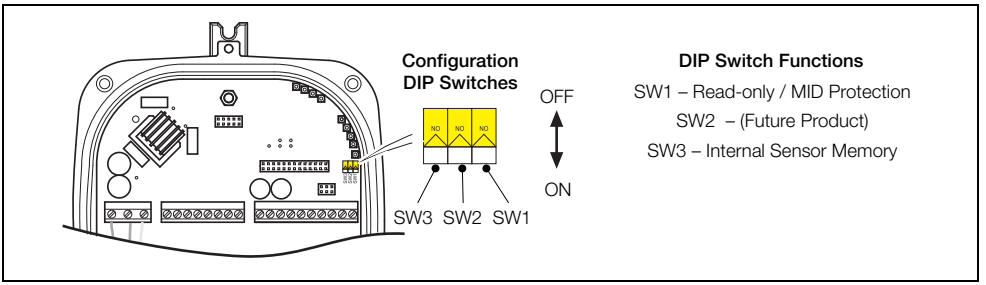


Fig. 3.20 Configuration DIP Switches

3.7 Refitting the Cartridge and Cover

Warning. Ensure the transmitter is isolated from power supplies before refitting the cover.

Caution.

- The communications bus type is HART FEX100 if not specified on the cartridge label. An example of the PROFIBUS FEX100-DP variant cartridge label is shown on the right.

PROFIBUS variant cartridge label

- The cartridge communications type must match the communications type of the transmitter backplane PCB.
- To avoid damaging the cartridge during refitting, do not overtighten the cartridge screws.

Referring to Fig. 3.21:

1. Confirm that the cartridge to be fitted is of the correct power supply and for the correct communications bus type (HART, PROFIBUS OR MODBUS) by checking the label (A) on the side of the cartridge:
   - AC cartridges have one **black** label on the cartridge side.
   - DC (and low voltage AC) cartridges have two **red** DC labels – one on the cartridge side and one on the cartridge rear plate.
2. Align the three cartridge screws (B) with the cartridge housing pillars and tighten the screws carefully until the cartridge is held in position.
3. If necessary, rotate the cartridge to the required orientation before refitting the cover – see Fig. 3.3, page 10 for details.
4. For high integrity / security installations, set DIP switch SW1 to the 'ON' (Read-only) position – see Fig. 3.20, page 22.
5. Align the transmitter cover with the housing and tighten the four cover screws (C) carefully.
6. For high integrity / security installations or where MID is required, fit anti-tamper seals to the security fixtures (D).

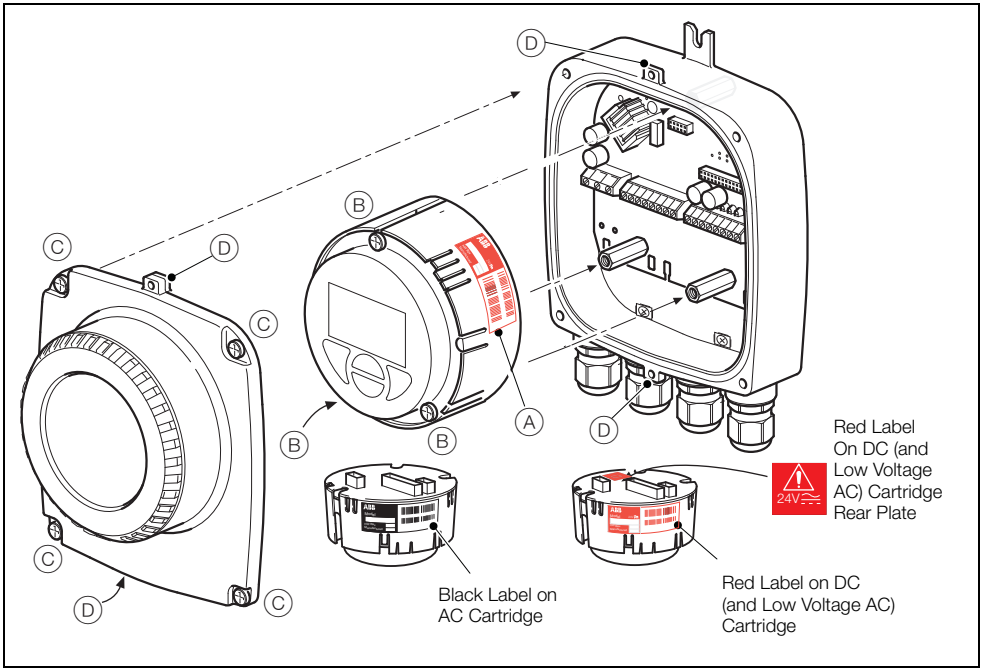


Fig. 3.21 Refitting the Cartridge and Cover

4 Start-up and Operation

Note. This section describes the options available at the 'Easy Setup' menu. Refer to the Programming Manual (IM/WMP) for comprehensive details of all end-user menus and operating levels.

4.1 Navigating the Menus and Parameters

The four keys below the display are used to navigate through the menus and to execute all system commands and selections.

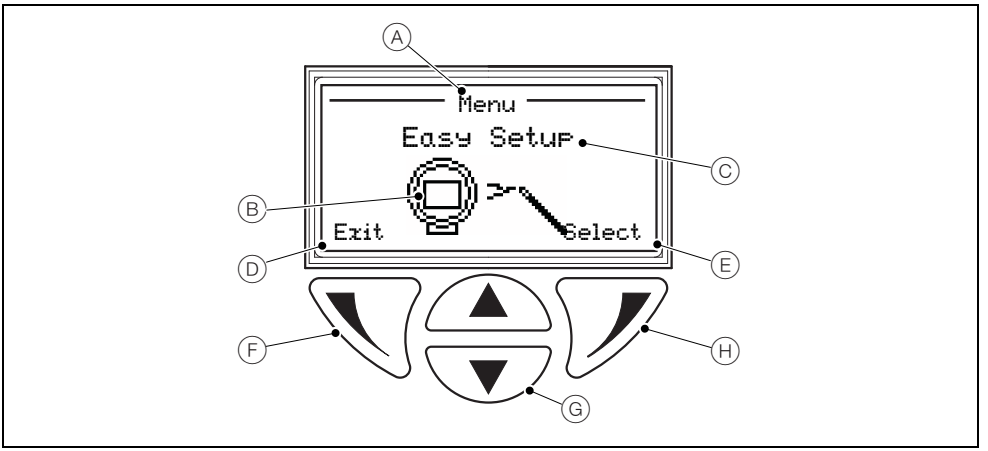


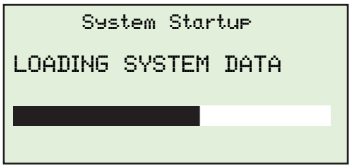
Fig. 4.1 Display and Keys

Item	Description
A	Screen title at the current level / parameter
B	Main level icon
C	Menu level title
D	Prompt executed by pressing the key
E	Prompt executed by pressing the key
F	Left key – used for parameter navigation and to enter editable parameters
G	Up / Down keys – used to scroll through menu options and to increase / decrease values in editable parameters
H	Right key – used to accept / select parameter values / selections and exit sub-levels

4.2 Start-up Screens

At start-up, the type of screen displayed indicates the status of the system.

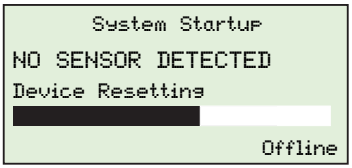
There are four common start-up screen types as follows:



System Start-up

At system start-up, a progress bar is displayed for the duration of the start-up period.

After this period, one of the four following screens is displayed according to the current status of the system.



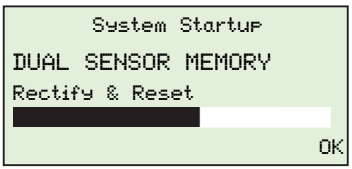
No Sensor Connected

If no sensor is detected during start-up, an auto-recovery routine is run to look for the sensor. If no sensor is detected, this routine continues until it is stopped manually.

If 'Offline' is selected during auto-recovery (by pressing the ▽ key) the transmitter ceases to operate as a flowmeter and the following conditions apply at the transmitter:

- Plant and transmitter data can be configured.
- Sensor data cannot be configured.

Note. If this screen is displayed on an integral transmitter, check that DIP switch SW3 is in the 'ON' position (refer to Fig. 3.20, page 22).

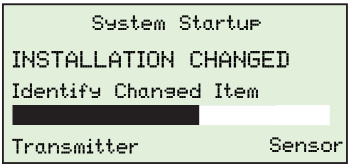


Dual Sensor Memory

Integral and retrofit systems have the sensor memory mounted on the transmitter backplane board.

If two sensor memory types (integral and remote) are detected at start-up, the warning 'DUAL SENSOR MEMORY' is displayed.

To correct this condition, set DIP switch SW3 to the 'OFF' position (refer to Fig. 3.20, page 22).



Installation Changed

If the sensor data stored in the transmitter memory does not match the data of the connected sensor, the warning 'INSTALLATION CHANGED' is displayed.

The changed item(s) (transmitter or sensor) can be identified and data copied as follows:

Transmitter

Selecting this option copies plant and stack data from the sensor memory to the transmitter memory and loads the totalizer from the sensor memory.

It is used to make the following changes:

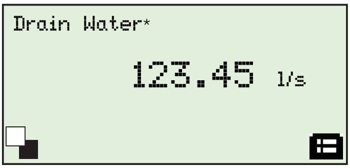
- Remote or integral cartridge change
- Remote Tx change
- New installation

Sensor

Selecting this option copies data from the transmitter memory to the sensor and loads the totalizer from the sensor memory.

It is used to make the following changes:

- Integral backplane change
- Sensor change
- Integral transmitter change



*Example legend only

Process Display (Operator Page)

When the 'Process Display' (Operator Page) is displayed, normal operation is assumed.

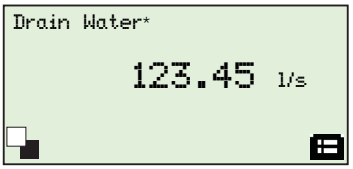
To access menus at a permitted access level, press the key to display the 'Access Level' screen – see Section 4.3, page 27.

4.3 Security Levels and Password Access

At power-up, the 'Start-up Display' and 'Process Display' screens are activated in sequence.

Note.

- Passwords at 'Standard' and 'Advanced' level can be set and changed by end-users.
- Access to the 'Service' level is reserved for factory-only personnel and not available to end-users.
- To navigate from the 'Operator Page(s)' directly back to the menus, accept the default access level selection at the 'Access Level' screen and press the key.

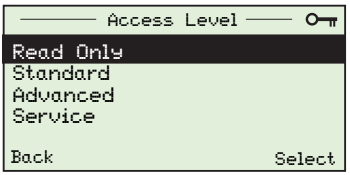


**Example legend only*

Operator Pages (Process Display)

When the start-up routine is completed, and if no changes have occurred since last start-up, the 'Process Display' (Operator Page) screen is displayed.

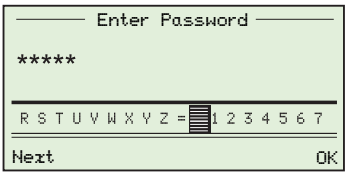
Press the key to display the 'Access Level' screen where the level of user access is selected.



Access Level

Passwords are required for 'Standard' and 'Advanced' level access. Passwords are not required for 'Read Only' access.

Select the permitted level of access and press the key to display the 'Enter Password' screen (the 'Enter Password' screen is bypassed if 'Read Only' is selected).



Enter Password

Enter the password and press the key to display menus available at the permitted access level.

Note. If a time-out occurs (5 minutes of no activity), enter the password again to access the menus.

4.3.1 Default Passwords

The WaterMaster transmitter is supplied with default passwords for access to 'Standard' and 'Advanced' level menus.

The two passwords are:

- 'Standard' access password: 2 or blank
- 'Advanced' access password: 3 or blank

Passwords can contain up to 5 characters and are not case sensitive.

To prevent unauthorized access ABB recommend the default passwords are changed on commissioning.

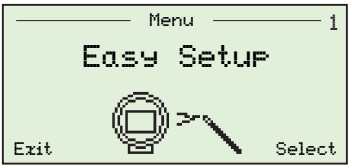
Note. When allocating passwords, record a copy of each password and store in a safe location. It is not possible to interrogate the transmitter to 'recover' passwords once they have been set.

4.3.2 Entering Passwords

To select password characters and enter passwords:

1. Scroll to the 'Access Level' screen and select the required access level. Press the key to display the 'Enter Password' screen.
2. Use the ▲ and ▼ keys to scroll to and highlight the first password character to be selected.
3. Press the key to select the highlighted character (add it to the password set).
4. Use the ▲ and ▼ keys to highlight the next password character to be selected.
5. Repeat steps 2 to 4 until all characters have been added to the password.
6. Press the key to accept the password and display menus available at the requested access level.

4.4 Easy Setup



Easy Setup

The 'Easy Setup' level is used to set the system up quickly and contains a series of options for users with 'Standard' and 'Advanced' access permission. Users with 'Read Only' access cannot make selections at this level.

To navigate the 'Easy Setup' parameters:

- Enter 'Easy Setup' by pressing the key at the 'Select' prompt.
- View and edit a parameter by pressing the key at the 'Edit' prompt.
- Scroll parameter options by pressing the and keys (press and retain contact to scroll multiple options consecutively).
- Edit parameters by pressing the key at the 'Next' prompt to enter the text field and press the and keys to increase or decrease the value. Press the key at the 'OK' prompt to accept the new value.
- Accept a highlighted parameter by pressing the key at the 'OK' prompt.
- Exit the current parameter without changing the setting by pressing the key at the 'Cancel' prompt.
- Move to the next parameter by pressing the key at the 'Next' prompt.
- Exit 'Easy Setup' level by pressing the key at the 'Exit' prompt on the 'Easy Setup' main level screen.

Parameter	Range	[Default] *Note*
Language	English, Deutsch, Français, Español, Italiano, Polski, Portuguese	[English] Selectable
Q (Flowrate) Unit	m^3/s, m^3/min, m^3/h, m^3/d, ft^3/s, ft^3/min, ft^3/h, ft^3/d, ugal/s, ugal/min, ugal/h, ugal/d, Mugal/d, igal/s, igal/min, igal/h, igal/d, bls/s, bls/min, bls/h, bls/d, hl/h, ml/s, ml/min, l/s, l/min, l/h, Ml/d,	[m^3/h] Selectable
Qmax	Dependent on sensor size	[Factory set]
Volume & Pulse Unit	m^3, l, ml, ft^3, hl, igal, ugal, bls, Ml, Mugal	Selectable*
Pulse Width	0.09 to 2000.00 ms	[0.09 ms] Editable
Pulses / Unit	0.000010 to 10,000,000 pulses / unit	[1.0] Editable (Only shown when Pulse Mode is Pulse / Unit)
Fullscale Frequency	0.250000 to 10,000,000 Hz	[5,000.000] Editable (Only shown when Pulse Mode is Fullscale Frequency)
Damping	0.02 to 60 s	[3.00 s] Editable
Mains Frequency	50 or 60 Hz	[50 Hz] Selectable

* For OIML and MID flowmeters, only m^3 must be used.

5 Specification

Functional Specification

Power supply

Mains	85 to 265 V AC @ <7 VA
Low voltage	24 V AC +10 %/–30 % @ <7 VA
DC	24 V ±30 % @ <0.4 A

Supply voltage fluctuations within the specified range have no effect on accuracy

Digital outputs (3 off)

Rating 30 V @ 220 mA, open collector, galvanically isolated

Maximum output frequency 5250 Hz

1 off dedicated to Alarm / Logic, programmable function

2 off configurable to either Pulse / Frequency or Alarm/Logic function

Current output – HART FEX100 variant

4 to 20 mA or 4 to 12/20 mA, galvanically isolated

Maximum loop resistance 750 Ω

HART protocol Version 5.7 (HART registered)

Signal levels compliant with NAMUR NE 43 (3.8 to 20.5 mA)

Low alarm 3.6 mA, High alarm 21.8 mA

Additional accuracy

±0.1 % of reading

Temperature coefficient: typically <±20 ppm/°C

RS485 communications – PROFIBUS FEX100-DP variant

Registered name: FEX100-DP

RS485 (9.6kbps to 1.5Mbps), galvanically isolated

DPV0, DPV1

PA Profile 3.01

Standard idents: 9700, 9740, 9741

FEX100-DP specific ident: 3431

3 Concurrent MS2 master connections

RS485 communications – MODBUS FEX100-MB variant

MODBUS RTU protocol

RS485 (9.6kbps to 115.2kbps), galvanically isolated

Electrical connections

20 mm glands, $^1/_2$ in NPT, 20 mm armored glands

Temperature limitations

Ambient temperature	–20 to 60 °C (–4 to 140 °F)
Temperature coefficient	Typically <±10 ppm/°C @ Vel ≥0.5 mls

Environmental protection

Humidity: 0 to 100 %

Rating: IP67 (NEMA 4X) to 1m (3.3 ft) depth

Tamper-proof security

Write access prevented by internal switch combined with external security seals for MID applications

Languages

English, French, German, Italian, Spanish, Polish

Infrared service port

USB adapter (accessory), USB 1.1. and 2.0 compatible

Driver software for Windows 2000, XP, 7 (32-bit) and Vista

Housing material

Powder-coated aluminium with glass window

Hazardous approvals (HART variant only)

FM & FMc Class 1 Div 2

(FM listing NI / 1 / 2 / ABCD / T4, S / II, III / 2 / FG /T4, Ta=60C; Type 4X, IP67 – for transmitter and integral mounting Ta=70C, Type 6P, IP68 – for remote sensor type, IP67 on DN10 to 32)

(FMc listing NI / 1 / 2 / ABCD / T4, DIP / II, III / 2 / FG /T4, Ta=60C; Type 4X, IP67 – for transmitter and integral mounting Ta=70C, Type 6P, IP68 – for remote sensor type, IP67 on DN10 to 32)

FET, FEV, FEW and FEF DN700 to 2200 (27/28* to 84) only

*Size is dependent on flange specification

Declaration of Conformance

Copies of CE and PED certification will be available on request.

WaterMaster has OIML R49 Certificate of Conformity to accuracy class 1 and 2 (FEV DN40 to 200). Copies of accuracy certification are available on request.

WaterMaster (FEV DN40 to 200) has been type examined under directive MID 2004/22/EC, Annex MI-001. Copies of this certificate are available on request.

DS/WM–EN Rev. K

Products and customer support

Automation Systems
For the following industries:
— Chemical & Pharmaceutical
— Food & Beverage
— Manufacturing
— Metals and Minerals
— Oil, Gas & Petrochemical
— Pulp and Paper

Drives and Motors
— AC and 6 Drives, AC and DC Machines, AC Motors to 1kV
— Drive Systems
— Force Measurement
— Servo Drives

Controllers & Recorders
— Single and Multi-loop Controllers
— Circular Chart and Strip Chart Recorders
— Paperless Recorders
— Process Indicators

Flexible Automation
— Industrial Robots and Robot Systems

Flow Measurement
— Electromagnetic Flowmeters
— Mass Flowmeters
— Turbine Flowmeters
— Wedge Flow Elements

Marine Systems & Turbochargers
— Electrical Systems
— Marine Equipment
— Offshore Retrofit and Refurbishment

Process Analytics
— Process Gas Analysis
— Systems Integration

Transmitters
— Pressure
— Temperature
— Level
— Interface Modules

Valves, Actuators and Positioners
— Control Valves
— Actuators
— Positioners

Water, Gas & Industrial Analytics Instrumentation
— pH, Conductivity and Dissolved Oxygen Transmitters and Sensors
— Ammonia, Nitrate, Phosphate, Silica, Sodium, Chloride, Fluoride, Dissolved Oxygen and Hydrazine Analyzers
— Zirconia Oxygen Analyzers, Katharometers, Hydrogen Purity and Purge-gas Monitors, Thermal Conductivity

Customer support
We provide a comprehensive after sales service via a Worldwide Service Organization. Contact one of the following offices for details on your nearest Service and Repair Centre.

UK
ABB Limited
Tel: +44 (0)1453 826661
Fax: +44 (0)1453 829671

USA
ABB Inc.
Tel: +1 215 674 6000
Fax: +1 215 674 7183

Client Warranty
Prior to installation, the equipment referred to in this manual must be stored in a clean, dry environment, in accordance with the Company's published specification.
Periodic checks must be made on the equipment's condition. In the event of a failure under warranty, the following documentation must be provided as substantiation:
— A listing evidencing process operation and alarm logs at time of failure.
— Copies of all storage, installation, operating and maintenance records relating to the alleged faulty unit.

Contact us

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Process Automation
Oldends Lane
Stonehouse
Gloucestershire GL10 3TA
UK
Tel: +44 1453 826 661
Fax: +44 1453 829 671

ABB Inc.
Process Automation
125 E. County Line Road
Warminster
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USA
Tel: +1 215 674 6000
Fax: +1 215 674 7183

www.abb.com

3KXF208111R4201

OI/FET100–EN Rev. D 10.2012

Section 6: Swingflex Check Valve Data Sheet + IOM

HMA VALVECO

VAL-MATIC

Swing Flex Check Valves

Features:

- 100% unrestricted flow area for improved flow characteristics and lower head loss
- One piece precision molded steel disc reinforced with nylon and backed by a 25 year warranty
- Memory-flex disc is the only moving part for long life and minimal maintenance
- Full sized top access port allows disc removal without removing valve from line
- Integral O-ring on disc assures positive seating at high and low pressures
- "Short Disc Stroke" combined with memory flex disc action reduces potentially destructive water hammer
- Backflow capabilities are available by means of an optional screw type backflow actuator
- Every Swing-Flex® Check Valve is 100% tested including a seat test to assure drop tight sealing and hydrostatic testing to assure the integrity of the casting

Technical Data:

- Sizes: DN50-1200 (2"- 48")
- Max. Working Pressure: 1,600kPa
- Ductile Iron Body
- Fusion Bonded Epoxy Coated to AS4158
- Buna-N Encapsulated Disc
- Flanges Drilled AS4087 Class 16
- 316 Stainless Steel Fasteners and Plugs
- Lay Length to AS3578 & AS4794
- WA Watercorp approval SPS223 coating

Options

Disc Accelerator (SURGEBUSTER)

The Disc Accelerator is a precision formed stainless steel mechanism that closes the valve disc rapidly thus avoiding slamming by flow reversal and yet allowing the disc to be stabilised under flow conditions. The accelerator is fully enclosed within the valve and completely out of the flow path.

Disc Position Indicator

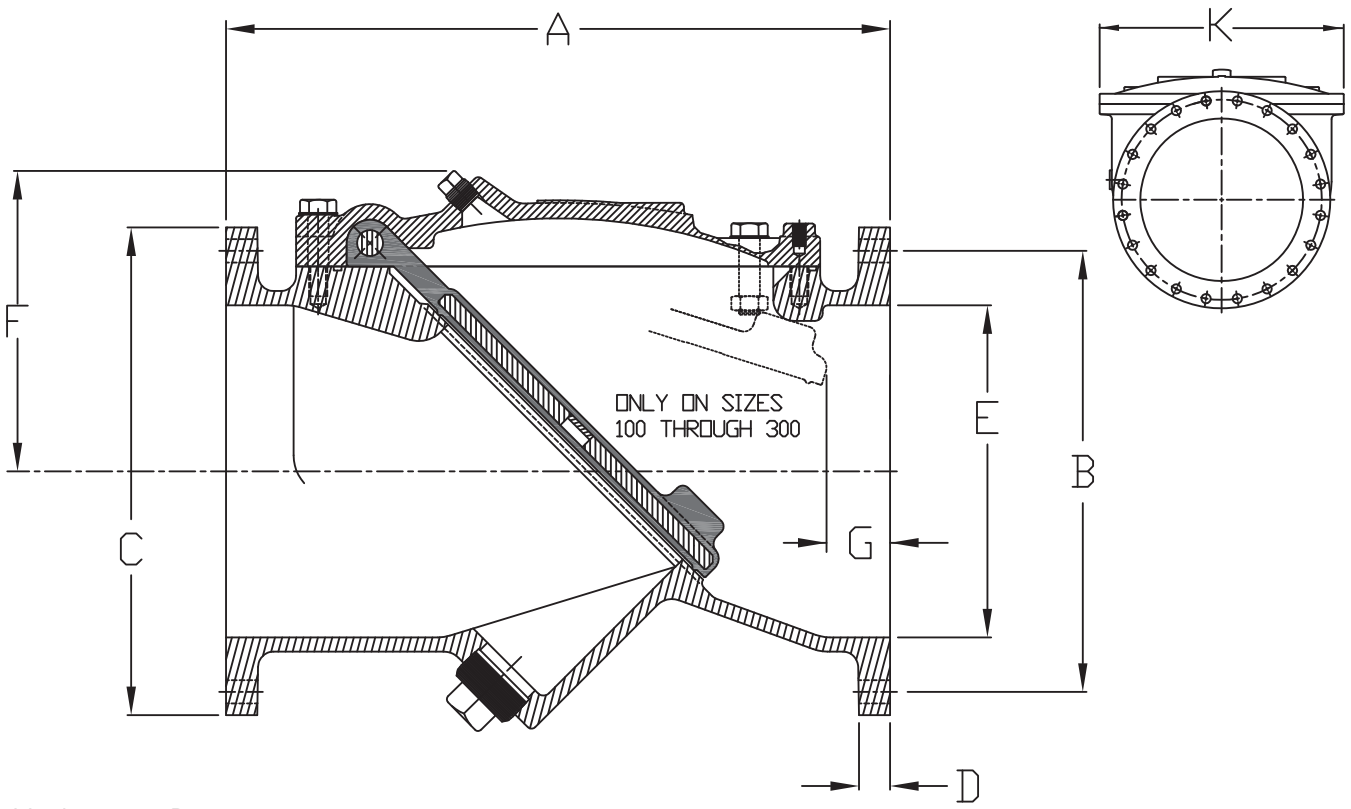
The cover mounted disc position indicator provides clear indication of the valve's disc position. A proximity limit switch can also be provided to indicate open/closed position to remote location.

Backflow Actuator

Available for use when manual backflow operation is required. Most commonly used for priming pumps, back flushing, draining lines, and system testing.

Rubber Lining

Unlike conventional swing check valves, the Swing Flex Check Valves is designed to accept synthetic or natural rubber lining. Body lining coupled with synthetic Memory-Flex discs makes the Swingflex ideally suited for systems containing abrasive or corrosive fluids.



Hydro test Pressure
1.5 Times Cold Working Pressure - CWP

AS4087 Class 16, Millimeters													
Valve Size	Model No.	CWP BAR	A	B	C	D	E	F	G	K	Bolt Size	No. of Bolts	WT-Kg
50*	502A	16	203	114	152	16	50	86	41	132	M16	4	11
80	503AU	16	260	146	185	19	76	130	41	190	M16	4	20
100	504AU	16	330	178	215	19	102	146	54	210	M16	4	32
150	506AU	16	410	235	280	21	152	173	54	284	M16	8	57
200	508AU	16	540	292	335	22	203	213	73	406	M16	8	109
225*	510X005	16	622	324	405	30	254	273	80	533	M16	8	190
250	510AU	16	640	356	405	24	254	273	80	533	M20	8	190
300	512AU	16	700	406	455	30	305	317	88	610	M20	12	290
375	515AU	16	820	495	550	30	375	330	92	591	M24	12	330
450	518AU	16	970	584	640	32	457	388	80	718	M24	12	546
500	520AU	16	1070	641	705	35	508	429	89	778	M24	16	771
600	524AU	16	1220	756	813	48	610	489	127	914	M27	16	998

*NOTES:
Flange holes are slotted for ANSI 150 and AS4087 Class 16 on 50mm valve
Flange holes are drilled and tapped to AS4087 Class 16 on 225mm valve.
50mm and 225mm sizes are not to AS lay length.

The designs, materials, dimensions and specifications shown are subject to change without notice due to our continuing program of product development.

Manual No.
SFCV-OM1-4

Swing-Flex® Check Valve

Operation, Maintenance and Installation Manual

VAL-MATIC VALVE AND MANUFACTURING CORP.

905 RIVERSIDE DRIVE ■ ELMHURST, IL 60126
PHONE (630)941-7600 ■ FAX (630)941-8042

VAL-MATIC'S SWING-FLEX® CHECK VALVE OPERATION, MAINTENANCE AND INSTALLATION

INTRODUCTION

The Swing-Flex® Check Valve has been designed to give years of trouble-free operation. This manual will provide you with the information needed to properly install and maintain the valve and to ensure a long service life. The valve is opened by the fluid flow in one direction and closes automatically to prevent flow in the reverse direction.

An optional backflow actuator may be mounted on the bottom of the valve to allow manual backflow through the valve in the reverse direction.

Optional Mechanical Indicators and Limit Switches may be mounted on the valve cover to provide local and remote position indication.

An oil dashpot may be mounted on the bottom of 6" and larger valves to provide slow closure over the last 10% of travel.

The valve is of the swing check type utilizing an angled seat and fully encapsulated, resilient disc. It is capable of handling a wide range of fluids including flows containing suspended solids. The Size, Flow Direction, Maximum Working Pressure, and Series No. are stamped on the nameplate for reference.

CAUTION:
Do not use valve for line testing at pressures higher than nameplate rating or damage to valve may occur.

The "Maximum Working Pressure" is the non-shock pressure rating of the valve at 150°F. The valve is not intended as an isolation valve for line testing above the valve rating.

RECEIVING AND STORAGE

Inspect valves upon receipt for damage in shipment. Unload all valves carefully to the ground without dropping. Do not allow lifting slings or chains to come in contact with the seat area; use eyebolts or rods through the flange holes on large valves.

WARNING
Do not use threaded holes in cover for lifting the valve. Serious injury may result.

Valves should remain crated, clean and dry until installed to prevent weather related damage. For long term storage greater than six months, the rubber surfaces of the disc should be coated with a thin film of FDA approved grease such as Lubriko #CW-606. Do not expose disc to sunlight or ozone for any extended period.

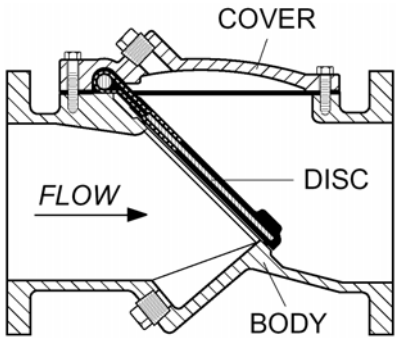


FIGURE 1. SWING FLEX® CHECK VALVE

DESCRIPTION OF VALVE OPERATION

The valve is designed to prevent reverse flow automatically. During system flow conditions, the movement of the fluid forces the disc to the open position allowing 100% un-restricted flow area through the valve. Under reverse flow conditions, the disc automatically returns to the closed position to prevent reverse flow.

Several optional features are a backflow actuator, mechanical indicator, limit switch and bottom oil dashpot. All of these options ship loose of the valve and require field installation.

INSTALLATION

Correct installation of the Swing-Flex® is important for proper operation. It may be installed in either horizontal or vertical flow-up applications. However, when horizontal, the valve must be installed with the nameplate facing up and the cover level. In all installations, the flow arrow cast in the valve cover must be pointed in the direction of flow during normal system operation.

WARNING
Do not use threaded holes in cover for lifting the valve. Serious injury may result.

FLANGED ENDS: Flanged valves should only be mated with flat-faced pipe flanges equipped with full-face resilient gaskets. The valve and adjacent piping must be supported and aligned to prevent cantilevered stress on the valve. Once the flange bolts or studs are lubricated and inserted around the flange, tighten them uniformly hand tight. The tightening of the bolts should then be done in graduated steps using the **crossover tightening** method. Recommended lubricated torque values for use with resilient gaskets (75 durometer) are given in Table 1. If leakage occurs, allow gaskets to absorb fluid and check torque and leakage after 24 hours. Do not exceed bolt rating or extrude gasket.

CAUTION: The use of ring gaskets or excessive bolt torque may damage valve flanges.

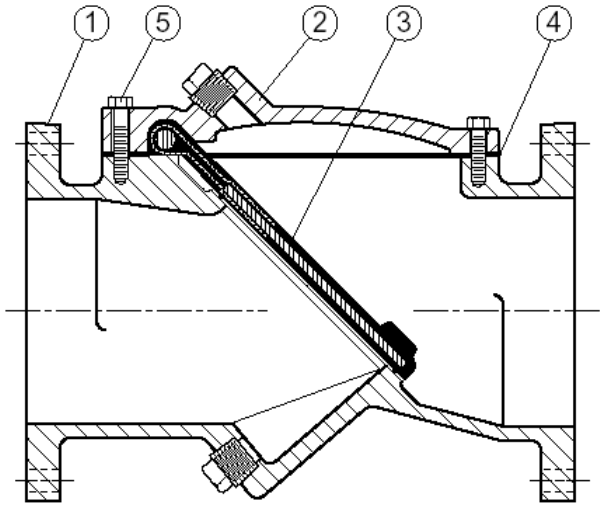
FLANGE BOLTS

VALVE SIZE (in)	BOLT DIA (in)	RECOM. TORQUE (ft-lbs)	MAX. TORQUE (ft-lbs)
3	5/8	25	90
4	5/8	25	90
6	3/4	30	150
8	3/4	40	150
10	7/8	45	205
12	7/8	65	205
14	1	80	300
16	1	80	300
18	1 1/8	100	425
20	1 1/8	100	425
24	1 1/4	150	600
30	1 1/4	160	600
36	1 1/2	300	900
42	1 1/2	300	900
48	1 1/2	300	1,000

TABLE 1. FLANGE BOLT TORQUES

VALVE CONSTRUCTION

The standard Swing-Flex® Check Valve is constructed of rugged cast iron with a rubber encapsulated disc. See the specific Materials List submitted for the order if other than standard cast iron construction. The disc is the only moving part assuring long life with minimal maintenance. The general details of construction are illustrated in Figure 2. The body (1) is flanged for connection to the pipeline with an open top sealed with a cast cover (2). The disc (3) is retained by the cover.



ITEM	DESCRIPTION	MATERIAL
1	Body	Ductile Iron – 250 psi Cast Iron – 150 psi
2	Cover	Ductile Iron – 250 psi Cast Iron – 150 psi
3	Disc*	Steel With Buna-N Facing
4	Cover Seal*	Buna-N or Non-Asbestos
5	Cover Bolt	Alloy Steel

*RECOMMENDED SPARE PART

FIGURE 2. CHECK VALVE CONSTRUCTION

MAINTENANCE

The Swing Flex® Check Valve requires no scheduled lubrication or maintenance. For service or inspection, the valve can be serviced without removal from the line.

VALVE INSPECTION: If inspection of the valve is required, follow the Disassembly Instructions given on page 3.

TROUBLESHOOTING

Several problems and solutions are presented below to assist you in troubleshooting the valve assembly in an efficient manner.

- Leakage at Bottom Actuator: Remove line pressure and exercise actuator. If leak persists, replace seals in actuator; see the Backflow Actuator Seal Replacement Procedure on page 4.
- Leakage at Cover or Flanges: Tighten bolts, replace cover seal.
- Valve Leaks when Closed: Inspect disc for damage and replace. Inspect metal seating surface and clean if necessary.
- Valve Does not Open: Check for obstruction in valve or pipeline; see Disassembly procedure on page 4. Operating pressure may be less than cracking pressure. If less than 0.5 psig, review application with factory.

DISASSEMBLY

The valve can be disassembled without removing it from the pipeline. Or for convenience, the valve can be removed from the line. All work on the valve should be performed by a skilled mechanic with proper tools and a power hoist for larger valves. Disassembly may be required to inspect the disc for wear or the valve for deposits.

WARNING: The line must be drained before removing the cover or pressure may be released causing bodily harm.

1. Relieve pressure and drain the pipeline. Refer to Figure 2 on page 2. Remove the cover bolts (5) on the top cover.
2. Pry cover (2) loose and lift off valve body. 12” and larger valves have tapped holes in cover for lifting eyes.
3. Remove disc (3) and inspect for cracks, tears or damage in rubber sealing surface.
4. Clean and inspect parts. Replace worn parts as necessary and lubricate parts with FDA grease such as Lubriko #CW-606.

RE-ASSEMBLY

All parts must be cleaned. Gasket surfaces should be cleaned with a stiff wire brush in the direction of the serrations or machine marks. Worn parts, gaskets and seals should be replaced during reassembly.

1. Lay disc (3) over seat with beaded seating surface directed down.
2. Lay cover gasket (4) and cover (2) over bolt holes and disc hinge.
3. Insert lubricated bolts (5) noting that the bolts in the hinge area are longer than the other cover bolts.
4. Cover bolts should be tightened to the following specifications during assembly.

COVER BOLTS

VALVE	SIZE	TORQUE (FT-LBS)
2”-2.5”	1/2"	75
3”	7/16"	50
4”	1/2"	75
6”	7/16"	50
8”	9/16"	100
10”	3/4"	200
12”-20”	7/8”	250
24”	1”	500
30”	1 1/8”	600
36”	1 1/4”	900
42”	1 1/2"	1,400
48”	1 1/2”	1,400

TABLE 2. VALVE COVER BOLT TORQUES

BACKFLOW ACTUATOR FIELD INSTALLATION AND MAINTENANCE (OPTIONAL)

BACKFLOW ACTUATOR OPERATION:
An optional **backflow actuator** assembly is available which can be easily installed in the field. The actuator is not designed to operate at the valve's Maximum Working Pressure rating. Therefore, prior to using the actuator, close the pump isolation valve and bleed off line pressure. To operate, turn the handle clockwise. This will open the valve disc allowing backflow through the valve. The handle should turn easily. When resistance is felt, the disc has reached its body stop and is in the full open position. Upon completion of the back flushing operation, turn the handle counter-clockwise and the valve will automatically return to the closed position. Lock the actuator in the closed position with the jam nut provided. The system is again ready for normal operation

WARNING:	**Relieve line pressure before using backflow actuator or damage may occur.**

BACKFLOW ACTUATOR FIELD INSTALLATION:
The backflow actuator is supplied as an optional assembly from the factory, which is shipped loose with the valve.

WARNING:	**Removal of the bottom plug while under pressure may cause bodily harm.**

1. Depressurize and drain the pipeline.

2. Remove the pipe plug in the bottom boss of the valve.

3. Inspect the backflow rod and place in the non-extended position. (The rod should extend about 1" past the end of the brass bushing.) Apply Teflon thread sealant to brass threads.

4. Insert the threaded end of the assembly into the valve boss. Slowly turn the assembly into the boss taking care not to cross-thread the bushing. Continue turning the assembly into the valve for a tight fit.

BACKFLOW ACTUATOR SEAL REPLACEMENT:
There are two parts (8 & 9) on the backflow actuator that are subject to wear. To replace the seals, the pipeline must first be depressurized and drained. Next, remove the backflow assembly from the valve by turning the brass bushing (6) counter-clockwise. Disassemble the actuator as follows:

1. Remove one of the vinyl caps (12).

2. Remove the T-Handle (10) and jam nut (11) from the rod (7).

3. Remove the rod (7) from the bushing (6) by screwing in the rod fully clockwise and pull the rod through the valve end of the bushing (6).

4. Lubricate new seals with FDA approved grease such as Lubriko #CW-606 and install in the bushing end grooves.

5. Clean, lubricate, and reinstall rod in bushing.

6. Re-install jam nut (11) and T-Handle (10).

7. Place vinyl cap (12) on handle (10).

8. Apply Teflon thread sealant to bushing and carefully thread into valve taking care not to cross-thread the bushing

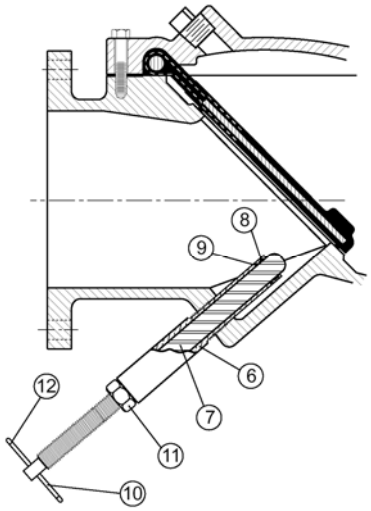


FIG. 3. BACKFLOW ACTUATOR ASSEMBLY

ITEM	DESCRIPTION	MATERIAL
6	Bushing	Lead-Free Brass
7	Rod	Stainless Steel
8	Rod Wiper*	Molythane
9	O-Ring*	Buna-N
10	Handle	Stainless Steel
11	Jam nut	Brass
12	Cap*	Vinyl

*RECOMMENDED SPARE PART

BACKFLOW ACTUATOR PARTS LIST

MECHANICAL INDICATOR (OPTIONAL)

The mechanical indicator is an option that fits into the cover and can easily be installed in the field by going through the following steps. The mechanical indicator is used to visually indicate when the valve is opened or closed.

1. Remove line pressure and drain valve.

> **WARNING: REMOVAL OF THE PIPE PLUG WHILE UNDER PRESSURE MAY CAUSE BODILY HARM.**

2. Remove the pipe plug from the cover.
3. Apply pipe joint compound to indicator body (21) threads.
4. Insert the indicator body (21), without the indicator plate (27), into the valve cover and tighten. Make sure that two of the tapped holes in the indicator body (21) are aligned with the valve and pipeline. This will ensure proper orientation of the indicator plate.
5. Remove the two socket head screws (31) from the indicator body (21).
6. Slide the indicator plate (27) over the indicator rod (23) and spring (28).
7. Align the indicator plate (27) as shown on the back of this card and secure with the 5mm socket head screws (31).
8. Connect the spring (28) to the indicator plate (27) notch.

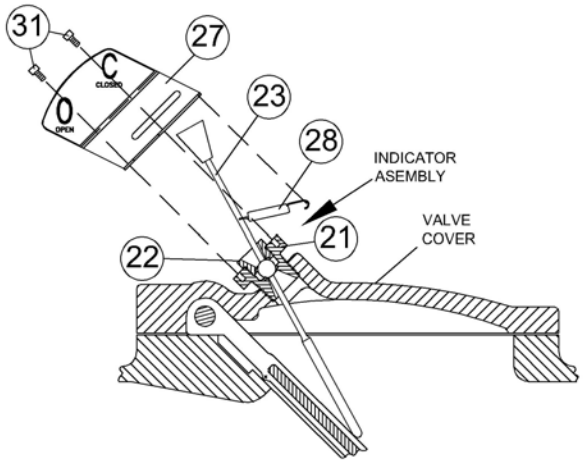


FIG. 4. MECHANICAL INDICATOR ASSEMBLY

Mechanical Indicator Parts List

Item	Description	Material
21	Body	Brass
22	Bushing	Brass
23	Rod	Stainless Steel T410
27	Plate	Stainless Steel T316
28	Spring	Stainless Steel T302
31	Screws	Stainless Steel T316

LIMIT SWITCH (OPTIONAL)

The limit switch is used in conjunction with the Mechanical Indicator. The standard limit switch is MICROSWITCH Model Number 914CE20-3. The limit switch is SCADA (Supervisory Control and Data Acquisition) compatible for applications requiring open/close indication.

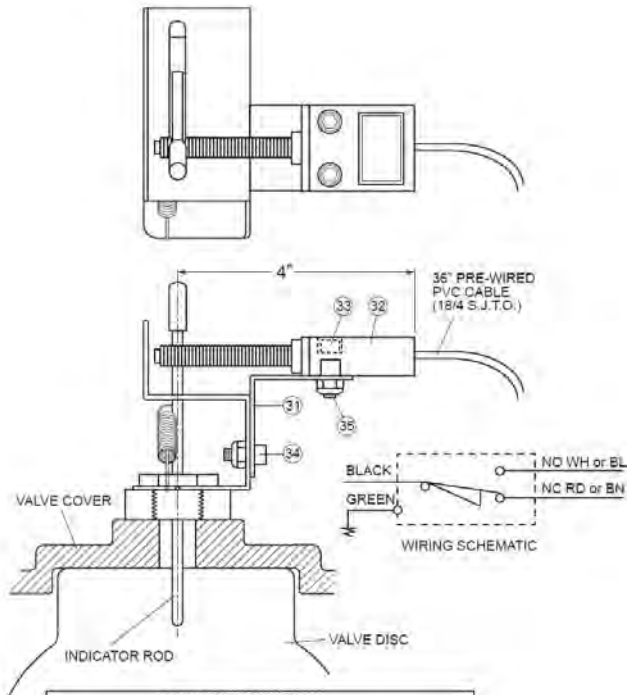
NEMA Ratings: 1, 2, 4, 6, 6P, 12, 13
UL Ratings: 5 AMPS, 1/10 HP, 125 or 250 VAC, SPDT

Installation:

1. Attach limit switch assembly to indicator using the supplied screws (34) and bracket (32).

2. Position the assembly so that the switch trips when the valve is closed.

3. Connect wiring to either the normally open or normally closed contact as shown in the schematic diagram.



BILL OF MATERIAL

PART NO.	DESCRIPTION	QTY
31	MOUNTING BRACKET	1
32	LIMIT SWITCH (SPDT) HONEYWELL 914CE20-3 ALLEN BRADLEY 802B-CSACXSXCE	1
33	SCREW	2
34	SCREW	2
35	NUT	4

FIGURE 5. LIMIT SWITCH ASSEMBLY

BOTTOM MOUNTED OIL DASHPOT FIELD INSTALLATION AND MAINTENANCE (OPTIONAL)

DASHPOT FIELD INSTALLATION: The bottom dashpot is supplied as an optional assembly from the factory. This unit provides control of the disc's final 10% travel to the closed position to reduce valve slam and water hammer. The 10% travel time is adjustable between 1 and 5 seconds.

1. Depressurize and drain the valve and pipeline.

   WARNING: Removal of the bottom plug in the valve while under pressure may cause bodily harm.

2. Remove the pipe plug in the bottom boss of the valve. Apply Teflon thread sealant or tape to brass threads on the dashpot.

3. Insert the threaded end of the assembly into the valve boss. Slowly turn the assembly into the boss taking care not to cross-thread the bushing. Continue turning the assembly into the valve for a tight fit and so that the tank is upright.

4. Adjust the air pressure in the tank to be a minimum of 50 psi over the line pressure. Set the flow control valve in the mid position (i.e. 1 turn open). The dashpot rod should be extended and hold the disc open about 1 inch. The water line pressure will close the disc.

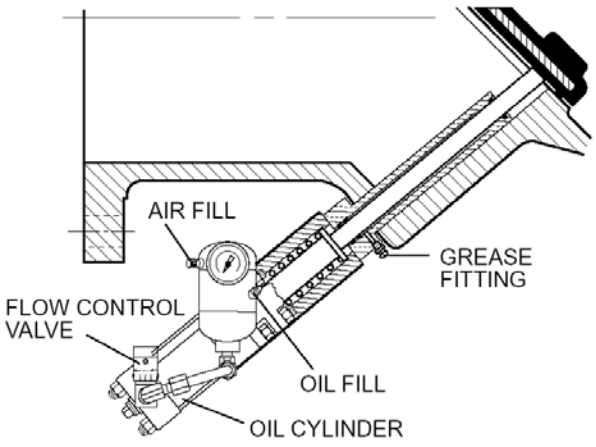


FIGURE 6. BOTTOM MOUNTED OIL DASHPOT

CHECKING OIL AND GREASE LEVELS:

1. The check valve should be closed.

2. The air in the oil reservoir must be bled from the reservoir, using the air fill valve mounted on the reservoir.

3. Remove the pipe plug from the oil reservoir fill port.

4. Add hydraulic fluid equal to Mobil #DTE 24 until fluid is up to level indicated on the reservoir. Replace pipe plug.

5. Recharge the reservoir with air pressure to a minimum of 10 psi over the water line pressure.

6. The grease level can not be checked but it is recommended that the grease fitting be charged with grease twice a year. Use a cartridge grease gun and pump grease into the fitting using two full strokes. An FDA approved grease such as Lubriko #CW-606 should be used (Master Lubricants Company, Philadelphia, PA)

DASHPOT SEAL REPLACEMENT: There are several seals in the unit that may require replacement.

1. Depressurize and drain the valve and pipeline.

2. Unscrew the dashpot from the valve and remove the 4 bolts holding the dashpot spacer.

3. Replace the (2) rod wipers and o-ring seal.

4. If the oil cylinder is leaking oil, tighten the tie rod nuts. The cylinder should be returned to the factory for rebuilding.

5. Reinstall the unit as listed above for a new unit.

PARTS AND SERVICE

Parts and service are available from your local representative or the factory. Make note of the valve Model No and Working Pressure located on the valve nameplate and contact:

Val-Matic Valve and Mfg. Corp.
905 Riverside Drive
Elmhurst, IL 60126
PH: 630/941-7600
FAX: 630/941-8042

A sales representative will quote prices for parts or arrange for service as needed.

LIMITED WARRANTY

All products are warranted to be free of defects in material and workmanship for a period of one year from the date of shipment, subject to the limitations below.

If the purchaser believes a product is defective, the purchaser shall: (a) Notify the manufacturer, state the alleged defect and request permission to return the product; (b) if permission is given, return the product with transportation prepaid. If the product is accepted for return and found to be defective, the manufacturer will, at his discretion, either repair or replace the product, f.o.b. factory, within 60 days of receipt, or refund the purchase price. Other than to repair, replace or refund as described above, purchaser agrees that manufacturer shall not be liable for any loss, costs, expenses or damages of any kind arising out of the product, its use, installation or replacement, labeling, instructions, information or technical data of any kind, description of product use, sample or model, warnings or lack of any of the foregoing. NO OTHER WARRANTIES, WRITTEN OR ORAL, EXPRESS OR IMPLIED, INCLUDING THE WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE AND MERCHANTABILITY, ARE MADE OR AUTHORIZED. NO AFFIRMATION OF FACT, PROMISE, DESCRIPTION OF PRODUCT OF USE OR SAMPLE OR MODEL SHALL CREATE ANY WARRANTY FROM MANUFACTURER, UNLESS SIGNED BY THE PRESIDENT OF THE MANUFACTURER. These products are not manufactured, sold or intended for personal, family or household purposes.

Section 7: Resilient Seat Gate Valve Data Sheet + IOM

HMA VALVECO

Series 728 Resilient Seated Gate Valve to AS2638.2

Optional Handwheel

Certified Product ™

Australian Standard

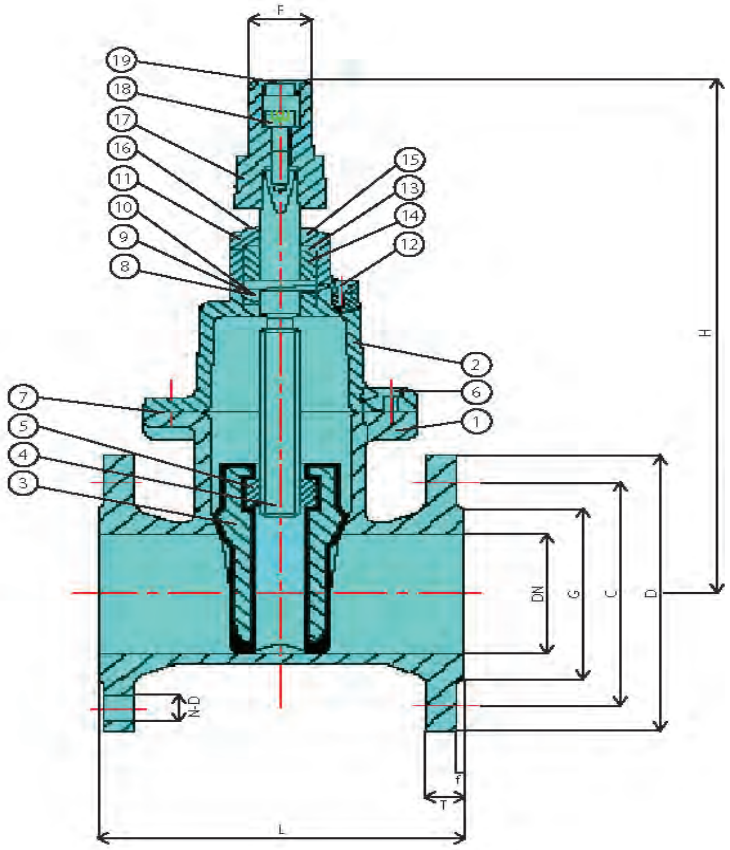
Features:

- Ductile iron body and bonnet for high strength and impact resistance
- Ductile iron gate fully encapsulated in EPDM rubber to ensure tight seals
- Grade SS431 Stainless steel stem for strength and corrosion resistance
- Back seal facility to allow replacements of stem seals under pressure
- SS316 bolts and fasteners for corrosion resistance
- Available in both flanged and sockets ends
- Full port design
- Stem nut is separated from the gate for easy open and close
- Cast integral feet for safe and easy storage
- Lifting eyes bolts for easy installation (6" and over)
- Available in both clockwise and anti-clockwise closing
- Key, handwheel and gear box operator available
- Suitable for drinking water, waste water and other liquids
- Available for above ground and underground applications

Technical Data

- Sizes: DN50-600 (2"- 24")
- Max. Working Pressure: 1600kPa
- Max. Working Temperature: 60° C
- Flanged Or Socket End Connections
- SAI Approved to AS2638.2, 2006 (Sizes 80-300mm)
- Epoxy Coated to AS4158 300µm minimum DFT

No.	Description	Material	Standard
1	Body	Ductile Iron	QT500-7 (AS1831)
2	Bonnet	Ductile Iron	QT500-7 (AS1831)
3	Gate	Ductile Iron EPDM Encapsulated	QT500-7 (AS1831) & AS1646
4	Stem	Stainless Steel SS431	ASTM A276
5	Gate Nut	Gunmetal	ZnCuAl10Fe3 (AS1565)
6	Bolts	SS316	SS316
7	Body Gasket	EPDM	AS1646
8	Seal Bushing	Gunmetal	ZnCuAl10Fe3 (AS1565)
9	O-Ring	EPDM	AS1646
10	Bonnet Gasket	EPDM	AS1646
11	Seal Retainer	Ductile Iron	QT500-7 (AS1831)
12	Bolts	SS316	SS316
13	Seal Bushing	Gunmetal	ZnCuAl10Fe3 (AS1565)
14	O-Ring	EPDM	AS1646
15	O-Ring	EPDM	AS1646
16	Dustproof Cap	Ductile Iron	QT500-7 (AS1831)
17	Stem Cap	Ductile Iron	QT500-7 (AS1831)
18	Screws	SS316	SS316
19	Plastic Cap	PE	PE



DN	Clockwise Close	Anti-Clockwise Close	L	H	G	C	D	T	F	N-D	f	Weight (Kgs)
50	728-VRSCC050C	728-VRSACC050C	178	308	90	114	150	18	35	4-19	3	18
65	728-VRSCC065C	728-VRSACC065C	190	318	103	127	165	18	35	4-19	3	19
80	728-VRSCC080C	728-VRSACC080C	203	358	122	146	185	18	35	4-19	3	20
100	728-VRSCC100C	728-VRSACC100C	229	386	154	178	215	20	35	4-19	3	28
125	728-VRSCC125C	728-VRSACC125C	254	451	186	210	255	23	35	8-19	3	45
150	728-VRSCC150C	728-VRSACC150C	267	506	209	235	280	23	35	8-19	3	50
200	728-VRSCC200C	728-VRSACC200C	292	634	264	292	335	23	35	8-19	3	85
225	728-VRSCC225C	728-VRSACC225C	305	724	296	324	370	24	35	8-23	3	105
250	728-VRSCC250C	728-VRSACC250C	330	724	328	356	405	24	35	8-23	3	125
300	728-VRSCC300C	728-VRSACC300C	356	834	376	406	455	30	35	12-23	4	170

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Valveco Industries Pty Ltd : ABN 68 092 292 718

Model 728 Installation Operation and Maintenance Instructions

1 General

Gate valves are designed to close off or open up the flow in a pipeline. Gate valves are not recommended for throttling use.
The disc goes down to close the pipe line when turning the hand-wheel clockwise, and goes up to open it when turning anti-clockwise. For actuated valve, when emergency for power failure, can open or close valve with spare hand-wheel.
Even, the customers could replace the stem "O"rings under the pipe line pressure.

2 Valve Storage

2.1 Preparation and Preservation for Shipment

All valves are properly packed in order to protect the parts that are subject to deterioration during transportation and storage on site. In particular, the following precautions should be taken:
1) The valves must be packed with the wedge in the closed position.
2) The flange sealing surfaces and the thread ends shall be protected with suitable protective grease. The ends shall be closed with wooden or plywood discs fixed with straps to protect the end surfaces and the inside of valve.
3) All actuated valves must be securely palleted or crated, with particular attention, in order to ensure that parts of actuator do not extend beyond the packing size.
4) The type of packing must be defined in the Customer's order and shall be appropriate to ensure safe transportation to final destination and eventual conservation before installation.

2.2 Handling Requirements

A - Packed Valves

Pallets: Lifting and handling of the packed valves in pallets will be carried out by a fork lift truck, by means of the appropriate fork hitches.
Cases: The lifting of packed valves in cases will be carried out in the lifting points and at the center of gravity position which have been marked. The transportation of all packed material must be carried out safely and following the local safety regulations.

B - Unpacked Valves

1) The lifting and the handling of these valves have to be carried out by using appropriate means and by respecting the carrying limits. The handling must be carried out on pallets, protecting the machined surfaces to avoid any damage.
2) With large dimensions valves, the sling and the hooking of the load must be carried out by using the appropriate tools (brackets, hooks, fasteners, ropes) and load balancing tools in order to prevent them from falling or moving during the lifting and the handling.

CAUTION !

1) For valve handling and/or lifting, the lifting equipment (fasteners, hooks, etc.) must be sized and selected while taking into account the valve weight indicated in the packing list and/or delivery note.
2) Lifting and handling must be made only by qualified personnel.
3) Caution must be taken during the handling to avoid that this equipment passes over the workers or over any other place where a possible fall could cause damage. In any case, the local safety regulations must be respected.
4) Do not pick up valves by use of straps or chains on or around the handwheels, yoke, bevel gear, motor or cylinder operator, or any override attachment.

2.3 Storage and Preservation before Installation

1) The valves have to be stocked in a closed, clean and dry storage room.
2) The wedge must be in the closed position, and the ends shall be closed with plastic or wooden or plywood discs fixed with straps to protect the end surfaces and the inside of valve. If possible, keep the original protection.
3) Periodical checks have to be carried out in the storage area to verify that the above mentioned conditions are maintained.
4) See the actuator user manual for the storage and preservation of electric or pneumatic/hydraulic actuator.

NOTE !

Storage in an open area for a limited period can be considered only in case the valves have appropriate

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packing (packed in cases lined with tarred paper, and contents well protected with barrier sacks), and the following rules should be stand by:

1) Do not place consignment packages directly on the ground.
2) Do not expose consignment packages to the weather or directly to the sun.
3) Check the packaging every month.

3 Installations

3.1 Preparation before Installation

1) Carefully remove the valve from the shipping package (box or pallet) avoiding any damage to the valve. Be sure valve mark and content listed on the nameplate is in accordance with the requirements of use before installation.

2) The valves are shipped with the ends protected with caps and a thin layer of protective grease. Before installing the valve, remove the caps and clean carefully, then degrease both surfaces with a solvent. Ensure no any foreign material e.g. package materials of wooden attaching inside of valve. Clean the inside of the valve with a clean cloth.

3) Define the preferred mounting orientation with respect to the system pressure. If any (see arrow on the body), identify the upstream side and downstream side. (Suitable to low-temperature and cryogenic valves)

4) Ensuring that valve can be installed perfectly and have suitable supporting, if necessary, apply proper measures to compensate for expanding and bending with pipe line, to avoid damage for excessive pipe stresses.

3.2 Installation Instructions

1) Gate valves are normally installed in horizontal pipe with vertical stem.

2) The wedge must be in the closed position to avoid damage of seat/disc sealing surface during installation.

3) For operating temperatures above 200°C (392°F) a thermal insulation of the valve body is recommended to avoid any harm to installation and operator.

4) Note specially the condition of valve (e.g. “open” or “close”) when power failure for actuated valve.

5) Handling and lifting of the valves during installation MUST be performed following the same criteria and instruction described in previous points “2.2 Handling Requirements”.

Flanged Valves

-- Check mating flange facings. If a condition is found which might cause leakage, (e.g. a deep radial groove or cut), do not attempt to assemble until the condition is corrected.

-- Use care to provide good alignment of flanges being assembled. Use suitable lubricants on bolt threads. When assembling, sequence the bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Tighten gradually and uniformly to avoid tendency to twist one flange relative to the other.

-- Parallel alignment of flanges is especially important in the case of assembly of a valve into an existing system. It should be recognized that if the flanges are not parallel, in such instances, it would be necessary to bend something to make the flange joint tight. Simply forcing the flanges together with the bolting may bend the pipe, or it may bend the valve. In large diameter piping particularly, such conditions should always be brought to the attention of someone capable of evaluating the bending conditions, and corrective measures taken as needed.

Threaded Valves

-- Check the threads on both the valve and the mating pipe for form and cleanliness. Inspect for obvious dents, deformation of the thread or out-of-round areas. Ensure that no chips or grit are present.

-- Use care to align threads at point of assembly. Tapered pipe threads are inherently loose fit at entry; substantial wrenching force should not be applied until it is apparent that threads are properly engaged.

-- Apply appropriate tape or thread compound to the external pipe threads (except when dry seal threading is specified).

-- Specially note that it is possible to damage valves by applying excessive twisting forces through the body.

6) After the installation, the following examinations should be performed prior to pressure the pipe system:

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Model 728 Installation Operation and Maintenance Instructions

-- Be sure all screw plugs are screwed tightening;
-- Be sure all bolts are tightened;
-- be sure the packing are compacted tightly. But the movement of stem shall not be hampered.
-- Remove the protective materials of stem. The stem threads that are exposed to atmosphere and bearings should be lubricated;
-- Open the valve fully.

5 Maintenance

It's recommended to perform periodic inspections, As a minimum, all valves should be checked quarterly to ensure proper operation and discourage the damage compounding effects of leakage. The following list details the specific valve types and areas requiring inspection and maintenance:
-- Check stems threads for wear;
-- Check for packing leakage;
-- Check body/bonnet joint for leakage;
-- Inspect all external connections;
-- If conditions permitted, operate valve;
-- Inspect condition of motor and/or gear operators (when used);
-- Inspect valve for obvious damage.

6 Possible Troubles, Cause & Solution

Tab.1 Possible Trouble, Cause & Solution

Troubles	Probable Causes	Solutions
Mechanical failure; Leakage; Explosion	Storage faults	1. Valve stored for a long-term shall be checked periodically and cleaned to be free from stain. And coat corrosion-resistant oil on machined surface 2. If the stored time exceed 18 months, valve should be retested, or exceed 24 months, should be replaced all the wearing parts and then be retested, to ensure the structural and functional integrity, and make records
	Installation Faults	1. Be sure valve mark (e.g. type, nominal size, nominal pressure, material etc.) is accordance with the requirements before installation 2. Best location is horizontal(1) and stem is vertical; 3. Valve should be fully open during pressure test of system after installation and normal operation.
Leakage at the sealing surface of seat ring	**1.** Dirt on the sealing surface **2.** Wear of sealing surface	**1.** Clean the dirt **2.** Repair it or replace seat ring or disc
Leakage at the joint of body/bonnet connection	**1.** Damage of sealing surface of body and bonnet flanges **2.** Rupture or failure of bonnet gasket	**1.** Repair it **2.** Replace the gasket
Leakage at the packing	**1.** Tightening of packing not enough **2.** Packing failure due to long-term use or improper preservation	**1.** Retighten the nuts of packing **2.** Replace the packing

8 Guarantee

Guarantee period of valve's quality is 12 months after using, but not exceed 18 months after delivery. Manufacture factory will repair or provide spare parts free fee on the occurrence of damage because of materials, manufacture or the damage under correct operation during the guarantee period.

Section 8: Heavy Duty Knifegate Valve Data Sheet + IOM

Heavy Duty Knifegate

General Purpose Lugged Style Knifegates

Heavy Duty General Purpose Lugged Style Knifegate Valve

Features

- Compact design for easy installation and maintenance
- Both 304SS and 316SS valves available
- Available in metal & resilient seat
- Uni & bi-directional design
- One piece integral cast body, chest and lugs
- Integral cast in gate wedges minimize flow obstructions
- High flow rates with low pressure drops
- Gate guides to support gate
- Complies with AS6401 & MSS SP-81 face to face dimensions
- Every valve pressure tested
- Gate machined over full length for optimum sealing
- 50 to 1200mm sizes available, 50 to 600mm kept in stock
- 10 bar pressure rating
- Specifically formulated PTFE impregnated packing material for increased service life and lower friction
- Specialised packing for chemical resistant or abrasive applications available on request
- Available with a variety of actuators including handwheel, chain wheel, quick acting lever, geared, electric, air or hydraulic cylinder actuator

Options

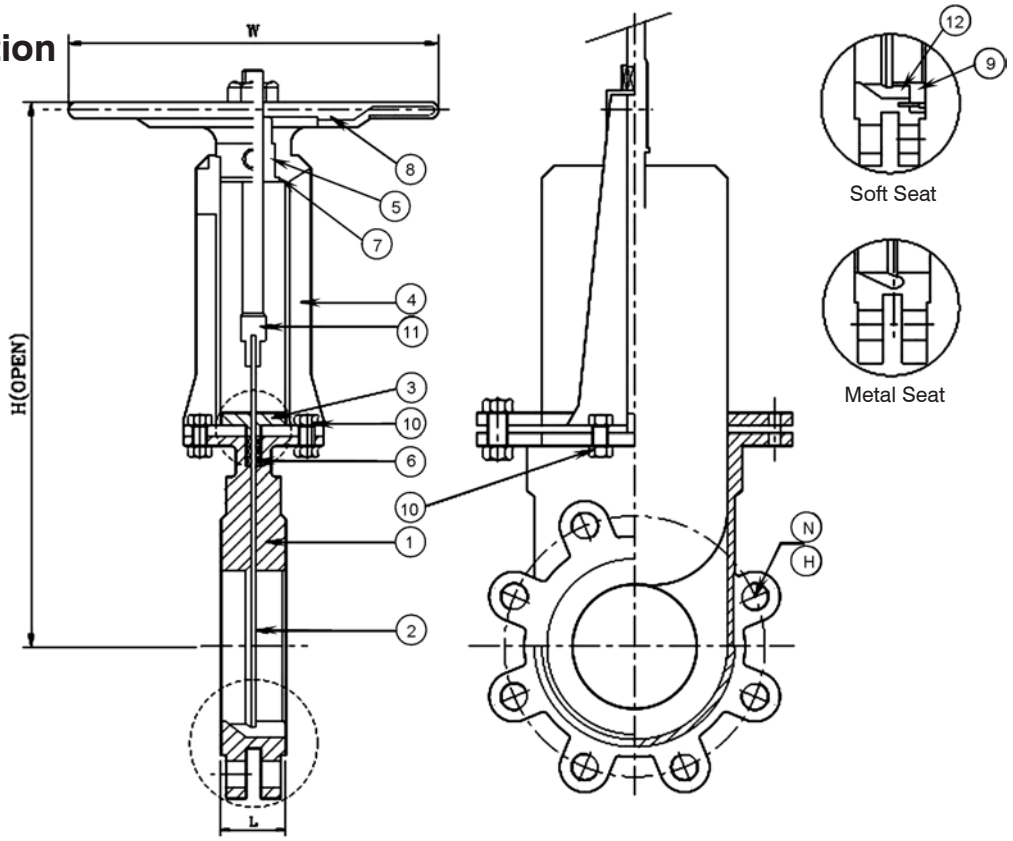
- Bonneted, non-rising stem adapter, deflection cones, positioners, limit switches, solenoids, pneumatic failsafe & shrouds.

Applications

The Valveco Heavy Duty General Purpose Knifegate Valve is designed for a wide range of applications such as:

- Waste Water & Water
- Mining
- Fly Ash Handling Plants
- Bulk Conveying
- Corrosive Environments
- Pulp & Paper
- Food & Beverage
- Chemical Plants

Manual Actuation



Standard Materials

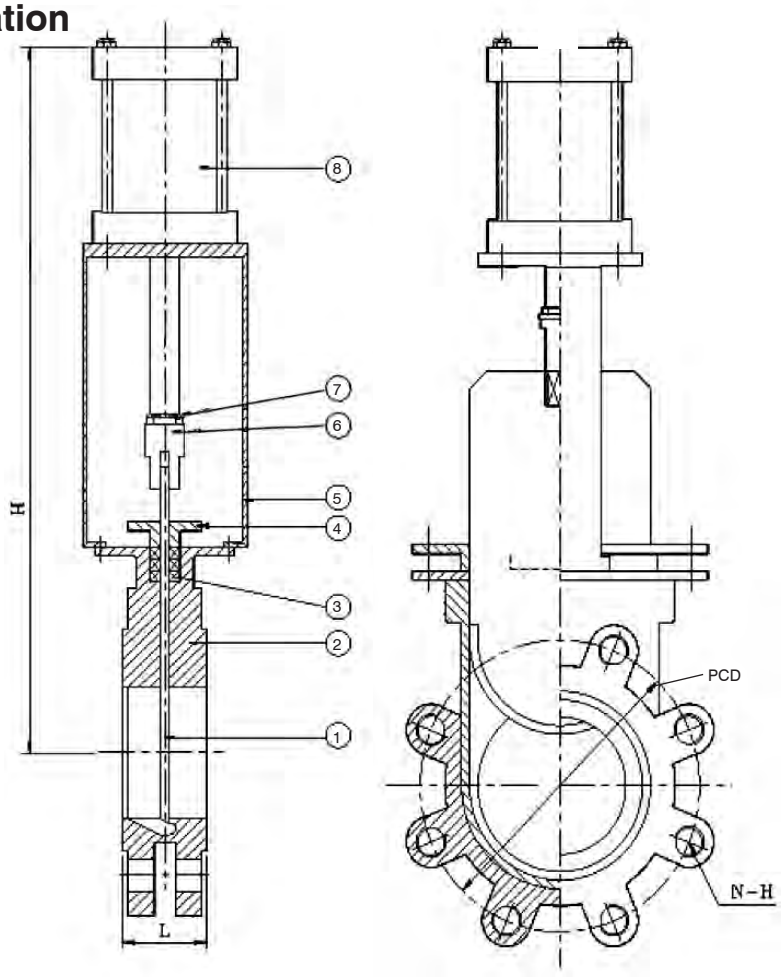
No.	Part Name	Material Code (ASTM)
1	Body	SS304, 316 or 316L (A351-CF8)
2	Gate	SS304, 316 or 316L (A351-CF8)
3	Packing Gland	SS304, 316 or 316L (A351-CF8)
4	Super Structure	SS304, 316 or 316L (A351-CF8)
5	Sleeve	Bronze Casting (C83600)
6	Packing	PTFE Impregnated Braided Fibre
7	Thrust Bearing	2”- 12”: Thrust Plate (Bronze) 14”- 24”: 51112
8	Hand Wheel	Cast Iron
9	Seat Ring	SS304, 316 or 316L (A351-CF8)
10	Fasteners	SS304, 316 or 316L (A351-CF8)
11	Clevis	SS304, 316 or 316L (A351-CF8)
12	Resilient Seat Replaceable Seat	Viton NBR, EPDM, PTFE, Polyamide

Dimensions

Class	Size	In	2	2½	3	4	5	6	8	10	12	14	16	18	20	24
		mm	50	65	80	100	125	150	200	250	300	350	400	450	500	600
10 Bar & 150lb	L mm		48	51	51	51	57	57	70	70	76	76	89	89	114	114
	H mm		350	410	440	520	595	660	880	1025	1190	1355	1530	1690	1880	2200
	PCD mm		114	127	146	178	210	235	292	356	406	470	521	584	641	756
	W mm		200	200	200	225	250	250	280	350	400	400	450	450	600	600
	N-H		4-M16	4-M16	4-M16	4-M16	8-M16	8-M16	8-M16	8-M20	12-M20	12-M24	12-M24	12-M24	16-M24	16-M27
	Weight (kg)		9.5	12	13	16	19	22	34	53	65	90	145	180	227	282

*other flange drilling available

Pneumatic Actuation



Standard Materials

No.	Part Name	Material Code (ASTM)
1	Body	SS304, 316 or 316L (A351-CF8)
2	Gate	SS304, 316 or 316L (A351-CF8)
3	Packing	PTFE Impregnated Braided Fibre
4	Packing Gland	SS304, 316 or 316L (A351-CF8)
5	Super Structure	SS304, 316 or 316L (A351-CF8)
6	Clevis	SS304
7	Piston Rod	SS304
8	Cylinder	Aluminium or Fibreglass

Dimensions

Class	Size	In	2	2½	3	4	5	6	8	10	12	14	16	18	20	24
		mm	50	65	80	100	125	150	200	250	300	350	400	450	500	600
10 Bar & 150lb	L mm		48	51	51	51	57	57	70	70	76	76	89	89	114	114
	H mm		500	561	574	675	750	815	966	1181	1340	1448	1648	1834	2020	2120
	PCD mm		114	127	146	178	210	235	292	356	406	470	521	584	641	756
	N-H		4-M16	4-M16	4-M16	4-M16	8-M16	8-M16	8-M16	8-M20	12-M20	12-M24	12-M24	12-M24	16-M24	16-M27
	Weight (kg)		11	13	15	21	25	31	58	103	137	158	172	202	256	494

*other flange drilling available

Note
The designs, materials, dimensions and specifications shown are subject to change without notice due to our continuing program of product development. Please request a certified drawing if dimensions are critical.

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VALVECO KNIFE GATE VALVES.
INSTALLATION & MAINTENANCE INSTRUCTIONS

DESCRIPTION

The Valveco Knife Gate Valve, 50mm to 600mm are bonnetless valves with a stainless steel body and gate, and an all-metal or resilient-faces seat. A choice of several actuators and accessories is available.

INSTALLATION

- Before installation, remove foreign material such as weld spatter, oil, grease and dirt from the valve and pipeline.
- Install the valve between mating pipeline flanges
- Check valve flange drilling metric / imperial tapping.
- Flange gaskets are required.
- Install the valve so that the side marked "*seat*" is on the lower pressure side of the valve when the valve is closed; the pipeline pressure will then help seal the valve in the closed position:

NOTE: This may be opposite to the main flow in some applications.

Observe the following points to prevent distortion of the valve body and gate when the flange bolts are tightened:

- Align the mating pipeline flanges.
- Select the length of the flange bolts so that the bolts used in the blind holes near the chest are of the valve do not bottom out when tightened.
- We recommend stud bolts and nuts. Use anti-seize or grease on the stud bolts. Never use dry stainless steel nuts and bolts.
- Tighten the flange bolts evenly, in a crisscross pattern.

OPERATION

The gate in the valve is positioned by the valve actuator. The actuator moves the gate over the valve seat in the closed position, and withdraws the gate from the seat in the throttling and open positions.

LUBRICATION

The valve does not require lubrication.

PACKING ADJUSTMENT

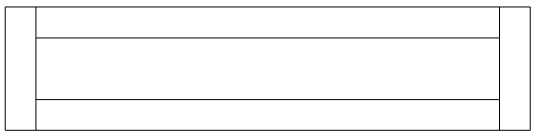
The gate packing is contained and compressed by the packing gland. If packing leakage occurs, tighten the adjustment nuts on top of the packing gland. Tighten the nuts evenly and gently-just enough to stop the leakage. Over tightening, will cause excessive operating forces, and will decrease the life of the packing.

PACKING REPLACEMENT

1. Relieve the pressure in the pipeline
2. Close the valve.
3. Disconnect and lock out pneumatic, hydraulic or electrical power to the actuator too prevent accidental operation.
4. Remove the Actuator.
5. Remove the gland bolts and gland follower.
6. Using a packing extractor remove the old packing.
7. Inspect the gate, seat and packing chamber, for damage or burrs.

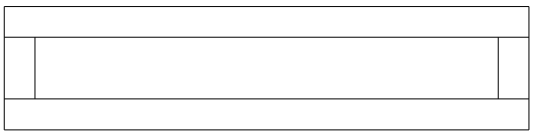
We recommend the Brick method of packing. This overcomes the problem of leakage at the corners where the packing raps around the square edge of the gate.

8. Cut the new packing to length.
9. Push the first row of packing into place using a pin punch or similar, and ensuring that the gate stays flat on the seat.

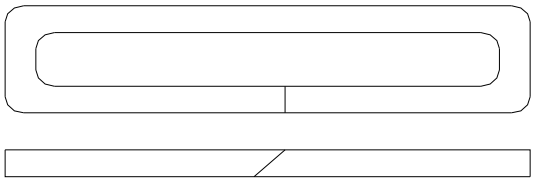


Do not use force. Gently push the packing into place if excessive force is used it will remove any resilience from the packing making a seal impossible.

10. The second row overlaps the first.



11. Cut the final row long enough to rap all the way around the gate. Cut the packing on 45 degrees so that it overlaps.



12. Replace the gland following and bolts.

DO NOT OVER-TIGHTEN THE BOLTS.
Use anti-seize or grease on the bolts. Never use dry stainless steel nuts and bolts.

13. Replace the actuator.

14. Pressure the line and adjust the gland bolts only enough to stop the leaks.

Section 9: SS316 Ball Valve Data Sheet + IOM

Operation Instruction

The Safe Factors for Designation

1. Lock Device, Stop Pin: for fixing the handle lever
2. Stem up side down put into body: for the function of Blow-out proof on body
3. Stem: with Anti-static function
4. Valve: The valve of body with fire-safe device

Operation Manual

Name of the Manufacturer: Valve-tek MFG. CO., LTD.

Address of the Manufacturer: 105, Cheng Kuang Str.,Taiping,,
Taichung, Taiwan. R.O.C.

Year of manufacture:_____

Type:_____

Normally, all pressure equipment is placed on the market. It must be accompanied with instructions for the user. The instructions, containing **all the related safety information**, are divided into three sections: storage & protection, installation & operation and routine maintenance.

1. Storage & Protection

1.1. Storage

The valves are already packed carefully to avoid any possible damage before the delivery. Before installation, please do not open the package, for once the valves are exposed in the air, sand or other substance might go into the valves. Then, unless the user cleans out the valves, there will be problems of using them. Store the valves, pack them carefully so as to prevent any corrosion gas from going into the valves. Meanwhile, be sure not to press the valves heavily or toss them.

1.2. Protection

The complete valve is packed with the bag, carton and wood case outside (for size up to 2") but for those over 2-1/2", extra plastic jackets will be put on the flange and bags are used finally to hold the pieces.

2. Installation

2.1.Warning Precautions

Make sure the valve pressure can fulfill the requirement of the pipe equipment. The valves have our marking on them with the details for the size, pressure, year of manufacture, material, CE marking, notify party number, our logo (the size is from 1-1/4" to 4" for thread end, and 1-1/4" to 6" for flanged end)

Tests and inspections of the open and close are necessary to see whether the ball is in the correct position or there is any trouble for the open/close. The material of carbon steel always comes with rust. Please make sure the rust will not affect the connection of the pipe. Besides, deflate the pipe. The fluid inside the pipe when at high temperature will cause inflation of the pipe and therefore stress. Then, the value of the inflation needs to be carefully calculated, otherwise, the stress will exist in the pipe and the valve as well. But when the fluid is at low temperature, the whole situation will be different. Notice that if the pipe shortens, something should be done to compensate for it. Make sure all the changes of the pipe will not affect the function of the valve.

2.2. Installation Procedures

A) Before installation, wash the valve with compress air or clean water to de-burr it and brush out the dirt. Also, the pipe needs to be washed.

B) Proper space needs to be reserved in the valve for the handle lever, because the length of lever is longer than that of the valve, and its turning is 90 degree.

Thread end valve installation.

Make sure the thread valve matches the pipe thread. The thread is in standard size and tolerance. Remember that the painting, lubrication or the connection sealing grease could only be put on the male thread rather than into the body thread. Otherwise, the grease will go into the seats or other parts. Problems will immediately show up. Usually the use of the correct size plane spanner could reduce the damage or slant of the valve; meanwhile, when used, the spanner needs to be near the valve of the pipe, to reduce the possibility of the damage of the valve body.

The Socket weld end installation (for 3-pc ball valve)

Users could ask the manufacturer to weld a 3" pipe for valve size up to 2". This action of welding the short pipe will not affect the body and seats. The following process shows after disassembling of the body and cap how to put the welding of the cap into the pipe goes.

*Users can follow the torque by table 1 “Torque of the bolt table” to disassembling of the body and cap

*To cut the pipe end on the right side. The diameter should be round. Remove all burrs.

*Get the de-grease medicine to clean the pipe end and the inside of the socket pipe and erase all the oil, grease and other sorts of substance

*Put the pipe into the socket end. The space is indicated in Drawing 1-1.
The pipe end needs to touch the inside, the shoulder of the valve, then pull it to 1/16”, or users could use the movable ring to separate it. Then, make the point of weld.

*Before heating make sure disassembling of the body and cap to avoid the damaging of seat. For heating, users just need to put the pipe into the socked end. After cooling follow the torque by table 1 to assembling of the body and cap.

*The pre-heating welding temperature ranges from 204 degree C to 260 degree C.

*When the first welding finished, prior to second line welding, clean and remove the scar. If the scar exists in heating, it will cause changes to the valve or make the valve function abnormally.

*Changes of color after welding could be removed by steel wire.

The Butt weld end ball valve (for 3-pc ball valve)

Users could ask the manufacturer to weld a 3” pipe for valve size up to 2”. This action of welding the short pipe will not affect the body and seats. The following process shows after disassembling of the body and cap how to put the welding of the cap into the pipe goes.

* Users can follow the torque by table 1 “Torque of the bolt table” to disassembling of the body and cap

*Machine the pipe end, prepare the welding, and remove all burr.

*Get the de-grease medicine to clean the pipe end and the inside of the socket pipe and clean all the oil, grease and other substance.

*Separate the connection (as Drawing 1.2 indicates), use the fixture, let the center be in one line, and fix the welding position.

*Before heating make sure disassembling of the body and cap to avoid the damaging of seat. For heating, users just need to put the pipe and butt end together. After cooling follow the torque by table 1 to assembling of the body and cap.

*The pre-heating welding temperature ranges from 204 degree C to 260 degree C.

*When the first welding finished, prior to second line welding, the scar needs to be cleaned and removed. If the scar exists in heating, it will cause changes to the valve or make the valve function abnormally.

*Changes of color after welding could be removed by steel wire.

*After welding, non-destroy testing should be performed to prove that this welding has been done perfectly.

The flanged end ball valve.

To install the raise face flange end, turn two end diameter nuts (opposite) of the flanged end firstly, and do the same number of turning until all the nuts are finished. Use hands to tighten the spanner from 1 or 3 or 4 turning to the nuts, and then do the same number of turning to tighten every nut. Please refer to our Exhibit 1-3. This procedure repeats for several times till the degree of the tightening meets your request. The raise face will have the equal stress, please reduce the leakage of the sealing.

3. Operation & Routing Maintenance

3.1. Operation

*The Max. temperature for our ball valve with the PTFE, RTFE is 180 degree C. The minimum temperature is –23 degree C (Only for water, other liquids refer to Hazard Analysis Instruction.) but the pressure has to match the pressure and temperature shown in the chart of our catalogue-Valve-tek. The principle is that high temperature goes with low pressure. Remember that different temperature goes with different pressure.

*The Max. pressure is indicated on the body of the valve. Please make sure the pressure meets the requirement of your equipment.

*As for the fluid like the Nitrating Acid (H2SO4), our valve can not be used in this kind of dangerous fluid.

*For corrosion, only fluids recommended by the listing attached can be used.

The material for Stainless steel 316 and 304 of austenitic steel should be kept away from the

over high temperature. Otherwise, it will cause the extension, changes of the components, and the leakage in the body and seats and seals.

* When the valve is used at high temperature or under high pressure, the proper protection equipment, for example anti-heating gloves, is highly suggested. Do not touch the valve directly.

* Do not use the extensible lever for opening/closing the valve.

* Any unsuitable operation action will cause the leaking or other problems. If that happens, the first step is to turn off the pipe fluid and valve. Then, disassemble the valve.

3.2.Rountine Maintenance

*Clean the valve after using it for a period of time. The user should take it off from the pipe or
equipment. If corrosion happens, the valve will change its dimension and the broken of the Teflon
will be caused. Such being the case, a new valve is suggested to replace the old one.

*Our valve is designed according to the ANSI B16.34 or EN12516-1 without the wall thickness corrosion allowance. The user needs to check the wall thickness by himself.
Please refer to the list of fluids in Hazard Analysis Instruction, which can/can not be used for our valves (suitable only)
a. Fluid analysis against PTFE
b. Fluid analysis against 316

*Please make a regular time for inspection in dimension and open/close function.

*Check the stem gland nut. Be sure the nut has to be tightened, but can not be put overhead. To avoid this, the user could turn the ball.
Otherwise, if the user tightens it overhead, he should replace the seals and stem packing. If so, he needs to take the nut off from the equipment or the pipe for the replacement of this complete valve with new seals and stem packing. The following are the ways we offer for replacement.

* What follows is for seals (for 3-pc ball valve)

****Ball seats and seals.**

De-assemble the body and caps. Firstly, take off four nuts and bolts, take out the old seats and seals and replace them with new seats and seals. Then put on the bolts and nuts and tighten them. Its pressure and leakage should be double-checked.

****Stem packing and stem seals.**

Take off the valve from the equipment or pipe, and de-assemble the body and caps. Take off the handle, four bolts, nuts, hex nut, ball and stem, stem packing and seals. Replace them with new sets. The procedure is the same as what is mentioned above. Put on the stem, balls and tighten the hexagon nuts. The ball position needs to be closed. Then tighten the four bolts and nuts (please refer to our Table 2 for the value of the tightening), and finally tighten the handle. Also, pressure testing for the valve assembled should be performed.

Enclose:

Table 1. Temperature/Pressure Curve

Table 2. Torque Bolt & Gland Nut

Exhibit 1-1~1-3 But weld end & socket weld location, order for tighten the nut of the Raise Face

Table 1

3-PC ball valve

Torque of the bolt table (Min. tighten torque)

SIZE	TORQUE (KGF-CM)
1/4”	40
3/8”	40
1/2”	60
3/4”	80
1”	100
1-1/4”	120
1-1/2”	140
2”	160
2-1/2”	250
3”	300
4”	400

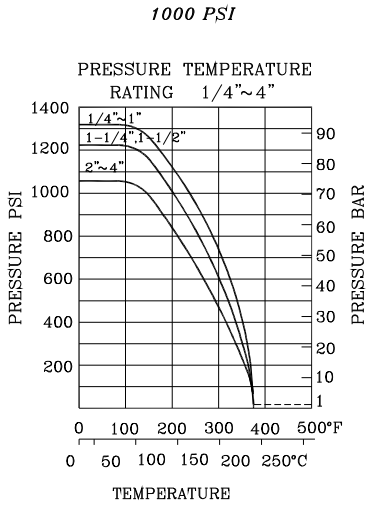
3-PC BALL VALVE

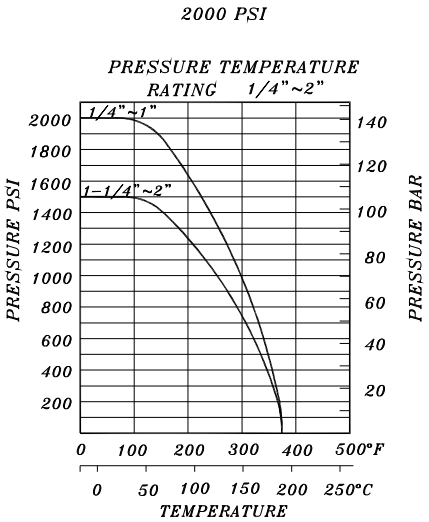
Torque of the gland nut (Min. tighten torque)

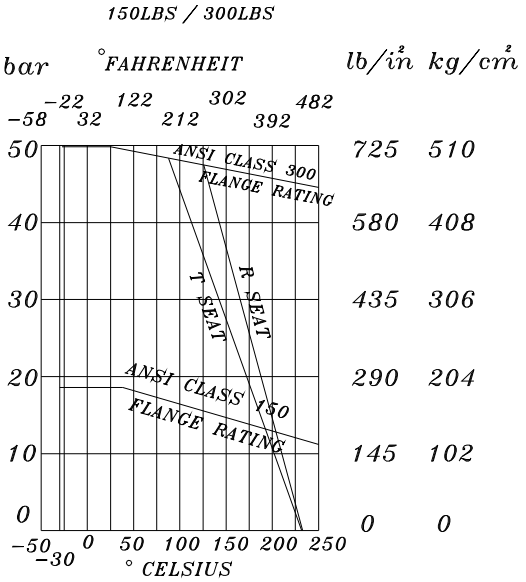
SIZE	TORQUE (KGF-CM)
1/4”	75
3/8”	100
1/2”	120
3/4”	140
1”	150
1-1/4”	170
1-1/2”	180
2”	200
2-1/2”	260
3”	380
4”	500

TABLE 2

Pressure Temperature Chart
For 1000PSI/2000PSI/150LBS/300LBS Ball Valves







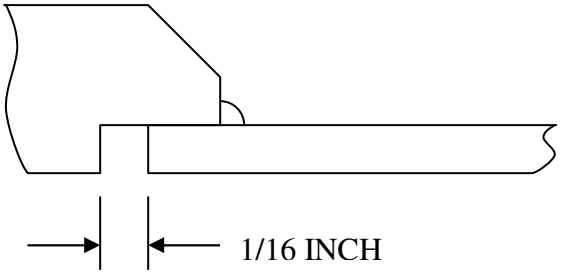


Exhibit 1-1 SOCKET WELD LOCATION

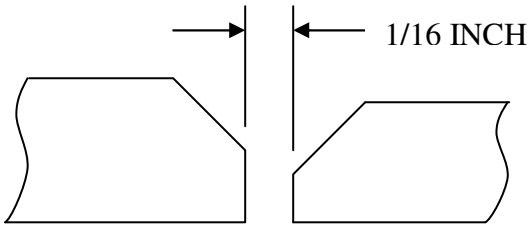


Exhibit 1-2 BUTT WELD LOCATION

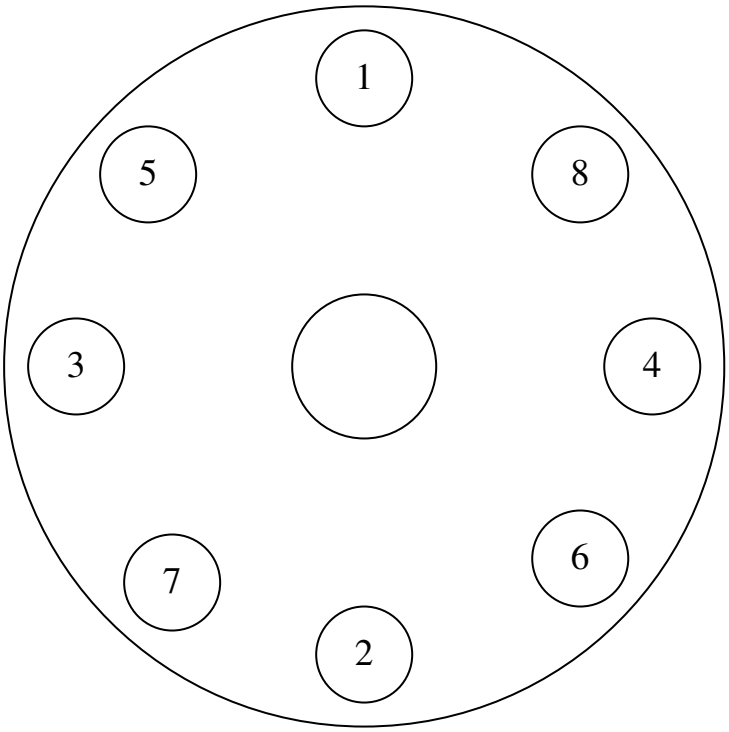
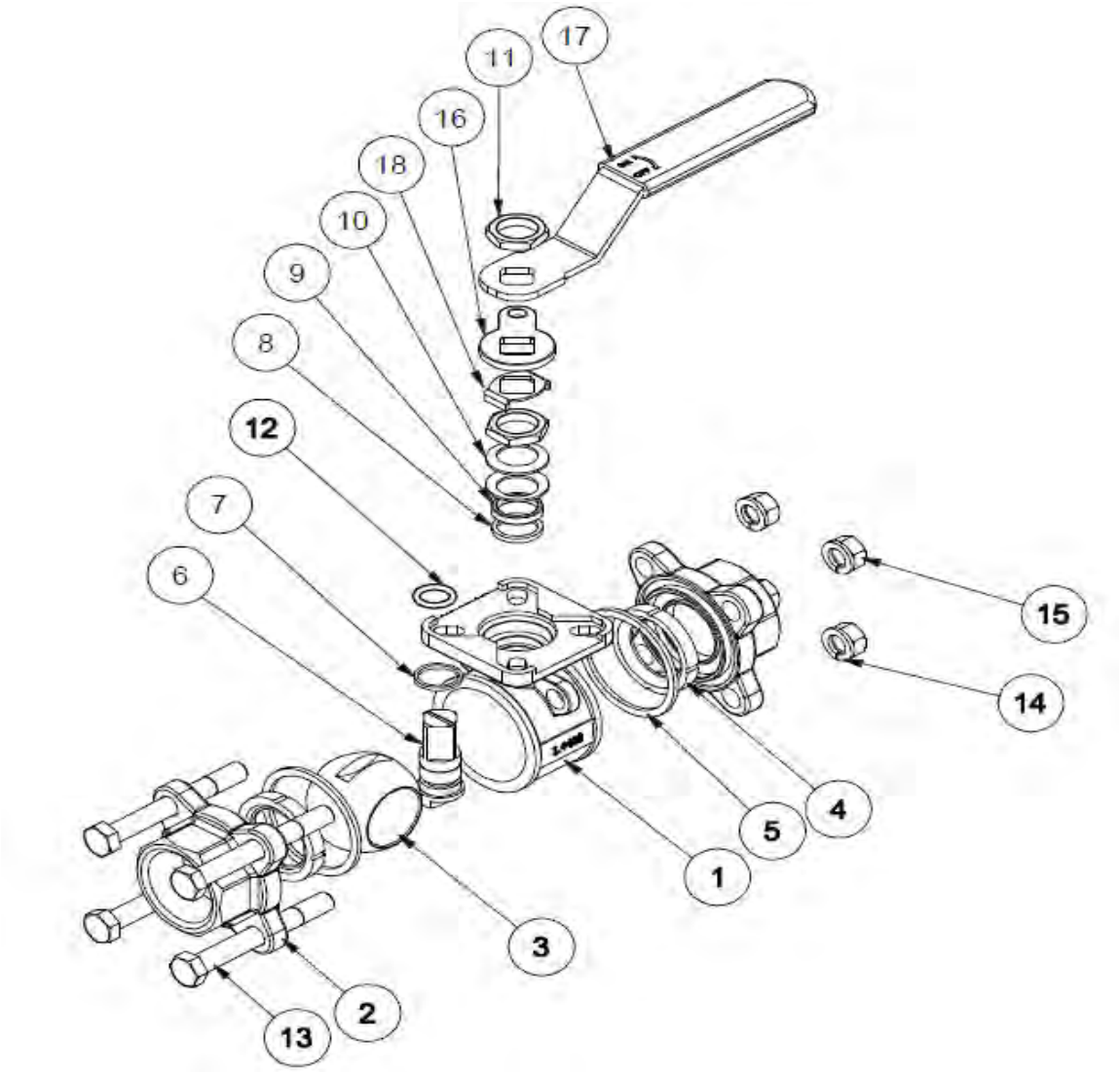


Exhibit 1-3 ORDER FOR TIGHTEN THE NUT OF THE RAISE FACE

TABLE 3:



NO:	名稱	數量	材料
1	BODY	1	CF8M
2	CAP	2	CF8M
3	BALL	1	CF8M
4	BALL SEAT	2	15% R-PTFE
5	JOINT GASKET	2	PTFE
6	STEM	1	AISI 316
7	THRUST WASHER	1	PTFE
8	STEM PACKING	2	PTFE
9	HIGH WASHER	1	AISI 304
10	BELLEVILLE WASHER	2	AISI 301
11	STEM NUT	2	AISI 304
12	O-RING	1	VITON
13	BOLT	4-6	AISI 304
14	SPRING WASHER	4-6	AISI 304
15	HEX NUT	4-6	AISI 304
16	STOPPER	1	AISI 304
17	HANDLE	1	AISI 304
18	LOCK WASHER	1	AISI 304

Analyzing Report for Chemical
(TEFLON)

(FLUID)

(FLUID)	(Max Temp℃)	(FLUID)	(Max Temp℃)
CH3CH0	180	CH3CONH2	180
C6H5COCH3	180	CH3COCH3	180
HC-CH	120	CH3COCL	90
H2C:CHCN	180	H2C:CHCOOH	90
CHCO2C2H5	150	COOH(CH2)4COOH	180
5%AKTIV CL2	90	12%AKTIV CL2	90
C36H74	120	CH2=CHCH2OH	120
CH2CHCH2CL	180	ALF3	120
AI(C2H4O2)3	180	ALNH4(SO4)2.12H12O	120
ALO3.3HO	120	ALK(SO4)2.12H2O	200
ALCL3	120	AL(NO3)3.9H2O	120
AL2(SO4)3	120	Amerikansk olie	175
NH3	200	NH4OH	200
NH4(C2H3O2)	200	CH2O3.2H3N	200
NH4F	200	NH3H3PO4	200
NH4HF2	200	(NH4)HS	200
NH4OH	200	NH4CL	200
NH4NO3	200	(NH4)S2O8	90
(NH4)SO4	200	(NH4)2S	175
CH3COOC5H11	40	C5H11OH	200
C6H5NH2	90	CIHHNO3	90
ARGON AR	175	H3ASO4.H2O	200
ASFAIT	175	BACO3	200

ANNEX:1

Analyzing Report for Chemical
(TEFLON)

(FLUID)

(FLUID)	(Max Temp℃)	(FLUID)	(Max Temp℃)
BA(OH)3	200	BACL2.2H2O	200
BA(NO3)2	120	BASO4	200
BAS	200	C6H5	120
BENZIN	90	C6H5COOH	175
BITUMEN	175	BLOD	90
PBCL2	150	CUSO.5H2O	120
BOMULDSFROLIE	200	NA2B4O7.10H2O	150
BRINE H2	150	HBR	120
H2C:CHHC:CH2	175	C4H10	175
CH3(CH2)2CH2OH	150	CH3CH2CH2COOH	150
CH3CH:CHCH3	200	CH3COOCH(CH3)(C2H5)	75
CH3(CH2)2CH2OH	150	CH3CH:CHCH3	200
CA(HSO3)2	175	CACO3	175
CA(HS)2Y6H2O	90	CA(OH)2	120
CA(CLD3).2H2O	175	CACL2	175
CA(NO3)2	90	CASO4	90
C10H16O	175	CARBTOL	90
CO2	200	CS2	90
CO	200	CCL4	175
CASTOROLIE	175	C4h10o2	90
H2CRO4	175	C6H8O7	90
COLLAGEN	150	COREOSOT	175
CH3C6H4OH	90	C7H8O	175

ANNEX:1

Analyzing Report for Chemical
(TEFLON)

(FLUID)

(FLUID)	(Max Temp℃)	(FLUID)	(Max Temp℃)
CH3CH:CHCHO	90	C6H5CH(CH3)2	150
CUSO4.5H2O	120	CUCL	175
C6H12	150	C6H11OH	120
C6H10O	90	C10H18	200
CH3(CH2)6COOH	175	STIVELSE	90
C6H12O6	200	CH3COCH2(CH3)2OH	175
BRCH2CH2BR	175	C6H4(COOC4H9)2	175
O(CH2COOH)2	120	C4H10NH	90
C6H4(CH3)2	175	C2H4CL2	175
NA2HPO4	200	HCON(CH3)2	120
C6H4(COOC8H17)2	90	N2O	200
C12H10YC12H10O	100	CH3(CH2)10COOH	150
CH3COOH	180	C6H12O6	200
(CH3CO)2O	180	CH3CO2CH3	150
CH3COOC2H5	90	CH3COCH2COOC2H5	90
CH2CHCOOC2H5	175	C2H5OH	150
C6H5C2H5	175	BrCH2CH2BR	175
C2H4CL2	175	CLCH2CH2OH	90
CLCH2CH2CL	175	CH2CH2O	200
(C2H5)2O	120	C2H5CL	175
HC−CH	120	R-COOH	200
C6H5NHNH2	20	Fe(OH)3	200

ANNEX:1

Analyzing Report for Chemical
(TEFLON)

(FLUID)

(FLUID)	(Max Temp℃)	(FLUID)	(Max Temp℃)
Fecl3	200	Fe(NO3)3 . 9H2O	200
Fe(SO4)3	90	Fe(OH)2	200
FeCl2	200	Fe(NO3)2	200
FeSO4	200	VANDfri HF	120
HBF4	175	H2SiF6	150
HF	150	P	150
HCHO	150	PCL3	150
P	150	C2CL3F3	150
H3PO4	150	CHCL2F	150
CCL3F	150	C4H3OCHO	150
C2CL2F4	150	C76H52O46	120
C6H12O6	150	CaSO4 . 2H2O	175
C6H2(OH)3CO2H	150	NAso4	200
CaSO4	90	C6h12o6 . H2O	200
NaSO4 . 10H2O	90	C3H5(OH)3	200
C12h22o11	200	HOCH2CH2O24H9	90
C3H5(OH)	200	(C2H8OSI)x	90
OHCH2CH2OH	150	CH3(CH2)14COOH	150
OHCH2COOH	90	C7H16	150

ANNEX:1

Analyzing Report for Chemical
(TEFLON)

(FLUID)

(FLUID)	(Max Temp℃)	(FLUID)	(Max Temp℃)
CH3(CH2)14COOH	150	COOH(CH2)4COOH	180
CH3(CH2)4CH2OH	150	H2NNH2	120
H2SiF6	150	H2	150
HCN	150	HCN	120
Vandfrl HF	120	H2O2	150
H2H2	150	C6H4(OH)2	150
HOCL	150	O2	200
I2	90	(CH3)2CHCH3	60
(CH3)2CHCH2OH	150	(CH3)3CCH2 CH(CH3)2	150
CH3COCOCH(CH3)2	90	(CH3)2CHOH	150
C6H5CH(CH3)2	150	(CH3)2CHOCH(CH3)2	60
CH3CHCLCH3	90	FeSO4	200
FeSO4	200	KCN	200
KOH	200	ALK(SO4)2 . 12H2O	200
KNO3	200	KbrO3	200
KHSO4	200	ALK(H2SO4)2	200
ALK(SO4)2 . 12H2O	200	KHSO4	200
KbrO3	200	Kbr	200
K2CrO4	200	KCN	200
K2Cr2O7	200	K3Fe(CN)6	200
K3Fe(CN)6 . 3H2O	200	KF	200
KH2CO3	200	KOH	175

KCIO	200	KI	200
K2CO3	200	KCLO3(vandig)	200

ANNEX:1

Analyzing Report for Chemical
(TEFLON)

(FLUID)

(FLUID)	(Max Temp℃)	(FLUID)	(Max Temp℃)
KCL	200	KNO3	200
KCLO4	90	KMnO4	200
KMnO4	200	K2S2O8	200
K2SO4	90	K2S	150
K2SO3．2H2O	150	K2B4O7．8H2O	200
K5P3O10	150	C10H16O	175
KOH	175	NaOH	175
(C2H6OSI)x	90	SiO．nH2O	200
C6H5CL	90	CH2CLCOOH	90
CH3CL	120	CHCL3	90
CLSO2OH	90	HCLO．7H2O	60
KCLO．7H2O	60	CuSO4．5H2O	120
Cu(C2H3O2)2．H2O	175	CuCO3	175
Cu(CN)2	175	CuCL2	175
CIHHNO3	90	CaCO3	175
CS2	90	CO	200

CH2O3．2H3N	200	MgCO2	105
CO2	200	H2CO3	175
Hg	150	HgCL2	150
(C2H6OSI)x	90	N2O	200
CH3(CH2)10COOH	150	C12H25CL	150
CHCH2CH:CH(CH2)7COOH	150	LiBr	150
NaCH	175	Ca(OH)2	120
MgCO2	105	MgHC6H5O7．5H2O	150

ANNEX:1

Analyzing Report for Chemical
(TEFLON)

(FLUID)

(FLUID)	(Max Temp℃)	(FLUID)	(Max Temp℃)
Mg(OH)2	150	MgCL2	200
Mg(NO3)2．2H2O	150	MgSO4．7H2O	150
HOOCCH:CHCOOH	120	MnSO4．4H2O	150
Hg(CN)2	150	HgCL2	150
HgNO3．2H2O	150	HgSO4	150
CH4	150	CH3OH	150
CH3CO2CH3	150	CH2NH2	150
CH3Br	150	CH2Br3	120
CH2I2	120	CH2CL2	120

CH3COC2H5	90	(CH3)2CHCH2CH (CH3)OH	90
(CH3)2CHCH2 COCH3	90	CH3COCH(CH3)2	65
CH3CL	120	C5H8O2	65
(CH3)2SO4	20	CH3CCL	90
CHCO2C2H5	150	CH3OH	150
CH2CLCOOH	90	HOCH2CH2NH2	40
C6H5CL	90	C4H8ONH	90
HCOOH	150	CH3CHOHCOOH	150
C10H8	120	C5H11CL	200
NaC2H3O2	200	NaALO2	150
C6H5COONa	150	Na2B4O7 . 10H2O	150
NaBr	150	Nacio3	175
NaCLO2	90	NaCH	175
Na3Fe(CN)6 . H2O	175	Na2Cr2O7 . 2H2O	150

ANNEX:1

Analyzing Report for Chemical
(TEFLON)

(FLUID)

(FLUID)	(Max Temp℃)	(FLUID)	(Max Temp℃)
NaCHCO3	200	NaHSO3	200
NaCL	175	NaOCL . 5H2O	175
NaNO2	200	NaNO3	200
NaBO2 . H2O2 . 3H2O	175	CH3(CH2)14COONa	175
Na2O2	120	NaCLO4	175
Na2S	175	Na2SO4	200

Na2B4O7 . 10H2O	150	Na2SO3	175
NaCO3	200	Na2S2O3 . 5H2O	175
NaOH	175	NaHCO3	200
C4H9CL	200	C4H9OC4H9	175
C6H14	150	Ni(OOC2H3)2 . 4H2O	150
NiSO4 . (NH4)2SO4 . 6H2O	120	NiCL2	200
Ni(NO3)2 . 6H2O	200	NiSO4	200
C6H5NO2	200	N2	150
CH2NO3CHNO3CH2NO3	20	CH8H18	200
CH3(CH2)3CH3	40	CH3CH2CH2Br	150
C3H7NO3	90	CH3(CH2)5COOH	175
CH3(CH2)7CH:CH(CH2)7COOH	120	Xh2so4yYso3	65
HOOCCOOH	150	CH2CH2O	200
O2	200	O3	150
CH3(CH2)14COOH	150	CH3(CH2)14COOH	150
C36H74	120	C5H11OH	200

ANNEX:1

Analyzing Report for Chemical
(TEFLON)

(FLUID)

(FLUID)	(Max Tem℃)	(FLUID)	(Max Tem℃)
CL2C:CCL2	175	*HCLO4*	120
C36H74	120	*(C4H6O2)x*	175
KOH	200	C3H8	150
CH3CH2CH2OH	170	C3H7OOCCH3	60
C6H3(OH)3	65	CH3CHCH2O	65

C6H4OHCHO	90	CO2H(CH2)2CO2H	90
NH4CL	200	C6H4(OH)(COOH)	150
NH4NO3	200	NH4OH	200
HNO3 10%~70%	120	MgSO4．7H2O	150
HNO3 100%	20	HCL	120
NaCL	175	HNO3	120
MgSO4．7H2O	150	NaCO3	200
HCL	120	NaOH 30%~70%	175
CH3CH2CH2COOH	150	SnCL2	175
NaOH 15%~20%	200	C6H5	120
NaCO3	200	HgCL2	150
CH3(CH2)16COOH	175	C6H12O6	175
(C6H5CHCH2)n	175	SO2	175
CO2H(CH2)2CO2H	90	CS2	90
S	175	H2SO4 70%~100%	90
S2CL2	175	H2SO4 30~60%	120

ANNEX:1

Analyzing Report for Chemical
(TEFLON)

(FLUID)

(FLUID)	(Max Temp ℃)	(FLUID)	(Max Temp℃)
H2SO4	90	H2SO4	90
xH2SO4．Yso3	65	H2SO3	17590

AgCN	170	AgNO3	170
AgSO4	170	C76H52O46	120
C76H52O46	120	PB(C2H5)4	175
C10H12	90	CHCL2CHCL2	200
CCL4	175	C10H12	90
SnCL2	175	CH3C6H5	90
DTE/30	150	(C4H9)3PO4	150
CCL3COOH	90	CHCL:CCL2	90
CHCL3	90	N3PO4 . 12H2O	175
CH2NO3CH NO3CH2NO3	20	O3	150
CH3OH	150	(C6H5CHCH2)n	175
H2O	120	CH3COOHCH:CH2	175
HOOC(CHOH) 2COOH	120	C6H4(CH3)2	175
C6H4(CH3)2	175	ZnSO4Y7H2O	200
ZnCL	200	KOH	175
COOHCH2CH2CH (OH)COOH	120	NaOH	175

ANNEX:1

Analyzing Report for Chemical Corrosion

(MATERIAL):S.S316

CANNOT USE CORROSION FLUID

FLUID	FLUID	FLUID	FLUID
C6H5COCH			
Bitumen			
Fecl3			

I2			
CLSO2OH			
S2CL2			
NH4F			
Br2			
Fecl2			
CL			
KC.7H2O			
H2SO4			
C6H5NH2 . HCL			
Hbr			
HF			
CH2CLCOOH			
HgCL2			
AgCL			
SBCL3			
Collagen			
Celatine			
Klorgas			
MgCL2			

ANNEX:2

Valveco

Full Port Ball Valve

Screwed End - 2 Piece

V-2IN Type - Size:1/4”-4”

ANSI Class 150 - Stainless Steel

AISI-316 (EN10213-4 1.4408)(ASTM-A351-CF8M)
AISI-304 (EN10213-4 1.4308)(ASTM-A351-CF8)

Carbon Steel

S-20C (EN10213-2 1.0619)(ASTM-A216-WCB)

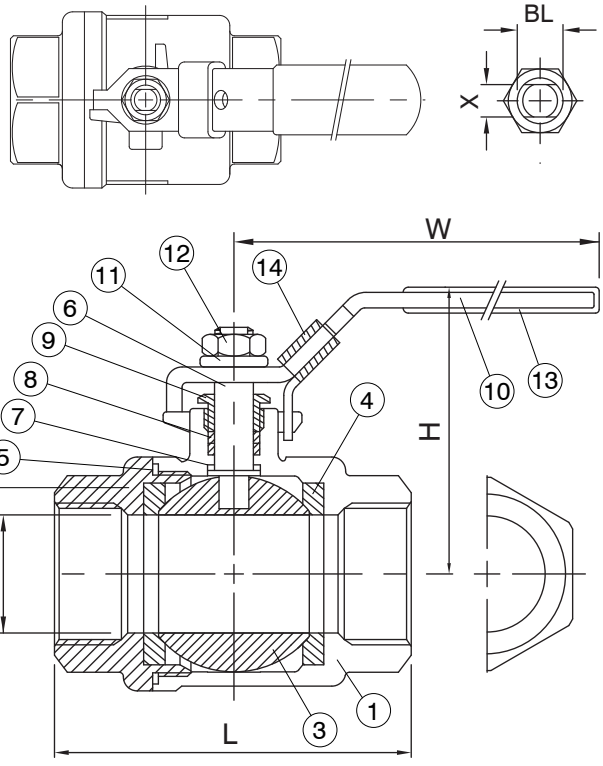
Features:

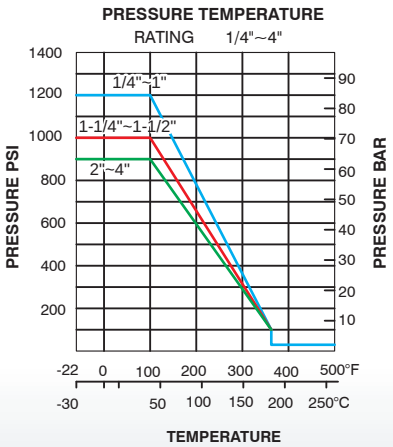
- Pipe Thread in accordance with ANSI B2.1. BS21 1973, DIN 259/2999, ISO 228
- Lug Body
- Blow-out proof stem/Full port
- Investment casting body and cap
- 1000PSI (69Bar) W.O.G.

Option:

Locking Device

No	Name of Parts	Material		
1	Body	ASTM	CF8M	A351
2	CAP	ASTM	CF8M	A351
3	Ball	ASTM	CF8M	A351
4	Ball Seat	R-PTFE		
5	Joint Gasket	PTFE		
6	Stem	AISI 316		
7	Thrust Washer	R-PTFE		
8	Stem Packing	R-PTFE		
9	Gland Nut	AISI 304		
10	Handle	AISI 304		
11	Spring Washer	AISI 304		
12	Stem Nut	AISI 304		
13	Plastic Cover	Plastic		
14	Lock Device	AISI 304		





Size	d	L	H	W	Cv Factor	Torque NM	Kgs
1/4”	11.6	48	48	100	6	4.1	0.18
3/8”	11.6	48	48	100	7	4.1	0.19
1/2”	15	58	52	100	10	4.9	0.26
3/4”	20	65.7	61	127	25	7.3	0.4
1”	25	77	65	127	35	11.4	0.59
1-1/4”	32	90	79	154	80	21.1	1.0
1-1/2”	38	98	83	154	80	21.1	1.32
2”	50	121	97	192	110	26	2.46
2-1/2”	65	145	135	244	310	48.6	4.83
3”	80	166	144	244	360	75.5	7.45
4”	100	240	159	275	820	107.8	17.1

VALVECO

Section 10: ARI Combination Air Valve Data Sheet + IOM

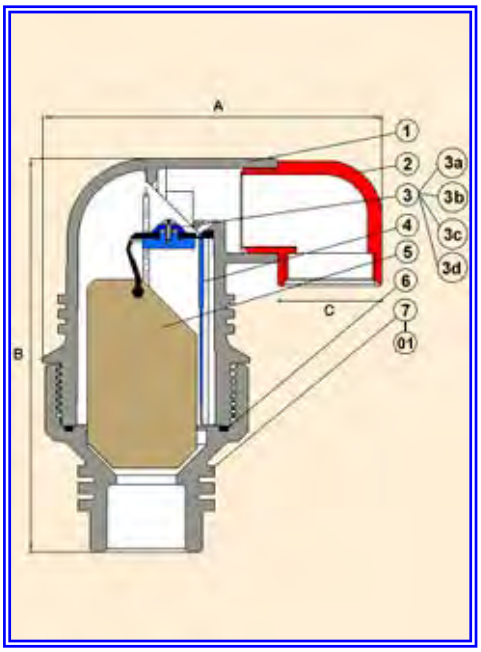
COMBINATION AIR VALVE
BARAK, MODEL D-040
MAINTENANCE INSTRUCTIONS

GENERAL INSTRUCTIONS

1. Routine service is an integral part of the standard procedure for maintenance of a water supply system.
2. Recommended routine maintenance– once or twice a year, according to the quality and kinds of the fluids in the system.

PROCEDURE:

1. Close the service valve under the valve base, before servicing.
2. Turn , release and remove the valve body (1).
3. Check the soundness of the seal plug assembly (3) by washing it with water. Replace the seal assembly in case it is torn.
4. Check and wash the body (1) and the float (5) with clean water. Replace the float if it is damaged.
5. Clean the drainage elbow (2) to remove insects and debris.
6. While you are closing the body of the valve by turning it, be sure that the O-ring (6) is located in its place in the base of the valve (7).
7. Do not forget to open the service valve after the servicing.



PARTS SPECIFICATION

NO.	DESCRIPTION	MATERIAL
1.	BODY	REINFORCED NYLON
2.	DRAINAGE ELBOW	POLYPROPYLENE
3.	SEAL PLUG ASSEMBLY	
4.	CLAMPING STEM	REINFORCED NYLON
5.	FLOAT	FOAMED POLYPROPYLENE
6.	O-RING	BUNA-N
7.	BASE	REINFORCED NYLON/ BRASS

A.R.I FLOW CONTROL ACCESSORIES
KIBBUTZ KFAR CHARUV 12932 WWW.ARIVALVES.COM
TEL. 972-4-6761988 FAX. 972-4-6763402 E.MAIL: ari@ari.co.il

A.R.I. FLOW CONTROL ACCESSORIES Ltd.

D-040 PN 16

Water Supply

D-040-C PN 16

Combination Air Valve

Description

The D-040 Combination Air Valve has the features of both an Air-release valve and an Air/vacuum valve.
The Air-release component of the D-040 was designed to automatically release to the atmosphere small pockets of air as they accumulate along a pipeline when the pipeline or piping system is full and operating under pressure.
The Air/vacuum component was designed to automatically discharge or admit large volumes of air during the filling or draining of a pipeline or piping system. This valve will open to relieve negative pressures whenever water column separation occurs.

Applications

- Pump stations: after the pump and after the check valve
- Downstreem (after) and upstreem (before) shut-off valve
- After deep-well pump
- On long contant slope segments
- At peaks along the pipeline and at peaks relative to hydraulic gradient.
- At dead-ends
- Before water meter
- On strainers and filters

Operation

The air & vacuum component, with the large orifice, discharges air at high flow rates during the filling of the system and admits air into the system at high flow rates during its drainage and at water column seperation.
High velocity air, should not blow the float shut. Water will life the float and cause sealing of the valve.
At any time during system operation, should internal pressure of the system fall below atmospheric pressure, air will re-enter the systems, preventing down-surge and cavitation.
The smooth release of air prevents pressure surges and other destructive phenomena.
Admitting air in response to negative pressure protects the system from destructive vacuum conditions, prevents damage caused by water column separation. Air re-entry is essential to efficiently drain the system.
The automatic small orifice air release component releases entrapped air in the pressurized systems.
Without air valves pockets of accumulated air may cause the following destructive phenomena:
- Obstruction to effective flow and hydraulic conductivity of the system along with a throttling effect similar to a partially closed valve. In extreme cases this will cause complete flow stoppage.
- Accelerate cavitation damages.
- High-pressure surges.
- Accelerate corrosion.
- Danger of a high-energy burst of compressed air.

As the system starts to fill, the valve functions according to the following stages:
1. Entrapped air is released by the valve
2. Liquid enters the valve, lifting the float which draws the "seal plug" to its sealing position.
3. Entrapped air, which accumulates at peaks along the system (where combination air valves should be installed), rises to the top of the valve, which in turn displaces the liquid in the valve's body.
4. The float descends, peeling the "rolling seal", the smaller orifice opens and the accumulated air is released.
5. Liquid penetrates into the valve and the float rises unrolling the rolling seal to its sealing position.

When internal pressure falls below atmospheric pressure (negative pressure):
1. Both orifices will be immediately unplugged and the float drops away.
2. Air is admitted to the system.

Main Features

- Working pressure range: 0.2-16 bar
- Test pressure for the air valve is 1.5 times its working pressure.
- Working temperature: 60^0 C.
- Maximum short-term temperature: 90^0 C.
- Light, simple and reliable structure.
- The valve discharges air at high velocity, without premature closing.
- The automatic air release orifice is very large relative to the size of the air valve body, therefore it discharges air at high flow rates.
- The size of the automatic orifice lessens the danger of its obstruction by debris.
- The rolling seal mechanism of the valve is less sensitive to pressure differential than a direct float seal. It is due to its comparably large orifice and its wide pressure range.
- The body is made of high strength composite materials and all operating parts are made of specially selected, corrosion resistant materials.
- Due to its light weight, the valve may be installed on plastic piping systems, as well as other light weight piping.

EnC-D040WTR-09

Valve Selection

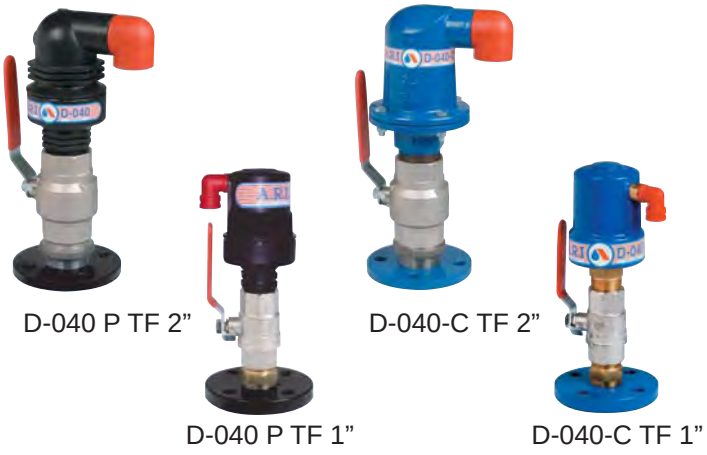
The air valve is available with:
- 3/4", 1", 2" male NPT , BSPT connections.
- a ball valve tap BSPT/NPT male connection upon request.
- one-way device.

D-040-C the body is covered with metal casting as an anti-vandalism application

ACCESSORIES

Ball Valve

Shut-off valve
Made of brass ATSM B-124
Suitable for: D-040 1" 2", D-040-C 1" 2"



Flanges

Made of reinforced nylon / cast iron
Suitable for: D-040 1" 2", D-040-C 1" 2"
Diameter 40/50/60 Internal threads: 3/4" 1" 2"
Diameter 40/50/65 Internal threads: 3/4" 1" 2"
Diameter 50mm Internal threads: 1" 2"
Diameter 80mm Internal threads: 2" 3"
Diameter 100mm Internal threads: 3" 4"

Thermal frotection Jacket

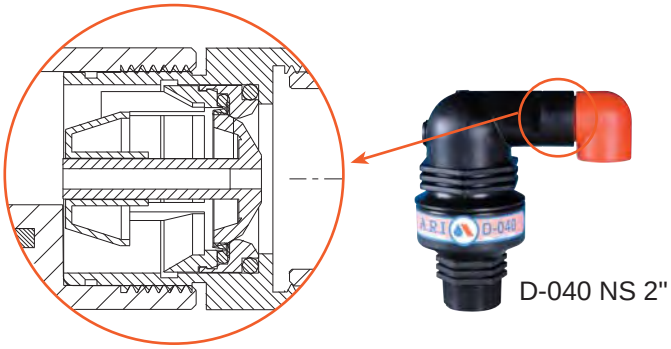
Made of polyurethan

Extension

Available with extended pipe.

One way models

The D-040 air valve is available as:
D040-V -With a vacuum guarding, out-only attachment, which only allows air discharge, not allowing air intake (all models).
D-040-I -With a vacuum breaking, In-only attachment, which only allows air intake, not allowing air discharge (D-040 2" only).
D-040-NS -With a non-slam, discharge-throttling attachment, which allows free air intake, but throttles air discharge (D-040 2" only).



D-040

A.R.I. FLOW CONTROL ACCESSORIES Ltd.


D-040 P 1”

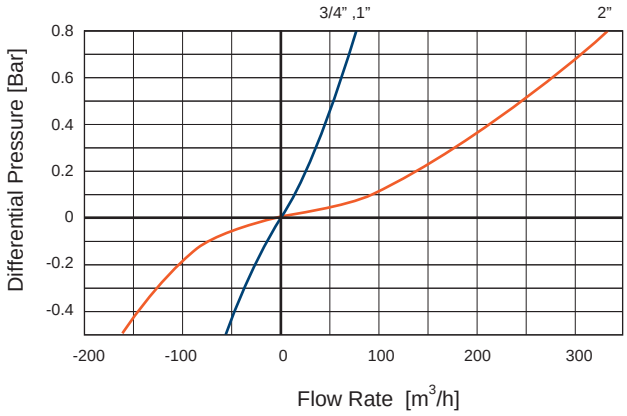

D-040 P 2”


D-040 B 2”

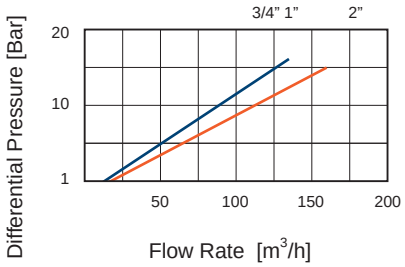

D-040 ST 2”


D-040 ST.ST. 2”

AIR AND VACUUM FLOW RATE

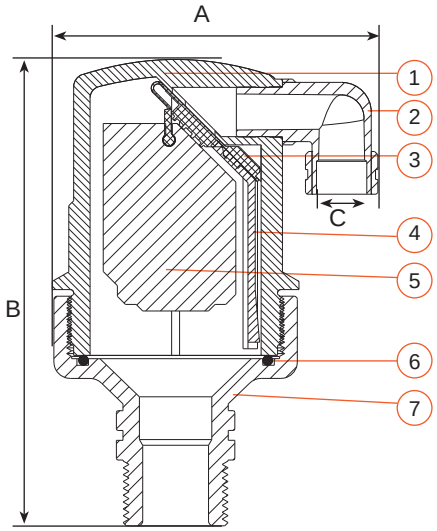


AUTOMATIC AIR RELEASE



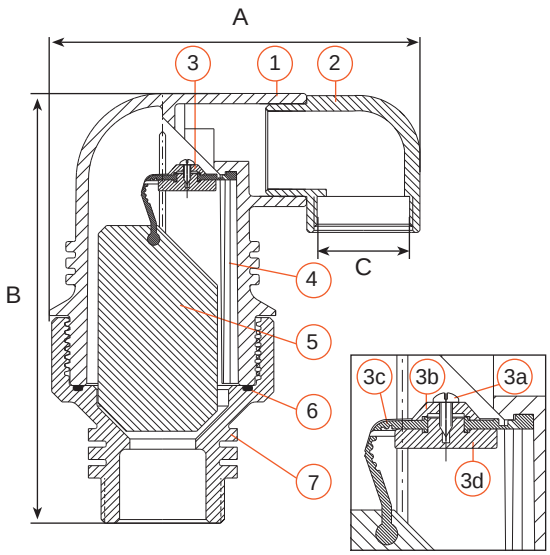
PARTS LIST AND SPECIFICATION

No.	Part	Material D-040 P / B / ST	Material D-040 ST ST
1.	Body	Reinforced Nylon	St.St. SAE 316
2.	Drainage Elbow	Polypropylene	Polypropylene
3.	3/4” 1” Rolling Seal	E.P.D.M.	Viton/BUNA-N/E.P.D.M.
	2” Seal Plug Assembly		
3a.	Screws	Stainless Steel	Stainless Steel
3b.	Plug Cover	Reinforced Nylon	Polypropylene
3c.	Rolling Seal	E.P.D.M.	Viton/BUNA-N/E.P.D.M.
3d.	Plug	Reinforced Nylon	Polypropylene
4.	Clamping Stem	Reinforced Nylon	Polypropylene
5.	Float	Foamed Polypropylene	
6.	O-Ring	BUNA-N	Viton/BUNA-N/E.P.D.M.
7.	Base	Reinforced Nylon / Brass ASTM B124 / St.St. SAE 316	St.St. SAE 316
Optional			
	Ball valve	Brass ASTM-B-124, Nickel plated.	



DIMENSIONS AND WEIGHTS

Model	Dimensions mm A	B	C	Weight Kg.	Orifice Area mm² Auto.	A / V
1”, 3/4”						
D-040 P	100	143	3/8” BSP	0.33	7.8	100
D-040 B	100	143	3/8” BSP	0.70	7.8	100
D-040 ST.	100	143	3/8” BSP	0.65	7.8	100
D-040 ST.ST.	100	143	3/8” BSP	1.40	7.8	100
2”						
D-040-P	180	209	1 1/2” BSP	1.1	12	804
D-040-B	180	209	1 1/2” BSP	1.8	12	804
D-040-ST.	180	209	1 1/2” BSP	2.1	12	804
D-040 ST.ST.	180	209	1 1/2” BSP	3.1	12	804



D-040-C

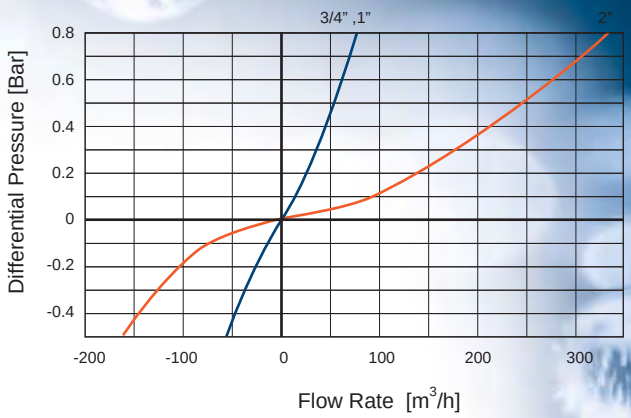
A.R.I. FLOW CONTROL ACCESSORIES Ltd.


D-040-C 1”

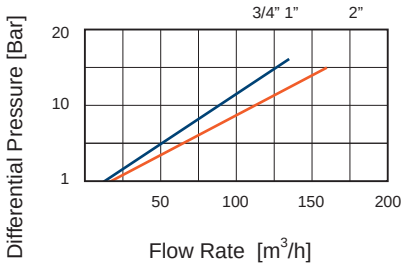

D-040-C 2”


D-040-C F 2”

AIR AND VACUUM FLOW RATE



AUTOMATIC AIR RELEASE



PARTS LIST AND SPECIFICATION

No.	Part	Material
1.	Body	Cast Iron ASTM A48 CL.35B
2.	Sleeve	Reinforced Nylon
3.	3/4” 1” Rolling Seal	E.P.D.M.
3.	Seal Plug Assembly	
3a.	Screws	Stainless Steel
3b.	Plug Cover	Reinforced Nylon
3c.	Rolling Seal	E.P.D.M.
3d.	Plug	Reinforced Nylon
4.	Drainage Elbow	Polypropylene
5.	Clamping Stem	Reinforced Nylon
6.	Float	Foamed Polypropylene
7.	O - Ring	Buna-N
8.	Base 3/4” 1”	Brass
	2”	Cast Iron ASTM A48 CL.35B
9.	Bolt & Nut (x4)	Steel Zinc Cobalt Coated
Optional		
	Ball valve	Brass ASTM-B-124, Nickel plated.

DIMENSIONS AND WEIGHTS

Model	Dimensions mm			Weight	Orifice Area mm²	
	A	B	C	Kg.	Auto.	A / V
1”, 3/4”						
D-040-C	119	150	3/8” BSP	1.2	5	82
2”						
D-040-C	203	231	1 1/2” BSP	5.4	12	804
D-040-C F	250	233	1 1/2” BSP	7.3	12	804