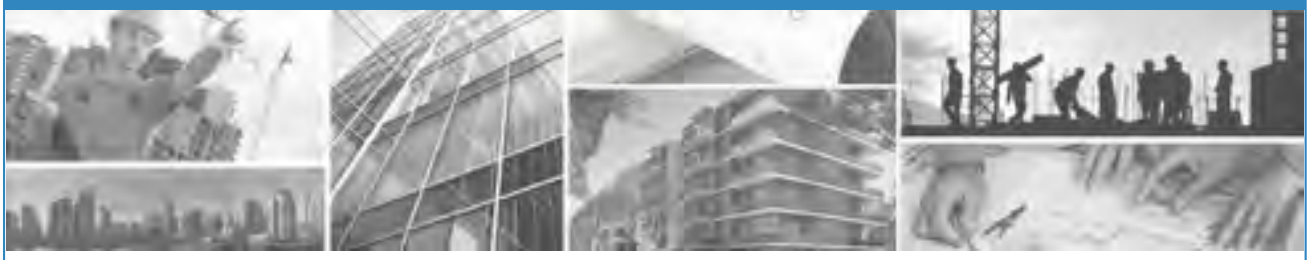

OPERATIONS AND MAINTENANCE MANUALS

# Regional Lagoons Manuals > ST53 Laidley > Electrical

Builder
Thomas Coffey

Compiled
Feb 03, 2015

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# Introduction

**Supply of new switch board and electrical power to new buildings onsite.**

- Design and costruction of new switch board with CT metering enclosure and meter board.
- Installation of electrical power to newly constructed MF, CO2 and PH building.
- Installation of florecent  lighting in new buildings.

# Assets

| | | | |
|---|---|---|---|
| Asset ID | #AST3 | Parent ID | |
| Description | New 250A switchboard | Service | (5.0) Electrical Distribution |
| Subservice | (SWB) SWITCHBOARD_MCC | Site | (ST053) Laidley |
| Process | (1100.0) GENERAL | Sub | (1150) SEWERAGE |
| Location Description | | Make | Distribution board |
| Model | Metering and distribution | Serial Number | |
| Supplier | | Quantity | 1 |
| Retail Price $ | 32 | Install Date | Jun 26, 2013 |
| Wty Expiry Date | Jun 26, 2014 | Life Expectancy (yrs) | 25 |
| Reference Information | This item will be covered by the Principal Contractor until the end of the 12 month defect liability period. | | |

| | | | |
|---|---|---|---|
| Asset ID | #AST8 | Parent ID | |
| Description | Lights | Service | (5.0) Electrical Distribution |
| Subservice | (LGT) GENERAL_LIGHTS | Site | (ST053) Laidley |
| Process | (0300) PRIMARY TREATMENT | Sub | (0390) PROCESS, CONTROL & ELECTRICAL POWER |
| Location Description | Newly constructed MF building | Make | Clipsal |
| Model | WEATHERPROOF IP65 T8 2X36W | Serial Number | |
| Supplier | | Quantity | 4 |
| Retail Price $ | 60 | Install Date | Jun 17, 2013 |
| Wty Expiry Date | | Life Expectancy (yrs) | 5 |
| Reference Information | | | |

| | | | |
|---|---|---|---|
| Asset ID | #AST19 | Parent ID | |
| Description | Flow Meter | Service | (6.0) Control and Instrumentation |
| Subservice | (FM_) FLOW_METER | Site | (ST053) Laidley |
| Process | (2700.0) EFFLUENT REUSE | Sub | (2710) EFFLUENT TREATMENT AND DELIVERY |
| Location Description | Flow meter chamber | Make | Endress & Hauser |
| Model | Proline Promag 10 | Serial Number | |
| Supplier | Endress & Hauser | Quantity | 1 |
| Retail Price $ | 3500 | Install Date | Dec 23, 2013 |
| Wty Expiry Date | Dec 22, 2014 | Life Expectancy (yrs) | 15 |
| Reference Information | Note: Endress & Hauser factory warranty is 12 months from installation so this item will be covered by the Principal Contractor until the end of the 12 month defect liability period. | | |

# Maintenance

**Electrical Components**

1 - Monthly

- Carry out the following tasks in accordance with AS3666, SAHB32 and the Public Health Act
- Check for signs of burnt, hot connections and burnt contacts on starters and relays. Confirm tightness and report any defects.
- Check operation of each item of equipment.
- Examine general condition of conduits, connectors switches and wiring, especially in damp and outdoor areas.
- Replace any faulty indicator lights.

3 - Monthly

- Check and inspect for faulty meters and/or control switches.

12 - Monthly

Switchboard and Wiring

- Check all fuses for correct rating.
- Check all time delays where possible.
- Check and report where wiring diagrams are considered to be incorrect.
- Check connections to (a) motors, (b) switchboards, or (c) equipment subject to vibration.
- Check for existence of Switch Board card.
- Check overload ratings against motor nameplate.
- Check that conduits are securely fixed.
- Check, and rectify where necessary, condition of exposed cable insulation.
- Examine and rectify panel seals.
- Examine external switches for damage to seals.
- Reattach any labels that have fallen off. Report any labels that have been removed.
- Test operation of all time switches where possible.
- Vacuum clean interior of all switchboards.
- Carry out the following tasks in accordance with AS3666, SAHB32 and the Public Health Act
- The following tasks were supplied by AIRAH and are indicative only.

For Servicing The Following Assets

#AST3

# Operations & Tech Data

**Technical Data - Lighting**

**Service :** (5.0) Electrical Distribution

**Subservice :** (LGT) GENERAL_LIGHTS

**Linked Documents**

Clipsal T8 IP65.pdf

**Proline Promag 10 - Flow Meter - Technical Data**

**Linked Documents**

Proline Promag 10 Techical Data.pdf

**Proline Promag 10 Operating Instructions**

**Service :** (1.0) Site, Process or Subprocess

**Subservice :** (SP_) SEWER_PS

Note: Facotry set password for this flowmeter is 10.

**Linked Documents**

Proline Promag 10 Operating Instructions.pdf

LIGHTING

Technical Data Sheet

CLIPSAL by Schneider Electric

# IP65 Typhoon

## Weatherproof fluorescent lamp luminaire

### Specifications

| | | |
|---|---|---|
| T8 (T26) | G13 | 18-36W |
| T5 (T16) | G5 | 14-35W |
| Class I Electrical | | |
| IP65 | AS/NZS 60598 | |

Weatherproof IP65 fluorescent luminaire

Polycarbonate base and diffuser

T8 (T26) or T5 (T16) lamps

HPF or high frequency non-dimming gear


A versatile and robust weatherproof fluorescent lamp luminaire specifically designed for a wide range of general exterior and industrial purposes.

### Applications

For exterior and commercial applications such as security, factories, warehouse areas and public buildings.

### Features

- IP65 rated
- Stainless steel lockable latches
- Polycarbonate base and diffuser
- HPF to 0.9
- Gear tray 0.5mm powder coated steel
- High quality gasket
- Cable entry and grommets at both ends
- Suspension mounted stainless steel kit supplied
- Large terminal blocks for looping applications
- Control gear options available (DSI and DALI)
- Emergency versions available on request
- Supplied with B2 ballast as standard, or high frequency non-dimming electronic
- T5 models supplied with electronic high frequency non-dimming ballast

### Warranty

12 months

LIGHTING

CLIPSAL by Schneider Electric

## Ordering Guide

### TYPHOON IP65 T8 Series

Supplied Less Lamps

| Catalogue No. | T8 Series |
|---|---|
| **WP118** | 1 x 18W Weatherproof Fluorescent HPF |
| **WP218** | 2 x 18W Weatherproof Fluorescent HPF |
| **WP136** | 1 x 36W Weatherproof Fluorescent HPF |
| **WP236** | 2 x 36W Weatherproof Fluorescent HPF |
| **WP136EL** | 1 x 36W Weatherproof Fluorescent HF Electronic |
| **WP236EL** | 2 x 36W Weatherproof Fluorescent HF Electronic |

### TYPHOON IP65 T5 Series

Supplied Less Lamps

| Catalogue No. | T5 Series |
|---|---|
| **WP114** | 1 x 14W Weatherproof Fluorescent HF Electronic |
| **WP214** | 2 x 14W Weatherproof Fluorescent HF Electronic |
| **WP128** | 1 x 28W Weatherproof Fluorescent HF Electronic |
| **WP228** | 2 x 28W Weatherproof Fluorescent HF Electronic |
| **WP135** | 1 x 35W Weatherproof Fluorescent HF Electronic |
| **WP235** | 2 x 35W Weatherproof Fluorescent HF Electronic |

## Specifications

| Wattage | Length | Width | Height | Operating Temp. | Clip Quantity | Weight (kg) |
|---|---|---|---|---|---|---|
| **1 x 14W T5** | 620mm | 62mm | 80mm | –15°C to +60°C | 6 | 0.8 |
| **2 x 14W T5** | 620mm | 104mm | 80mm | –15°C to +60°C | 6 | 2.4 |
| **1 x 18W T8** | 660mm | 100mm | 101mm | –20°C to +50°C | 4 | 2.8 |
| **2 x 18W T8** | 660mm | 158mm | 101mm | –20°C to +50°C | 4 | 2.8 |
| **1 x 28W T5** | 1220mm | 62mm | 80mm | –15°C to +60°C | 10 | 2.5 |
| **2 x 28W T5** | 1220mm | 104mm | 80mm | –15°C to +60°C | 10 | 3.2 |
| **1 x 18W T8** | 1270mm | 100mm | 101mm | –20°C to +50°C | 8 | 2.9 |
| **2 x 18W T8** | 1270mm | 158mm | 101mm | –20°C to +50°C | 8 | 3.5 |
| **1 x 35W T5** | 1510mm | 62mm | 80mm | –15°C to +60°C | 12 | 3.3 |
| **2 x 35W T5** | 1510mm | 104mm | 80mm | –15°C to +60°C | 12 | 3.9 |

**Schneider Electric (Australia) Pty Ltd**
33-37 Port Wakefield Road,
Gepps Cross, South Australia 5094

Contact us clipsal.com/feedback

**National Customer Care Enquiries:**
**1300 2025 25**

clipsal.com

Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Technical Information

# Proline Promag 10W

## Electromagnetic Flow Measuring System
## Flow measurement of liquids in water or wastewater applications

**Application**
Electromagnetic flowmeter for bidirectional measurement of liquids with a minimum conductivity of ≥ 50 µS/cm:

- Drinking water
- Wastewater
- Sewage sludge

- Flow measurement up to 110000 m³/h (484315 gal/min)
- Fluid temperature up to +80 °C (176 °F)
- Process pressures up to 40 bar (580 psi)
- Lengths in accordance with DVGW/ISO

Application-specific lining materials:
- Polyurethane
- Hard rubber

Lined measuring pipes with materials approved for drinking water:
- KTW
- WRAS
- NSF
- ACS

**Your benefits**
Promag measuring devices offer you cost-effective flow measurement with a high degree of accuracy for a wide range of process conditions.

The uniform Proline transmitter concept comprises:
- High degree of reliability and measuring stability
- Uniform operating concept

The tried-and-tested Promag sensors offer:
- No pressure loss
- Not sensitive to vibrations
- Simple installation and commissioning

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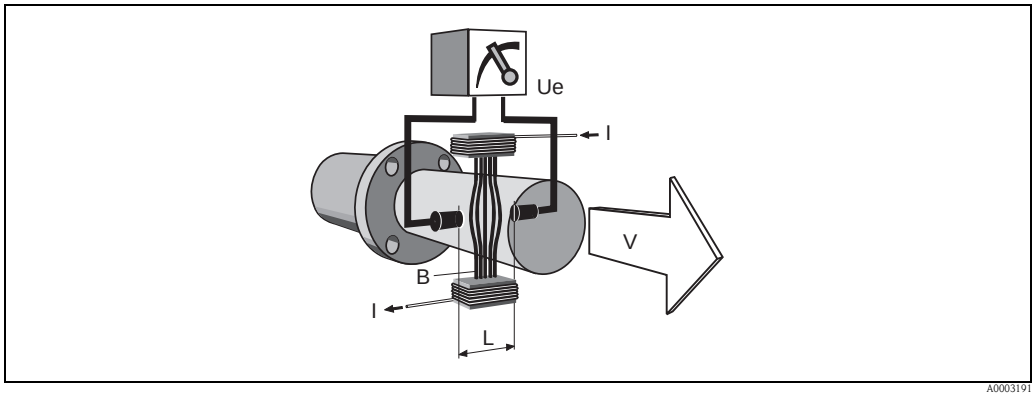
Endress+Hauser
People for Process Automation

# Table of contents

# Function and system design

**Measuring principle**

Following *Faraday's law of magnetic induction*, a voltage is induced in a conductor moving through a magnetic field.
In the electromagnetic measuring principle, the flowing medium is the moving conductor.
The voltage induced is proportional to the flow velocity and is supplied to the amplifier by means of two measuring electrodes. The flow volume is calculated by means of the pipe cross-sectional area.
The DC magnetic field is created through a switched direct current of alternating polarity.




$Ue = B \cdot L \cdot v$
$Q = A \cdot v$

*Ue* *Induced voltage*
*B* *Magnetic induction (magnetic field)*
*L* *Electrode spacing*
*v* *Flow velocity*
*Q* *Volume flow*
*A* *Pipe cross-section*
*I* *Current strength*

**Measuring system**

The measuring system consists of a transmitter and a sensor.
Two versions are available:
- Compact version: Transmitter and sensor form a mechanical unit.
- Remote version: Sensor is mounted separate from the transmitter.

Transmitter:
- Promag 10 (key operation, two-line, unilluminated display)

Sensor:
- Promag W
  DN 25 to 2000 (1 to 78")

# Input

| | |
|---|---|
| **Measured variable** | Flow velocity (proportional to induced voltage) |
| **Measuring ranges** | Typically v = 0.01 to 10 m/s (0.033 to 33 ft/s) with the specified accuracy |
| **Operable flow range** | Over 1000 : 1 |

# Output

**Output signal**

**Current output**

- Galvanically isolated
- Active: 4 to 20 mA, $R_L < 700\ \Omega$ (for HART: $R_L \geq 250\ \Omega$)
- Full scale value adjustable
- Temperature coefficient: typ. 2 µA/°C, resolution: 1.5 µA

**Pulse/status output**

- Galvanically isolated
- Passive: 30 V DC / 250 mA
- Open collector
- Can be configured as:
  - Pulse output
    Pulse value and pulse polarity can be selected, max. pulse width adjustable (5 to 2000 ms), pulse frequency max. 100 Hz
  - Status output
    For example, can be configured for error messages, empty pipe detection, flow recognition, limit value

**Signal on alarm**

**Current output**

Failsafe mode can be selected (e.g. in accordance with NAMUR Recommendation NE 43)

**Pulse output**

Failsafe mode can be selected

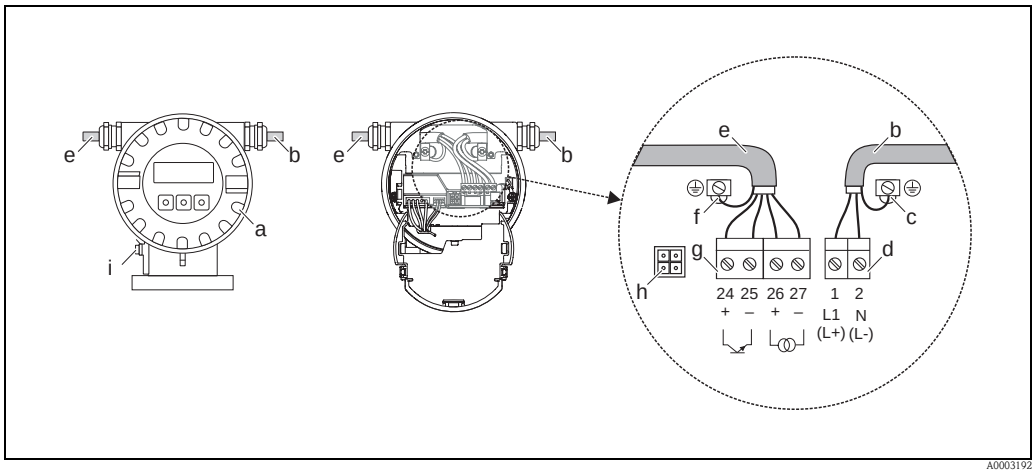
**Status output**

"Not conductive" in the event of fault or power supply failure

| | |
|---|---|
| **Load** | See "Output signal" |
| **Low flow** | Low flow cutoff, switch-on point can be selected as required |
| **Galvanic isolation** | All circuits for inputs, outputs and power supply are galvanically isolated from each other. |

# Power supply

**Electrical connection, measuring unit**



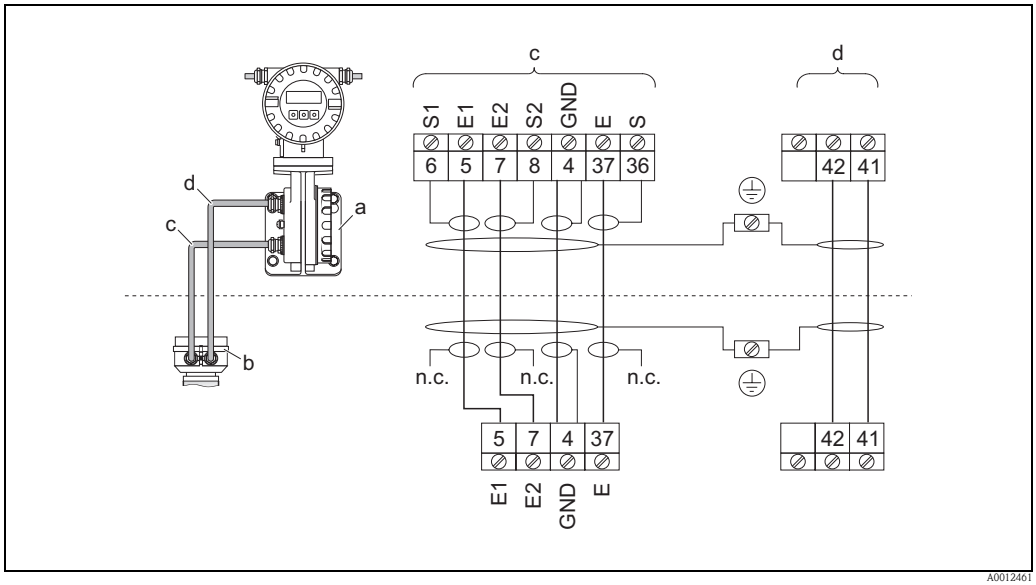

*Connecting the transmitter (aluminum field housing), cable cross-section max. 2.5 mm² (14 AWG)*

*a* *Electronics compartment cover*
*b* *Power supply cable*
*c* *Ground terminal for power supply cable*
*d* *Terminal connector for power supply cable*
*e* *Signal cable*
*f* *Ground terminal for signal cable*
*g* *Terminal connector for signal cable*
*h* *Service connector for connecting service interface FXA 193 (Fieldcheck, FieldCare)*
*i* *Ground terminal for potential equalization*

**Electrical connection, terminal assignment**

| **Order version** | **Terminal No.** | | | | | |
|---|---|---|---|---|---|---|
| | **24 (+)** | **25 (–)** | **26 (+)** | **27 (–)** | **1 (L1/L+)** | **2 (N/L–)** |
| 10***-********** A | Pulse/status output | | HART current output | | Power supply | |
| Functional values | See “Output signal” | | | | See “Supply voltage” | |

**Electrical connection, remote version**




*Connecting the remote version*

*a Wall-mount housing connection compartment*
*b Sensor connection housing cover*
*c Signal cable*
*d Coil current cable*
*n.c. Not connected, insulated cable shields*

*Cable colors/numbers for terminals:*
*5/6 = brown; 7/8 = white; 4 = green; 37/36 = yellow*

**Supply voltage (power supply)**

- 85 to 250 V AC, 45 to 65 Hz
- 20 to 28 V AC, 45 to 65 Hz, 11 to 40 V DC

**Cable entry**

**Power supply and signal cables (inputs/outputs):**

- Cable entry M20 × 1.5 (8 to 12 mm / 0.31 to 0.47")
- Thread for cable entries, ½" NPT, G ½"

**Connecting cable for remote version:**

- Cable entry M20 × 1.5 (8 to 12 mm / 0.31 to 0.47")
- Thread for cable entries, ½" NPT, G ½"

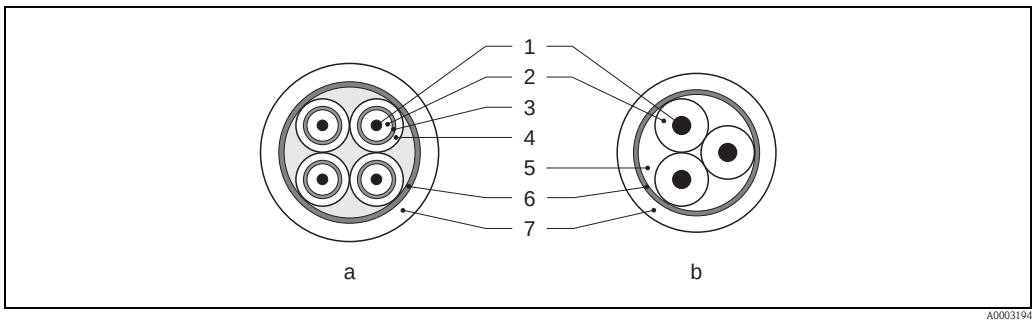
**Remote version cable specifications**

**Coil cable**

- 2 × 0.75 mm² (18 AWG) PVC cable with common, braided copper shield (∅ ~ 7 mm / 0.28")
- Conductor resistance: ≤ 37 Ω/km (≤ 0.011 Ω/ft)
- Capacitance core/core, shield grounded: ≤ 120 pF/m (≤37 pF/ft)
- Operating temperature: –20 to +80 °C (–4 to +176 °F)
- Cable cross-section: max. 2.5 mm² (16 AWG)
- Test voltage for cable insulation: ≥ 1433 V AC r.m.s. 50/60 Hz or ≥ 2026 V DC

**Signal cable**

- 3 × 0.38 mm² (20 AWG) PVC cable with common, braided copper shield (∅ ~ 7 mm / 0.28") and individual shielded cores
- Conductor resistance: ≤ 50 Ω/km (≤ 0.015 Ω/ft)
- Capacitance core/shield: ≤ 420 pF/m (≤ 128 pF/ft)
- Operating temperature: –20 to +80 °C (–4 to +176 °F)
- Cable cross-section: max. 2.5 mm² (16 AWG)




*a Signal cable*
*b Coil current cable*

*1 Core*
*2 Core insulation*
*3 Core shield*
*4 Core jacket*
*5 Core reinforcement*
*6 Cable shield*
*7 Outer jacket*

**Operation in zones of severe electrical interference**

The measuring device complies with the general safety requirements in accordance with EN 61010-1, the EMC requirements of IEC/EN 61326 and NAMUR Recommendation NE 21.

Caution!
Grounding is by means of the ground terminals provided for the purpose inside the connection housing. Ensure that the stripped and twisted lengths of cable shield to the ground terminal are as short as possible.

**Power consumption**

Power consumption
- 85 to 250 V AC: < 12 VA (incl. sensor)
- 20 to 28 V AC: < 8 VA (incl. sensor)
- 11 to 40 V DC: < 6 W (incl. sensor)

Switch-on current
- Max. 16 A (< 5 ms) for 250 V AC
- Max. 5.5 A (< 5 ms) for 28 V AC
- Max. 3.3 A (< 5 ms) for 24 V DC

**Power supply failure**

Lasting min. ½ cycle frequency: EEPROM saves measuring system data

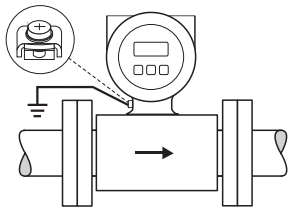
**Potential equalization**

Warning!
The measuring system must be included in the potential equalization.

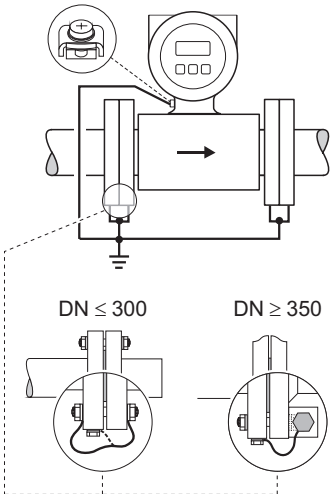
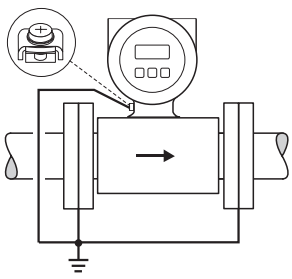
Perfect measurement is only ensured when the fluid and the sensor have the same electrical potential. This is ensured by the reference electrode integrated in the sensor as standard.

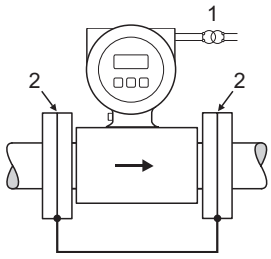
The following should also be taken into consideration for potential equalization:
- Internal grounding concepts in the company
- Operating conditions, such as the material/grounding of the pipes (see table)

*Standard situation*

| Operating conditions | Potential equalization |
|---|---|
| When using the measuring device in a:<br>■ Metal, grounded pipe<br>Potential equalization takes place via the ground terminal of the transmitter.<br>Note!<br>When installing in metal pipes, we recommend you connect the ground terminal of the transmitter housing with the piping. |  <br>A0010831<br>*Via the ground terminal of the transmitter* |

*Special situations*

| Operating conditions | Potential equalization |
|---|---|
| When using the measuring device in a:<br>■ Metal pipe that is not grounded<br>This connection method also applies in situations where:<br>■ Customary potential equalization cannot be ensured.<br>■ Excessively high equalizing currents can be expected.<br>Both sensor flanges are connected to the pipe flange by means of a ground cable (copper wire, at least 6 mm² / 0.0093 in²) and grounded. Connect the transmitter or sensor connection housing, as applicable, to ground potential by means of the ground terminal provided for the purpose.<br>Ground cable installation depends on the nominal diameter:<br>■ DN ≤ 300 (12"): The ground cable is mounted directly on the conductive flange coating with the flange screws.<br>■ DN ≥ 350 (14"): The ground cable is mounted directly on the metal transport bracket.<br>Note!<br>The ground cable for flange-to-flange connections can be ordered separately as an accessory from Endress+Hauser. |  <br>A0010832<br>*Via the ground terminal of the transmitter and the flanges of the pipe* |
| When using the measuring device in a:<br>■ Plastic pipe<br>■ Pipe with insulating lining<br>This connection method also applies in situations where:<br>■ Customary potential equalization cannot be ensured.<br>■ Excessively high equalizing currents can be expected.<br>Potential equalization takes place using additional ground disks, which are connected to the ground terminal via a ground cable (copper wire, at least 6 mm² / 0.0093 in²). When installing the ground disks, please comply with the enclosed Installation Instructions. |  <br>A0010833<br>*Via the ground terminal of the transmitter and the optionally available ground disks* |

| Operating conditions | Potential equalization |
|---|---|
| When using the measuring device in a:<br>■ Pipe with a cathodic protection unit<br><br>The device is installed potential-free in the pipe.<br>Only the two flanges of the pipe are connected with a ground cable (copper wire, at least 6 mm² / 0.0093 in²). Here, the ground cable is mounted directly on the conductive flange coating with flange screws.<br><br>Note the following when installing:<br>■ The applicable regulations regarding potential-free installation must be observed.<br>■ There should be **no** electrically conductive connection between the pipe and the device.<br>■ The mounting material must withstand the applicable torques. |  <br>A0010834<br>*Potential equalization and cathodic protection*<br>*1 Power supply isolation transformer*<br>*2 Electrically isolated* |

# Performance characteristics

**Reference operating conditions**

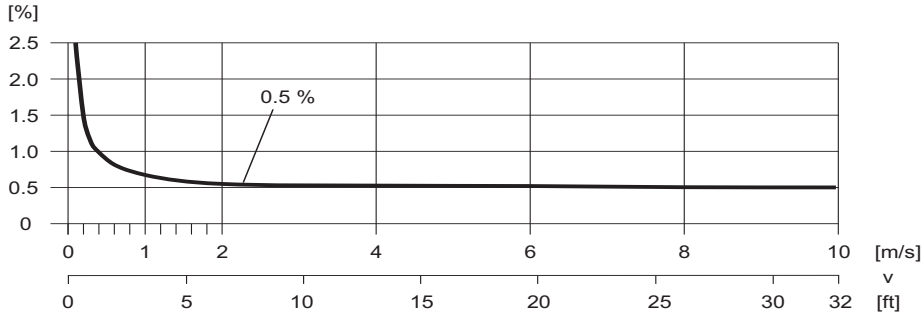
**As per DIN EN 29104 and VDI/VDE 2641:**
- Fluid temperature: +28 °C ± 2 K (+82 °F ± 2 K)
- Ambient temperature: +22 °C ±2 K (+72 °F ± 2 K)
- Warm-up period: 30 minutes

**Installation conditions:**
- Inlet run > 10 × DN
- Outlet run > 5 × DN
- Sensor and transmitter grounded.
- The sensor is centered in the pipe.

**Maximum measured error**

- Current output: also typically ± 5 µA
- Pulse output: ±0.5% o.r. ± 2 mm/s (±0.5% o.r. ± 0.08 in/s) (o.r. = of reading)

Fluctuations in the supply voltage do not have any effect within the specified range.



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*Max. measured error in % of reading*

**Repeatability**

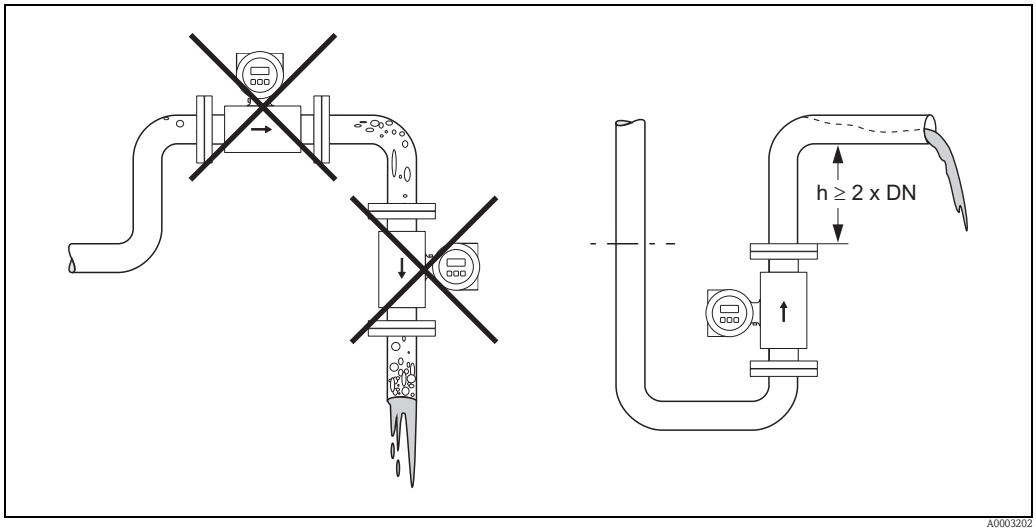
Max. ±0.2% o.r. ± 2 mm/s (±0.2% o.r. ± 0.08 in/s) (o.r. = of reading)

# Operating conditions: Installations

## Installation instructions

### Mounting location

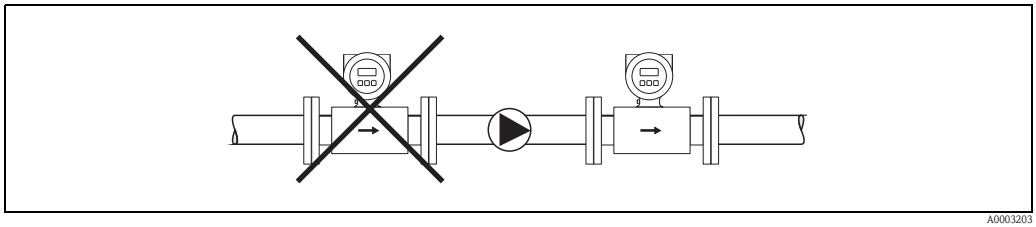
Entrained air or gas bubble formation in the measuring tube can result in an increase in measuring errors.
**Avoid** the following installation locations in the pipe:
- Highest point of a pipeline. Risk of air accumulating!
- Directly upstream from a free pipe outlet in a vertical pipeline.




*Mounting location*

### Installation of pumps

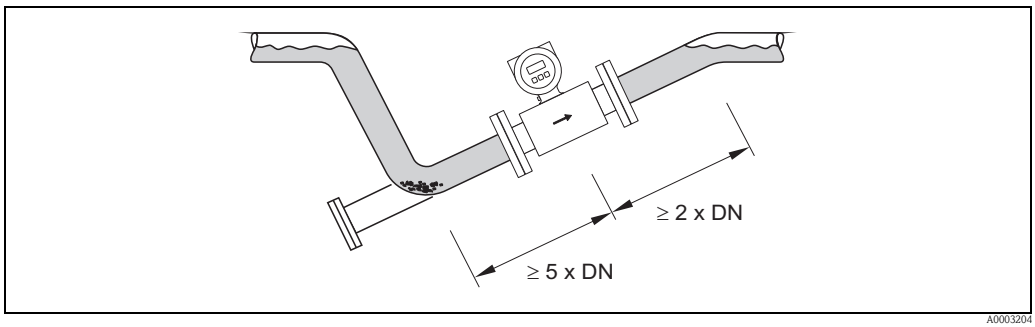
Sensors may not be installed on the pump suction side. This precaution is to avoid low pressure and the consequent risk of damage to the lining of the measuring tube. Information on the pressure tightness of the measuring tube lining → 17, Section "Pressure tightness".
Pulsation dampers may be needed when using piston pumps, piston diaphragm pumps or hose pumps. Information on the shock and vibration resistance of the measuring system → 16, Section "Shock and vibration resistance".




*Installation of pumps*

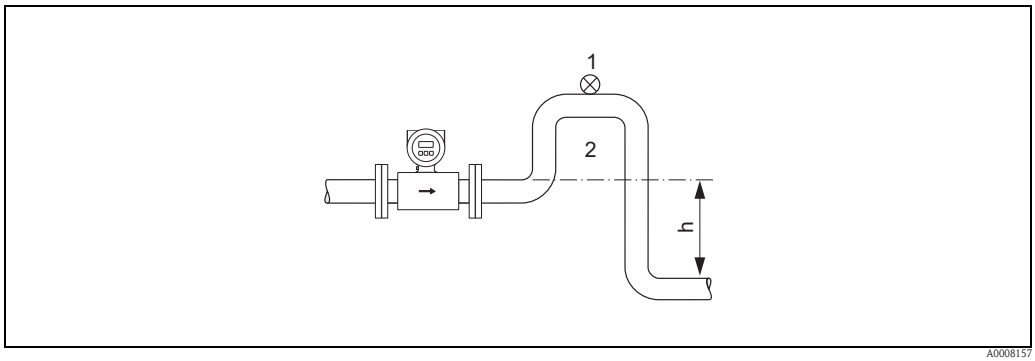
**Partially filled pipes**
Partially filled pipes with gradients necessitate a drain-type configuration.
The empty pipe detection function (EPD) provides additional security in detecting empty or partially filled pipes.

Caution!
Risk of solids accumulating. Do not install the sensor at the lowest point in the drain. It is advisable to install a cleaning valve.




*Installation with partially filled pipes*

**Down pipes**
Install a siphon or a vent valve downstream of the sensor in down pipes h ≥ 5 m (16.4 ft). This precaution is to avoid low pressure and the consequent risk of damage to the lining of the measuring tube. This measure also prevents the liquid current stopping in the pipe which could cause air locks. Information on the pressure tightness of the measuring tube lining → 17, Section "Pressure tightness".




*Installation measures for vertical pipes*

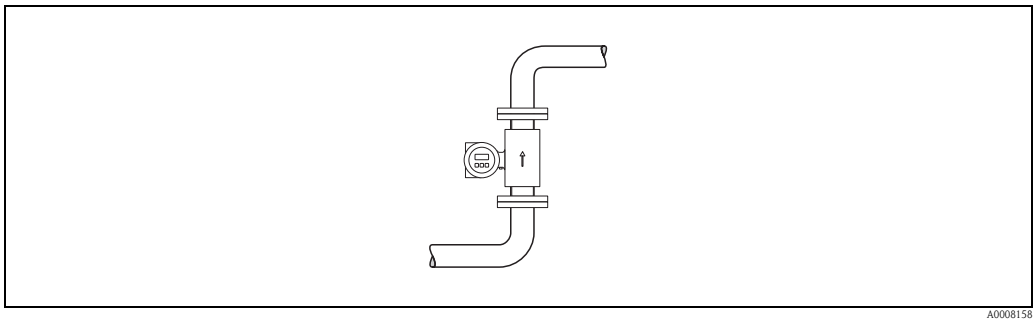
*1 Vent valve*
*2 Pipe siphon*
*h Length of the down pipe*

**Orientation**

An optimum orientation helps avoid gas and air accumulations and deposits in the measuring tube. However, the measuring device also offers the additional function of empty pipe detection (EPD) for detecting partially filled measuring tubes or if outgassing fluids or fluctuating operating pressures are present.

*Vertical orientation*

This is the ideal orientation for self-emptying piping systems and for use in conjunction with empty pipe detection.



A0008158

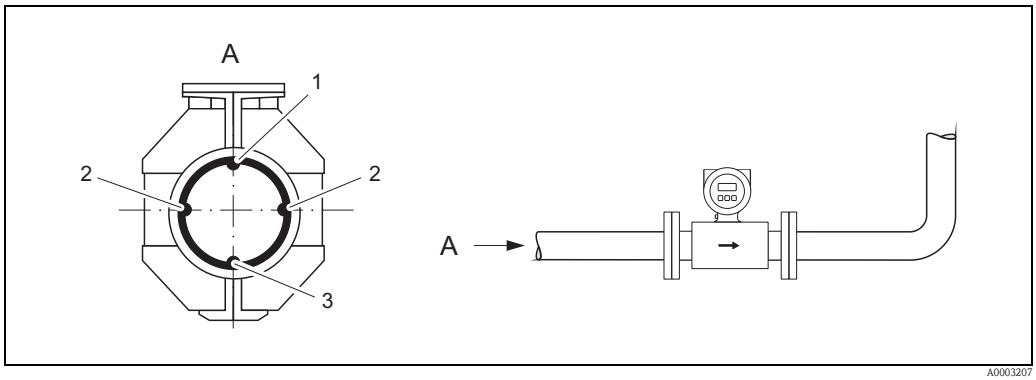
*Vertical orientation*

*Horizontal orientation*

The measuring electrode axis should be horizontal. This prevents brief insulation of the two measuring electrodes by entrained air bubbles.

Caution!

Empty pipe detection only works correctly with horizontal orientation if the transmitter housing is facing upwards. Otherwise there is no guarantee that empty pipe detection will respond if the measuring tube is only partially filled or empty.




A0003207

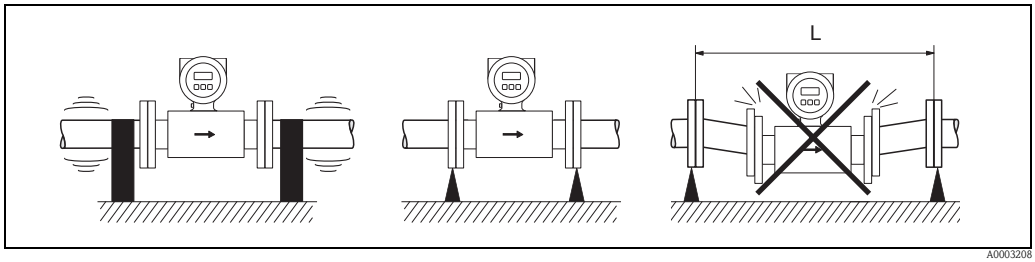
*Horizontal orientation*

*1 EPD electrode for empty pipe detection*
*2 Measuring electrodes for signal detection*
*3 Reference electrode for potential equalization*

**Vibrations**

Secure the piping and the sensor if vibration is severe.

Caution!
If vibrations are too severe, we recommend the sensor and transmitter be mounted separately. Information on the permitted shock and vibration resistance → 16, Section "Shock and vibration resistance".



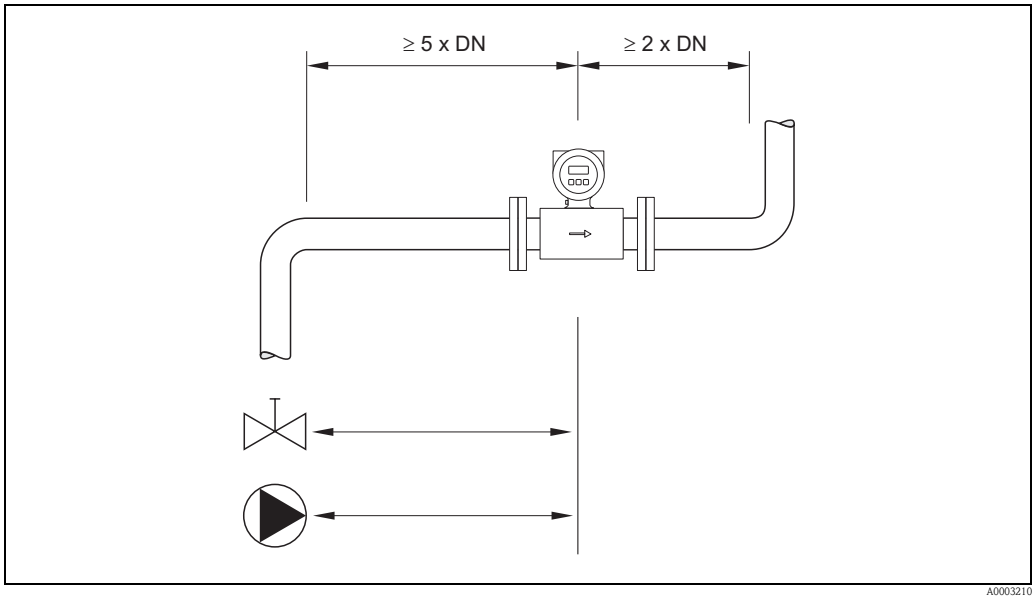

*Measures to prevent vibration of the measuring device*

*L > 10 m (33 ft)*

**Inlet and outlet run**

If possible, install the sensor well clear of assemblies such as valves, T-pieces, elbows etc.

Note the following inlet and outlet runs to comply with measuring accuracy specifications:
- Inlet run: ≥ 5 × DN
- Outlet run: ≥ 2 × DN



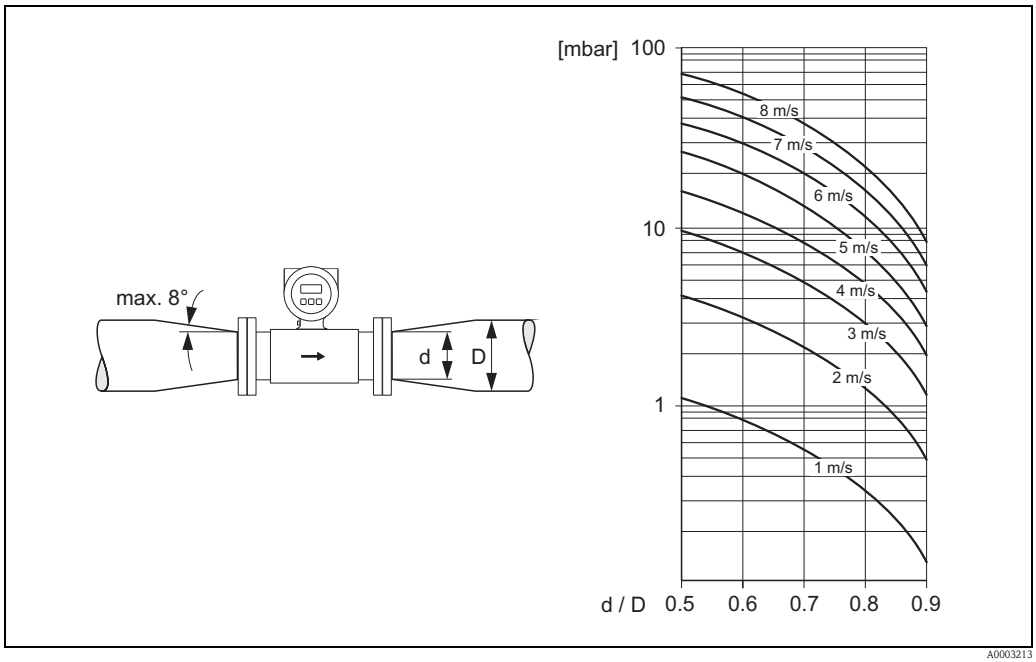

*Inlet and outlet run*

**Adapters**

Suitable adapters to DIN EN 545 (double-flange reducers) can be used to install the sensor in larger-diameter pipes. The resultant increase in the rate of flow improves measuring accuracy with very slow-moving fluids. The nomogram shown here can be used to calculate the pressure loss caused by reducers and expanders.

Note!
The nomogram only applies to liquids of viscosity similar to water.

1. Calculate the ratio of the diameters d/D.
2. From the nomogram read off the pressure loss as a function of flow velocity (downstream from the reduction) and the d/D ratio.

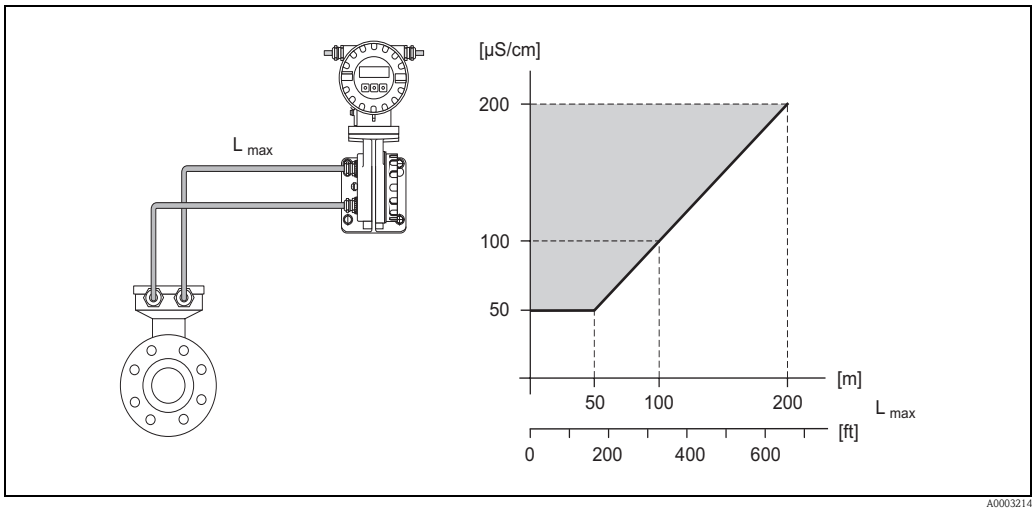



*Pressure loss due to adapters*

**Length of connecting cable**

When mounting the remote version, please note the following to achieve correct measuring results:

- Fix cable run or lay in armored conduit. Cable movements can falsify the measuring signal especially in the case of low fluid conductivities.
- Route the cable well clear of electrical machines and switching elements.
- If necessary, ensure potential equalization between sensor and transmitter.
- The permitted cable length $L_{max}$ is determined by the fluid conductivity. A minimum conductivity of 50 µS/cm is needed for all fluids.
- When the empty pipe detection function is switched on (EPD), the maximum connecting cable length is 10 m (33 ft).




*Permitted length of connecting cable for remote version*
*Area marked in gray = permitted range; $L_{max}$ = length of connecting cable in [m] ([ft]); fluid conductivity in [µS/cm]*

# Operating conditions: Environment

**Ambient temperature range**

**Transmitter**
- –20 to +60 °C (–4 to +140 °F)

**Sensor**
- Flange material carbon steel: –10 to +60 °C (+14 to +140 °F)
- Flange material stainless steel: –40 to +60 °C (–40 to +140 °F)

Caution!
The permitted temperature range of the measuring tube lining may not be undershot or overshot (→ 17, Section "Medium temperature range").

Please note the following points:
- Install the device in a shady location. Avoid direct sunlight, particularly in warm climatic regions.
- The transmitter must be mounted separate from the sensor if both the ambient and fluid temperatures are high.

**Storage temperature**

The storage temperature corresponds to the operating temperature range of the measuring transmitter and the appropriate measuring sensors.

Caution!
- The measuring device must be protected against direct sunlight during storage in order to avoid unacceptably high surface temperatures.
- A storage location must be selected where moisture does not collect in the measuring device. This will help prevent fungus and bacteria infestation which can damage the liner.

**Degree of protection**
- Standard: IP 67 (NEMA 4X) for transmitter and sensor.
- Optional: IP 68 (NEMA 6P) for sensor for remote version.
- For information regarding applications where the device is buried directly in the soil or is installed in a flooded wastewater basin please contact your local Endress+Hauser Sales Center.

**Shock and vibration resistance**

Acceleration up to 2 g following IEC 600 68-2-6

**Electromagnetic compatibility (EMC)**
- As per IEC/EN 61326 as well as NAMUR Recommendation NE 21
- Emission: to limit value for industry EN 55011

# Operating conditions: Process

**Medium temperature range**

The permitted temperature depends on the measuring tube lining:
- Polyurethane: –20 to +50 °C (-4 to +122 °F) (DN 25 to 1200 / 1 to 48")
- Hard rubber: 0 to +80 °C (+32 to +176 °F) (DN 50 to 2000 / 2 to 78")

**Conductivity**

The minimum conductivity is: ≥ 50 µS/cm

Note!
In the remote version, the necessary minimum conductivity also depends on the cable length (→ 15, Section "Length of connecting cable").

**Medium pressure range (nominal pressure)**

- EN 1092-1 (DIN 2501)
  - PN 6 (DN 350 to 2000 / 14 to 78")
  - PN 10 (DN 200 to 2000 / 8 to 78")
  - PN 16 (DN 65 to 2000 / 3 to 78")
  - PN 25 (DN 200 to 1000 / 8 to 40")
  - PN 40 (DN 25 to 150 / 1 to 6")
- ANSI B 16.5
  - Class 150 (DN 25 to 600 / 1 to 24")
  - Class 300 (DN 25 to 150 / 1 to 6")
- AWWA
  - Class D (DN 700 to 2000 / 28 to 78")
- JIS B2220
  - 10 K (DN 50 to 300 / 2 to 12")
  - 20 K (DN 25 to 300 / 1 to 12")
- AS 2129
  - Table E (DN 80, 100, 150 to 1200 / 3", 4", 6 to 48")
- AS 4087
  - PN 16 (DN 80, 100, 150 to 1200 / 3", 4", 6 to 48")

**Pressure tightness**

*Measuring tube lining: Polyurethane*

| Nominal diameter | | Limit values for abs. pressure [mbar] ([psi]) at fluid temperatures: | | | |
|---|---|---|---|---|---|
| | | 25 °C (77 °F) | | 50 °C (122 °F) | |
| [mm] | [inch] | [mbar] | [psi] | [mbar] | [psi] |
| 25 to 1200 | 1 to 48" | 0 | 0 | 0 | 0 |

*Measuring tube lining: Hard rubber*

| Nominal diameter | | Limit values for abs. pressure [mbar] ([psi]) at fluid temperatures: | | | | | |
|---|---|---|---|---|---|---|---|
| | | 25 °C (77 °F) | | 70 °C (158 °F) | | 80 °C (176 °F) | |
| [mm] | [inch] | [mbar] | [psi] | [mbar] | [psi] | [mbar] | [psi] |
| 50 to 2000 | 2 to 78" | 0 | 0 | 0 | 0 | 0 | 0 |

**Limiting flow**

The diameter of the pipe and the flow rate determine the nominal diameter of the sensor.
The optimum flow velocity is between 2 to 3 m/s (6.5 to 9.8 ft/s). The velocity of flow (v), moreover, has to be matched to the physical properties of the fluid:

- v < 2 m/s (6.5 ft/s): for abrasive fluids such as potter's clay, lime milk, ore slurry etc.
- v > 2 m/s (6.5 ft/s): for fluids causing build-up such as wastewater sludges etc.

**Flow characteristic values (SI units)**

| Diameter | | Recommended flow | Factory settings | | |
|---|---|---|---|---|---|
| | | Min./max. full scale value | Full scale value Current output | Pulse value | Low flow |
| [mm] | [inch] | (v ~ 0.3 or 10 m/s) | (v ~ 2.5 m/s) | (~ 2 pulses/s) | (v ~ 0.04 m/s) |
| 25 | 1" | 9 to 300 dm³/min | 75 dm³/min | 0.50 dm³ | 1 dm³/min |
| 32 | – | 15 to 500 dm³/min | 125 dm³/min | 1.00 dm³ | 2 dm³/min |
| 40 | 1½" | 25 to 700 dm³/min | 200 dm³/min | 1.50 dm³ | 3 dm³/min |
| 50 | 2" | 35 to 1100 dm³/min | 300 dm³/min | 2.50 dm³ | 5 dm³/min |
| 65 | – | 60 to 2000 dm³/min | 500 dm³/min | 5.00 dm³ | 8 dm³/min |
| 80 | 3" | 90 to 3000 dm³/min | 750 dm³/min | 5.00 dm³ | 12 dm³/min |
| 100 | 4" | 145 to 4700 dm³/min | 1200 dm³/min | 10.00 dm³ | 20 dm³/min |
| 125 | – | 220 to 7500 dm³/min | 1850 dm³/min | 15.00 dm³ | 30 dm³/min |
| 150 | 6" | 20 to 600 m³/h | 150 m³/h | 0.025 m³ | 2.5 m³/h |
| 200 | 8" | 35 to 1100 m³/h | 300 m³/h | 0.05 m³ | 5.0 m³/h |
| 250 | 10" | 55 to 1700 m³/h | 500 m³/h | 0.05 m³ | 7.5 m³/h |
| 300 | 12" | 80 to 2400 m³/h | 750 m³/h | 0.10 m³ | 10 m³/h |
| 350 | 14" | 110 to 3300 m³/h | 1000 m³/h | 0.10 m³ | 15 m³/h |
| 375 | 15" | 140 to 4200 m³/h | 1200 m³/h | 0.15 m³ | 20 m³/h |
| 400 | 16" | 140 to 4200 m³/h | 1200 m³/h | 0.15 m³ | 20 m³/h |
| 450 | 18" | 180 to 5400 m³/h | 1500 m³/h | 0.25 m³ | 25 m³/h |
| 500 | 20" | 220 to 6600 m³/h | 2000 m³/h | 0.25 m³ | 30 m³/h |
| 600 | 24" | 310 to 9600 m³/h | 2500 m³/h | 0.30 m³ | 40 m³/h |
| 700 | 28" | 420 to 13500 m³/h | 3500 m³/h | 0.50 m³ | 50 m³/h |
| – | 30" | 480 to 15000 m³/h | 4000 m³/h | 0.50 m³ | 60 m³/h |
| 800 | 32" | 550 to 18000 m³/h | 4500 m³/h | 0.75 m³ | 75 m³/h |
| 900 | 36" | 690 to 22500 m³/h | 6000 m³/h | 0.75 m³ | 100 m³/h |
| 1000 | 40" | 850 to 28000 m³/h | 7000 m³/h | 1.00 m³ | 125 m³/h |
| – | 42" | 950 to 30000 m³/h | 8000 m³/h | 1.00 m³ | 125 m³/h |
| 1200 | 48" | 1250 to 40000 m³/h | 10000 m³/h | 1.50 m³ | 150 m³/h |
| – | 54" | 1550 to 50000 m³/h | 13000 m³/h | 1.50 m³ | 200 m³/h |
| 1400 | – | 1700 to 55000 m³/h | 14000 m³/h | 2.00 m³ | 225 m³/h |
| – | 60" | 1950 to 60000 m³/h | 16000 m³/h | 2.00 m³ | 250 m³/h |
| 1600 | – | 2200 to 70000 m³/h | 18000 m³/h | 2.50 m³ | 300 m³/h |
| – | 66" | 2500 to 80000 m³/h | 20500 m³/h | 2.50 m³ | 325 m³/h |
| 1800 | 72" | 2800 to 90000 m³/h | 23000 m³/h | 3.00 m³ | 350 m³/h |
| – | 78" | 3300 to 100000 m³/h | 28500 m³/h | 3.50 m³ | 450 m³/h |
| 2000 | – | 3400 to 110000 m³/h | 28500 m³/h | 3.50 m³ | 450 m³/h |

| Flow characteristic values (US units) | | | | | |
|---|---|---|---|---|---|
| **Diameter** | | **Recommended flow rate** | **Factory settings** | | |
| [inch] | [mm] | Min./max. full scale value (v ~ 0.3 or 10 m/s) | Full scale value Current output (v ~ 2.5 m/s) | Pulse value (~ 2 pulses/s) | Low flow (v ~ 0.04 m/s) |
| 1" | 25 | 2.5 to 80 gal/min | 18 gal/min | 0.20 gal | 0.25 gal/min |
| – | 32 | 4 to 130 gal/min | 30 gal/min | 0.20 gal | 0.50 gal/min |
| 1½" | 40 | 7 to 190 gal/min | 50 gal/min | 0.50 gal | 0.75 gal/min |
| 2" | 50 | 10 to 300 gal/min | 75 gal/min | 0.50 gal | 1.25 gal/min |
| – | 65 | 16 to 500 gal/min | 130 gal/min | 1 gal | 2.0 gal/min |
| 3" | 80 | 24 to 800 gal/min | 200 gal/min | 2 gal | 2.5 gal/min |
| 4" | 100 | 40 to 1250 gal/min | 300 gal/min | 2 gal | 4.0 gal/min |
| – | 125 | 60 to 1950 gal/min | 450 gal/min | 5 gal | 7.0 gal/min |
| 6" | 150 | 90 to 2650 gal/min | 600 gal/min | 5 gal | 12 gal/min |
| 8" | 200 | 155 to 4850 gal/min | 1200 gal/min | 10 gal | 15 gal/min |
| 10" | 250 | 250 to 7500 gal/min | 1500 gal/min | 15 gal | 30 gal/min |
| 12" | 300 | 350 to 10600 gal/min | 2400 gal/min | 25 gal | 45 gal/min |
| 14" | 350 | 500 to 15000 gal/min | 3600 gal/min | 30 gal | 60 gal/min |
| 15" | 375 | 600 to 19000 gal/min | 4800 gal/min | 50 gal | 60 gal/min |
| 16" | 400 | 600 to 19000 gal/min | 4800 gal/min | 50 gal | 60 gal/min |
| 18" | 450 | 800 to 24000 gal/min | 6000 gal/min | 50 gal | 90 gal/min |
| 20" | 500 | 1000 to 30000 gal/min | 7500 gal/min | 75 gal | 120 gal/min |
| 24" | 600 | 1400 to 44000 gal/min | 10500 gal/min | 100 gal | 180 gal/min |
| 28" | 700 | 1900 to 60000 gal/min | 13500 gal/min | 125 gal | 210 gal/min |
| 30" | – | 2150 to 67000 gal/min | 16500 gal/min | 150 gal | 270 gal/min |
| 32" | 800 | 2450 to 80000 gal/min | 19500 gal/min | 200 gal | 300 gal/min |
| 36" | 900 | 3100 to 100000 gal/min | 24000 gal/min | 225 gal | 360 gal/min |
| 40" | 1000 | 3800 to 125000 gal/min | 30000 gal/min | 250 gal | 480 gal/min |
| 42" | – | 4200 to 135000 gal/min | 33000 gal/min | 250 gal | 600 gal/min |
| 48" | 1200 | 5500 to 175000 gal/min | 42000 gal/min | 400 gal | 600 gal/min |
| 54" | – | 9 to 300 Mgal/min | 75 Mgal/min | 0.0005 Mgal | 1.3 Mgal/min |
| – | 1400 | 10 to 340 Mgal/min | 85 Mgal/min | 0.0005 Mgal | 1.3 Mgal/min |
| 60" | – | 12 to 380 Mgal/min | 95 Mgal/min | 0.0005 Mgal | 1.3 Mgal/min |
| – | 1600 | 13 to 450 Mgal/min | 110 Mgal/min | 0.0008 Mgal | 1.7 Mgal/min |
| 66" | – | 14 to 500 Mgal/min | 120 Mgal/min | 0.0008 Mgal | 2.2 Mgal/min |
| 72" | 1800 | 16 to 570 Mgal/min | 140 Mgal/min | 0.0008 Mgal | 2.6 Mgal/min |
| 78" | – | 18 to 650 Mgal/min | 175 Mgal/min | 0.001 Mgal | 3.0 Mgal/min |
| – | 2000 | 20 to 700 Mgal/min | 175 Mgal/min | 0.001 Mgal | 3.0 Mgal/min |

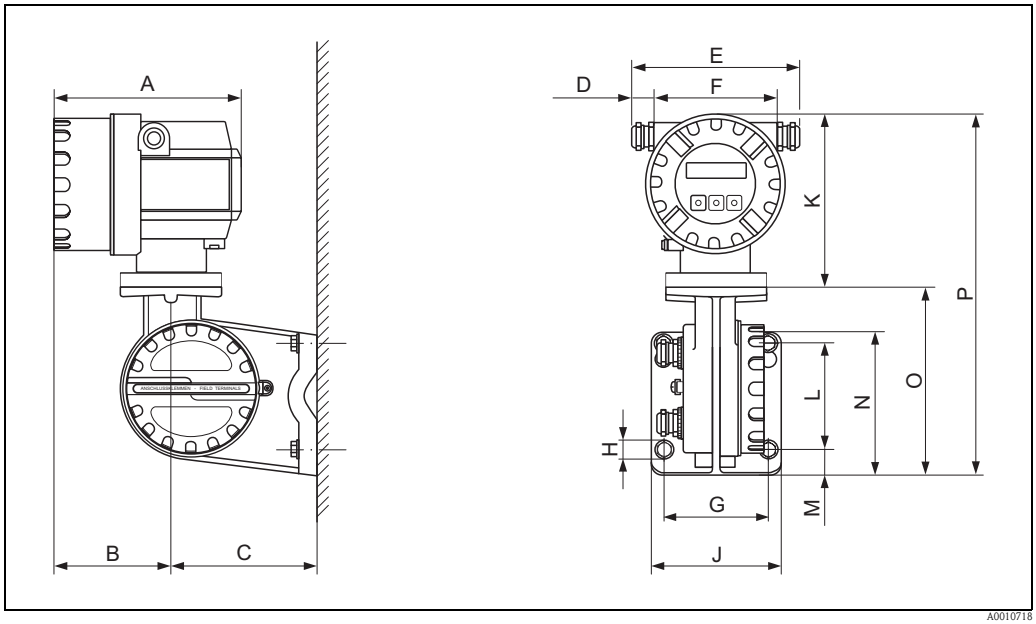
**Pressure loss**

- No pressure loss if the sensor is installed in a pipe with the same nominal diameter.
- Pressure losses for configurations incorporating adapters according to DIN EN 545 (→ 14, Section "Adapters").

# Mechanical construction

**Design, dimensions**

**Transmitter, remote version**




*Transmitter dimensions, remote version*

*Dimensions in SI units*

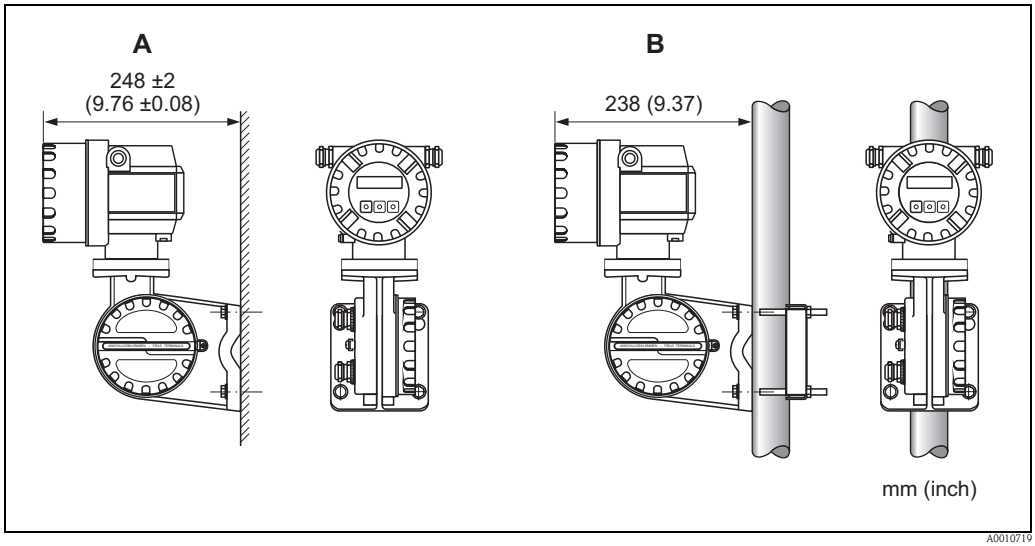
| A | B | C | D | E | F | G | Ø H |
|---|---|---|---|---|---|---|---|
| 178 | 113 | 135 | 20 to 30 | 161 to 181 | 113 | 100 | 8.6 (M8) |
| J | K | L | M | N | O | P | |
| 123 | 150 | 100 | 25 | 133 | 177.5 | 327.5 | |

All dimensions in [mm]

*Dimensions in US units*

| A | B | C | D | E | F | G | Ø H |
|---|---|---|---|---|---|---|---|
| 7.00 | 4.45 | 5.31 | 0.79 to 1.81 | 6.34 to 7.13 | 4.45 | 3.94 | 0.34 (M8) |
| J | K | L | M | N | O | P | |
| 4.84 | 5.90 | 3.94 | 0.98 | 5.24 | 6.99 | 12.89 | |

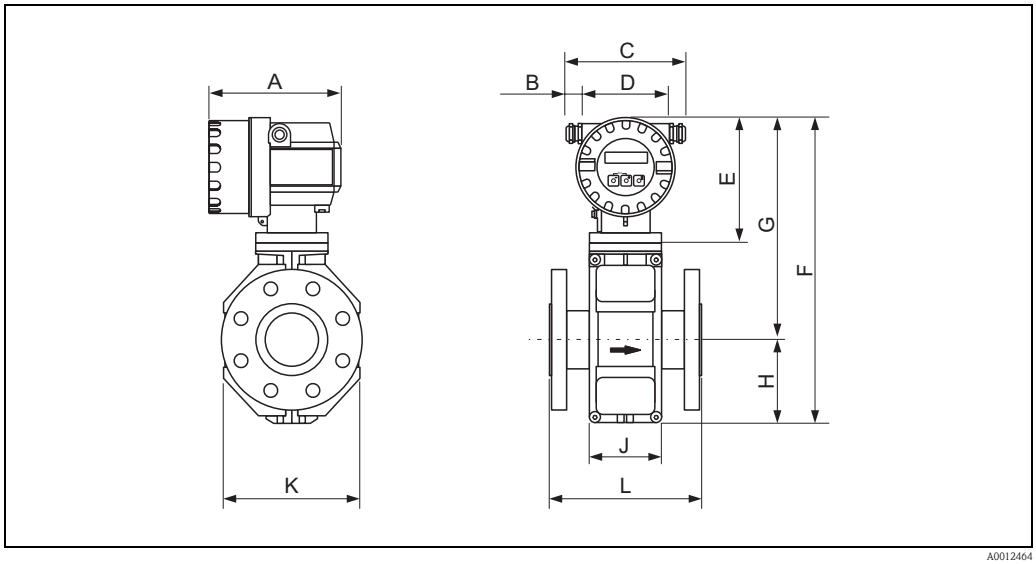
All dimensions in [inch]




*Transmitter mounting, remote version*

*A Direct wall mounting*
*B Pipe mounting*

**Compact version DN ≤ 300 (12")**




*Dimensions in SI units*

| DN<br>EN (DIN) / JIS / AS [2] | L [1] | A | B | C | D | E | F | G | H | J | K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 25 | 200 | 178 | 20 to 30 | 161 to 181 | 113 | 150 | 341 | 257 | 84 | 94 | 120 |
| 32 | 200 | | | | | | 341 | 257 | 84 | 94 | 120 |
| 40 | 200 | | | | | | 341 | 257 | 84 | 94 | 120 |
| 50 | 200 | | | | | | 341 | 257 | 84 | 94 | 120 |
| 65 | 200 | | | | | | 391 | 282 | 109 | 94 | 180 |
| 80 | 200 | | | | | | 391 | 282 | 109 | 94 | 180 |
| 100 | 250 | | | | | | 391 | 282 | 109 | 94 | 180 |
| 125 | 250 | | | | | | 472 | 322 | 150 | 140 | 260 |
| 150 | 300 | | | | | | 472 | 322 | 150 | 140 | 260 |
| 200 | 350 | | | | | | 527 | 347 | 180 | 156 | 324 |
| 250 | 450 | | | | | | 577 | 372 | 205 | 166 | 400 |
| 300 | 500 | | | | | | 627 | 397 | 230 | 166 | 460 |

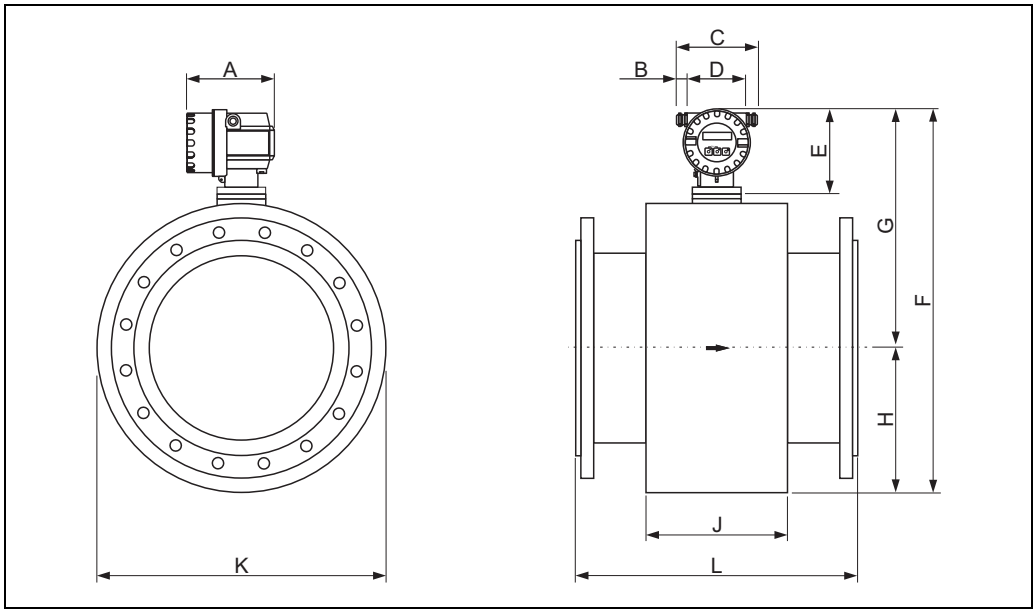
[1] The length is regardless of the pressure rating selected. Fitting length to DVGW.
[2] For flanges to AS, only the nominal diameters DN 80, 100 and 150 to 300 are available.
All dimensions in [mm]

*Dimensions in US units*

| DN ANSI | L [1)] | A | B | C | D | E | F | G | H | J | K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1" | 7.87 | 7.01 | 0.79 to 1.18 | 6.34 to 7.13 | 4.45 | 5.91 | 13.4 | 10.1 | 3.31 | 3.70 | 4.72 |
| 1½" | 7.87 | | | | | | 13.4 | 10.1 | 3.31 | 3.70 | 4.72 |
| 2" | 7.87 | | | | | | 13.4 | 10.1 | 3.31 | 3.70 | 4.72 |
| 3" | 7.87 | | | | | | 15.4 | 11.1 | 4.29 | 3.70 | 7.09 |
| 4" | 9.84 | | | | | | 15.4 | 11.1 | 4.29 | 3.70 | 7.09 |
| 6" | 11.8 | | | | | | 18.6 | 12.7 | 5.91 | 5.51 | 10.2 |
| 8" | 13.8 | | | | | | 20.8 | 13.7 | 7.09 | 6.14 | 12.8 |
| 10" | 17.7 | | | | | | 22.7 | 14.7 | 8.07 | 6.14 | 15.8 |
| 12" | 19.7 | | | | | | 24.7 | 15.6 | 9.06 | 6.54 | 18.1 |

[1)] The length is regardless of the pressure rating selected. Fitting length to DVGW.
All dimensions in [inch]

**Compact version DN ≥ 350 (14")**




*Dimensions in SI units*

| DN EN (DIN) / AS [2] | L [1] | A | B | C | D | E | F | G | H | J | K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 350 | 550 | 178 | 20 to 30 | 161 to 181 | 113 | 150 | 738.5 | 456.5 | 282.0 | 276 | 564 |
| 375 | 600 | | | | | | 790.5 | 482.5 | 308.0 | 276 | 616 |
| 400 | 600 | | | | | | 790.5 | 482.5 | 308.0 | 276 | 616 |
| 450 | 650 | | | | | | 840.5 | 507.5 | 333.0 | 292 | 666 |
| 500 | 650 | | | | | | 891.5 | 533.0 | 358.5 | 292 | 717 |
| 600 | 780 | | | | | | 995.5 | 585.0 | 410.5 | 402 | 821 |
| 700 | 910 | | | | | | 1198.5 | 686.5 | 512.0 | 589 | 1024 |
| 750 | 975 | | | | | | 1198.5 | 686.5 | 512.0 | 626 | 1024 |
| 800 | 1040 | | | | | | 1241.5 | 708.5 | 533.5 | 647 | 1067 |
| 900 | 1170 | | | | | | 1394.5 | 784.5 | 610.0 | 785 | 1220 |
| 1000 | 1300 | | | | | | 1546.5 | 860.5 | 686.0 | 862 | 1372 |
| 1050 | 1365 | | | | | | 1598.5 | 886.5 | 712.0 | 912 | 1424 |
| 1200 | 1560 | | | | | | 1796.5 | 985.5 | 811.0 | 992 | 1622 |
| 1350 | 1755 | | | | | | 1998.5 | 1086.5 | 912.0 | 1252 | 1824 |
| 1400 | 1820 | | | | | | 2148.5 | 1161.5 | 987.0 | 1252 | 1974 |
| 1500 | 1950 | | | | | | 2196.5 | 1185.5 | 1011.0 | 1392 | 2022 |
| 1600 | 2080 | | | | | | 2286.5 | 1230.5 | 1056.0 | 1482 | 2112 |
| 1650 | 2145 | | | | | | 2360.5 | 1267.5 | 1093.0 | 1482 | 2186 |
| 1800 | 2340 | | | | | | 2550.5 | 1362.5 | 1188.0 | 1632 | 2376 |
| 2000 | 2600 | | | | | | 2650.5 | 1412.5 | 1238.0 | 1732 | 2476 |

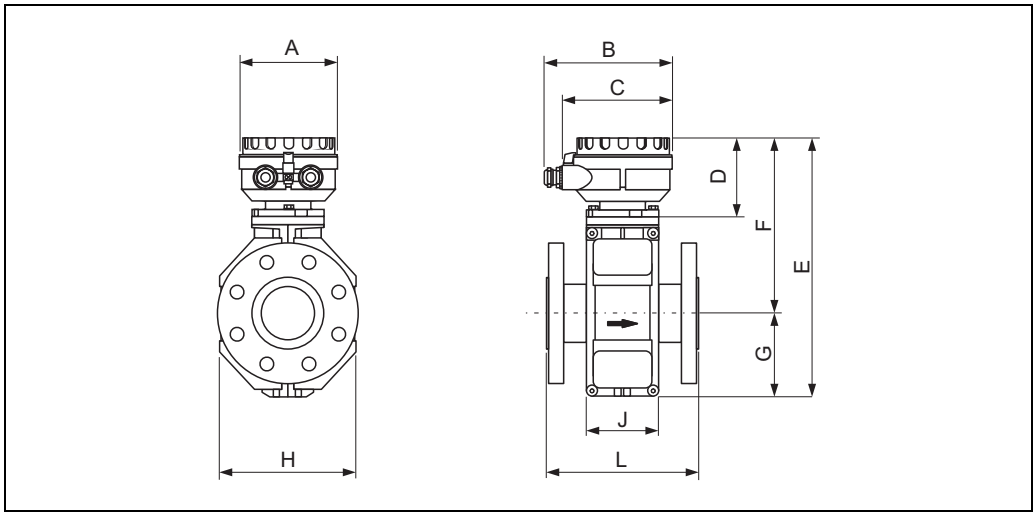
[1] The length is regardless of the pressure rating selected. Fitting length to DVGW.
[2] For flanges to AS, only DN 350, 400, 500 and 600 are available.
All dimensions in [mm]

*Dimensions in US units*

| DN ANSI / AWWA [2] | L [1] | A | B | C | D | E | F | G | H | J | K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 14" | 21.6 | 7.01 | 0.79 to 1.18 | 6.34 to 7.13 | 4.45 | 5.91 | 29.1 | 17.9 | 11.1 | 10.9 | 22.2 |
| 15" | 23.6 | | | | | | 31.1 | 18.9 | 12.1 | 10.9 | 24.2 |
| 16" | 23.6 | | | | | | 31.1 | 18.9 | 12.1 | 10.9 | 24.2 |
| 18" | 25.6 | | | | | | 33.1 | 19.9 | 13.1 | 11.5 | 26.2 |
| 20" | 25.6 | | | | | | 35.1 | 20.9 | 14.1 | 11.5 | 28.2 |
| 24" | 30.7 | | | | | | 39.2 | 23.0 | 16.2 | 15.8 | 32.3 |
| 28" | 35.8 | | | | | | 47.2 | 27.0 | 20.1 | 23.2 | 40.3 |
| 30" | 38.4 | | | | | | 47.2 | 27.0 | 20.1 | 24.6 | 40.3 |
| 32" | 40.9 | | | | | | 48.9 | 27.9 | 21.0 | 25.5 | 42.0 |
| 36" | 46.0 | | | | | | 54.9 | 30.9 | 24.0 | 30.9 | 48.0 |
| 40" | 51.2 | | | | | | 60.9 | 33.9 | 27.0 | 33.9 | 54.0 |
| 42" | 53.7 | | | | | | 62.9 | 34.9 | 28.0 | 35.9 | 56.0 |
| 48" | 61.4 | | | | | | 71.7 | 38.8 | 31.9 | 39.0 | 63.8 |
| 54" | 69.1 | | | | | | 78.7 | 42.8 | 35.9 | 42.3 | 71.8 |
| 56" | 71.7 | | | | | | 84.6 | 45.7 | 38.9 | 49.3 | 77.7 |
| 60" | 76.8 | | | | | | 86.5 | 46.7 | 39.8 | 54.8 | 79.6 |
| 64" | 81.9 | | | | | | 90.0 | 48.4 | 41.6 | 58.4 | 83.2 |
| 66" | 84.4 | | | | | | 92.9 | 49.9 | 43.0 | 58.4 | 86.0 |
| 72" | 92.1 | | | | | | 100.4 | 53.6 | 46.8 | 64.2 | 93.5 |
| 78" | 102.3 | | | | | | 104.3 | 55.6 | 48.7 | 68.2 | 97.5 |

[1] The length is regardless of the pressure rating selected. Fitting length to DVGW.
[2] Flanges ≤ DN 600 only to ANSI available, ≥ DN 700 only to AWWA available.
All dimensions in [inch]

**Sensor, remote version DN ≤ 300 (12")**




A0012462

*Dimensions in SI units*

| DN<br>EN (DIN) / JIS / AS [2] | L [1] | A | B | C | D | E | F | G | H | J |
|---|---|---|---|---|---|---|---|---|---|---|
| 25 | 200 | 129 | 163 | 143 | 102 | 286 | 202 | 84 | 120 | 94 |
| 32 | 200 | 129 | 163 | 143 | 102 | 286 | 202 | 84 | 120 | 94 |
| 40 | 200 | 129 | 163 | 143 | 102 | 286 | 202 | 84 | 120 | 94 |
| 50 | 200 | 129 | 163 | 143 | 102 | 286 | 202 | 84 | 120 | 94 |
| 65 | 200 | 129 | 163 | 143 | 102 | 336 | 227 | 109 | 180 | 94 |
| 80 | 200 | 129 | 163 | 143 | 102 | 336 | 227 | 109 | 180 | 94 |
| 100 | 250 | 129 | 163 | 143 | 102 | 336 | 227 | 109 | 180 | 94 |
| 125 | 250 | 129 | 163 | 143 | 102 | 417 | 267 | 150 | 260 | 140 |
| 150 | 300 | 129 | 163 | 143 | 102 | 417 | 267 | 150 | 260 | 140 |
| 200 | 350 | 129 | 163 | 143 | 102 | 472 | 292 | 180 | 324 | 156 |
| 250 | 450 | 129 | 163 | 143 | 102 | 522 | 317 | 205 | 400 | 166 |
| 300 | 500 | 129 | 163 | 143 | 102 | 572 | 342 | 230 | 460 | 166 |

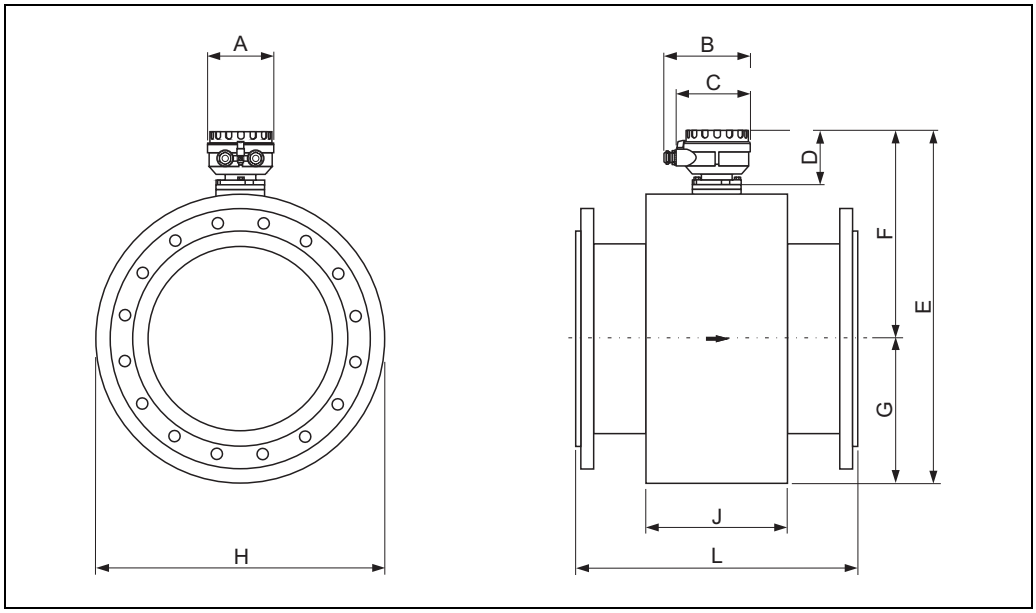
[1] The length is regardless of the pressure rating selected. Fitting length to DVGW.
[2] For flanges to AS, only the nominal diameters DN 80, 100 and 150 to 300 are available.
All dimensions in [mm]

*Dimensions in US units*

| DN<br>ANSI | L [1)] | A | B | C | D | E | F | G | H | J |
|---|---|---|---|---|---|---|---|---|---|---|
| 1" | 7.87 | 5.08 | 6.42 | 5.63 | 4.02 | 11.3 | 7.95 | 3.32 | 4.72 | 3.70 |
| 1½" | 7.87 | | | | | 11.3 | 7.95 | 3.32 | 4.72 | 3.70 |
| 2" | 7.87 | | | | | 11.3 | 7.95 | 3.32 | 4.72 | 3.70 |
| 3" | 7.87 | | | | | 13.2 | 8.94 | 4.30 | 7.10 | 3.70 |
| 4" | 9.84 | | | | | 13.2 | 8.94 | 4.30 | 7.10 | 3.70 |
| 6" | 11.8 | | | | | 16.4 | 10.5 | 5.91 | 10.2 | 5.51 |
| 8" | 13.8 | | | | | 18.6 | 11.5 | 7.10 | 12.8 | 6.14 |
| 10" | 17.7 | | | | | 20.6 | 12.5 | 8.08 | 15.8 | 6.14 |
| 12" | 19.7 | | | | | 22.5 | 13.5 | 9.06 | 18.1 | 6.54 |

[1)] The length is regardless of the pressure rating selected. Fitting length to DVGW.
All dimensions in [inch]

**Sensor, remote version DN ≥ 350 (14")**




*Dimensions in SI units*

| DN EN (DIN) / AS [2] | L [1] | A | B | C | D | E | F | G | H | J |
|---|---|---|---|---|---|---|---|---|---|---|
| 350 | 550 | 129 | 163 | 143 | 102 | 683.5 | 401.5 | 282.0 | 564 | 276 |
| 375 | 600 | | | | | 735.5 | 427.5 | 308.0 | 616 | 276 |
| 400 | 600 | | | | | 735.5 | 427.5 | 308.0 | 616 | 276 |
| 450 | 650 | | | | | 785.5 | 452.5 | 333.0 | 666 | 292 |
| 500 | 650 | | | | | 836.5 | 478.0 | 358.5 | 717 | 292 |
| 600 | 780 | | | | | 940.5 | 530.0 | 410.5 | 821 | 402 |
| 700 | 910 | | | | | 1143.5 | 631.5 | 512.0 | 1024 | 589 |
| 750 | 975 | | | | | 1143.5 | 631.5 | 512.0 | 1024 | 626 |
| 800 | 1040 | | | | | 1186.5 | 653.0 | 533.5 | 1067 | 647 |
| 900 | 1170 | | | | | 1339.5 | 729.5 | 610.0 | 1220 | 785 |
| 1000 | 1300 | | | | | 1491.5 | 805.5 | 686.0 | 1372 | 862 |
| 1050 | 1365 | | | | | 1543.5 | 831.5 | 712.0 | 1424 | 912 |
| 1200 | 1560 | | | | | 1741.5 | 930.5 | 811.0 | 1622 | 992 |
| 1350 | 1755 | | | | | 1943.5 | 1031.5 | 912.0 | 1824 | 1252 |
| 1400 | 1820 | | | | | 2093.5 | 1106.5 | 987.0 | 1974 | 1252 |
| 1500 | 1950 | | | | | 2141.5 | 1130.5 | 1011.0 | 2022 | 1392 |
| 1600 | 2080 | | | | | 2231.5 | 1175.5 | 1056.0 | 2112 | 1482 |
| 1650 | 2145 | | | | | 2305.5 | 1212.5 | 1093.0 | 2186 | 1482 |
| 1800 | 2340 | | | | | 2495.5 | 1307.5 | 1188.0 | 2376 | 1632 |
| 2000 | 2600 | | | | | 2595.5 | 1357.5 | 1238.0 | 2476 | 1732 |

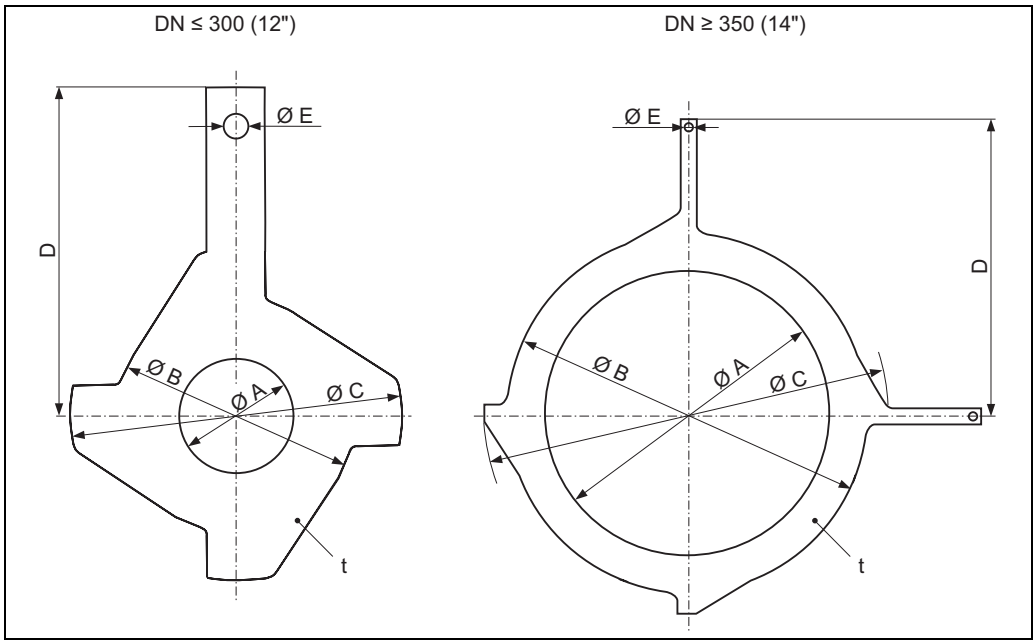
[1] The length is regardless of the pressure rating selected. Fitting length to DVGW.
[2] For flanges to AS, only DN 350, 400, 500 and 600 are available.
All dimensions in [mm]

*Dimensions in US units*

| DN ANSI / AWWA [2] | L [1] | A | B | C | D | E | F | G | H | J |
|---|---|---|---|---|---|---|---|---|---|---|
| 14" | 21.6 | 5.08 | 6.42 | 5.63 | 4.02 | 29.1 | 15.8 | 11.1 | 22.2 | 10.9 |
| 15" | 23.6 | | | | | 31.1 | 16.8 | 12.1 | 24.2 | 10.9 |
| 16" | 23.6 | | | | | 31.1 | 16.8 | 12.1 | 24.2 | 10.9 |
| 18" | 25.6 | | | | | 33.1 | 17.8 | 13.1 | 26.2 | 11.5 |
| 20" | 25.6 | | | | | 35.1 | 18.8 | 14.1 | 28.2 | 11.5 |
| 24" | 30.7 | | | | | 39.2 | 20.9 | 16.2 | 32.3 | 15.8 |
| 28" | 35.8 | | | | | 45.0 | 24.9 | 20.1 | 40.3 | 23.2 |
| 30" | 38.4 | | | | | 45.0 | 24.9 | 20.1 | 40.3 | 24.6 |
| 32" | 40.9 | | | | | 46.7 | 25.7 | 21.0 | 42.0 | 25.5 |
| 36" | 46.0 | | | | | 52.7 | 28.7 | 24.0 | 48.0 | 30.9 |
| 40" | 51.2 | | | | | 58.7 | 31.7 | 27.0 | 54.0 | 33.9 |
| 42" | 53.7 | | | | | 60.7 | 32.7 | 28.0 | 56.0 | 35.9 |
| 48" | 61.4 | | | | | 68.5 | 36.6 | 31.9 | 63.8 | 39.0 |
| 54" | 69.1 | | | | | 76.5 | 40.6 | 35.9 | 71.8 | 42.3 |
| 56" | 71.7 | | | | | 82.4 | 43.6 | 38.9 | 77.7 | 49.3 |
| 60" | 76.8 | | | | | 84.3 | 44.5 | 39.8 | 79.6 | 54.8 |
| 64" | 81.9 | | | | | 87.9 | 46.3 | 41.6 | 83.2 | 58.4 |
| 66" | 84.4 | | | | | 90.8 | 47.7 | 43.0 | 86.0 | 58.4 |
| 72" | 92.1 | | | | | 98.2 | 51.5 | 46.8 | 93.5 | 64.2 |
| 78" | 102.3 | | | | | 102.2 | 53.4 | 48.7 | 97.5 | 68.2 |

[1] The length is regardless of the pressure rating selected. Fitting length to DVGW.
[2] Flanges ≤ DN 600 only to ANSI available, ≥ DN 700 only to AWWA available.
All dimensions in [inch]

**Ground disk for flange connections**




*Dimensions (SI units)*

| DN [1] EN (DIN) / JIS / AS [2] | A | B | C | D | E | t |
|---|---|---|---|---|---|---|
| 25 | 26 | 62 | 77.5 | 87.5 | 6.5 | 2 |
| 32 | 35 | 80 | 87.5 | 94.5 | | |
| 40 | 41 | 82 | 101 | 103 | | |
| 50 | 52 | 101 | 115.5 | 108 | | |
| 65 | 68 | 121 | 131.5 | 118 | | |
| 80 | 80 | 131 | 154.5 | 135 | | |
| 100 | 104 | 156 | 186.5 | 153 | | |
| 125 | 130 | 187 | 206.5 | 160 | | |
| 150 | 158 | 217 | 256 | 184 | | |
| 200 | 206 | 267 | 288 | 205 | | |
| 250 | 260 | 328 | 359 | 240 | | |
| 300 [3] | 312 | 375 | 413 | 273 | | |
| 300 [4] | 310 | 375 | 404 | 268 | | |
| 350 [3] | 343 | 433 | 479 | 365 | 9.0 | |
| 375 [3] | 393 | 480 | 542 | 395 | | |
| 400 [3] | 393 | 480 | 542 | 395 | | |
| 450 [3] | 439 | 538 | 583 | 417 | | |
| 500 [3] | 493 | 592 | 650 | 460 | | |
| 600 [3] | 593 | 693 | 766 | 522 | | |

[1] Ground disks can be used for all flange standards/pressure ratings that can be delivered, except for DN ≥ 300.
[2] Only DN 32, 40, 65 and 125 are available for flanges according to AS.
[3] PN 10/16
[4] PN 25, JIS 10K/20K
All dimensions in [mm]

*Dimensions (US units)*

| DN [1] ANSI | A | B | C | D | E | t |
|---|---|---|---|---|---|---|
| 1" | 1.02 | 2.44 | 3.05 | 3.44 | 0.26 | 0.08 |
| 1½" | 1.61 | 3.23 | 3.98 | 4.06 | | |
| 2" | 2.05 | 3.98 | 4.55 | 4.25 | | |
| 3" | 3.15 | 5.16 | 6.08 | 5.31 | | |
| 4" | 4.09 | 6.14 | 7.34 | 6.02 | | |
| 6" | 6.22 | 8.54 | 10.08 | 7.24 | | |
| 8" | 8.11 | 10.5 | 11.3 | 8.07 | | |
| 10" | 10.2 | 12.9 | 14.1 | 9.45 | | |
| 12" | 12.3 | 14.8 | 16.3 | 10.8 | | |
| 14" | 13.5 | 17.1 | 18.9 | 14.4 | 0.35 | |
| 15" | 15.45 | 18.9 | 21.3 | 15.6 | | |
| 16" | 15.45 | 18.9 | 21.3 | 15.6 | | |
| 18" | 17.3 | 21.2 | 23.0 | 16.4 | | |
| 20" | 19.4 | 23.3 | 25.6 | 18.1 | | |
| 24" | 23.4 | 27.3 | 30.1 | 20.6 | | |

[1] Ground disks can be used for all flange standards/pressure ratings.
All dimensions in [inch]

**Weight**

*Weight in SI units*

Weight data in kg

| Diameter | | Compact version | | | | | | Remote version (without cable) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Sensor | | | | | | Transmitter |
| [mm] | [inch] | EN (DIN) / AS [1] | | JIS | | ANSI / AWWA | | EN (DIN) / AS [1] | | JIS | | ANSI / AWWA | | Wall housing |
| 25 | 1" | PN 40 | 5.7 | 10K | 5.7 | Class 150 | 5.7 | PN 40 | 5.3 | 10K | 5.3 | Class 150 | 5.3 | 3.1 |
| 32 | – | | 6.4 | | 5.7 | | – | | 6.0 | | 5.3 | | – | |
| 40 | 1½" | | 7.8 | | 6.7 | | 7.8 | | 7.4 | | 6.3 | | 7.4 | |
| 50 | 2" | | 9.0 | | 7.7 | | 9.0 | | 8.6 | | 7.3 | | 8.6 | |
| 65 | – | PN 16 | 10.4 | | 9.5 | | – | PN 16 | 10.0 | | 9.1 | | – | |
| 80 | 3" | | 12.4 | | 10.9 | | 12.4 | | 12.0 | | 10.5 | | 12.0 | |
| 100 | 4" | | 14.4 | | 13.1 | | 14.4 | | 14.0 | | 12.7 | | 14.0 | |
| 125 | – | | 19.9 | | 19.4 | | – | | 19.5 | | 19.0 | | – | |
| 150 | 6" | | 23.9 | | 22.9 | | 23.9 | | 23.5 | | 22.5 | | 23.5 | |
| 200 | 8" | PN 10 | 43.4 | | 40.3 | | 43.3 | PN 10 | 43 | | 39.9 | | 43 | |
| 250 | 10" | | 63.4 | | 67.8 | | 73.4 | | 63 | | 67.4 | | 73 | |
| 300 | 12" | | 68.4 | | 70.7 | | 108.4 | | 68 | | 70.3 | | 108 | |
| 350 | 14" | PN 6 | 105 | | | | 175 | PN 6 | 103 | | | | 173 | |
| 375 | 15" | | 120 | | | | – | | 118 | | | | – | |
| 400 | 16" | | 120 | | | | 205 | | 118 | | | | 203 | |
| 450 | 18" | | 161 | | | | 255 | | 159 | | | | 253 | |
| 500 | 20" | | 156 | | | | 285 | | 154 | | | | 283 | |
| 600 | 24" | | 208 | | | | 405 | | 206 | | | | 403 | |
| 700 | 28" | | 304 | | | Class D | 400 | | 302 | | | Class D | 398 | |
| – | 30" | | – | | | | 460 | | – | | | | 458 | |
| 800 | 32" | | 357 | | | | 550 | | 355 | | | | 548 | |
| 900 | 36" | | 485 | | | | 800 | | 483 | | | | 798 | |
| 1000 | 40" | | 589 | | | | 900 | | 587 | | | | 898 | |
| – | 42" | | – | | | | 1100 | | – | | | | 1098 | |
| 1200 | 48" | | 850 | | | | 1400 | | 848 | | | | 1398 | |
| – | 54" | | – | | | | 2200 | | – | | | | 2198 | |
| 1400 | – | | 1300 | | | | – | | 1298 | | | | – | |
| – | 60" | | – | | | | 2700 | | – | | | | 2698 | |
| 1600 | – | | 1700 | | | | – | | 1698 | | | | – | |
| – | 66" | | – | | | | 3700 | | – | | | | 3698 | |
| 1800 | 72" | | 2200 | | | | 4100 | | 2198 | | | | 4098 | |
| – | 78" | | – | | | | 4600 | | – | | | | 4598 | |
| 2000 | – | | 2800 | | | | – | | 2798 | | | | – | |

[1] For flanges to AS, only DN 80, 100, 150 to 400, 500 and 600 are available.

- Transmitter (compact version): 1.8 kg
- Weight data valid for standard pressure ratings and without packaging material

*Weight in US units (only ANSI/AWWA)*

| Weight data in lbs | | | | | |
|---|---|---|---|---|---|
| Diameter | | Compact version | | Remote version (without cable) | |
| | | | | Sensor | Transmitter |
| [mm] | [inch] | | ANSI /AWWA | ANSI / AWWA | Wall housing |
| 25 | 1" | Class 150 | 12.6 | Class 150 | 11.7 | 6.8 |
| 40 | 1½" | | 17.2 | | 16.3 | |
| 50 | 2" | | 19.9 | | 19.0 | |
| 80 | 3" | | 27.3 | | 26.5 | |
| 100 | 4" | | 31.8 | | 30.9 | |
| 150 | 6" | | 52.7 | | 51.8 | |
| 200 | 8" | | 95.5 | | 94.8 | |
| 250 | 10" | | 162.1 | | 161.0 | |
| 300 | 12" | | 239.0 | | 238.1 | |
| 350 | 14" | | 380.1 | | 381.5 | |
| 400 | 16" | | 448.5 | | 447.6 | |
| 450 | 18" | | 558.8 | | 557.9 | |
| 500 | 20" | | 624.9 | | 624.0 | |
| 600 | 24" | | 889.5 | | 888.6 | |
| 700 | 28" | Class D | 878.5 | Class D | 877.6 | |
| – | 30" | | 1010.8 | | 1009.9 | |
| 800 | 32" | | 1209.2 | | 1208.3 | |
| 900 | 36" | | 1760.5 | | 1759.6 | |
| 1000 | 40" | | 1981.0 | | 1980.1 | |
| – | 42" | | 2422.0 | | 2421.1 | |
| 1200 | 48" | | 3083.5 | | 3082.6 | |
| – | 54" | | 4847.5 | | 4846.6 | |
| – | 60" | | 5950.0 | | 5949.1 | |
| – | 66" | | 8155.0 | | 8154.1 | |
| 1800 | 72" | | 9037.0 | | 9036.1 | |
| – | 78" | | 10139.0 | | 10139.0 | |

- Transmitter (compact version): 4.0 lbs
- Weight data valid for standard pressure ratings and without packaging material

**Measuring tube specifications**

| Diameter | | Pressure rating | | | | | | Internal diameter | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | EN (DIN) | AS 2129 | AS 4087 | ANSI | AWWA | JIS | Hard rubber | | Polyurethane | |
| [mm] | [inch] | [bar] | | | [lbs] | | | [mm] | [inch] | [mm] | [inch] |
| 25 | 1" | PN 40 | – | – | Cl. 150 | – | 20 K | – | – | 24 | 0.94 |
| 32 | – | PN 40 | – | – | – | – | 20 K | – | – | 32 | 1.26 |
| 40 | 1½" | PN 40 | – | – | Cl. 150 | – | 20 K | – | – | 38 | 1.50 |
| 50 | 2" | PN 40 | Table E | PN 16 | Cl. 150 | – | 10 K | 50 | 1.97 | 50 | 1.97 |
| 65 | – | PN 16 | – | – | – | – | 10 K | 66 | 2.60 | 66 | 2.60 |
| 80 | 3" | PN 16 | Table E | PN 16 | Cl. 150 | – | 10 K | 79 | 3.11 | 79 | 3.11 |
| 100 | 4" | PN 16 | Table E | PN 16 | Cl. 150 | – | 10 K | 102 | 4.02 | 102 | 4.02 |
| 125 | – | PN 16 | – | – | – | – | 10 K | 127 | 5.00 | 127 | 5.00 |
| 150 | 6" | PN 16 | Table E | PN 16 | Cl. 150 | – | 10 K | 156 | 6.14 | 156 | 6.14 |
| 200 | 8" | PN 10 | Table E | PN 16 | Cl. 150 | – | 10 K | 204 | 8.03 | 204 | 8.03 |
| 250 | 10" | PN 10 | Table E | PN 16 | Cl. 150 | – | 10 K | 258 | 10.2 | 258 | 10.2 |
| 300 | 12" | PN 10 | Table E | PN 16 | Cl. 150 | – | 10 K | 309 | 12.2 | 309 | 12.2 |
| 350 | 14" | PN 6 | Table E | PN 16 | Cl. 150 | – | – | 342 | 13.5 | 342 | 13.5 |
| 375 | 15" | – | – | PN 16 | – | – | – | 392 | 15.4 | – | – |
| 400 | 16" | PN 6 | Table E | PN 16 | Cl. 150 | – | – | 392 | 15.4 | 392 | 15.4 |
| 450 | 18" | PN 6 | – | – | Cl. 150 | – | – | 437 | 17.2 | 437 | 17.2 |
| 500 | 20" | PN 6 | Table E | PN 16 | Cl. 150 | – | – | 492 | 19.4 | 492 | 19.4 |
| 600 | 24" | PN 6 | Table E | PN 16 | Cl. 150 | – | – | 594 | 23.4 | 594 | 23.4 |
| 700 | 28" | PN 6 | – | – | – | Class D | – | 692 | 27.2 | 692 | 27.2 |
| – | 30" | – | – | – | – | Class D | – | 742 | 29.2 | 742 | 29.2 |
| 800 | 32" | PN 6 | – | – | – | Class D | – | 794 | 31.3 | 794 | 31.3 |
| 900 | 36" | PN 6 | – | – | – | Class D | – | 891 | 35.1 | 891 | 35.1 |
| 1000 | 40" | PN 6 | – | – | – | Class D | – | 994 | 39.1 | 994 | 39.1 |
| – | 42" | – | – | – | – | Class D | – | 1043 | 41.1 | 1043 | 41.1 |
| 1200 | 48" | PN 6 | – | – | – | Class D | – | 1197 | 47.1 | 1197 | 47.1 |
| – | 54" | | – | – | – | Class D | – | 1339 | 52.7 | – | – |
| 1400 | – | PN 6 | – | – | – | – | – | 1402 | 55.2 | – | – |
| – | 60" | – | – | – | – | Class D | – | 1492 | 58.7 | – | – |
| 1600 | – | PN 6 | – | – | – | – | – | 1600 | 63.0 | – | – |
| – | 66" | – | – | – | – | Class D | – | 1638 | 64.5 | – | – |
| 1800 | 72" | PN 6 | – | – | – | Class D | – | 1786 | 70.3 | – | – |
| 2000 | 78" | PN 6 | – | – | – | Class D | – | 1989 | 78.3 | – | – |

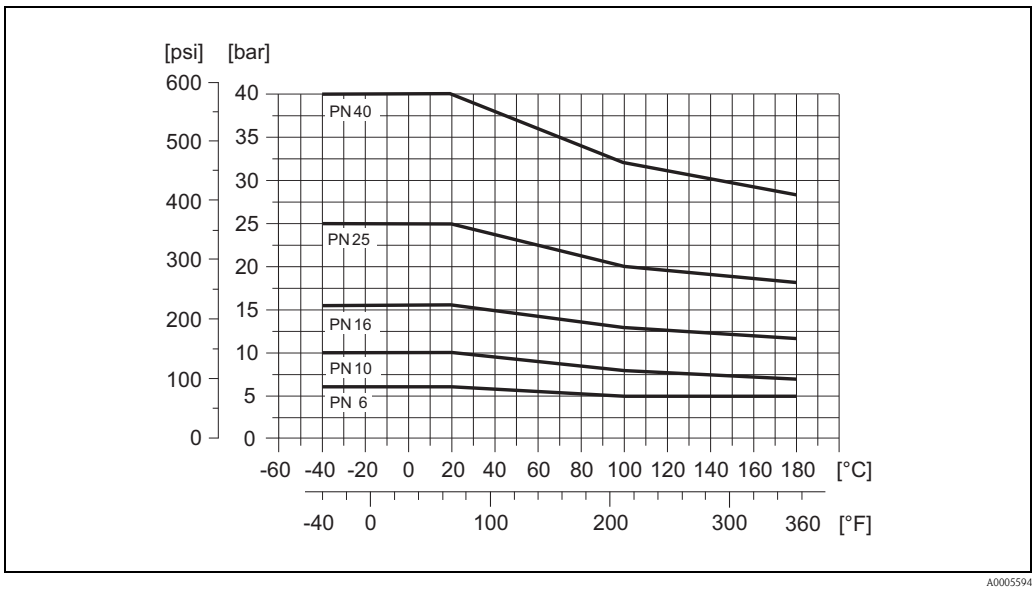
**Material**

- Housing: powder-coated die-cast aluminum
- Sensor housing
  - DN 25 to 300 (1 to 12"): powder-coated die-cast aluminum
  - DN 350 to 2000 (14 to 78"): with protective lacquering
- Measuring tube
  - DN ≤ 300 (12"): stainless steel 1.4301 or 1.4306/304L; (Flange material: carbon steel with Al/Zn protective coating)
  - DN ≥ 350 (14"): stainless steel 1.4301 or 1.4306/304L; (Flange material: carbon steel with protective lacquering)
- Electrodes: 1.4435/316L, Alloy C-22
- Flanges
  - EN 1092-1 (DIN2501): RSt37-2 (S235JRG2); C22, Fe 410W B (DN ≤ 300 (12"): with Al/Zn protective coating; DN ≥ 350 (14") with protective lacquering)
  - ANSI: A105 (DN ≤ 300 (12"): with Al/Zn protective coating; DN ≥ 350 (14") with protective lacquering)
  - AWWA: 1.0425 (with protective lacquering)
  - JIS: RSt37-2 (S235JRG2); HII; 1.0425 (DN ≤ 300 (12"): with Al/Zn protective coating; DN ≥ 350 (14") with protective lacquering)
  - AS 2129
    - (DN 25, 80, 100, 150…1200 / 1", 3", 4", 6…48"): A105 or RSt37-2 (S235JRG2)
    - (DN 50, 80, 350, 400, 500 / 2", 3", 14", 16", 20"): A105 or St44-2 (S275JR)
  - AS 4087: A105 or St44-2 (S275JR) (DN ≤ 300 (12"): with Al/Zn protective coating; DN ≥ 350 (14") with protective lacquering)
- Seals: to DIN EN 1514-1
- Ground disks: 1.4435/316L or Alloy C-22

**Material load diagram**

Caution!
The following diagrams contain material load diagrams (reference curves) for flange materials with regard to the medium temperature. However, the maximum medium temperatures permitted always depend on the lining material of the sensor and/or the sealing material.

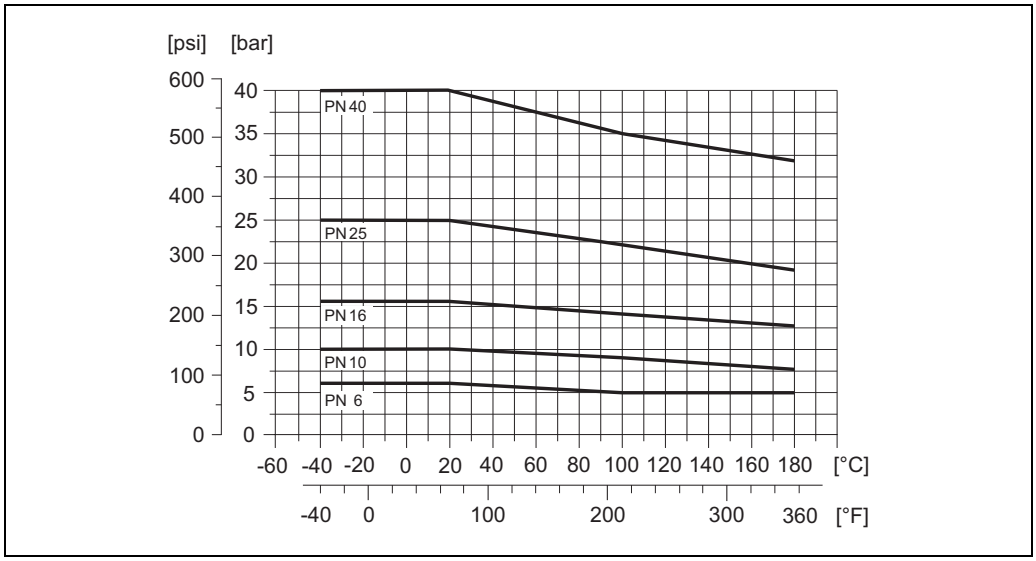
**Flange connection to EN 1092-1 (DIN 2501)**
Material: RSt37-2 (S235JRG2) / C22 / Fe 410W B




A0005594

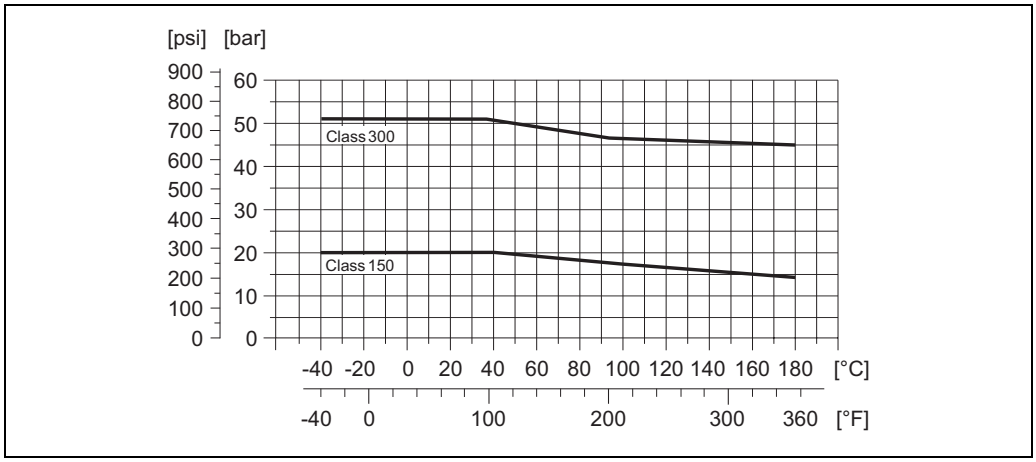
**Flanschanschluss nach EN 1092-1 (DIN 2501)**

Werkstoff: 316L / 1.4571



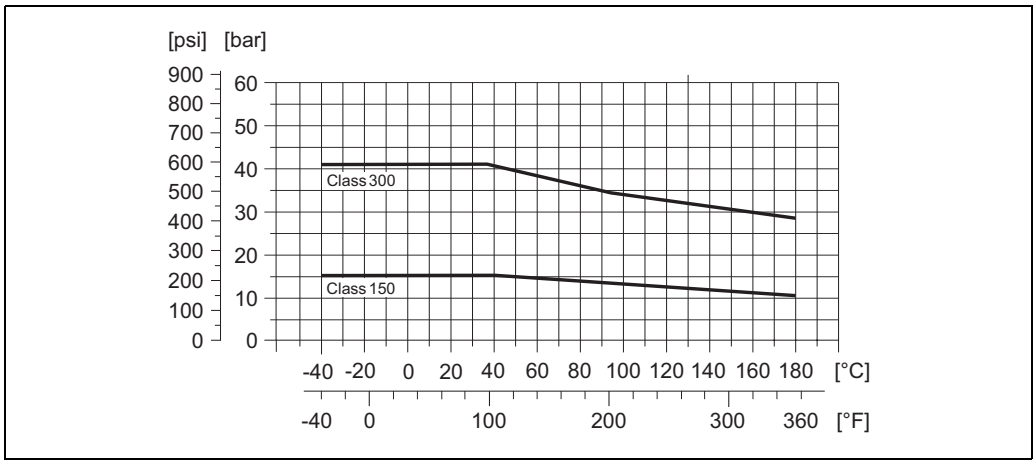

**Flange connection to ANSI B16.5**

Material: A 105

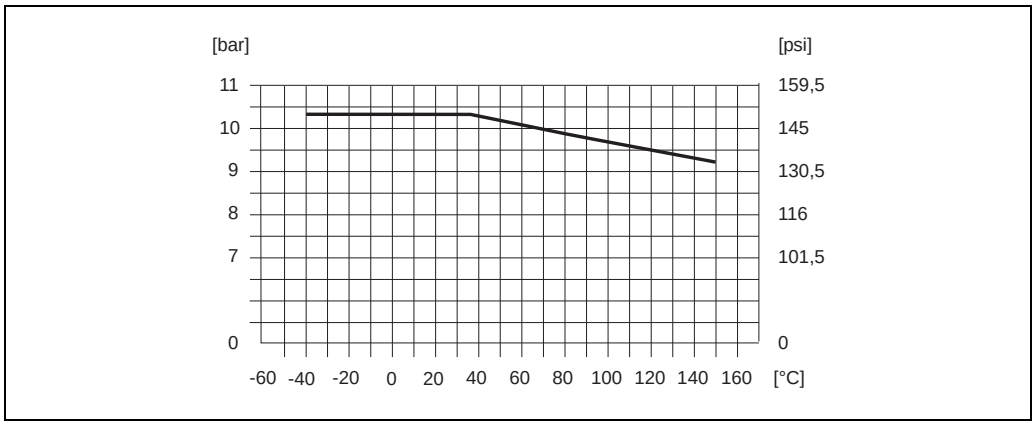



**Flanschanschluss nach ANSI B16.5**

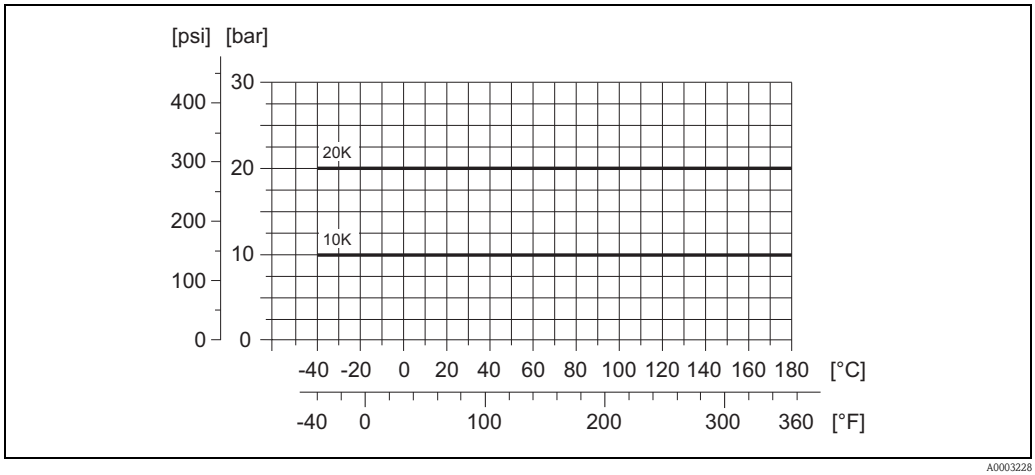
Werkstoff: F316L



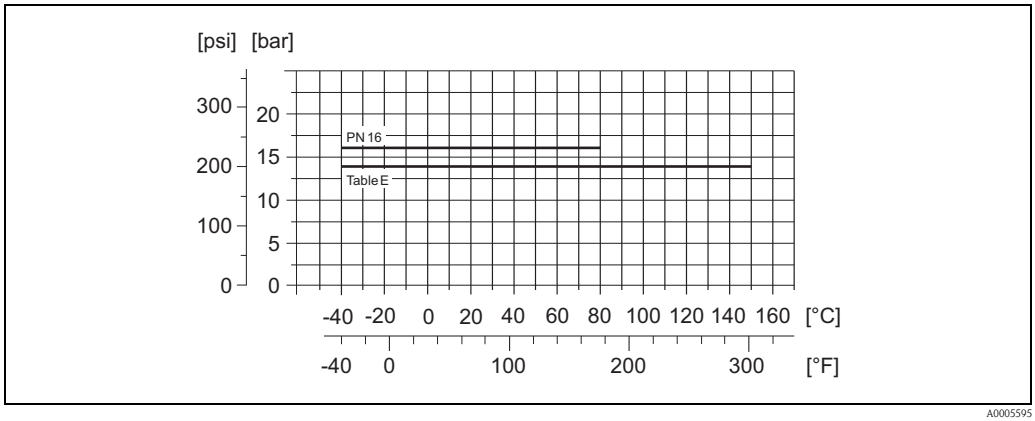
**Flange connection to AWWA C207, Class D**
Material: 1.0425




**Flange connection to JIS B2220**
Material: RSt37-2 (S235JRG2) / HII / 1.0425 / 316L




**Flange connection to AS 2129 Table E or AS 4087 PN 16**
Material: A105 / RSt37-2 (S235JRG2) / St44-2 (S275JR)




**Fitted electrodes**

Measuring electrodes, reference electrodes and empty pipe detection electrodes available as standard with:
- 1.4435
- Alloy C-22

| | |
|---|---|
| **Process connections** | Flange connection:<br>■ EN 1092-1 (DIN 2501), DN ≤ 300 (12") form A, DN ≥ 350 (14") form B<br>(Dimensions to DIN 2501, DN 65 PN 16 and DN 600 (24") PN 16 exclusively to EN 10921)<br>■ ANSI B16.5<br>■ AWWA C 207, Class D<br>■ JIS B2220<br>■ AS 2129 Table E<br>■ AS 4087 PN 16 |
| **Surface roughness** | Electrodes with 1.4435 (AISI 316L), Alloy C-22: ≤ 0.3 to 0.5 µm (12 to 20 µin)<br>(All data refer to parts in contact with medium) |

## Human interface

| | |
|---|---|
| **Display elements** | ■ Liquid crystal display: unilluminated, two-line, 16 characters per line<br>■ Display (operating mode) preconfigured: volume flow and totalizer status<br>■ 1 totalizer |
| **Operating elements** | Local operation via three keys (−, +, E) |
| **Remote operation** | Operation via HART protocol and FieldCare |

## Certificates and approvals

| | |
|---|---|
| **CE mark** | The measuring system is in conformity with the statutory requirements of the EC Directives. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark. |
| **C-tick mark** | The measuring system meets the EMC requirements of the "Australian Communications and Media Authority (ACMA)". |
| **Ex approval** | Information about currently available Ex versions (FM, CSA etc.) can be supplied by your Endress+Hauser Sales Center on request. All explosion protection data are given in a separate documentation which is available upon request. |
| **Other standards and guidelines** | ■ EN 60529<br>Degrees of protection by housing (IP code).<br>■ EN 61010<br>Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures.<br>■ IEC/EN 61326<br>“Emission in accordance with requirements for Class A”.<br>Electromagnetic compatibility (EMC requirements).<br>■ ANSI/ISA-S82.01<br>Safety Standard for Electrical and Electronic Test, Measuring, Controlling and related Equipment – General Requirements. Pollution degree 2, Installation Category II.<br>■ CAN/CSA-C22.2 No. 1010.1-92<br>Safety requirements for Electrical Equipment for Measurement and Control and Laboratory Use. Pollution degree 2, Installation Category II. |
| **Pressure measuring device approval** | Measuring devices with a nominal diameter smaller than or equal to DN 25 correspond to Article 3(3) of the EC Directive 97/23/EC (Pressure Equipment Directive) and have been designed and manufactured according to good engineering practice. Where necessary (depending on the medium and process pressure), there are additional optional approvals to Category II/III for larger nominal diameters. |

# Ordering information

Your Endress +Hauser service organization can provide detailed ordering information and information on the order codes on request.

# Accessories

Various accessories, which can be ordered separately from Endress+Hauser, are available for the transmitter and the sensor. Your Endress+Hauser service organization can provide detailed information on the order codes in question.

# Documentation

- System Information Promag 10 (SI042D/06)
- Operating Instructions Promag 10 (BA082D/06)

# Registered trademarks

KALREZ® and VITON®
Registered trademarks of E.I. Du Pont de Nemours & Co., Wilmington, USA

TRI-CLAMP®
Registered trademark of Ladish & Co., Inc., Kenosha, USA

HART®
Registered trademark of the HART Communication Foundation, Austin, USA

FieldCare®, Fieldcheck®, Field Xpert™, Applicator®
Registered or registration-pending trademarks of Endress+Hauser Flowtec AG, Reinach, CH

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Switzerland

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Fax +41 61 715 25 00
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info@ii.endress.com

Endress+Hauser

People for Process Automation

TI093D/06/en/11.09
71105946
FM+SGML6.0 ProMoDo

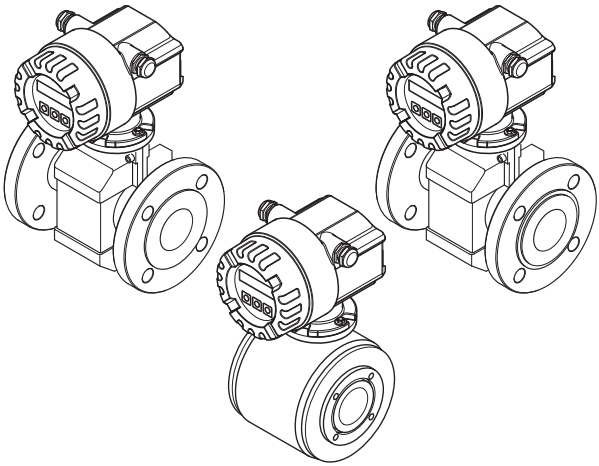
Level Pressure Flow Temperature Liquid Analysis Registration Systems Components Services Solutions

Brief Operating Instructions

# Proline Promag 10

Electromagnetic Flow Measuring System

HART



These Brief Operating Instructions are not intended to replace the Operating Instructions provided in the scope of supply.
Detailed information is provided in the Operating Instructions and the additional documentation on the CD-ROM supplied.

The complete device documentation consists of:
- These Brief Operating Instructions
- Depending on the device version:
  - Operating Instructions and the Description of Device Functions
  - Approvals and safety certificates
  - Special safety instructions in accordance with the approvals for the device (e.g. explosion protection, pressure equipment directive etc.)
  - Additional device-specific information

KA00032D/06/EN/14.11
71154553

Endress+Hauser
People for Process Automation

# Table of contents

# 1 Safety instructions

## 1.1 Designated use

- The measuring device is to be used only for measuring the flow of conductive liquids in closed pipes. Most liquids can be measured as of a minimum conductivity of 50 µS/cm.
- Any use other than that described here compromises the safety of persons and the entire measuring system and is, therefore, not permitted.
- The manufacturer is not liable for damage caused by improper or non-designated use.

## 1.2 Installation, commissioning and operation

- The measuring device must only be installed, connected, commissioned and maintained by qualified and authorized specialists (e.g. electrical technicians) in full compliance with the instructions in these Brief Operating Instructions, the applicable norms, legal regulations and certificates (depending on the application).
- The specialists must have read and understood these Brief Operating Instructions and must follow the instructions they contain. If you are unclear on anything in these Brief Operating Instructions, you must read the Operating Instructions (on the CD-ROM). The Operating Instructions provide detailed information on the measuring device.
- The measuring device should only be installed in the pipe in a de-energized state free from outside loads or strain.
- The measuring device may only be modified if such work is expressly permitted in the Operating Instructions (on the CD-ROM).
- Repairs may only be performed if a genuine spare parts kit is available and this repair work is expressly permitted.
- If performing welding work on the piping, the welding unit may not be grounded by means of the measuring device.

## 1.3 Operational safety

- The measuring device is designed to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition in which it is safe to operate. Relevant regulations and European standards have been observed.
- The manufacturer reserves the right to modify technical data without prior notice. Your Endress+Hauser distributor will supply you with current information and updates to these Operating Instructions.
- The information specified on the warning notices, nameplates and connection labels fitted on the measuring device must be observed. These contain important data, including information on the permitted operating conditions, the application of the measuring device and data on materials.
- If the measuring device is not operated at atmospheric temperatures, compliance with the relevant basic conditions specified in the device documentation provided (on the CD-ROM) is absolutely essential

- The measuring device must be wired in accordance with the wiring diagrams and connection labels. Interconnecting must be permitted.
- All parts of the measuring device must be integrated into the potential matching system of the plant.
- The cables, tested cable glands and tested dummy plugs must suit the prevailing operating conditions, e.g. the temperature range of the process. Housing openings that are not used need to be sealed with dummy plugs.
- The measuring device can only be used in conjunction with fluids to which all the wetted parts of the measuring device are adequately resistant. With regard to special fluids, including fluids used for cleaning, Endress+Hauser will be happy to assist in clarifying the corrosion-resistant properties of wetted materials. However, minor changes in temperature, concentration or in the degree of contamination in the process may result in variations in corrosion resistance. For this reason, Endress+Hauser does not accept any responsibility with regard to the corrosion resistance of wetted materials in a specific application. The user is responsible for the choice of suitable wetted materials in the process.
- When hot fluid passes through the measuring tube, the surface temperature of the housing increases. In the case of the sensor, in particular, users should expect temperatures that can be close to the fluid temperature. If the temperature of the fluid is high, implement sufficient measures to prevent burning or scalding.
- Hazardous areas
  Measuring devices for use in hazardous areas are labeled accordingly on the nameplate. Relevant national regulations must be observed when operating the device in hazardous areas.
- Hygienic applications
  Measuring devices for hygienic applications have their own special labeling. Relevant national regulations must be observed when using these devices.
- Pressure instruments
  Measuring devices for use in systems that need to be monitored are labeled accordingly on the nameplate. Relevant national regulations must be observed when using these devices. The documentation on the CD-ROM for pressure instruments in systems that need to be monitored is an integral part of the entire device documentation. The installation regulations, connection data and safety instructions provided in the Ex documentation must be observed.
- Endress+Hauser will be happy to assist in clarifying any questions on approvals, their application and implementation.

## 1.4 Safety conventions

⚠ Warning!
"Warning" indicates an action or procedure which, if not performed correctly, can result in injury or a safety hazard. Comply strictly with the instructions and proceed with care.

☝ Caution!
"Caution" indicates an action or procedure which, if not performed correctly, can result in incorrect operation or destruction of the device. Comply strictly with the instructions.

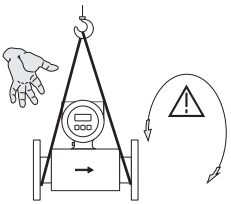
✎ Note!
"Note" indicates an action or procedure which, if not performed correctly, can have an indirect effect on operation or trigger an unexpected response on the part of the device.

# 2 Installation

## 2.1 Transporting to the measuring point

- Transport the measuring device to the measuring point in the original packaging.
- Do not remove the covers or caps until immediately before installation.

### 2.1.1 Transporting flanged devices DN ≤ 300 (≤ 12")



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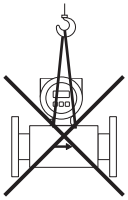
To transport the unit, use slings slung around the process connections or use lugs (if available).

⚠ Warning!
Risk of injury! The device can slip.
The center of gravity of the measuring device may be higher than the holding points of the slings.
Always ensure that the device cannot slip or turn around its axis.



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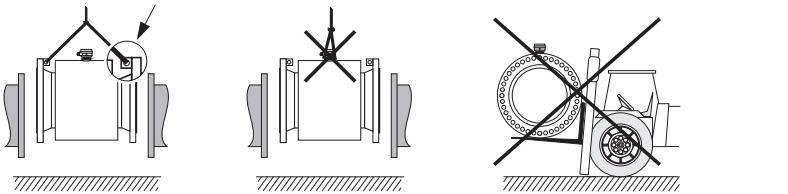
Do not lift measuring devices by the transmitter housing or the connection housing in the case of the remote version. Do not use chains as they could damage the housing.

### 2.1.2 Transporting flanged devices DN > 300 (> 12")

Use only the metal eyes provided on the flanges to transport, lift or position the sensor in the piping.

☝ Caution!
Do not attempt to lift the sensor with the tines of a fork-lift truck beneath the metal casing! This would buckle the casing and damage the internal magnetic coils.



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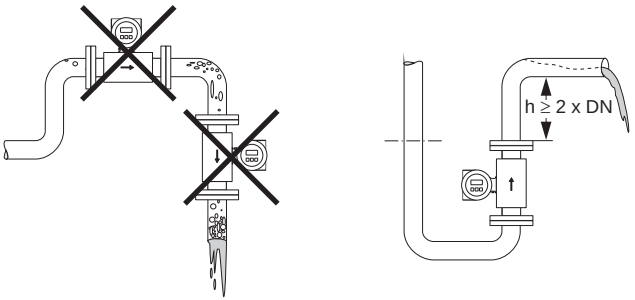
## 2.2 Installation conditions

### 2.2.1 Dimensions

For the dimensions of the measuring device, see the associated Technical Information on the CD-ROM.

### 2.2.2 Mounting location

The accumulation of air or formation of gas bubbles in the measuring tube can result in an increase in measuring errors. For this reason **avoid** the following mounting locations in the pipe:
- At the highest point of a pipeline. Risk of air accumulating!
- Directly upstream from a free pipe outlet in a down pipe.

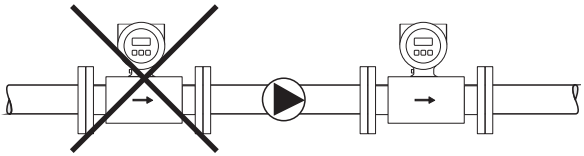



A0008154

**Installation of pumps**

Do not install the sensor on the intake side of a pump. This precaution is to avoid low pressure and the consequent risk of damage to the lining of the measuring tube. It might be necessary to use pulse dampers in systems incorporating piston pumps, piston diaphragm pumps or peristaltic pumps.

Information on the measuring system's pressure tightness and resistance to vibration and shock → can be found in the Operating Instructions of the CD-ROM.



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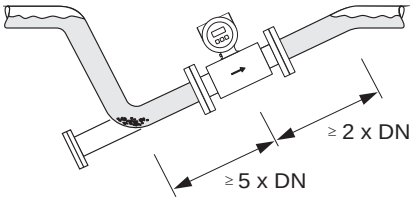
### Partially filled pipes

Partially filled pipes with gradients necessitate a drain-type configuration.
The empty pipe detection (EPD) function offers additional protection by detecting empty or partially filled pipes.

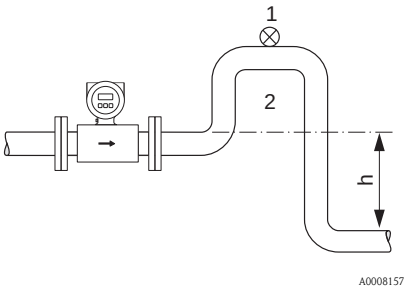
Caution!
Risk of solids accumulating! Do not install the sensor at the lowest point in the drain. It is advisable to install a cleaning valve.




Installation in a partially filled pipe

### Down pipes

Install a siphon or a vent valve downstream of the sensor in down pipes longer than 5 meters (16 ft). This precaution is to avoid low pressure and the consequent risk of damage to the lining of the measuring tube. This measure also prevents the system losing prime, which could cause air pockets.
For information on the pressure tightness of the measuring tube lining, → see the Operating Instructions on the CD-ROM.




Measures for installation in a down pipe (h > 5 m/16 ft)

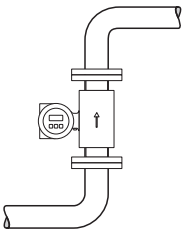
1. Vent valve
2. Siphon

### 2.2.3 Orientation

An optimum orientation helps avoid gas and air accumulations and buildup in the measuring tube. The measuring device, nevertheless, supplies a range of functions and tools to measure problematic fluids correctly:

- Electrode cleaning circuitry (ECC) to prevent electrically conductive deposits in the measuring tube, e.g. for fluids causing buildup
- Empty pipe detection (EPD) for detecting partially filled measuring tubes, e.g. in the case of degassing fluids or varying process pressures
- Exchangeable measuring electrodes for abrasive fluids (only Promag W)

**Vertical orientation**



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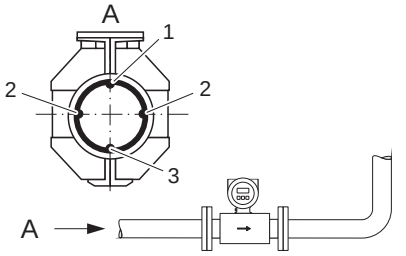
This orientation is optimum for self-emptying piping systems and when using empty pipe detection (EPD) or open electrode detection (OED).

**Horizontal orientation**

The measuring electrode plane should be horizontal. This prevents brief insulation of the two electrodes by entrained air bubbles.

Caution!
In the case of horizontal orientation, empty pipe detection only works correctly if the transmitter housing is facing upwards. Otherwise there is no guarantee that empty pipe detection will respond if the measuring tube is only partially filled or empty.

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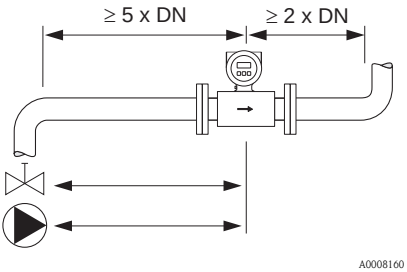
1. EPD electrode for empty pipe detection (not for Promag H, DN 2 to 15, 1/12" to ½").
2. Measuring electrodes for signal detection
3. Reference electrode for potential equalization (not for Promag H)

### Inlet and outlet runs

If possible, install the sensor upstream from fittings such as valves, T-pieces, elbows, etc.

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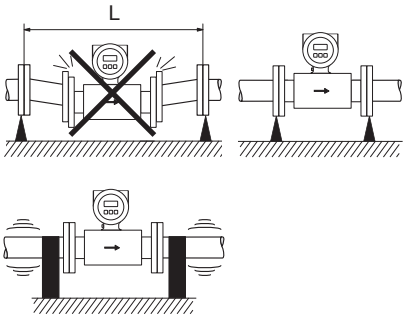
The following inlet and outlet runs must be observed in order to meet accuracy specifications:
- Inlet run: ≥ 5 × DN
- Outlet run: ≥ 2 × DN

## 2.2.4 Vibrations

Secure and fix both the piping and the sensor if vibrations are severe.

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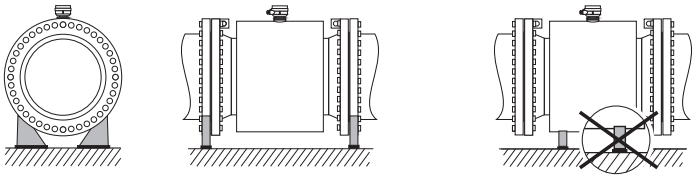
Measures to prevent device vibration
(L > 10 m/33 ft)

Caution!
It is advisable to install the sensor and transmitter separately if vibration is excessively severe. For information on the permitted shock and vibration resistance → , see the Operating Instructions on the CD-ROM.

### 2.2.5 Foundations, supports

If the nominal diameter is DN ≥ 350 (≥ 14"), mount the sensor on a foundation of adequate load-bearing strength.

Caution!
Risk of damage! Do not support the weight of the sensor on the metal casing.
This would buckle the casing and damage the internal magnetic coils.



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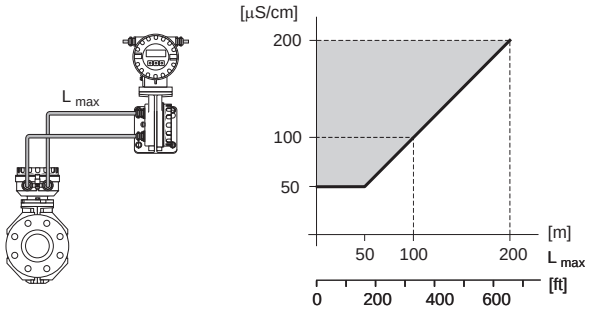
### 2.2.6 Length of connecting cable

Comply with the following instructions in order to ensure correct measuring results:
- Secure the cable run or route the cable in an armored conduit. Movement of the cable can falsify the measuring signal, particularly if the fluid conductivity is low.
- Route the cable well clear of electrical machines and switching elements.
- Ensure potential equalization between the sensor and transmitter, if necessary.
- The permissible cable length $L_{max}$ depends on the fluid conductivity.

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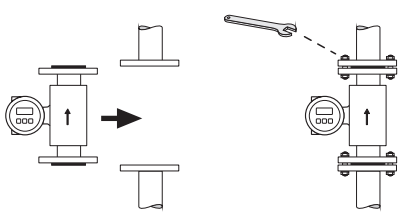
Gray shaded area = permissible range

$L_{max}$ = length of connecting cable in [m]/[ft]

Fluid conductivity in [µS/cm]

## 2.3 Installing the Promag L sensor

Caution!
- The protective covers mounted on the two sensor flanges (DN 50…300) are used to hold the lap joint flanges in place and to protect the PTFE liner during transportation. Consequently, do not remove these covers until **immediately before** the sensor is installed in the pipe.
- The protective plates must always remain mounted while the device is in storage.
- Make sure that the lining at the flange is not damaged or removed.




Note!
Screws, nuts, seals, etc. are not included in the scope of supply and must be supplied by the customer.

The sensor is installed between the two pipe flanges:
- The requisite torques must be observed → 13
- If grounding disks are used, follow the mounting instructions which will be enclosed with the shipment.
- To comply with the device specification, a concentrical installation in the measuring section is required

### 2.3.1 Seals

Comply with the following instructions when installing seals:
- Hard rubber lining → additional seals are **always** required!
- Polyurethane lining → **no** seals are required.
- **No** seals are required for PFTE measuring tube lining.
- For DIN flanges, only use seals to DIN EN 1514-1.
- Make sure that the mounted seals do not protrude into the piping cross-section.

Caution!
Risk of short circuit!
Do not use electrically conductive sealing compounds such as graphite! An electrically conductive layer could form on the inside of the measuring tube and short-circuit the measuring signal.

### 2.3.2 Ground cable

If necessary, special ground cables can be ordered as accessories for potential equalization.

### 2.3.3 Screw tightening torques (Promag L)

Please note the following:
- The tightening torques listed below are for lubricated threads only.
- Always tighten the screws uniformly and in diagonally opposite sequence.
- Overtightening the screws will deform the sealing faces or damage the seals.
- The tightening torques listed below apply only to pipes not subjected to tensile stress.

*Promag L tightening torques for EN (DIN)*

| Nominal diameter | EN (DIN) | | Max. tightening torque | | |
|---|---|---|---|---|---|
| | | | Hard rubber | Polyurethane | PTFE |
| [mm] | Pressure rating [bar] | Threaded fasteners | [Nm] | [Nm] | [Nm] |
| 50 | PN 10/16 | 4 × M 16 | - | 15 | 40 |
| 65* | PN 10/16 | 8 × M 16 | - | 10 | 22 |
| 80 | PN 10/16 | 8 × M 16 | - | 15 | 30 |
| 100 | PN 10/16 | 8 × M 16 | - | 20 | 42 |
| 125 | PN 10/16 | 8 × M 16 | - | 30 | 55 |
| 150 | PN 10/16 | 8 × M 20 | - | 50 | 90 |
| 200 | PN 10 | 8 × M 20 | - | 65 | 130 |
| 250 | PN 10 | 12 × M 20 | - | 50 | 90 |
| 300 | PN 10 | 12 × M 20 | - | 55 | 100 |
| 350 | PN 6 | 12 × M 20 | 111 | 120 | - |
| 350 | PN 10 | 16 × M 20 | 112 | 118 | - |
| 400 | PN 6 | 16 × M 20 | 90 | 98 | - |
| 400 | PN 10 | 16 × M 24 | 151 | 167 | - |
| 450 | PN 6 | 16 × M 20 | 112 | 126 | - |
| 450 | PN 10 | 20 × M 24 | 153 | 133 | - |
| 500 | PN 6 | 20 × M 20 | 119 | 123 | - |
| 500 | PN 10 | 20 × M 24 | 155 | 171 | - |
| 600 | PN 6 | 20 × M 24 | 139 | 147 | - |
| 600 | PN 10 | 20 × M 27 | 206 | 219 | - |
| 700 | PN 6 | 24 × M 24 | 148 | 139 | - |
| 700 | PN 10 | 24 × M 27 | 246 | 246 | - |
| 800 | PN 6 | 24 × M 27 | 206 | 182 | - |
| 800 | PN 10 | 24 × M 30 | 331 | 316 | - |
| 900 | PN 6 | 24 × M 27 | 230 | 637 | - |
| 900 | PN 10 | 28 × M 30 | 316 | 307 | - |
| 1000 | PN 6 | 28 × M 27 | 218 | 208 | - |
| 1000 | PN 10 | 28 × M 33 | 402 | 405 | - |
| 1200 | PN 6 | 32 × M 30 | 319 | 299 | - |
| 1200 | PN 10 | 32 × M 36 | 564 | 568 | - |
| 1400 | PN 6 | 36 × M 33 | 430 | - | - |

| Nominal diameter [mm] | EN (DIN) Pressure rating [bar] | Threaded fasteners | Max. tightening torque Hard rubber [Nm] | Polyurethane [Nm] | PTFE [Nm] |
|---|---|---|---|---|---|
| 1400 | PN 10 | 36 × M 39 | 654 | – | – |
| 1400 | PN 16 | 36 × M 45 | 729 | – | – |
| 1600 | PN 6 | 40 × M 33 | 440 | – | – |
| 1600 | PN 10 | 40 × M 45 | 946 | – | – |
| 1600 | PN 16 | 40 × M 52 | 1007 | – | – |
| 1800 | PN 6 | 44 × M 36 | 547 | – | – |
| 1800 | PN 10 | 44 × M 45 | 961 | – | – |
| 1800 | PN 16 | 44 × M 52 | 1108 | – | – |
| 2000 | PN 6 | 48 × M 39 | 629 | – | – |
| 2000 | PN 10 | 48 × M 45 | 1047 | – | – |
| 2000 | PN 16 | 48 × M 56 | 1324 | – | – |
| 2200 | PN 6 | 52 × M 39 | 698 | – | – |
| 2200 | PN 10 | 52 × M 52 | 1217 | – | – |
| 2400 | PN 6 | 56 × M 39 | 768 | – | – |
| 2400 | PN 10 | 56 × M 52 | 1229 | – | – |
| * Designed acc. to EN 1092-1 (not to DIN 2501) | | | | | |

*Promag L tightening torques for ANSI*

| Nominal diameter [mm] | [inch] | ANSI Pressure rating [lbs] | Threaded fasteners | Max. tightening torque Hard rubber [Nm] | [lbf · ft] | Polyurethane [Nm] | [lbf · ft] | PTFE [Nm] | [lbf · ft] |
|---|---|---|---|---|---|---|---|---|---|
| 50 | 2" | Class 150 | 4 × 5/8" | – | – | 15 | 11 | 40 | 29 |
| 80 | 3" | Class 150 | 4 × 5/8" | – | – | 25 | 18 | 65 | 48 |
| 100 | 4" | Class 150 | 8 × 5/8" | – | – | 20 | 15 | 44 | 32 |
| 150 | 6" | Class 150 | 8 × ¾" | – | – | 45 | 33 | 90 | 66 |
| 200 | 8" | Class 150 | 8 × ¾" | – | – | 65 | 48 | 125 | 92 |
| 250 | 10" | Class 150 | 12 × 7/8" | – | – | 55 | 41 | 100 | 74 |
| 300 | 12" | Class 150 | 12 × 7/8" | – | – | 68 | 56 | 115 | 85 |
| 350 | 14" | Class 150 | 12 × 1" | 135 | 100 | 158 | 117 | – | – |
| 400 | 16" | Class 150 | 16 × 1" | 128 | 94 | 150 | 111 | – | – |
| 450 | 18" | Class 150 | 16 × 1 1/8" | 204 | 150 | 234 | 173 | – | – |
| 500 | 20" | Class 150 | 20 × 1 1/8" | 183 | 135 | 217 | 160 | – | – |
| 600 | 24" | Class 150 | 20 × 1 ¼" | 268 | 198 | 307 | 226 | – | – |

*Promag L tightening torques for AWWA*

| Nominal diameter | | AWWA | Threaded fasteners | Max. tightening torque | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Pressure rating | | Hartgummi | | Polyurethane | | PTFE | |
| [mm] | [inch] | | | [Nm] | [lbf · ft] | [Nm] | [lbf · ft] | [Nm] | [lbf · ft] |
| 700 | 28" | Class D | 28 × 1 ¼" | 247 | 182 | 292 | 215 | – | – |
| 750 | 30" | Class D | 28 × 1 ¼" | 287 | 212 | 302 | 223 | – | – |
| 800 | 32" | Class D | 28 × 1 ½" | 394 | 291 | 422 | 311 | – | – |
| 900 | 36" | Class D | 32 × 1 ½" | 419 | 309 | 430 | 317 | – | – |
| 1000 | 40" | Class D | 36 × 1 ½" | 420 | 310 | 477 | 352 | – | – |
| 1050 | 42" | Class D | 36 × 1 ½" | 528 | 389 | 518 | 382 | – | – |
| 1200 | 48" | Class D | 44 × 1 ½" | 552 | 407 | 531 | 392 | – | – |
| 1350 | 54" | Class D | 44 × 1 ¾" | 730 | 538 | – | – | – | – |
| 1500 | 60" | Class D | 52 × 1 ¾" | 758 | 559 | – | – | – | – |
| 1650 | 66" | Class D | 52 × 1 ¾" | 946 | 698 | – | – | – | – |
| 1800 | 72" | Class D | 60 × 1 ¾" | 975 | 719 | – | – | – | – |
| 2000 | 78" | Class D | 64 × 2" | 853 | 629 | – | – | – | – |
| 2150 | 84" | Class D | 64 × 2" | 931 | 687 | – | – | – | – |
| 2300 | 90" | Class D | 68 × 2 ¼" | 1048 | 773 | – | – | – | – |

*Promag L tightening torques for AS 2129*

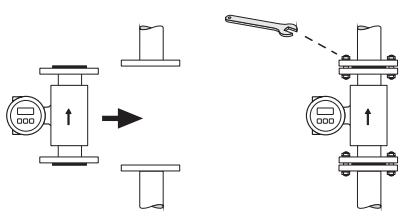
| Nominal diameter | AS 2129 | Threaded fasteners | Max. tightening torque | | |
|---|---|---|---|---|---|
| | Pressure rating | | Hard rubber | Polyurethane | PTFE |
| [mm] | | | [Nm] | [Nm] | [Nm] |
| 350 | Table E | 12 × M 24 | 203 | – | – |
| 400 | Table E | 12 × M 24 | 226 | – | – |
| 450 | Table E | 16 × M 24 | 226 | – | – |
| 500 | Table E | 16 × M 24 | 271 | – | – |
| 600 | Table E | 16 × M 30 | 439 | – | – |
| 700 | Table E | 20 × M 30 | 355 | – | – |
| 750 | Table E | 20 × M 30 | 559 | – | – |
| 800 | Table E | 20 × M 30 | 631 | – | – |
| 900 | Table E | 24 × M 30 | 627 | – | – |
| 1000 | Table E | 24 × M 30 | 634 | – | – |
| 1200 | Table E | 32 × M 30 | 727 | – | – |

*Promag L tightening torques for AS 4087*

| Nominal diameter [mm] | AS 4087 Pressure rating | Threaded fasteners | Max. tightening torque Hard rubber [Nm] | Polyurethane [Nm] | PTFE [Nm] |
|---|---|---|---|---|---|
| 350 | PN 16 | 12 × M 24 | 203 | - | - |
| 375 | PN 16 | 12 × M 24 | 137 | - | - |
| 400 | PN 16 | 12 × M 24 | 226 | - | - |
| 450 | PN 16 | 12 × M 24 | 301 | - | - |
| 500 | PN 16 | 16 × M 24 | 271 | - | - |
| 600 | PN 16 | 16 × M 27 | 393 | - | - |
| 700 | PN 16 | 20 × M 27 | 330 | - | - |
| 750 | PN 16 | 20 × M 30 | 529 | - | - |
| 800 | PN 16 | 20 × M 33 | 631 | - | - |
| 900 | PN 16 | 24 × M 33 | 627 | - | - |
| 1000 | PN 16 | 24 × M 33 | 595 | - | - |
| 1200 | PN 16 | 32 × M 33 | 703 | - | - |

## 2.4 Installing the Promag W sensor

Caution!
- The protective covers mounted on the two sensor flanges are used to hold the lap joint flanges in place and to protect the PTFE liner during transportation. Consequently, do not remove these covers until immediately before the sensor is installed in the pipe.
- The protective plates must always remain mounted while the device is in storage.
- Make sure that the lining at the flange is not damaged or removed.



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Note!
Screws, nuts, seals, etc. are not included in the scope of supply and must be supplied by the customer.

The sensor is installed between the two pipe flanges:
- The requisite torques must be observed → 18
- If grounding disks are used, follow the mounting instructions which will be enclosed with the shipment.
- To comply with the device specification, a concentrical installation in the measuring section is required

### 2.4.1 Seals

Comply with the following instructions when installing seals:
- Hard rubber lining → additional seals are **always** necessary.
- Polyurethane lining → **no** seals are required.
- PTFE lining → **no** seals are required.
- For DIN flanges, use only seals according to EN 1514-1.
- Make sure that the seals do not protrude into the piping cross-section.

Caution!
Risk of short circuit!
Do not use electrically conductive sealing compounds such as graphite! An electrically conductive layer could form on the inside of the measuring tube and short-circuit the measuring signal.

### 2.4.2 Ground cable

If necessary, special ground cables can be ordered as accessories for potential equalization.

### 2.4.3 Screw tightening torques (Promag W)

Please note the following:
- The tightening torques listed below are for lubricated threads only.
- Always tighten the screws uniformly and in diagonally opposite sequence.
- Overtightening the screws will deform the sealing faces or damage the seals.
- The tightening torques listed below apply only to pipes not subjected to tensile stress.

*Promag W tightening torques for EN (DIN)*

| Nominal diameter [mm] | EN (DIN) Pressure rating [bar] | Threaded fasteners | Max. tightening torque [Nm] Hard rubber | Polyurethane |
|---|---|---|---|---|
| 25 | PN 40 | 4 × M 12 | – | 15 |
| 32 | PN 40 | 4 × M 16 | – | 24 |
| 40 | PN 40 | 4 × M 16 | – | 31 |
| 50 | PN 40 | 4 × M 16 | 48 | 40 |
| 65* | PN 16 | 8 × M 16 | 32 | 27 |
| 65 | PN 40 | 8 × M 16 | 32 | 27 |
| 80 | PN 16 | 8 × M 16 | 40 | 34 |
| 80 | PN 40 | 8 × M 16 | 40 | 34 |
| 100 | PN 16 | 8 × M 16 | 43 | 36 |
| 100 | PN 40 | 8 × M 20 | 59 | 50 |
| 125 | PN 16 | 8 × M 16 | 56 | 48 |
| 125 | PN 40 | 8 × M 24 | 83 | 71 |
| 150 | PN 16 | 8 × M 20 | 74 | 63 |
| 150 | PN 40 | 8 × M 24 | 104 | 88 |
| 200 | PN 10 | 8 × M 20 | 106 | 91 |
| 200 | PN 16 | 12 × M 20 | 70 | 61 |
| 200 | PN 25 | 12 × M 24 | 104 | 92 |
| 250 | PN 10 | 12 × M 20 | 82 | 71 |
| 250 | PN 16 | 12 × M 24 | 98 | 85 |
| 250 | PN 25 | 12 × M 27 | 150 | 134 |
| 300 | PN 10 | 12 × M 20 | 94 | 81 |
| 300 | PN 16 | 12 × M 24 | 134 | 118 |
| 300 | PN 25 | 16 × M 27 | 153 | 138 |
| 350 | PN 6 | 12 × M 20 | 111 | 120 |
| 350 | PN 10 | 16 × M 20 | 112 | 118 |
| 350 | PN 16 | 16 × M 24 | 152 | 165 |
| 350 | PN 25 | 16 × M 30 | 227 | 252 |
| 400 | PN 6 | 16 × M 20 | 90 | 98 |
| 400 | PN 10 | 16 × M 24 | 151 | 167 |
| 400 | PN 16 | 16 × M 27 | 193 | 215 |
| 400 | PN 25 | 16 × M 33 | 289 | 326 |
| 450 | PN 6 | 16 × M 20 | 112 | 126 |
| 450 | PN 10 | 20 × M 24 | 153 | 133 |

| Nominal diameter [mm] | EN (DIN) Pressure rating [bar] | Threaded fasteners | Max. tightening torque [Nm] Hard rubber | Polyurethane |
|---|---|---|---|---|
| 450 | PN 16 | 20 × M 27 | 198 | 196 |
| 450 | PN 25 | 20 × M 33 | 256 | 253 |
| 500 | PN 6 | 20 × M 20 | 119 | 123 |
| 500 | PN 10 | 20 × M 24 | 155 | 171 |
| 500 | PN 16 | 20 × M 30 | 275 | 300 |
| 500 | PN 25 | 20 × M 33 | 317 | 360 |
| 600 | PN 6 | 20 × M 24 | 139 | 147 |
| 600 | PN 10 | 20 × M 27 | 206 | 219 |
| 600 * | PN 16 | 20 × M 33 | 415 | 443 |
| 600 | PN 25 | 20 × M 36 | 431 | 516 |
| 700 | PN 6 | 24 × M 24 | 148 | 139 |
| 700 | PN 10 | 24 × M 27 | 246 | 246 |
| 700 | PN 16 | 24 × M 33 | 278 | 318 |
| 700 | PN 25 | 24 × M 39 | 449 | 507 |
| 800 | PN 6 | 24 × M 27 | 206 | 182 |
| 800 | PN 10 | 24 × M 30 | 331 | 316 |
| 800 | PN 16 | 24 × M 36 | 369 | 385 |
| 800 | PN 25 | 24 × M 45 | 664 | 721 |
| 900 | PN 6 | 24 × M 27 | 230 | 637 |
| 900 | PN 10 | 28 × M 30 | 316 | 307 |
| 900 | PN 16 | 28 × M 36 | 353 | 398 |
| 900 | PN 25 | 28 × M 45 | 690 | 716 |
| 1000 | PN 6 | 28 × M 27 | 218 | 208 |
| 1000 | PN 10 | 28 × M 33 | 402 | 405 |
| 1000 | PN 16 | 28 × M 39 | 502 | 518 |
| 1000 | PN 25 | 28 × M 52 | 970 | 971 |
| 1200 | PN 6 | 32 × M 30 | 319 | 299 |
| 1200 | PN 10 | 32 × M 36 | 564 | 568 |
| 1200 | PN 16 | 32 × M 45 | 701 | 753 |
| 1400 | PN 6 | 36 × M 33 | 430 | 398 |
| 1400 | PN 10 | 36 × M 39 | 654 | 618 |
| 1400 | PN 16 | 36 × M 45 | 729 | 762 |
| 1600 | PN 6 | 40 × M 33 | 440 | 417 |
| 1600 | PN 10 | 40 × M 45 | 946 | 893 |
| 1600 | PN 16 | 40 × M 52 | 1007 | 1100 |
| 1800 | PN 6 | 44 × M 36 | 547 | 521 |
| 1800 | PN 10 | 44 × M 45 | 961 | 895 |
| 1800 | PN 16 | 44 × M 52 | 1108 | 1003 |
| 2000 | PN 6 | 48 × M 39 | 629 | 605 |
| 2000 | PN 10 | 48 × M 45 | 1047 | 1092 |
| 2000 | PN 16 | 48 × M 56 | 1324 | 1261 |

* Designed acc. to EN 1092-1 (not to DIN 2501)

*Promag W tightening torques for ANSI*

| Nominal diameter | | ANSI | Threaded fasteners | Max. tightening torque | | | |
|---|---|---|---|---|---|---|---|
| | | | | Hard rubber | | Polyurethane | |
| [mm] | [inch] | Pressure rating [lbs] | | [Nm] | [lbf · ft] | [Nm] | [lbf · ft] |
| 25 | 1" | Class 150 | 4 × ½" | - | - | 7 | 5 |
| 25 | 1" | Class 300 | 4 × 5/8" | - | - | 8 | 6 |
| 40 | 1 ½" | Class 150 | 4 × ½" | - | - | 10 | 7 |
| 40 | 1 ½" | Class 300 | 4 × ¾" | - | - | 15 | 11 |
| 50 | 2" | Class 150 | 4 × 5/8" | 35 | 26 | 22 | 16 |
| 50 | 2" | Class 300 | 8 × 5/8" | 18 | 13 | 11 | 8 |
| 80 | 3" | Class 150 | 4 × 5/8" | 60 | 44 | 43 | 32 |
| 80 | 3" | Class 300 | 8 × ¾" | 38 | 28 | 26 | 19 |
| 100 | 4" | Class 150 | 8 × 5/8" | 42 | 31 | 31 | 23 |
| 100 | 4" | Class 300 | 8 × ¾" | 58 | 43 | 40 | 30 |
| 150 | 6" | Class 150 | 8 × ¾" | 79 | 58 | 59 | 44 |
| 150 | 6" | Class 300 | 12 × ¾" | 70 | 52 | 51 | 38 |
| 200 | 8" | Class 150 | 8 × ¾" | 107 | 79 | 80 | 59 |
| 250 | 10" | Class 150 | 12 × 7/8" | 101 | 74 | 75 | 55 |
| 300 | 12" | Class 150 | 12 × 7/8" | 133 | 98 | 103 | 76 |
| 350 | 14" | Class 150 | 12 × 1" | 135 | 100 | 158 | 117 |
| 400 | 16" | Class 150 | 16 × 1" | 128 | 94 | 150 | 111 |
| 450 | 18" | Class 150 | 16 × 1 1/8" | 204 | 150 | 234 | 173 |
| 500 | 20" | Class 150 | 20 × 1 1/8" | 183 | 135 | 217 | 160 |
| 600 | 24" | Class 150 | 20 × 1 ¼" | 268 | 198 | 307 | 226 |

*Promag W tightening torques for JIS*

| Nominal diameter | JIS | Threaded fasteners | Max. tightening torque [Nm] | |
|---|---|---|---|---|
| [mm] | Pressure rating | | Hard rubber | Polyurethane |
| 25 | 10K | 4 × M 16 | - | 19 |
| 25 | 20K | 4 × M 16 | - | 19 |
| 32 | 10K | 4 × M 16 | - | 22 |
| 32 | 20K | 4 × M 16 | - | 22 |
| 40 | 10K | 4 × M 16 | - | 24 |
| 40 | 20K | 4 × M 16 | - | 24 |
| 50 | 10K | 4 × M 16 | 40 | 33 |
| 50 | 20K | 8 × M 16 | 20 | 17 |
| 65 | 10K | 4 × M 16 | 55 | 45 |
| 65 | 20K | 8 × M 16 | 28 | 23 |
| 80 | 10K | 8 × M 16 | 29 | 23 |
| 80 | 20K | 8 × M 20 | 42 | 35 |
| 100 | 10K | 8 × M 16 | 35 | 29 |

| Nominal diameter [mm] | JIS Pressure rating | Threaded fasteners | Max. tightening torque [Nm] | |
|---|---|---|---|---|
| | | | Hard rubber | Polyurethane |
| 100 | 20K | 8 × M 20 | 56 | 48 |
| 125 | 10K | 8 × M 20 | 60 | 51 |
| 125 | 20K | 8 × M 22 | 91 | 79 |
| 150 | 10K | 8 × M 20 | 75 | 63 |
| 150 | 20K | 12 × M 22 | 81 | 72 |
| 200 | 10K | 12 × M 20 | 61 | 52 |
| 200 | 20K | 12 × M 22 | 91 | 80 |
| 250 | 10K | 12 × M 22 | 100 | 87 |
| 250 | 20K | 12 × M 24 | 159 | 144 |
| 300 | 10K | 16 × M 22 | 74 | 63 |
| 300 | 20K | 16 × M 24 | 138 | 124 |

*Promag W tightening torques for AWWA*

| Nominal diameter | | AWWA Pressure rating | Threaded fasteners | Max. tightening torque | | | |
|---|---|---|---|---|---|---|---|
| | | | | Hard rubber | | Polyurethane | |
| [mm] | [inch] | | | [Nm] | [lbf · ft] | [Nm] | [lbf · ft] |
| 700 | 28" | Class D | 28 × 1 ¼" | 247 | 182 | 292 | 215 |
| 750 | 30" | Class D | 28 × 1 ¼" | 287 | 212 | 302 | 223 |
| 800 | 32" | Class D | 28 × 1 ½" | 394 | 291 | 422 | 311 |
| 900 | 36" | Class D | 32 × 1 ½" | 419 | 309 | 430 | 317 |
| 1000 | 40" | Class D | 36 × 1 ½" | 420 | 310 | 477 | 352 |
| 1050 | 42" | Class D | 36 × 1 ½" | 528 | 389 | 518 | 382 |
| 1200 | 48" | Class D | 44 × 1 ½" | 552 | 407 | 531 | 392 |
| 1350 | 54" | Class D | 44 × 1 ¾" | 730 | 538 | 633 | 467 |
| 1500 | 60" | Class D | 52 × 1 ¾" | 758 | 559 | 832 | 614 |
| 1650 | 66" | Class D | 52 × 1 ¾" | 946 | 698 | 955 | 704 |
| 1800 | 72" | Class D | 60 × 1 ¾" | 975 | 719 | 1087 | 802 |
| 2000 | 78" | Class D | 64 × 2" | 853 | 629 | 786 | 580 |

*Promag W tightening torques for AS 2129*

| Nominal diameter [mm] | AS 2129 Pressure rating | Threaded fasteners | Max. tightening torque [Nm] Hard rubber |
|---|---|---|---|
| 50 | Table E | 4 × M 16 | 32 |
| 80 | Table E | 4 × M 16 | 49 |
| 100 | Table E | 8 × M 16 | 38 |
| 150 | Table E | 8 × M 20 | 64 |
| 200 | Table E | 8 × M 20 | 96 |
| 250 | Table E | 12 × M 20 | 98 |
| 300 | Table E | 12 × M 24 | 123 |

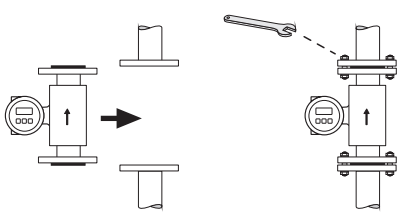
| Nominal diameter [mm] | AS 2129 Pressure rating | Threaded fasteners | Max. tightening torque [Nm] Hard rubber |
|---|---|---|---|
| 350 | Table E | 12 × M 24 | 203 |
| 400 | Table E | 12 × M 24 | 226 |
| 450 | Table E | 16 × M 24 | 226 |
| 500 | Table E | 16 × M 24 | 271 |
| 600 | Table E | 16 × M 30 | 439 |
| 700 | Table E | 20 × M 30 | 355 |
| 750 | Table E | 20 × M 30 | 559 |
| 800 | Table E | 20 × M 30 | 631 |
| 900 | Table E | 24 × M 30 | 627 |
| 1000 | Table E | 24 × M 30 | 634 |
| 1200 | Table E | 32 × M 30 | 727 |

*Promag W tightening torques for AS 4087*

| Nominal diameter [mm] | AS 4087 Pressure rating | Threaded fasteners | Max. tightening torque [Nm] Hard rubber |
|---|---|---|---|
| 50 | Table E | 4 × M 16 | 32 |
| 80 | PN 16 | 4 × M 16 | 49 |
| 100 | PN 16 | 4 × M 16 | 76 |
| 150 | PN 16 | 8 × M 20 | 52 |
| 200 | PN 16 | 8 × M 20 | 77 |
| 250 | PN 16 | 8 × M 20 | 147 |
| 300 | PN 16 | 12 × M 24 | 103 |
| 350 | PN 16 | 12 × M 24 | 203 |
| 375 | PN 16 | 12 × M 24 | 137 |
| 400 | PN 16 | 12 × M 24 | 226 |
| 450 | PN 16 | 12 × M 24 | 301 |
| 500 | PN 16 | 16 × M 24 | 271 |
| 600 | PN 16 | 16 × M 27 | 393 |
| 700 | PN 16 | 20 × M 27 | 330 |
| 750 | PN 16 | 20 × M 30 | 529 |
| 800 | PN 16 | 20 × M 33 | 631 |
| 900 | PN 16 | 24 × M 33 | 627 |
| 1000 | PN 16 | 24 × M 33 | 595 |
| 1200 | PN 16 | 32 × M 33 | 703 |

## 2.5 Installing the Promag P sensor

Caution!
- The plates mounted on the two sensor flanges protect the PTFE which is turned over the flanges and, consequently, should not be removed until **immediately prior** to mounting the sensor.
- The protective plates must always remain mounted while the device is in storage.
- Make sure that the lining at the flange is not damaged or removed.



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Note!
Screws, nuts, seals, etc. are not included in the scope of supply and must be supplied by the customer.

The sensor is installed between the two pipe flanges:
- The requisite torques must be observed → 24
- If grounding disks are used, follow the mounting instructions which will be enclosed with the shipment

### 2.5.1 Seals

Comply with the following instructions when installing seals:
- **No** seals are required for PFA or PFTE measuring tube lining.
- For DIN flanges, only use seals to DIN EN 1514-1.
- Make sure that the mounted seals do not protrude into the piping cross-section.

Caution!
Risk of short circuit! Do not use electrically conductive sealing compounds such as graphite! An electrically conductive layer could form on the inside of the measuring tube and short-circuit the measuring signal.

### 2.5.2 Ground cable

If necessary, special ground cables can be ordered as accessories for potential equalization.

### 2.5.3 Screw tightening torques (Promag P)

Please note the following:
- The tightening torques listed below are for lubricated threads only.
- Always tighten the screws uniformly and in diagonally opposite sequence.
- Overtightening the screws will deform the sealing faces or damage the seals.
- The tightening torques listed below apply only to pipes not subjected to tensile stress.

*Promag P tightening torques for EN (DIN)*

| Nominal diameter [mm] | EN (DIN) Pressure rating [bar] | Threaded fasteners | Max. tightening torque [Nm] |
|---|---|---|---|
| 25 | PN 40 | 4 × M 12 | 26 |
| 32 | PN 40 | 4 × M 16 | 41 |
| 40 | PN 40 | 4 × M 16 | 52 |
| 50 | PN 40 | 4 × M 16 | 65 |
| 65 * | PN 16 | 8 × M 16 | 43 |
| 65 | PN 40 | 8 × M 16 | 43 |
| 80 | PN 16 | 8 × M 16 | 53 |
| 80 | PN 40 | 8 × M 16 | 53 |
| 100 | PN 16 | 8 × M 16 | 57 |
| 100 | PN 40 | 8 × M 20 | 78 |
| 125 | PN 16 | 8 × M 16 | 75 |
| 125 | PN 40 | 8 × M 24 | 111 |
| 150 | PN 16 | 8 × M 20 | 99 |
| 150 | PN 40 | 8 × M 24 | 136 |
| 200 | PN 10 | 8 × M 20 | 141 |
| 200 | PN 16 | 12 × M 20 | 94 |
| 200 | PN 25 | 12 × M 24 | 138 |
| 250 | PN 10 | 12 × M 20 | 110 |
| 250 | PN 16 | 12 × M 24 | 131 |
| 250 | PN 25 | 12 × M 27 | 200 |
| 300 | PN 10 | 12 × M 20 | 125 |
| 300 | PN 16 | 12 × M 24 | 179 |
| 300 | PN 25 | 16 × M 27 | 204 |
| 350 | PN 10 | 16 × M 20 | 188 |
| 350 | PN 16 | 16 × M 24 | 254 |
| 350 | PN 25 | 16 × M 30 | 380 |
| 400 | PN 10 | 16 × M 24 | 260 |
| 400 | PN 16 | 16 × M 27 | 330 |
| 400 | PN 25 | 16 × M 33 | 488 |
| 450 | PN 10 | 20 × M 24 | 235 |
| 450 | PN 16 | 20 × M 27 | 300 |
| 450 | PN 25 | 20 × M 33 | 385 |

| Nominal diameter [mm] | EN (DIN) Pressure rating [bar] | Threaded fasteners | Max. tightening torque [Nm] |
|---|---|---|---|
| 500 | PN 10 | 20 × M 24 | 265 |
| 500 | PN 16 | 20 × M 30 | 448 |
| 500 | PN 25 | 20 × M 33 | 533 |
| 600 | PN 10 | 20 × M 27 | 345 |
| 600 * | PN 16 | 20 × M 33 | 658 |
| 600 | PN 25 | 20 × M 36 | 731 |
| * Designed acc. to EN 1092-1 (not to DIN 2501) | | | |

*Promag P tightening torques for ANSI*

| Nominal diameter | | ANSI Pressure rating | | Max. tightening torque PTFE | |
|---|---|---|---|---|---|
| [mm] | [inch] | [lbs] | Threaded fasteners | [Nm] | [lbf · ft] |
| 25 | 1" | Class 150 | 4 × ½" | 11 | 8 |
| 25 | 1" | Class 300 | 4 × 5/8" | 14 | 10 |
| 40 | 1 ½" | Class 150 | 4 × ½" | 24 | 18 |
| 40 | 1 ½" | Class 300 | 4 × ¾" | 34 | 25 |
| 50 | 2" | Class 150 | 4 × 5/8" | 47 | 35 |
| 50 | 2" | Class 300 | 8 × 5/8" | 23 | 17 |
| 80 | 3" | Class 150 | 4 × 5/8" | 79 | 58 |
| 80 | 3" | Class 300 | 8 × ¾" | 47 | 35 |
| 100 | 4" | Class 150 | 8 × 5/8" | 56 | 41 |
| 100 | 4" | Class 300 | 8 × ¾" | 67 | 49 |
| 150 | 6" | Class 150 | 8 × ¾" | 106 | 78 |
| 150 | 6" | Class 300 | 12 × ¾" | 73 | 54 |
| 200 | 8" | Class 150 | 8 × ¾" | 143 | 105 |
| 250 | 10" | Class 150 | 12 × 7/8" | 135 | 100 |
| 300 | 12" | Class 150 | 12 × 7/8" | 178 | 131 |
| 350 | 14" | Class 150 | 12 × 1" | 260 | 192 |
| 400 | 16" | Class 150 | 16 × 1" | 246 | 181 |
| 450 | 18" | Class 150 | 16 × 1 1/8" | 371 | 274 |
| 500 | 20" | Class 150 | 20 × 1 1/8" | 341 | 252 |
| 600 | 24" | Class 150 | 20 × 1 ¼" | 477 | 352 |

*Promag P tightening torques for JIS*

| Nominal diameter [mm] | JIS Pressure rating | Threaded fasteners | Max. tightening torque [Nm] PTFE |
|---|---|---|---|
| 25 | 10K | 4 × M 16 | 32 |
| 25 | 20K | 4 × M 16 | 32 |
| 32 | 10K | 4 × M 16 | 38 |
| 32 | 20K | 4 × M 16 | 38 |
| 40 | 10K | 4 × M 16 | 41 |
| 40 | 20K | 4 × M 16 | 41 |
| 50 | 10K | 4 × M 16 | 54 |
| 50 | 20K | 8 × M 16 | 27 |
| 65 | 10K | 4 × M 16 | 74 |
| 65 | 20K | 8 × M 16 | 37 |
| 80 | 10K | 8 × M 16 | 38 |
| 80 | 20K | 8 × M 20 | 57 |
| 100 | 10K | 8 × M 16 | 47 |
| 100 | 20K | 8 × M 20 | 75 |
| 125 | 10K | 8 × M 20 | 80 |
| 125 | 20K | 8 × M 22 | 121 |
| 150 | 10K | 8 × M 20 | 99 |
| 150 | 20K | 12 × M 22 | 108 |
| 200 | 10K | 12 × M 20 | 82 |
| 200 | 20K | 12 × M 22 | 121 |
| 250 | 10K | 12 × M 22 | 133 |
| 250 | 20K | 12 × M 24 | 212 |
| 300 | 10K | 16 × M 22 | 99 |
| 300 | 20K | 16 × M 24 | 183 |

*Promag P tightening torques for AS 2129*

| Nominal diameter [mm] | AS 2129 Pressure rating | Threaded fasteners | Max. tightening torque [Nm] PTFE |
|---|---|---|---|
| 25 | Table E | 4 × M 12 | 21 |
| 50 | Table E | 4 × M 16 | 42 |

*Promag P tightening torques for AS 4087*

| Nominal diameter [mm] | AS 4087 Pressure rating | Threaded fasteners | Max. tightening torque [Nm] PTFE |
|---|---|---|---|
| 50 | PN 16 | 4 × M 16 | 42 |

## 2.6 Installing the Promag H sensor

Depending on the order specifications, the sensor is supplied with or without ready-mounted process connections. Mounted process connections are fixed to the sensor with 4 or 6 hexagonal-headed bolts.

☝ Caution!
Depending on the application and length of the pipe, the sensor may have to be supported or additionally secured. The sensor must be secured if using plastic process connections. An appropriate wall mounting kit can be ordered separately from Endress+Hauser as an accessory.

### 2.6.1 Seals

When mounting the process connections, make sure that the seals in question are free from dirt and centered correctly.

☝ Caution!
- The screws must be securely tightened in the case of metal process connections. Together with the sensor, the process connection forms a metal connection that ensures defined seal compression.
- The seals should be replaced periodically depending on the application, particularly if molded seals are used (aseptic version)! The intervals between seal replacement depend on the frequency of the cleaning cycles and the fluid and cleaning temperatures. Replacement seals can be ordered as an accessory.

### 2.6.2 Welding the sensor into the pipe (weld nipples)

☝ Caution!
Risk of destroying the electronics! Make sure that the welding system is not grounded via the sensor or transmitter.

a. Secure the sensor with a few welding points in the pipe.
   A welding jig suitable for this purpose can be ordered separately as an accessory.

b. Release the screws on the process connection flange and remove the sensor, including the seal, from the pipe.

c. Weld the process connection into the pipe.

d. Mount the sensor back into the pipe.
   In doing so, make sure the seals are clean and correctly positioned.

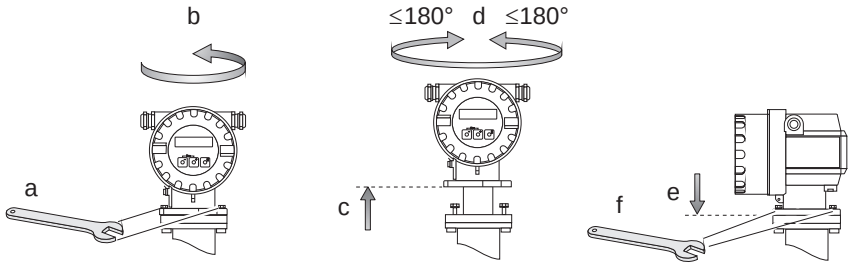
✎ Note!
- When welding is performed correctly with thin-walled pipes carrying food, the seal is not damaged by the heat even when it is mounted. It is recommended, however, to disassemble the sensor and seal.
- For the disassembly work, it must be possible to open the pipe approx. 8 mm (0.31 in) in total.

# 2.7 Installing the transmitter housing

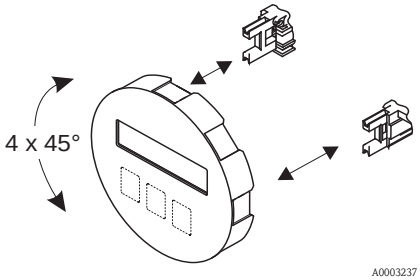
## 2.7.1 Turning the transmitter housing

### Turning the aluminum field housing

Aluminum field housing for non-Ex area




## 2.7.2 Turning the onsite display




a. Unscrew cover of the electronics compartment from the transmitter housing.

b. Remove the display module from the transmitter retaining rails.

c. Turn the display to the desired position (max. 4 × 45° in each direction).

d. Fit the display back onto the retaining rails.

e. Screw the cover of the electronics compartment firmly back onto the transmitter housing.

### 2.7.3 Mounting the transmitter (remote version)

The transmitter can be mounted in the following ways:
- Wall mounting
- Pipe mounting

The transmitter and the sensor must be mounted separate in the following circumstances:
- Poor accessibility
- Lack of space
- Extreme fluid/ambient temperatures
- Severe vibration (>2 g/2 h per day; 10 to 100 Hz)

Caution!
- The ambient temperature range (–20 to +60°C) may not be exceeded at the mounting location. Avoid direct sunlight.
- If the device is mounted to a warm pipe, make sure that the housing temperature does not exceed +60 °C, which is the maximum permissible temperature.

Mount the transmitter as illustrated in the diagram.

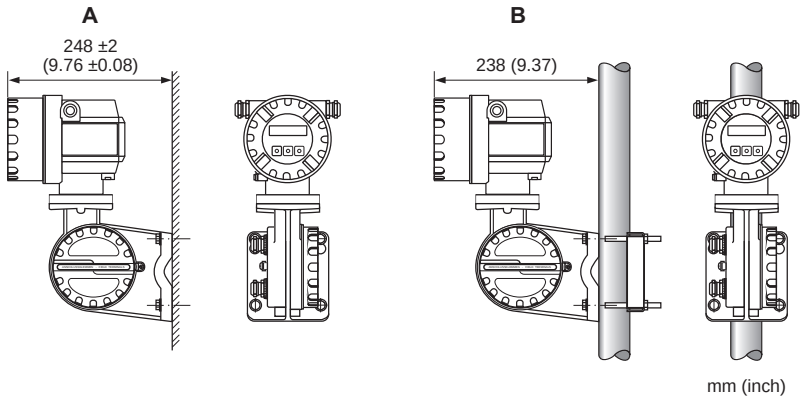



*Fig. 1: Mounting the transmitter (remote version)*

*A Mounted directly on the wall*
*B Pipe mounting*

## 2.8 Post-installation check

- Is the measuring device damaged (visual inspection)?
- Does the device correspond to specifications at the measuring point, including process temperature and pressure, ambient temperature, minimum fluid conductivity, measuring range, etc.?
- Does the arrow on the sensor nameplate match the actual direction of flow through the pipe?
- Is the position of the measuring electrode plane correct?
- Is the position of the empty pipe detection electrode correct?
- Were all screws tightened to the specified torques when the sensor was installed?
- Were the correct seals used (type, material, installation)?
- Are the measuring point number and labeling correct (visual inspection)?
- Were the inlet and outlet runs respected?
  - Inlet run $\geq 5 \times$ DN
  - Outlet run $\geq 2 \times$ DN
- Is the measuring device protected against moisture and direct sunlight?
- Is the sensor adequately protected against vibration (attachment, support)? Acceleration up to 2 g by analogy with IEC 600 68-2-8

# 3 Wiring

⚠ Warning!
Risk of electric shock! Components carry dangerous voltages.
- Never mount or wire the measuring device while it is connected to the power supply.
- Before connecting the power supply, check the safety equipment.
- Route the power supply and signal cables so they are securely seated.
- Seal the cable entries and covers tight.

☝ Caution!
Risk of damaging the electronic components!
- Connect the power supply in accordance with the connection data on the nameplate.
- Connect the signal cable in accordance with the connection data in the Operating Instructions or the Ex documentation on the CD-ROM.

**In addition, for the remote version:**

☝ Caution!
Risk of damaging the electronic components!
- Only connect sensors and transmitters with the same serial number.
- Observe the cable specifications of the connecting cable → Operating Instructions on the CD-ROM.

✎ Note!
Install the connecting cable securely to prevent movement.

**In addition, for measuring devices with fieldbus communication:**

☝ Caution!
Risk of damaging the electronic components!
- Observe the cable specification of the fieldbus cable → Operating Instructions on the CD-ROM.
- Keep the stripped and twisted lengths of cable shield as short as possible.
- Screen and ground the signal lines → Operating Instructions on the CD-ROM.
- When using in systems without potential equalization → Operating Instructions on the CD-ROM.

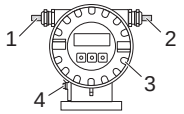
**In addition, for Ex-certified measuring devices:**

⚠ Warning!
When wiring Ex-certified measuring devices, all the safety instructions, wiring diagrams, technical information etc. of the related Ex documentation must be observed → Ex documentation on the CD-ROM.

## 3.1 Connecting the various housing types

Wire the unit using the terminal assignment diagram inside the cover.

### 3.1.1 Compact version

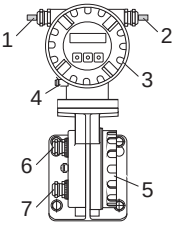



A0010755

Transmitter connection:

1 Signal cable
2 Power supply cable
3 Electronics compartment cover (connection diagram on the cover of the connection compartment)
4 Ground terminal for potential equalization

### 3.1.2 Remote version (transmitter)




A0010757

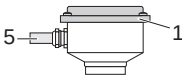
Transmitter connection:

1 Signal cable
2 Power supply cable
3 Electronics compartment cover (connection diagram on the cover of the connection compartment)
4 Ground terminal for potential equalization

Connecting the connecting cable (→ 33):

5 Connection compartment cover (connection diagram on the inside)
6 Coil current cable
7 Signal cable

### 3.1.3 Remote version (sensor)




A0008037

Transmitter connection:

1 Connection diagram inside the connection compartment cover

Connecting cable connection:

5 Sensor/transmitter connecting cable

## 3.2 Connecting the remote version connecting cable

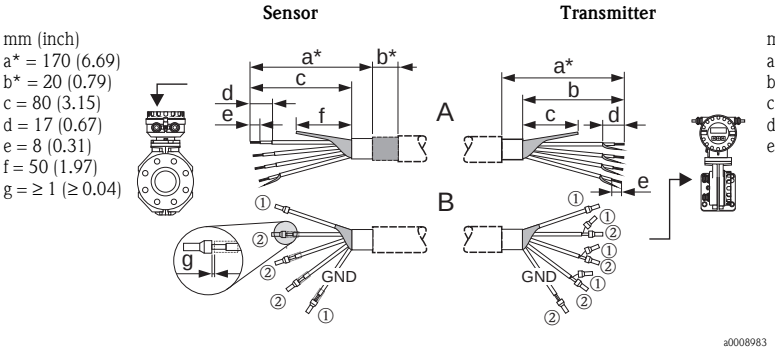
### 3.2.1 Connecting cable for Promag W, P, L

**Connecting cable termination**

Terminate the signal and coil current cables as shown in the figure below (Detail A).
Fit the fine-wire cores with cable end ferrules (Detail B).

*Signal cable termination*

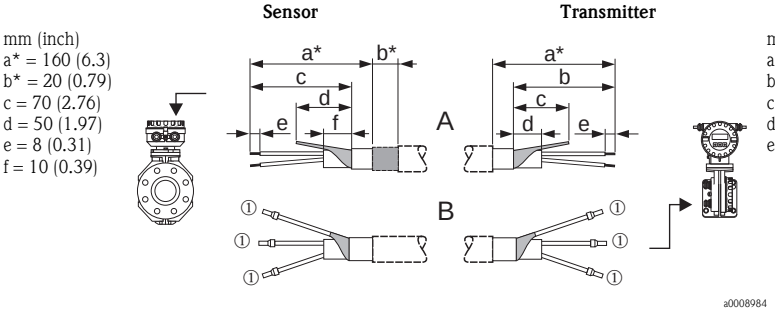
Make sure that the cable end ferrules do not touch the wire shields on the sensor side! Minimum distance = 1 mm (0.04 in), exception "GND" = green cable.




① = Cable end ferrules, red, Ø 1.0 mm (0.04"); ② = Cable end ferrules, white, Ø 0.5 mm (0.02")
* = Stripping for armored cables only

*Coil current cable termination*

Insulate one core of the three-core cable at the level of the core reinforcement; you only require two cores for the connection.




① = Cable end ferrules, red, Ø 1.0 mm (0.04"); ② = Cable end ferrules, white, Ø 0.5 mm (0.02")
* = Stripping for armored cables only

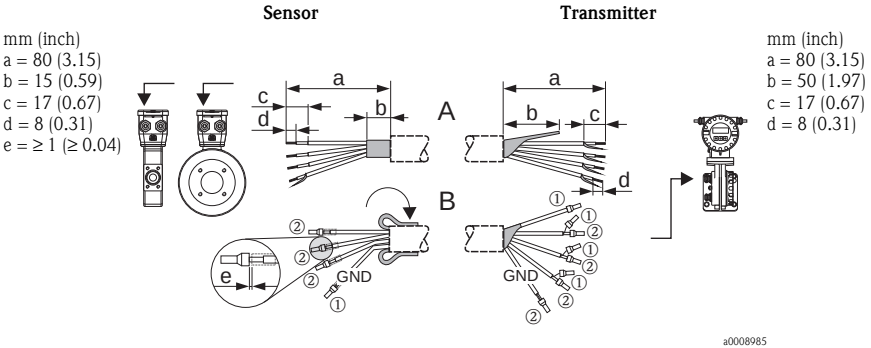
### 3.2.2 Promag H connecting cable

#### Connecting cable termination

Terminate the signal and coil current cables as shown in the figure below (Detail A).
Fit the fine-wire cores with cable end ferrules (Detail B).

*Signal cable termination*

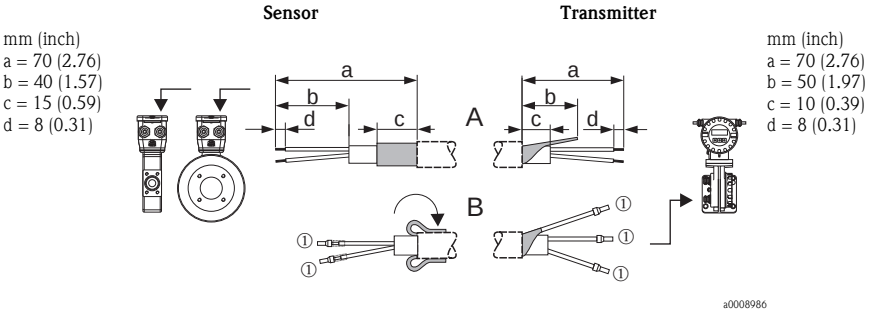
Make sure that the cable end ferrules do not touch the wire shields on the sensor side! Minimum distance = 1 mm (0.04 in), exception "GND" = green cable.




① = Cable end ferrules, red, Ø 1.0 mm (0.04"); ② = Cable end ferrules, white, Ø 0.5 mm (0.02")

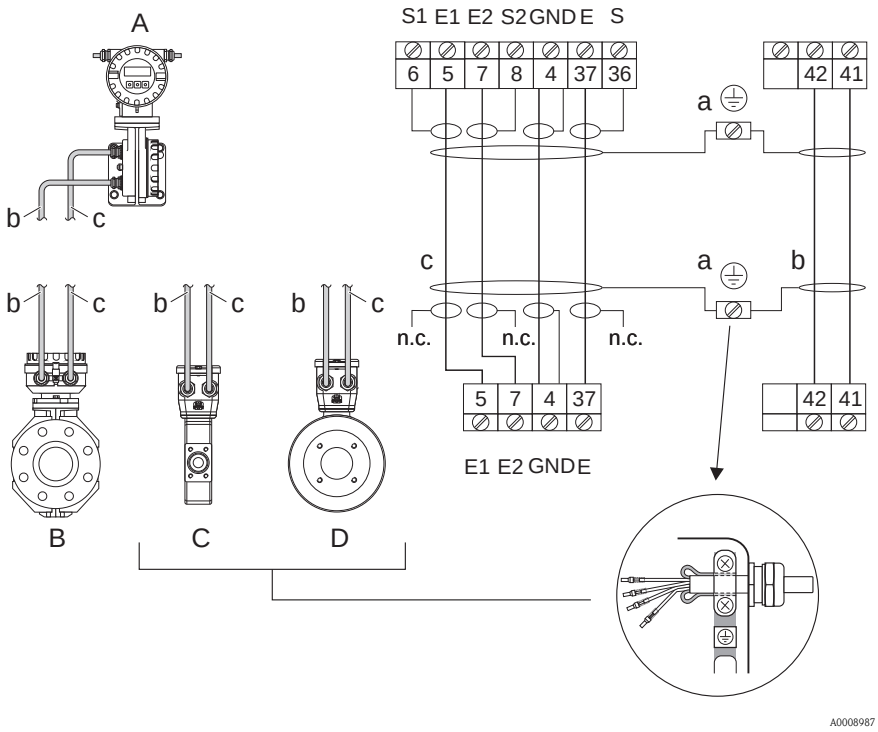
*Coil current cable termination*

Insulate one core of the three-core cable at the level of the core reinforcement; you only require two cores for the connection.




① = Cable end ferrules, red, Ø 1.0 mm (0.04"); ② = Cable end ferrules, white, Ø 0.5 mm (0.02")

### 3.2.3 Connecting cable connection




A Transmitter housing on connection housing, remote version

B Sensor connection housing, remote version for Promag W, P, L
C Sensor connection housing, remote version for Promag H, DN ≤ 25
D Sensor connection housing, remote version for Promag H, DN ≥ 40

a Ground terminals (are provided for potential equalization connection)
b Coil circuit connecting cable
c Signal circuit connecting cable (electrodes)

n.c. = not connected, isolated cable shields

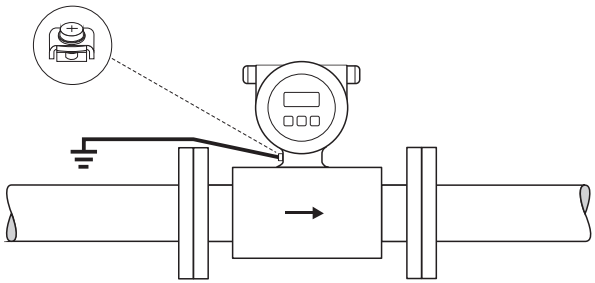
Cable colors for terminal numbers:
5/6 = brown
7/8 = white
4 = green
36/37 = yellow

## 3.3 Potential equalization

Perfect measurement is only ensured when the medium and the sensor have the same electrical potential. Most sensors have a reference electrode installed as standard, which guarantees the required potential connection. This usually means that the use of ground disks or other measures are unnecessary.

- Promag L, Promag W and Promag P
  Reference electrode available as standard.
- Promag H
  No reference electrode available. There is always an electrical connection to the fluid via the metal process connection.

**Standard situation**
Potential equalization takes place via the ground terminal of the transmitter when using the device in metal, grounded pipes.



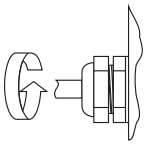
A0003195

✎ Note!
Potential equalization for other areas of application → Operating Instructions on the CD-ROM.

## 3.4 Degree of protection

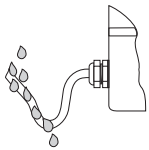
The devices meet all the requirements for IP 67.

After mounting in the field or service work, the following points have to be observed to ensure that IP 67 protection is retained:
- Install the measuring device in such a way that the cable entries do not point upwards.
- Do not remove the seal from the cable entry.
- Remove all unused cable entries and plug them with suitable/certified drain plugs.
- Use cable entries and drain plugs with a long-term operating temperature range in accordance with the temperature specified on the nameplate.



A0007549

Tighten the cable entries correctly.



A0007550

The cables must loop down before they enter the cable entries ("water trap").

## 3.5 Post-connection check

- Are cables or the device damaged (visual inspection)?
- Does the supply voltage match the information on the nameplate?
- Do the cables used comply with the necessary specifications?
- Do the mounted cables have adequate strain relief and are they routed securely?
- Is the cable type route completely isolated? Without loops and crossovers?
- Remote version only:
  - Is the flow sensor connected to the matching transmitter electronics?
  - Is the connecting cable between sensor and transmitter connected correctly?
- Are all screw terminals firmly tightened?
- Have all the measures for grounding and potential equalization been correctly implemented?
- Are all cable entries installed, firmly tightened and correctly sealed?
- Cable routed as a "water trap" in loops?
- Are all the housing covers installed and securely tightened?

**In addition, for measuring devices with fieldbus communication:**
- Are all the connecting components (T-boxes, junction boxes, connectors, etc.) connected with each other correctly?
- Has each fieldbus segment been terminated at both ends with a bus terminator?
- Has the max. length of the fieldbus cable been observed in accordance with the specifications?
- Has the max. length of the spurs been observed in accordance with the specifications?
- Is the fieldbus cable fully shielded and correctly grounded?

# 4 Commissioning

## 4.1 Switching on the measuring device

On completion of the installation (successful post-installation check), wiring (successful post-connection check) and after making the necessary hardware settings, where applicable, the permitted power supply (see nameplate) can be switched on for the measuring device.

When the power supply is switched on, the measuring device performs a number of power-up checks and device self-checks. As this procedure progresses the following messages can appear on the onsite display:

Display examples:

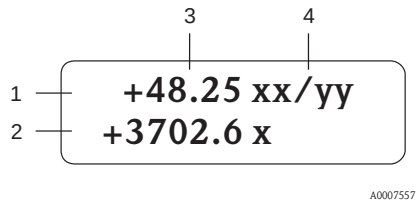
| | |
|---|---|
| PROMAG 10<br>**V XX.XX.XX** | Start-up message |

The measuring device starts operating as soon as the startup procedure is complete.
Various measured values and/or status variables appear on the display.

✎ Note!
If an error occurs during startup, this is indicated by an error message.

## 4.2 Operation

### 4.2.1 Display elements

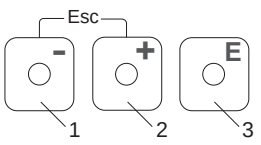



A0007557

Display lines/fields

1. Main line for primary measured values
2. Additional line for additional measured variables/status variables
3. Current measured values
4. Engineering units/time units

### 4.2.2 Operating elements



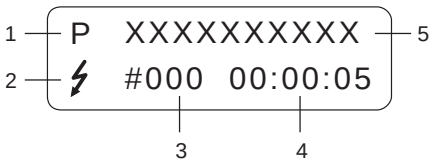

A0007559

Operating keys

1. (–) Minus key for entering, selecting
2. (+) Plus key for entering, selecting
3. Enter key for calling the function matrix, saving

When the +/– keys are pressed simultaneously (Esc):
- Exit the function matrix step-by-step:
- > 3 sec. = cancel data input and return to the measured value display

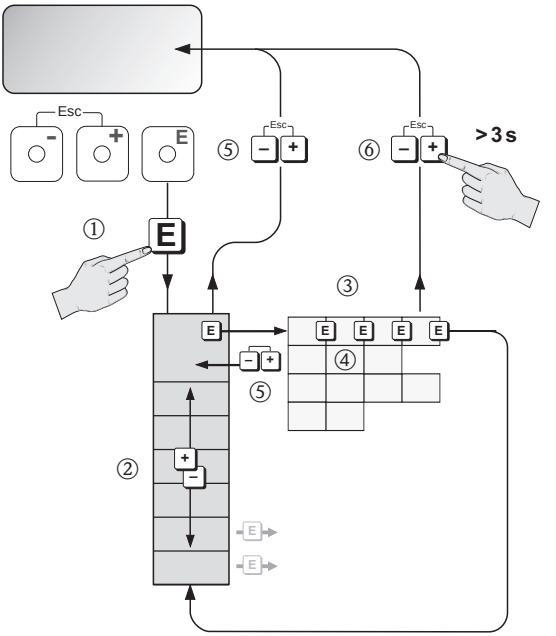
### 4.2.3 Displaying error messages




A0007561

1. Type of error:
   P = Process error, S = System error
2. Error message type:
   ϟ = Fault message, ! = Notice message
3. Error number
4. Duration of the last error that occurred:
   Hours: Minutes: Seconds
5. Error designation
   List of all error messages, see associated Operating Instructions on the CD-ROM

## 4.3 Navigating within the function matrix




1. E → Enter the function matrix (starting with measured value display)
2. ± → Select the group (e.g. OPERATION)
   E → Confirm selection
3. ± → Select function (e.g. LANGUAGE)
4. ± → Enter code **10** (only for the first time you access the function matrix)
   E → Confirm entry

   ± → Change function/selection (e.g. ENGLISH)
   E → Confirm selection
5. ± → Return to measured value display step by step
6. ± > 3 s → Return immediately to measured value display

## 4.4 Device functions to be configured during commissioning

Check the values and settings of the device functions **not** marked gray in the following function matrix (UNIT VOL. FLOW, UNIT VOLUME, LANGUAGE, CURRENT RANGE etc.) and adapt them to your application.

A complete description of all the device functions is provided in the Operating Instructions on the CD-ROM.

| Group | Functions | | | | | |
|---|---|---|---|---|---|---|
| SYSTEM UNITS | UNIT VOL. FLOW | UNIT VOLUME | FORMAT DATE/TIME | | | |
| OPERATION | LANGUAGE | ACCESS CODE | DEFINE PRIV. CODE | | | |
| USER INTERFACE | FORMAT | CONTRAST LCD | TEST DISPLAY | | | |
| TOTALIZER | SUM | OVERFLOW | RESET TOTALIZER | | | |
| CURRENT OUTPUT | CURRENT RANGE | VALUE 20 mA | TIME CONSTANT | | | |
| PULSE/ STATUS OUTP. | OPERATING MODE | PULSE VALUE | PULSE WIDTH | OUTPUT SIGNAL | | |
| | | ASSIGN STATUS | SWITCH-ON POINT | SWITCH-OFF POINT | | |
| COMMUNICA-TION | TAG NAME | TAG DESCR. | BUS ADDRESS | HART WRITE PROTECT. | MANUFAC-TURER ID | DEVICE ID |
| PROCESS PARAM. | LOW FLOW CUT OFF | EPD | EPD ADJ. | | | |
| SYSTEM PARAM. | INSTALL. DIRECTION | MEASURING MODE | POS. ZERO-RET. | SYSTEM DAMP. | | |
| SENSOR DATA | CALIBRAT. DATE | K-FACTOR | ZERO POINT | NOMINAL DIAMETER | MEASURING PERIOD | EPD ELECTRODE |
| SUPERVISION | FAILSAFE MODE | ALARM DELAY | SYSTEM RESET | SELF CHECKING | | |
| SIMULAT. SYSTEM | SIM. FAILSAFE | SIM. MEASURAND | VALUE SIM. MEASURAND | | | |
| SENSOR VERSION | SERIAL-NUMBER | SENSOR TYPE | | | | |
| AMPLIFIER VERS. | SW REV. | | | | | |

## 4.5 Troubleshooting

A complete description of all the error messages is provided in the Operating Instructions on the CD-ROM.

✎ Note!
The output signals (e.g. pulse, frequency) of the measuring device must correspond to the higher-order controller.

www.endress.com/worldwide

Endress+Hauser

People for Process Automation

KA00032D/06/EN/14.11
71154553
FM+SGML 9.0
Q-Pulse Id TMS1175
Active 15/05/2015

# Warranties

**MPA Engineering- Letter of Warranty**

MPA Engineering warrant their works from the date of practical completion for 12 months as per the terms and conditions of their contract with Thomas & Coffey.

# Commissioning Information

### Test Documents

#### Linked Documents

Laidley site.pdf

### FAT documents

#### Linked Documents

20142 4 lagoons LAIDLEY FAT& Sheet Metal check list.pdf

### Level Sensor Calibration Certificate

#### Linked Documents

Level Sensor Callibration Certificate- Laidley.pdf

**mpa Engineering Pty Ltd**
Specialists in Machine and Plant Automation
Queensland Electrical Contractor's Licence Number 10423

Unit 3, 22-24 Strathwyn Street
Brendale Qld 4500
Tel 07 3881 0722
Fax 07 3881 0723

3706

## CERTIFICATE OF:
(Mark relevant check-box)

☑ **TESTING AND COMPLIANCE** (Electrical Installations)
Issued in accordance with section 159 of the *Electrical Safety Regulation 2002*

☑ **TESTING AND SAFETY** (Electrical Equipment)
Issued in accordance with section 15 of the *Electrical Safety Regulation 2002*

Worked Performed for: Name Thomas & Coffey

Address East Rd Laidley

Details of work carried out:

**Visual Inspection:**

| Cables | | Switchboard | | Electrical Equipment | |
|---|---|---|---|---|---|
| Current rating | ☑ | Location / Access | ☑ | Isolating / switching devices | ☑ |
| Installation | ☑ | Protective devices | ☑ | Connections | ☑ |
| Terminations | ☑ | Isolating devices | ☑ | Compliance with Codes | ☑ |
| Identification | ☑ | Labelling | ☑ | Interlocks / Guards | ☑ |
| Colours | ☑ | Connections | ☑ | Emergency Stop Check | ☑ |

Earthing lead & electrode / Bonding conductors / MEN Connection / Identification ☑

**Electrical Testing:**

| | | Result |
|---|---|---|
| Main earthing conductor resistance | ☑ | 0.15 (Max 0.5 ohm) |
| Equipotential bonding conductor resistance | ☑ | 0.2 (Max 0.5 ohm) |
| Insulation resistance | ☑ | 200MΩ (Min 1.0 megohm) |
| Verification of polarity | ☑ | |
| Circuit connections | ☑ | |
| Earth fault loop impedance | ☑ | |
| RCD's trip tested by test button | ☑ | |

Comments: meets and exceeds requirements of AS/NZS 3000

For **electrical installations**, this certifies that the electrical installation, to the extent it is affected by the electrical work carried out, has been tested to ensure that it is electrically safe and is in accordance with the requirements of the wiring rules and any other standard applying under the *Electrical Safety Regulation 2002* to the electrical installation.

For **electrical equipment**, this certifies that the electrical equipment, to the extent it is affected by the electrical work carried out, is electrically safe.

Date of Test: 26/6/13

Tested by: Troy Conway

MPA Job No. 20142

Licence No: 127277

Signature:

| Effective Date:15/10/10 |
|---|
| Issue: 1 |

**WORK INSTRUCTION**
**INSTALLATION TEST SHEET**

| QWI 07.31 |
|---|
| Pages: 1 |

| TEST | CIRCUIT | | CIRCUIT | | CIRCUIT | | CIRCUIT | |
|---|---|---|---|---|---|---|---|---|
| | MF Building | | Aerator 1 | | Aerator 2 | | [redacted] MF Building Lts | |
| | Value | Pass | Value | Pass | Value | Pass | Value | Pass |
| Circuit breaker | 100 A | ✓ | 20 A | ✓ | 20 A | ✓ | 20 A | ✓ |
| Protection Size | | | | | | | | |
| 1 Ø or 3 Ø | 3Ø | ✓ | 3Ø | ✓ | 3Ø | ✓ | 1Ø | ✓ |
| Visual Inspection complete | | ✓ | | ✓ | | ✓ | | ✓ |
| Main earth resistance < 0.5 Ohms | 0.1 | ✓ | 0.2 | ✓ | 0.2 | ✓ | 0.23 | ✓ |
| Bonding conductors < 0.5 ohms | 0.15 | ✓ | N/A | ✓ | N/A | ✓ | N/A | ✓ |
| Correct polarity and connections | | ✓ | | ✓ | | ✓ | | ✓ |
| Insulation Resistance Ø(L1) to Ø(L2 or N) >1mΩ | 200MΩ | ✓ | 200MΩ | ✓ | 200MΩ | ✓ | 200MΩ | ✓ |
| Insulation Resistance Ø(L2) to Ø(L3) >1mΩ | 200MΩ | ✓ | 200MΩ | ✓ | 200MΩ | ✓ | | |
| Insulation Resistance Ø(L3) to Ø(L1) >1mΩ | 200MΩ | ✓ | 200MΩ | ✓ | 200MΩ | ✓ | | |
| Insulation Resistance Ø(L1) to earth >1mΩ | 200MΩ | ✓ | 200MΩ | ✓ | 200MΩ | ✓ | 200MΩ | ✓ |
| Insulation Resistance Ø(L2) to earth >1mΩ | 200MΩ | ✓ | 200MΩ | ✓ | 200MΩ | ✓ | | |
| Insulation Resistance Ø(L3) to earth >1mΩ | 200MΩ | ✓ | 200MΩ | ✓ | 200MΩ | ✓ | | |
| Insulation Resistance neutral to earth >1mΩ | 200MΩ | ✓ | 200MΩ | ✓ | 200MΩ | ✓ | 200MΩ | ✓ |
| Fault loop impedance correct for circuit | | ✓ | | ✓ | | ✓ | | ✓ |
| Thermal overload set (motors) | | | | ✓ | | ✓ | | |
| Motor runs in correct direction (motors) | | | | ✓ | | ✓ | | |
| Operates correctly (motors) | | | | ✓ | | ✓ | | |
| Connection (Y/Δ) – as per nameplate (motors) | | | | ✓ | | ✓ | | |

I certify that the electrical installation, to the extent that it is effected by the electrical work, has been tested to ensure it is electrically safe and is in accordance with the requirements of the wiring rules and any other standard applying to the electrical installation under state legislation.

| Tested By | License No. | Signature | Date |
|---|---|---|---|
| T. Conway | 127 277 | | 26/6/13 |

| Effective Date:15/10/10 |
|---|
| Issue: 1 |

**WORK INSTRUCTION**
**INSTALLATION TEST SHEET**

| QWI 07.31 |
|---|
| Pages: 1 |

| TEST | CIRCUIT | | CIRCUIT | | CIRCUIT | | CIRCUIT | |
|---|---|---|---|---|---|---|---|---|
| | Existing DB | | | | | | | |
| | Value | Pass | Value | Pass | Value | Pass | Value | Pass |
| Circuit breaker | C | ✓ | | | | | | |
| Protection Size | 63A | ✓ | | | | | | |
| 1 Ø or 3 Ø | 3Ø | ✓ | | | | | | |
| Visual Inspection complete | | | | | | | | |
| Main earth resistance < 0.5 Ohms | 0.15 | ✓ | | | | | | |
| Bonding conductors < 0.5 ohms | 0.15 | ✓ | | | | | | |
| Correct polarity and connections | | ✓ | | | | | | |
| Insulation Resistance Ø(L1) to Ø(L2 or N) >1mΩ | 200MΩ | ✓ | | | | | | |
| Insulation Resistance Ø(L2) to Ø(L3) >1mΩ | 200MΩ | ✓ | | | | | | |
| Insulation Resistance Ø(L3) to Ø(L1) >1mΩ | 200MΩ | ✓ | | | | | | |
| Insulation Resistance Ø(L1) to earth >1mΩ | 200MΩ | ✓ | | | | | | |
| Insulation Resistance Ø(L2) to earth >1mΩ | 200MΩ | ✓ | | | | | | |
| Insulation Resistance Ø(L3) to earth >1mΩ | 200MΩ | ✓ | | | | | | |
| Insulation Resistance neutral to earth >1mΩ | 200MΩ | ✓ | | | | | | |
| Fault loop impedance correct for circuit | | ✓ | | | | | | |
| Thermal overload set (motors) | | | | | | | | |
| Motor runs in correct direction (motors) | | | | | | | | |
| Operates correctly (motors) | | | | | | | | |
| Connection (Y/Δ) – as per nameplate (motors) | | | | | | | | |

I certify that the electrical installation, to the extent that it is effected by the electrical work, has been tested to ensure it is electrically safe and is in accordance with the requirements of the wiring rules and any other standard applying to the electrical installation under state legislation.

| Tested By | License No. | Signature | Date |
|---|---|---|---|
| T. Conway | | | 26/6/13 |

**Engineering Pty Ltd**

Specialists in Machine Plant Automation

QUU 4 LAGOON BOONAH STP UPGRADES – STP-ST53 LAIDLEY

# QUEENSLAND URBAN UTILITIES

# 4 LAGOON UPGRADES

# LAIDLEY

# STP-ST53

## FACTORY ACCEPTANCE TEST

## MAIN SWITCHBOARD

**MPA Engineering**

**Job Number** 20142




| | | | |
|---|---|---|---|
| **HEAD OFFICE** | Unit 3/ 22-24 Strathwyn St Brendale Qld 4500 | Tel: 07 3881 0722 | Fax: 07 3881 0723 |
| **IPSWICH** | 117 Toongarra Rd Ipswich Qld 4305 | Tel: 07 3813 7100 | Fax: 07 3813 7199 |
| **TOWNSVILLE** | 14 Chaimberlane Crt Kirwan Qld 4817 | Tel: 07 4723 6882 | Fax: 07 4723 6565 |
| **SYDNEY** | 8 Charles St St Marys NSW 2760 | Tel: 02 9623 7066 | Fax: 02 9623 7166 |
| **MELBOURNE** | Unit 10/64 Oakover Rd Preston Vic 3072 | Tel: 03 9480 6006 | Fax: 07 9416 8591 |

**QLD Electrical Contractor Licence No 10423**

| | | | |
|---|---|---|---|
| **Identification** | Document Title | 20142 QUU 4 Lagoon ST53 Laidley Switchboard FAT | |
| | Document Subtitle | 20142 QUU 4 Lagoon ST53 Laidley Switchboard FAT – Procedures and Records | |
| | Document Number | - Revision 1.0 | |
| | Client Reference | | |
| | Path\File Name | 20142 4 Lagoon ST53 Laidley Switchboard FAT.doc | |
| **Authority** | Written by | G Kelly | Testing Officer |
| | Authorised by | Paul Kajewski | Project Manager |
| | Client Authorisation | | |
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**Revision Record**

| Rev | Date | By | Description | Approved |
|---|---|---|---|---|
| 1.0 | 03 May 2013 | GK | Document created | |
| | | | | |

# CONTENTS

# 1. 4 Lagoon ST53 Laidley Switchboard FAT

This document describes the process of testing the switchboards to ensure that they conform to the standards and the design drawings, are electrically safe, function as designed and interface with the PLC controls as required. The FAT testing is carried out at MPA Engineering workshop, 22 Strathwyn Street, Brendale.

## 1.1 References

AS/NZS 3000:2007 Wiring Rules

AS/NZS 3008.1.1:2009 Cable Selection

AS/NZS 3017 Electrical Installations – Verification Guidelines

AS/NZS 3049.1:2002 Low Voltage Switchgear

AS/NZS 4836:2001 Safe Working on Low Voltage Electrical Installations

QUU SSM001/002/030/090

## 1.2 Objectives

To conduct thorough and electrically safe tests of switchboard.

Tests include:

- Inspecting all metalwork to ensure conformance to design
- Ensuring that the correct equipment is installed as defined in the design drawings
- Conducting a visual check to ensure conformity with Australian Standards
- Conducting a check to ensure connections are secure
- Measuring the insulation resistance of the switchboard to ensure conformance with Australian Standards
- Completing a point to point test of all wiring to ensure conformity with the design drawings
- Installing a temporary supply to the switchboard
- Testing all power circuits
- Testing the operation of all circuit breakers
- Testing the motor control operation
- Testing the operation of the PLC interposing signals
- Testing the operation of the pump protection equipment

## 1.3 Equipment & Software Requirements

The following Tools and Equipment will be needed to conduct the FAT:

**1.3.1** Fluke 1652C installation Tester

**1.3.2** Fluke 177 multimeter

**1.3.3** Project drawings

**1.3.4** Safety barrier and flashing amber light

**1.3.5** Temporary 3 phase and neutral supply

## 1.4 Methodology

### 1.4.1 De-energised Testing

The following steps are to be carried out on each section of the electrical equipment listed above.

**1.4.1.1** Referring to the drawings listed in Appendix A, confirm that the correct equipment is installed and is placed in the correct position.

**1.4.1.2** Referring to the drawings listed in Appendix A, use the multimeter to carry out point to point tests and confirm that all wiring conforms to the design drawings. Drawings will be highlighted and signed to record the point to point tests.

**1.4.1.3** Conduct a visual check to ensure conformity with Australian Standards.

**1.4.1.4** Using appropriate tools, check at least 30% of connections to ensure that connections are secure.

**1.4.1.5** Disconnect or isolate surge diverters, RCD's, power analyser and any voltage sensitive equipment. Using the insulation resistance tester, measure the insulation resistance of the switchboards and circuits to ensure conformance with Australian Standards. Reconnect any equipment that was disconnected.

**1.4.1.6** Where required, adjust circuit breakers, motor overloads and timer to appropriate settings

**1.4.1.7** Complete the FAT documentation as inspections and tests are carried out

**1.4.1.8** Ensure that all items including MEN link, which were disconnected for insulation resistance testing, have been reconnected.

### 1.4.2 Energised Testing

**1.4.2.1** Complete safe work method statement for live commissioning. All personnel to contribute, read, understand and sign the document

**1.4.2.2** Install barrier tape around the area to exclude unauthorised personnel.

**1.4.2.3** Install a temporary three phase and neutral supply to the switchboard.

**1.4.2.4** Communicate with personnel and install signage to warn personnel of live switchboard testing

**1.4.2.5** Install a flashing light to warn of live testing

**1.4.2.6** Turn on power to the switchboards

**1.4.2.7** Using the Multimeter to test for correct connections and polarity, test for 415 VAC and 240VAC where appropriate around the switchboard.

**1.4.2.8** Switch on circuit breakers for the 24 VDC power supplies. Use the multimeter to measure and if necessary adjust the output of the supplies for 24 VDC.

**1.4.2.9** Test operation of items listed in the function test sections

**1.4.2.10** Test the operation of all the controls

**1.4.2.11** Test the operation of light circuits

# 2. Tests Summary

## 2.1 Inspection and Test Plan 4 Lagoon ST53 Laidley Switchboard

| Client: | | Project: | | Switchboard: | | Job No: | |
|---|---|---|---|---|---|---|---|
| **ITEM** | **ACTIVITY** | **ACCEPTANCE STANDARD** | **RECORD** | **REMARKS** | **INSP** | **SIGN** |
| **Pre FAT Inspection** | | | | | | |
| 1 | Cabinet inspection | AS3000, AS3439, SSM001/002/030/090 | Sect 2.3 | | H | |
| 2 | Cabinet finish | SSM001/002/030/090 | Sect 2.3 | Metal colour and detailing acceptable | H | |
| 3 | Electrical design | AS3000, AS3439, SSM001/002/030/090 | SCH | Electrical design to meet specifications and relevant standards | H | |
| **FAT Testing** | | | | | | |
| 4 | Electrical equipment | GA, AS3000, AS3439, SSM001/002/030/090 | SCH, Sect 2.4 | Electrical equipment to meet specifications and standards | H | |
| 5 | Wiring implementation | SCH, AS3000, AS3439, SSM001/002/030/090 | SCH, Sect 2.4 | Point to point tests highlighted on schematics | H | |
| 6 | Insulation resistance testing | AS3000, AS3439, AS3017 | Sect 2.5 | Insulation resistance tested with kV tester | H | |
| 8 | PLC signals testing | SCH | Sect 2.6 | PLC I/O are tested as far as practical | H | |
| 9 | Electrical functional testing | SCH | QWI 07.13 | Electrical functional testing | H,W | |
| 10 | Photos and records stored | Present in the correct folder on server | Sect 2.13 | Photos and records stored in project directory | H | |
| 11 | Drawing markups incorporated | Drawings revised, checked and stored in the correct folder on the server | SCH | All drawings updated into AS BUILT revision | H | |
| **Pre Shipping** | | | | | | |
| 12 | Documentation placed in switchboard | AS BUILT drawings, test documents and manuals placed in the switchboard | Sect 2.13 | AS BUILT drawings, test documents and manuals placed in the switchboard | H | |
| 13 | Review of quality records | Quality documents completed and stored on the server | Sect 2.13 | Quality documents are completed and reviewed | R | |
| 14 | Packing and despatch | Switchboard is suitably protected | Sect 2.13 | Switchboard is prepared for transport | H | |

**H** = Hold Point **DR** = Document Required **R** = Review **W** = Witness **X** = Self Inspection **GA** = General Arrangement Drawings **SCH** = Electrical Schematics

## 2.2 Enclosure Inspection 4 Lagoon ST53 Laidley Switchboard

| | | | |
|---|---|---|---|
| Switchboard material as per specification | | ✓ | |
| Switchboard Finish as per specification | | ✓ | |
| Hood, sun shields provided | | ✓ | |
| Laptop tray provided | | ✓ | |
| Legend provided for distribution board | | ✓ | |
| Drawing support installed | | ✓ | |
| | | | |
| Doors square and even | | ✓ | |
| Door hinges tight | | ✓ | |
| Doors level | | ✓ | |
| Doors are all the same width | | ✓ | |
| Door mounted equipment is level | | ✓ | |
| Door gaskets fitted | | ✓ | |
| 1/4 turns / 3point locks correctly adjusted | | ✓ | |
| Doors open and close with ease | | ✓ | |
| | | | |
| Escutcheons are square and even | | ✓ | |
| Hinges are tight | | ✓ | |
| Cut outs are square and edges painted | | ✓ | |
| 1/4 turns locks correctly adjusted | | ✓ | |
| Escutcheons open and close with ease | | ✓ | |
| Escutcheon mounted equipment is level | | ✓ | |
| | | | |
| Plinth is mounted tight to board | | ✓ | |
| | | | |
| Lift off panels have handles fitted | | ✓ | |
| Dome nuts are drilled in Supply Authority tiers | | ✓ | |
| | | | |
| Gland plates fitted with gasket | | ✓ | |
| Earthing stud fitted to Gland plate | | ✓ | |
| | | | |
| Swarf removed and board vacuumed out | | ✓ | |
| Board wiped down and cleaned | | ✓ | |
| | | | |
| Busbar connections torque marked | | ✓ | |
| Busbars phase identified | | ✓ | |
| Busbar zone clear of debris | | ✓ | |
| All clearances in accordance with AS3439 | | ✓ | |
| | | | |
| Neutral and earth terminations provided for largest incoming cable | | ✓ | |
| Neutral and earth bar connections numbered (if in Specs) | | ✓ | |
| Neutral and earth bar bolts are provided | | ✓ | |
| Individual modules tested before installation | ✓ | | |
| Modules fitted correctly | ✓ | | |

| Testing Officer: GREG KELLY | Licence No: 40170S | Signature: GKelly | Date: 3/5/13 |
|---|---|---|---|

## 2.3 Enclosure Fit-out Inspection 4 Lagoon ST53 Laidley Switchboard

| ELECTRICAL | | | |
|---|---|---|---|
| 6mm SDI (Minimum)fitted to line side of control fuses for high fault level takeoffs | | | |
| Check surge arrestor line side cabling size | | ✓ | |
| Check cable size with cable schedule | | ✓ | |
| Check cable size with rating of CB | | ✓ | |
| All control wiring ferruled as required | | ✓ | |
| All control wiring numbers and colours as per drawings | | ✓ | |
| Wiring looms to doors incorporates suitable slack | | ✓ | |
| All terminal numbers fitted | | ✓ | |
| Terminals randomly checked for tightness | | ✓ | |
| Check contactors, O/L's and CB's are correct for particular operation | | ✓ | |
| Check fuses for continuity | | ✓ | |
| Check fuses for correct current rating | | ✓ | |
| All indicators correct colour and voltage | | ✓ | |
| All pushbuttons correct colour | | ✓ | |
| Labels correct sizes, colours and wording | | ✓ | |
| All labels secured with screws | | ✓ | |
| All internal equipment labelled | | ✓ | |
| Ammeters and CT's correct range | | ✓ | |
| Meter fuses fed from line side of main switch and CT's | | ✓ | |
| CT test block fitted | | ✓ | |
| Voltmeters correct range | ✓ | | |
| Bolts fitted to incoming terminations | | ✓ | |
| Phase separators and shrouds provided | | ✓ | |
| Fit fuse cartridges | | ✓ | |
| Sample check tightness of connections | | ✓ | |
| All protective covers in place | | ✓ | |
| All duct lid fitted | | ✓ | |
| All pole fillers fitted | | ✓ | |
| Lighting operation correct | | ✓ | |
| Door limit switches operational | ✓ | | |
| All doors are earthed | | ✓ | |
| All escutcheons are earthed | | ✓ | |
| C.T secondary's earthed | | ✓ | |
| All transformer secondaries are earthed | ✓ | | |
| All power supplies 0 Volts are earthed | | ✓ | |
| Check correct screen connections of analog and VSD cable | | ✓ | |
| Adjust O/L settings to motor current or minimum | | ✓ | |
| Adjust timers to correct values | | ✓ | |
| Adjust CB settings | ✓ | | |
| Adjust RCD settings | ✓ | | |
| Point to point wiring check completed | | ✓ | |
| | | | |

| Testing Officer: GREG KELLY | Licence No: 40170S | Signature: GKelly | Date: 3/5/13 |
|---|---|---|---|

## 2.4 Insulation Resistance Testing 4 Lagoon ST53 Laidley Switchboard

### 1000 VOLT APPLIED FOR 1 MINUTE

*Before performing the insulation resistance tests, disconnect or isolate the MEN link, RCD earths and neutrals, surge arrestors and any equipment that could be damaged by the tests. Carry out the tests with the test instrument on the 2500 Volt range.*

| MAINS SUPPLY AND BUSBAR SYSTEM INSULATION RESISTANCE TESTS – PASS CRITERIA IS > 1 MΩ | | | | | |
|---|---|---|---|---|---|
| Red – White | >2GΩ | White - Blue | >2GΩ | Red - Blue | >2GΩ |
| Red – Neutral | >2GΩ | White - Neutral | >2GΩ | Blue - Neutral | >2GΩ |
| Red – Earth | >2GΩ | White - Earth | >2GΩ | Blue - Earth | >2GΩ |
| Neutral – Earth | >2GΩ | | | | |
| **DISTRIBUTION BOARD INSULATION RESISTANCE TESTS – PASS CRITERIA IS > 1 MΩ** | | | | | |
| Red – White | >2GΩ | White - Blue | >2GΩ | Red - Blue | >2GΩ |
| Red – Neutral | >2GΩ | White - Neutral | >2GΩ | Blue - Neutral | >2GΩ |
| Red – Earth | >2GΩ | White - Earth | >2GΩ | Blue - Earth | >2GΩ |
| Neutral – Earth | >2GΩ | | | | |

***Reconnect all equipment isolated for the insulation tests***

| Testing Officer: GREG KELLY | Licence No: 40170S | Signature: GKelly | Date: 3/5/13 |
|---|---|---|---|

## 2.5 Electrical Operational Testing 4 Lagoon ST53 Laidley Switchboard

| EL | | | |
|---|---|---|---|
| *Before applying power to the switchboard for testing, connect test equipment where appropriate. Install barrier tape and flashing light to limit pedestrian access.* | | | |
| Check connections and phasing of all power circuits | | ✓ | |
| Check operation of operation of electrical switches | | ✓ | |
| Check mechanical interlocks | | ✓ | |
| Adjust 24 VDC power supply output if appropriate | | ✓ | |
| Test ammeter operation | | ✓ | |
| Test surge protection operation | | ✓ | |
| Test the operation of all equipment as far as practical | | ✓ | |
| Test pump controls | | ✓ | |
| Test alarm beacon | | ✓ | |
| Test hours run meter | | ✓ | |
| Test SCADA signals | | ✓ | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

| Testing Officer: GREG KELLY | Licence No: 40170S | Signature: GKelly | Date: 3/5/13 |
|---|---|---|---|

## 3. Corrective Action

| Item | | | |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| 6 | | | |
| 7 | | | |
| 8 | | | |
| 9 | | | |
| 10 | | | |
| 11 | | | |
| 12 | | | |
| 13 | | | |
| 14 | | | |
| 15 | | | |
| 16 | | | |
| 17 | | | |
| 18 | | | |
| 19 | | | |
| 20 | | | |

## 4. Witness

| ACCEPTANCE | | | |
|---|---|---|---|
| **NAME** | **COMPANY** | **SIGNATURE** | **DATE** |
| GREG KELLY | MPA ENGINEERING | G Kelly | 3/5/13 |
| | | | |
| | | | |
| | | | |
| | | | |

# 5. Attachments

## 5.1 4 Lagoon ST53 Laidley switchboard drawings 486/5/5-0105-nnn

| | MPA Engineering Pty Ltd<br>Quality Assurance ISO 9001 2008<br>*UNCONTROLLED – VALID ONLY ON THE DATE OF ISSUE* | |
|---|---|---|
| Effective Date: 15/10/10<br>Issue: 1 | **Work Instruction**<br>**Switchboard Check Sheet - Sheetmetal** | QWI 07.10<br>Page 1 of 1 |

**PROJECT:** QUU 4 LAGOON STP UPGRADES **JOB NO:** 2014

**DESCRIPTION:** LAIDLEY, FOREST HILL **DRAWING No'S**

**PRE PAINT CHECKLIST (Metalwork) – Assembly & Generic Checks**

| Assembly Alignment | Cabinet to Earth N/A | Cabinet to Earth Pass | Door to Cabinet N/A | Door to Cabinet Pass | Init | Date | Comment |
|---|---|---|---|---|---|---|---|
| Correct material & Thickness | | ✓ | | ✓ | | 25/3/13 | |
| Checked Against drawing | | ✓ | | ✓ | | " " " | |
| Square | | ✓ | | ✓ | | " " " | |
| Aligned | | ✓ | | ✓ | | " " " | |
| Level | | ✓ | | ✓ | | " " " | |

| Generic Checks | Cabinet N/A | Cabinet Pass | Door N/A | Door Pass | Init | Date | Comment |
|---|---|---|---|---|---|---|---|
| Correct Size | | ✓ | | ✓ | | 25/3/13 | |
| Earth Stud(s) Fitted | | ✓ | | ✓ | | " " " | |
| Loom Brackets | | ✓ | | ✓ | | " " " | |
| Spatter Removed | | | | ✓ | | " " " | |
| Pencil marks removed | | ✓ | | ✓ | | " " " | |
| PWD Coat Hanging Holes | ✓ | | NA | | | " " " | |
| Sanding complete | | ✓ | | ✓ | | " " " | |

**PRE PAINT CHECKLIST (Metalwork) – Cabinet / Door Specific Checks**

| Cabinet Checks | N/A | Pass | Init | Date | Comment |
|---|---|---|---|---|---|
| Door stays positioned | | ✓ | | 25/3/13 | |
| Gear tray(s) fitted | | ✓ | | " " " | |
| Gland Plate cut out size correct | | ✓ | | " " " | |
| Cable tray(s) fitted | NA | | | " " " | |
| Plinth fitted and aligned | | ✓ | | " " " | |
| Lifting facility | | ✓ | | " " " | |
| Mesh fitted | | ✓ | | " " " | |
| Mounting Bolts | | ✓ | | " " " | |
| Escutcheon | | ✓ | | " " " | |
| Cut outs square and to size | | ✓ | | " " " | |

| Door Checks | N/A | Pass | Init | Date | Comment |
|---|---|---|---|---|---|
| Cut outs square and to size | | ✓ | | 25/3/13 | |
| Document Holder fitted | | ✓ | | " " " | |
| Hinges level | | ✓ | | " " " | |
| Hinge Qty as shown on drawing | | ✓ | | " " " | |
| 3 Point locking rod guide fitted | | ✓ | | " " " | |
| 3 Point locking handle, rods and cams | | ✓ | | " " " | |
| Handles and 1/4 turn latches fitted and working | | ✓ | | " " " | |
| Legend Card Holder | | ✓ | | " " " | |
| Door stiffeners > 1000mm | | ✓ | | " " " | |
| Vent Assembly | | ✓ | | " " " | |

| Inspector Name : A.J. Gough. ANDREW GOUGH. | Signature: A.J. Gough. | Date: 25/3/13. |
|---|---|---|

**POST PAINT CHECKLIST (Metalwork)**

| General Checks | Pass | N/A | Init | Date | Comment |
|---|---|---|---|---|---|
| Colour as per purchase order | | | | | |
| No damage evident | | | | | |
| External Coverage | | | | | |
| Internal Coverage | | | | | |
| Gear Tray(s) | | | | | |
| Escutcheon(s) | | | | | |
| Plinth(s) Hot Dipped | | | | | |

| Inspector Name : | Signature: | Date: |
|---|---|---|

thomas &coffey

# LEVEL SENSOR CALIBRATION CERTIFICATE

**Site: Laidley Sewage Treatment Plant**

**Address: Braham Rd, North Laidley**

**Equipment: Vegason 61 – 4...20 mA/ HART**

**Date of calibration: 20th of November 2013**

The lagoon level sensor at Boonah has been calibrated to the following levels, which were provided by Queensland Urban Utilities:

| | BWL RL | BWL (0%)sensor reading | TWL RL | TWL (100%) sensor reading | Level sensor RL |
|---|---|---|---|---|---|
| **Laidley (Lagoon 1)** | 109.445 | 1.383 | 109.9 | 0.928 | 110.828 |
| **Laidley (Lagoon 2)** | 108.145 | 1.181 | 108.7 | 0.626 | 109.326 |

We hereby confirm that the above equipment has been installed and calibrated in accordance with the manufacturer's specifications.

For changes to these levels, please refer to the instructions in the level sensor section of Operations and Maintenance manual.

Calibrated by

Toby Grayson

# Help & Contact

**MPA Engineering**

**Trade or Product:** Electrical

**Contact & Address Details:**

Elmo Allan
Branch Manager

MPA Engineering Pty Ltd | 117 Toongarra Road, Ipswich QLD 4305
P +61 (0) 7 3413 8850 F +61 (0) 7 3413 8879
D +61 (0) 7 3413 8854
W www.mpaeng.com.au E Elmo.Allan@MpaEng.com.au

# As Built Drawings

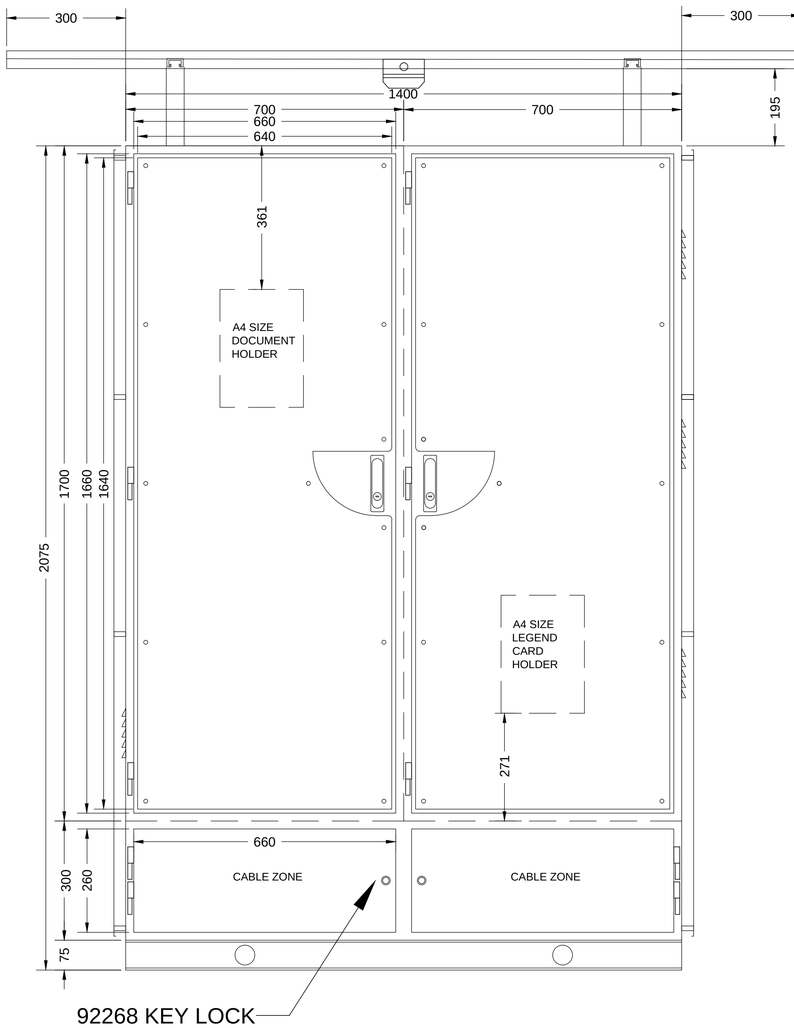
**Switchboard**

**Site:** (ST053) Laidley

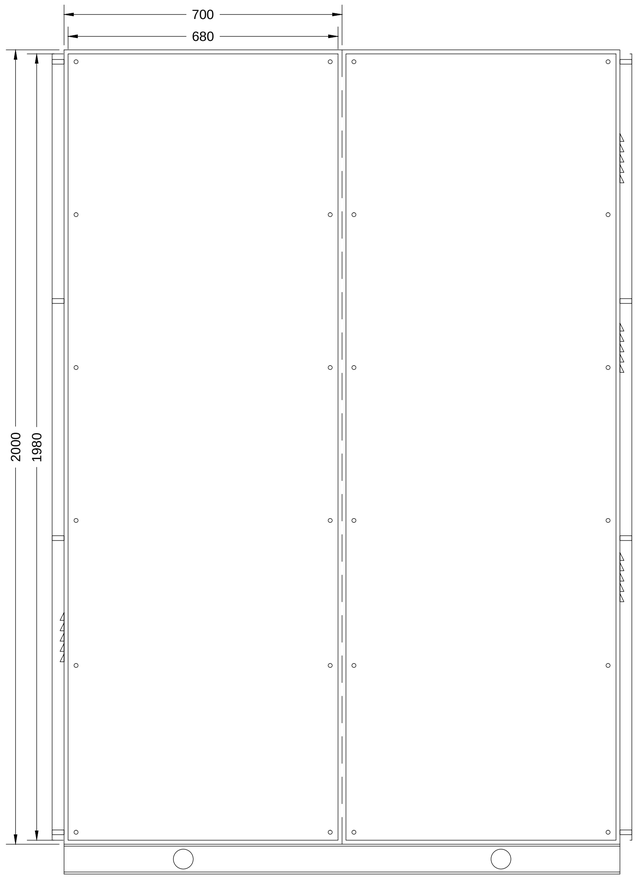
**Process:** (1000.0) SITE SERVICES

**Linked Documents**

20142 - Laidley As Built.pdf




FRONT VIEW SHOWING OUTER DOORS AND SUN SHIELDS




BACK VIEW SHOWING OUTER DOORS AND SUN SHIELDS, ROOF REMOVED

DF)

AS CONSTRUCTED DETAILS

I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.

SIGNED: DATE: 11/06/13

NAME of SIGNATORY: GREG BOTT

RPEQ No. or LICENCE: 10036

COMPANY NAME: MPA Engineering Pty. Ltd.

START DATE: 1/7/12 FINISH DATE: 30/6/13

**MPA ENGINEERING LTD PTY**

BRENDALE OFFICE
UNIT 3/22 STRATHWYN ST
BRENDALE QLD 4500
Phone:- 07 3881 0722
Fax:- 07 0881 0723
Website:- www.mpaeng.com.au

Job No:- 20142

NAME SIGNATURE DATE

QUEENSLAND URBAN UTILITIES DELEGATE
(AUTHORISED FOR 12 MONTHS FROM DATE SHOWN)

QUEENSLAND UrbanUtilities

AS BUILT

| No. | DATE | AMENDMENT | DWN | APD |
|---|---|---|---|---|
| 1 | 11/04/13 | AS BUILT | CX | EA |
| B | 22/01/13 | FOR REVIEW | CX | EA |
| A | 14/01/13 | FOR REVIEW | CX | EA |

FUNDING
DESIGN W.O. No.
CONSTRUCT W.O. No.
FUNDED BY Q.U.U. (✓) EXTERNAL ( )

| | |
|---|---|
| DRAFTED | CLAIRE XU |
| DRAFTING CHK | PAUL KAJEWSKI |
| CAD FILE | 486-5-5-0105-150_1.dwg |
| Q.U.U. FILE No. | |

| | | |
|---|---|---|
| GREG BOTT | 10036 | |
| DESIGN | R.P.E.Q. No. | DATE |
| GREG BOTT | 10036 | 11/06/13 |
| DESIGN CHECK | R.P.E.Q. No. | DATE |

APPROVED BY (CONSULTANT) SIGNATURE DATE

ASSET/PROJECT
QUU FOUR LAGOONS
STP UPGRADES

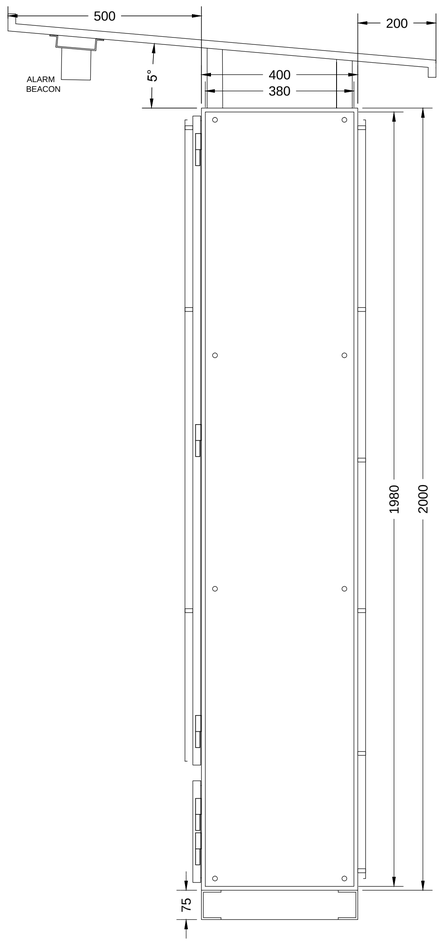
DRAWING TITLE
LAIDLEY
MAIN SWITCHBOARD
GENERAL ARRANGEMENT

SHEET No. 01 OF 07

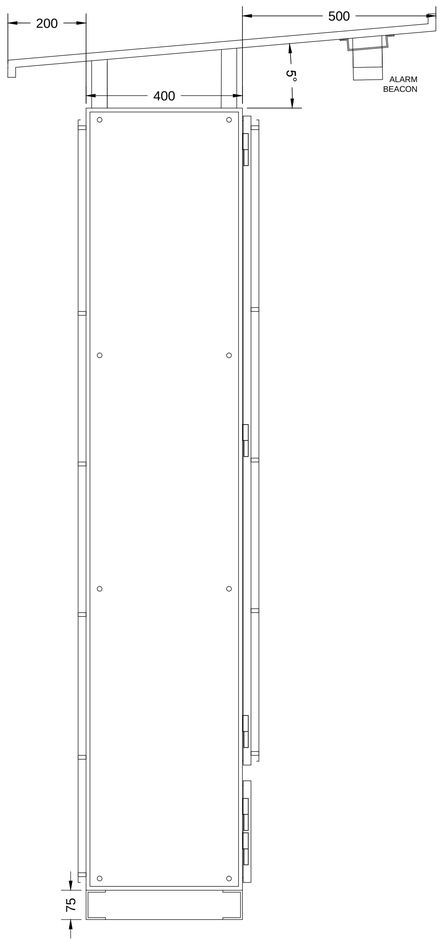
QUEENSLAND URBAN UTILITIES DRAWING No. 486/5/5-0105-150

AMEND. 1

LAST PLOTTED BY DARRYN WILEY ON 17/07/13 AT 3:05 PM

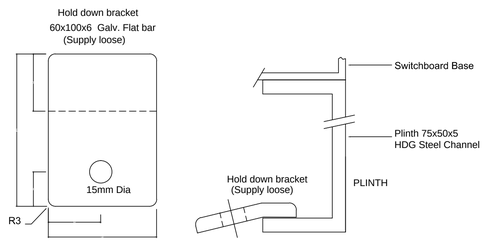



RIGHT VIEW



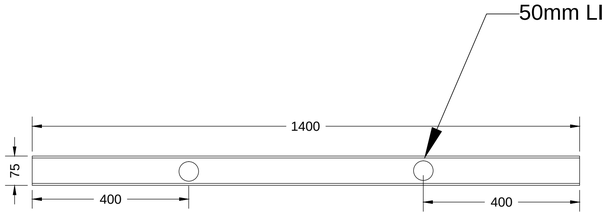

LEFT VIEW

DETAIL SWITCHBOARD MOUNTING DETAILS.

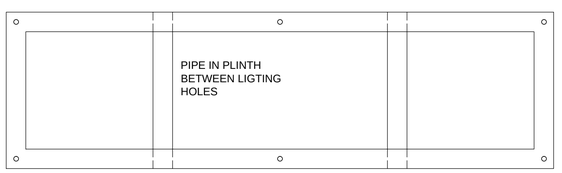



(BOLTING DOWN FACILITIES DETAIL)
(INTERNAL BRACKET, 6 PCS.)

SET UP CUBICLE TO BE LEVEL & PLUMB BEFORE BOLTING TO CONCRETE SLAB USING M12 S/STEEL DYNA-BOLTS.
MINIMUM ANCHORAGE 110mm.
FILL WITH NON-SHRINK GROUT WHERE REQUIRED.




PLINTH FRONT VIEW




PLINTH TOP VIEW

AS BUILT

AS CONSTRUCTED DETAILS

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NAME of SIGNATORY: GREG BOTT
RPEQ No. or LICENCE: 10036
COMPANY NAME: MPA Engineering Pty. Ltd.
START DATE: 1/7/12 FINISH DATE: 30/6/13

**MPA ENGINEERING LTD PTY**

BRENDALE OFFICE
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BRENDALE QLD 4500
Phone:- 07 3881 0722
Fax:- 07 0881 0723
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Job No:- 20142

NAME SIGNATURE DATE

QUEENSLAND URBAN UTILITIES DELEGATE
(AUTHORISED FOR 12 MONTHS FROM DATE SHOWN)

QUEENSLAND Urban Utilities

| No. | DATE | AMENDMENT | DWN | APD |
|---|---|---|---|---|
| 1 | 11/04/13 | AS BUILT | CX | EA |
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FUNDING
DESIGN W.O. No.
CONSTRUCT W.O. No.
FUNDED BY Q.U.U. (✓) EXTERNAL ( )

| | |
|---|---|
| DRAFTED | CLAIRE XU |
| DRAFTING CHK | PAUL KAJEWSKI |
| CAD FILE | 486-5-5-0105-150_1.dwg |
| Q.U.U. FILE No. | |

| | | | |
|---|---|---|---|
| GREG BOTT | 10036 | | |
| DESIGN | R.P.E.Q. No. | DATE | |
| GREG BOTT | 10036 | 11/06/13 | |
| DESIGN CHECK | R.P.E.Q. No. | DATE | |

APPROVED BY (CONSULTANT) SIGNATURE DATE

ASSET/PROJECT
QUU FOUR LAGOONS
STP UPGRADES

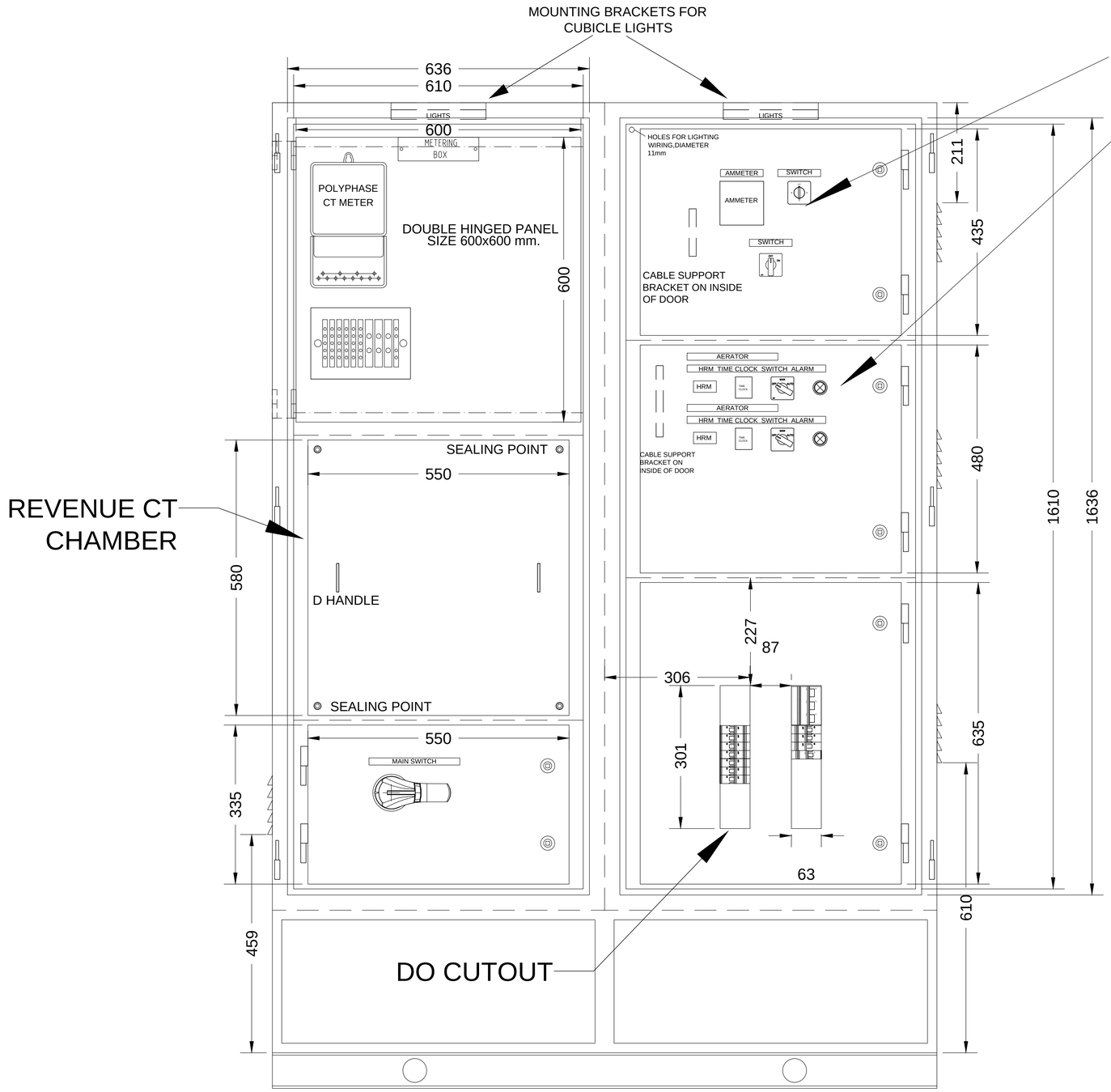
DRAWING TITLE
LAIDLEY
MAIN SWITCHBOARD
GENERAL ARRANGEMENT

SHEET No. 02 OF 07

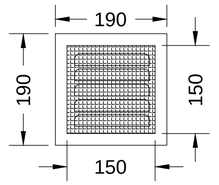
QUEENSLAND URBAN UTILITIES DRAWING No. 486/5/5-0105-151

AMEND. 1

LAST PLOTTED BY DARRYN WILEY ON 17/07/13 AT 3:05 PM




124H*128W




VENTS

FRONT VIEW SHOWING OUTER DOORS AND SUN SHIELDS REMOVED

AS BUILT

| No. | DATE | AMENDMENT | DWN | APD |
|---|---|---|---|---|
| 1 | 11/04/13 | AS BUILT | CX | EA |
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| GREG BOTT | 10036 | 11/06/13 |
| DESIGN CHECK | R.P.E.Q. No. | DATE |

APPROVED BY (CONSULTANT) SIGNATURE DATE

ASSET/PROJECT
QUU FOUR LAGOONS
STP UPGRADES

DRAWING TITLE
LAIDLEY
MAIN SWITCHBOARD
GENERAL ARRANGEMENT

SHEET No. 03 OF 07

| QUEENSLAND URBAN UTILITIES DRAWING No. | AMEND. |
|---|---|
| 486/5/5-0105-152 | 1 |

AS CONSTRUCTED DETAILS

I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.

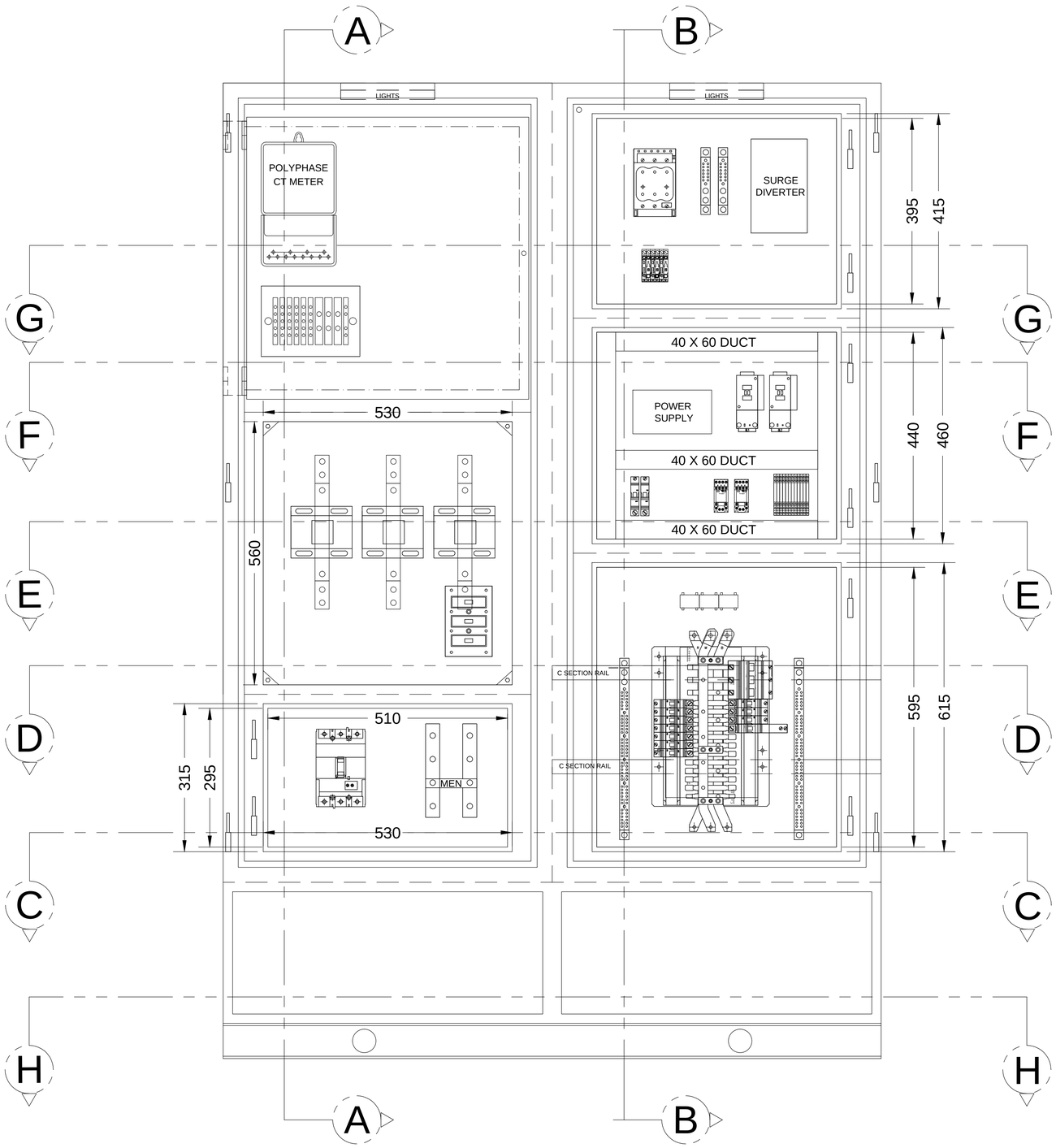
SIGNED: DATE: 11/06/13
NAME of SIGNATORY: GREG BOTT
RPEQ No. or LICENCE: 10036
COMPANY NAME: MPA Engineering Pty. Ltd.
START DATE: 1/7/12 FINISH DATE: 30/6/13

MPA ENGINEERING LTD PTY
BRENDALE OFFICE
UNIT 3/22 STRATHWYN ST
BRENDALE QLD 4500
Phone:- 07 3881 0722
Fax:- 07 0881 0723
Website:- www.mpaeng.com.au
Job No:- 20142

NAME SIGNATURE DATE
QUEENSLAND URBAN UTILITIES DELEGATE
(AUTHORISED FOR 12 MONTHS FROM DATE SHOWN)

QUEENSLAND UrbanUtilities

LAST PLOTTED BY DARRYN WILEY ON 17/07/13 AT 3:05 PM




FRONT VIEW SHOWING INNER ESCUTCHEONS

AS BUILT

| No. | DATE | AMENDMENT | DWN | APD |
|---|---|---|---|---|
| 1 | 11/04/13 | AS BUILT | CX | EA |
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| GREG BOTT | 10036 | 11/06/13 | |
| DESIGN CHECK | R.P.E.Q. No. | DATE | |

APPROVED BY (CONSULTANT) SIGNATURE DATE

ASSET/PROJECT
QUU FOUR LAGOONS
STP UPGRADES

DRAWING TITLE
LAIDLEY
MAIN SWITCHBOARD
GENERAL ARRANGEMENT

SHEET No. 04 OF 07

| QUEENSLAND URBAN UTILITIES DRAWING No. | AMEND. |
|---|---|
| 486/5/5-0105-153 | 1 |

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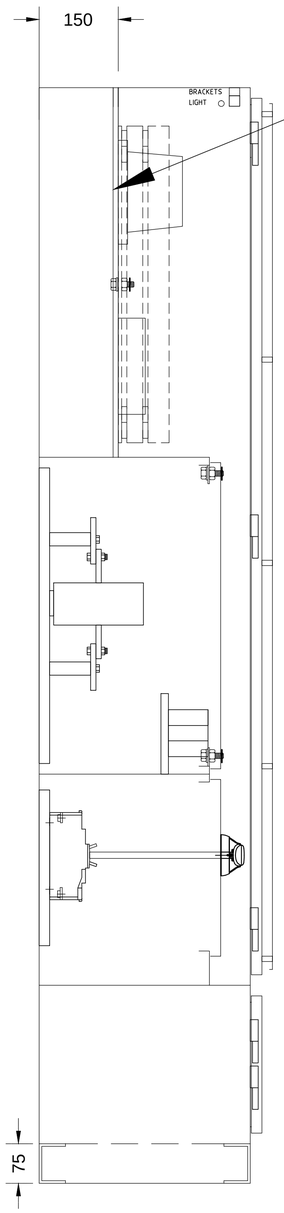
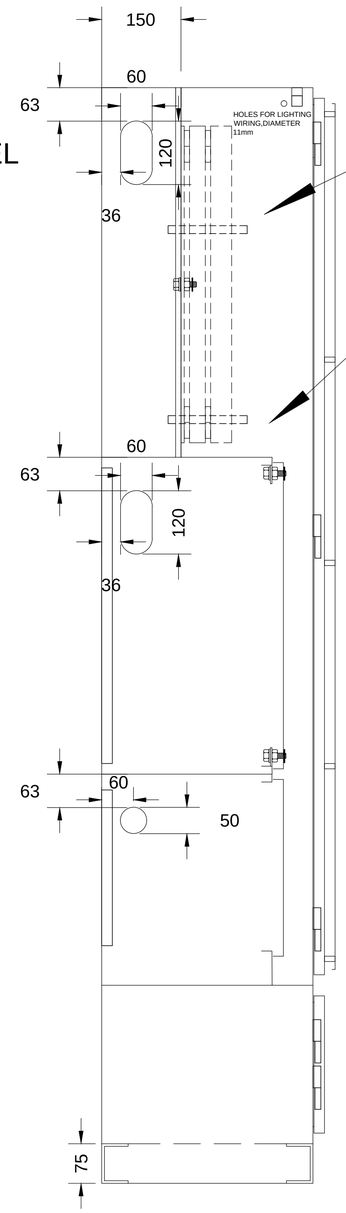
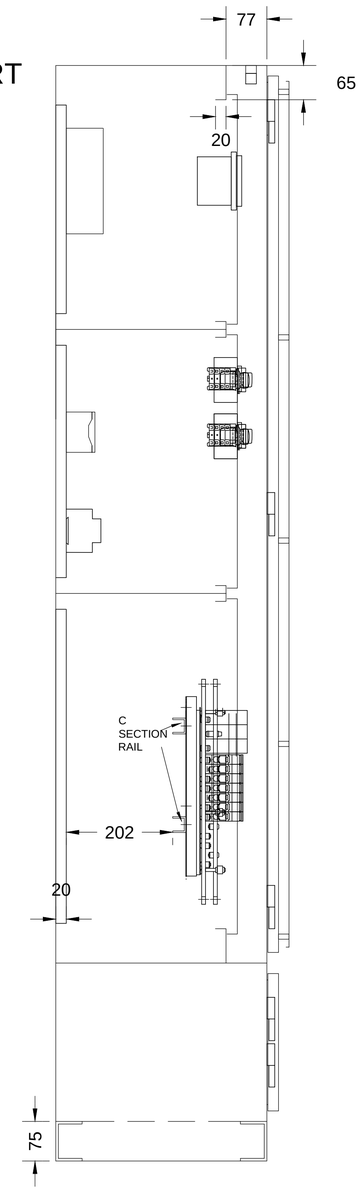
QUEENSLAND UrbanUtilities




SECTION A-A




SECTION A-A CUT OUT

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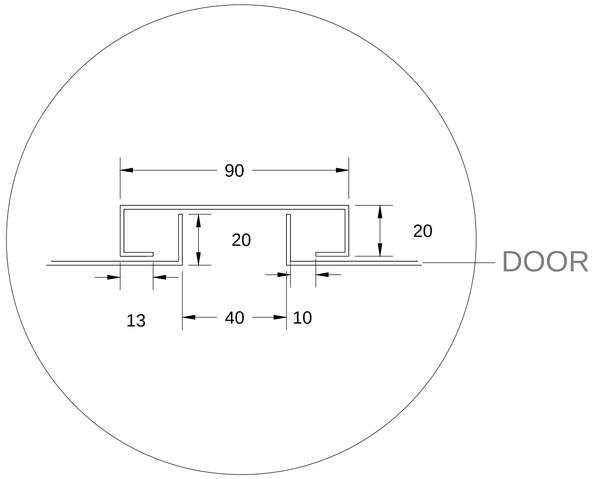
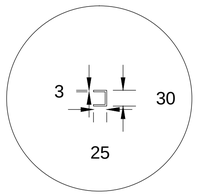



CENTRE DOOR MULLION DETAILS




C SECTION RAIL,SIDE VIEW

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APPROVED BY (CONSULTANT) SIGNATURE DATE

ASSET/PROJECT
QUU FOUR LAGOONS
STP UPGRADES

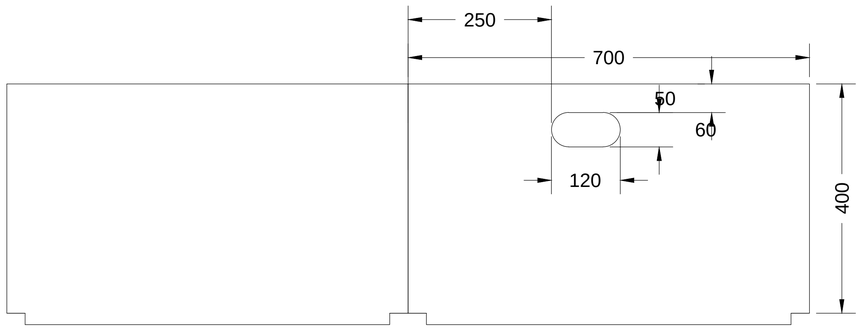
DRAWING TITLE
LAIDLEY
MAIN SWITCHBOARD
GENERAL ARRANGEMENT

SHEET No. 05 OF 07

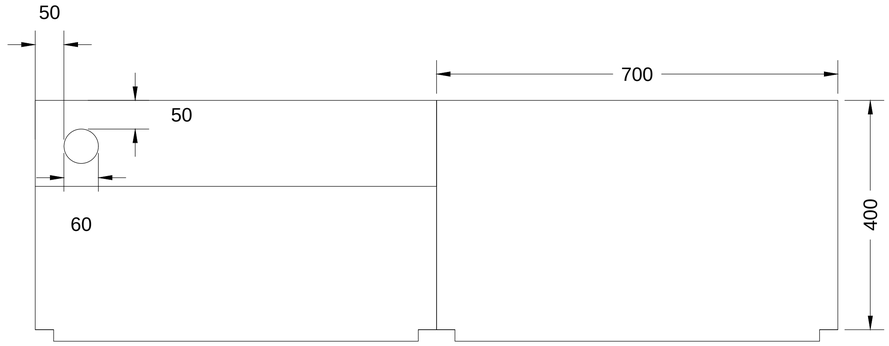
QUEENSLAND URBAN UTILITIES DRAWING No. 486/5/5-0105-154

AMEND. 1

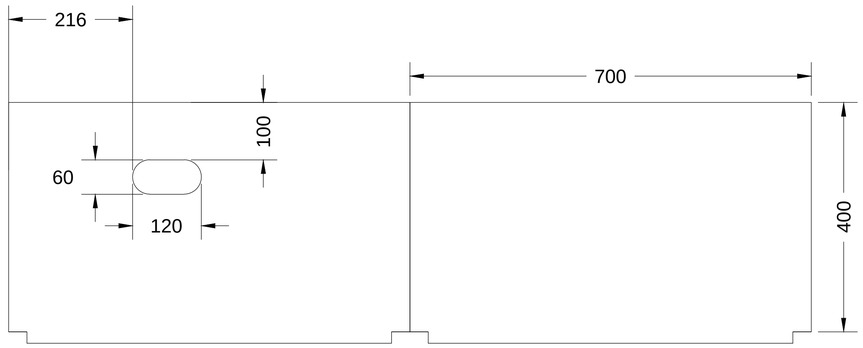
LAST PLOTTED BY DARRYN WILEY ON 17/07/13 AT 3:05 PM



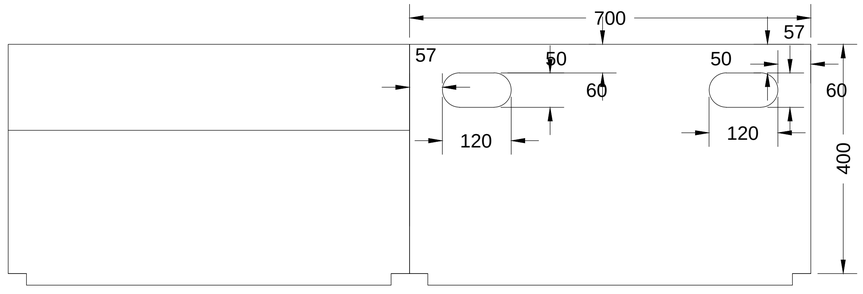

SECTION E-E CUT-OUTS



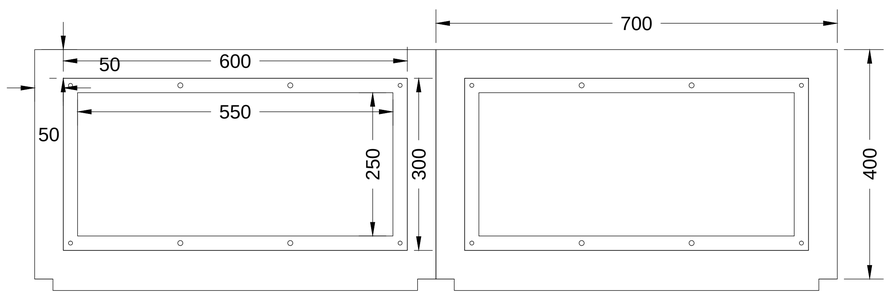

SECTION F-F CUT-OUTS



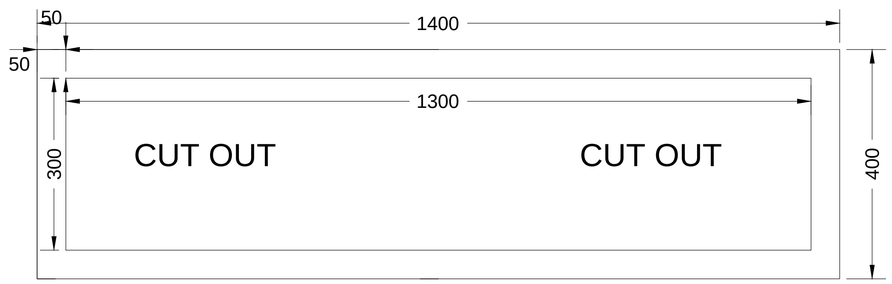

SECTION D-D CUT-OUTS




SECTION G-G CUT-OUTS




SECTION C-C GLAND PLATES




SECTION H-H CUT-OUTS

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QUEENSLAND Urban Utilities

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| GREG BOTT | 10036 | 11/06/13 |
| DESIGN CHECK | R.P.E.Q. No. | DATE |

APPROVED BY (CONSULTANT) SIGNATURE DATE

ASSET/PROJECT
QUU FOUR LAGOONS
STP UPGRADES

DRAWING TITLE
LAIDLEY
MAIN SWITCHBOARD
GENERAL ARRANGEMENT

SHEET No. 06 OF 07

QUEENSLAND URBAN UTILITIES DRAWING No. 486/5/5-0105-155

AMEND. 1

LAST PLOTTED BY DARRYN WILEY ON 17/07/13 AT 3:05 PM

## CONSTRUCTION NOTES

| | |
|---|---|
| ENCLOSURE. | 3mm MARINE GRADE ALUMINIUM. |
| FINISH . | DULUX 36648 MIST GREEN ,MATT FINISH. |
| MOUNTING PANS. | BRIGHT WHITE 32166. 3mm MARINE GRADE ALUMINIUM. |

| | |
|---|---|
| OPERATIONAL FREQUENCY. | 50 HZ |
| RATED VOLTAGE | 415V |
| RATED INSULATION VOLTAGE | 660V |
| RATED AUXILIARY VOLTAGE | 24VDC |
| RATED CURRENT | 250A |
| SHORT CIRCUIT CURRENT /SC | 20kA |
| DURATION OF /SC | 1 SEC |
| SERVICE CONDITION | OUTDOOR |
| FORM OF SEPARATION | FORM 2 |
| IP RATING | IP56 |
| PLINTH MATERIAL | 75 mm STEEL CHANEL ,HOT DIP GAL, TOE-IN |
| FINISH | |
| CABLE ENTRY | BOTTOM |
| SWITCHBOARD MOUNTING | FLOOR |
| SPARE | 20% |
| SWITCHBOARD TYPE | CUSTOM TYPE |
| GLAND PLATE MATERIAL | 3mm MARINE GRADE ALUMINIUM. |

DOORS STAYS ON OUTDOOR

A4 SIZE LENGEND CARD HOLDER AND DOCUMENT HOLDER ARE INSIDE THE OUTER DOOR

NO PARTITION BETWEEN THE CABLE ZONE

## SUN SHIELD NOTES:

### CONSTRUCTION:

* MACHINE FORMED AND CONTINUOUS SEAM WELDED FROM 3mm ALUMINIUM.
* SUN SHIELDS ON FRONT,BACK AND SIDES.
* ENSURE HEATSHIELDS ARE DESIGNED SO ANY DOOR MAY OPEN TO 100 DEGREE WITHOUT CLASHING ON ADJACENT DOOR.

* FULL LENGTH EXTERNAL DOOR REINFORCED WITH DOOR STIFFENER.
* NUTS, BOLTS & OTHER FASTENINGS TO BE 316 STAINLESS STEEL (MIN).
* ALL DOORS INNER & OUTER TO HAVE 6mm EARTH STUDS WELDED TO THE RIGHT HAND CORNER OF THE DOOR & ON THE SIDE OF THE CUBICLE AT EACH DOOR.
* WELDED MOUNTING BRACKETS ARE USED TO MOUNT SUN SHIELD

### SEALING / LOCKING:

* FULL RETURN GUTTERS ON MULLIONS.
* CLOSED CELL NEOPRENE RUBBER GASKET FITTED TO DOORS AND COVERS.
* EXTERNAL DOORS FITTED WITH 316 STAINLESS STEEL LOCKABLE SWING HANDLES KEYED 92268 WITH 3 POINT LOCKING MECHANISM ON FULL LENGTH DOOR.
* HINGES SHALL BE 316 STAINLESS STEEL, WITH 316 STAINLESS STEEL PINS.
* INTERNAL DOORS FITTED WITH QUARTER TURNS,316 STAINLESS STEEL.

AS BUILT

| No. | DATE | AMENDMENT | DWN | APD |
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| GREG BOTT | 10036 | 11/06/13 |
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APPROVED BY (CONSULTANT) SIGNATURE DATE

ASSET/PROJECT
QUU FOUR LAGOONS
STP UPGRADES

DRAWING TITLE
LAIDLEY
MAIN SWITCHBOARD
GENERAL ARRANGEMENT

SHEET No. 07 OF 07

QUEENSLAND URBAN UTILITIES DRAWING No. 486/5/5-0105-156

AMEND. 1

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AS CONSTRUCTED DETAILS

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SIGNED: DATE: 11/06/13

NAME of SIGNATORY: GREG BOTT

RPEQ No. or LICENCE: 10036

COMPANY NAME: MPA Engineering Pty. Ltd.

START DATE: 1/7/12 FINISH DATE: 30/6/13

MPA ENGINEERING LTD PTY

BRENDALE OFFICE
UNIT 3/22 STRATHWYN ST
BRENDALE QLD 4500
Phone:- 07 3881 0722
Fax:- 07 0881 0723
Website:- www.mpaeng.com.au

Job No:- 20142

NAME SIGNATURE DATE

QUEENSLAND URBAN UTILITIES DELEGATE
(AUTHORISED FOR 12 MONTHS FROM DATE SHOWN)

QUEENSLAND UrbanUtilities

# NEW MAIN SWITCHBOARD

E R W B N

JUNCTION BOX

Q303 20A — K301 — OL301 OVERLOAD (6,E) (4,G) — X1 1,2,3,4

M ~ 3.7kW AERATOR MOTOR 1

Q304 20A — K302 — OL302 OVERLOAD (6,F) (4,H) — X1 5,6,7,8

M ~ 3.7kW AERATOR MOTOR 2

(310-9,G) 311-32 — 311-29 — 311-47

PS301 24VDC POWER SUPPLY — 311-46 GND — 311-27 — 311-38

Q310 2A

SW302 TC301 TIME CLOCK — OL301 OVERLOAD — K301 — 311-34 — 311-35 — 311-39

SW303 TC302 TIME CLOCK — OL302 OVERLOAD — K302 — 311-36 — 311-37 — 311-40

311-28

K301 CONTACTOR — 311-30 — HRM301 HOURS RUN METER 1

TC301 TIME CLOCK (5,E)

OL301 OVERLOAD — 311-33 — R301 — H301 AERATOR 1 OVERLOAD

K302 CONTACTOR — 311-31 — HRM302 HOURS RUN METER 2

TC302 TIME CLOCK (5,F)

OL302 OVERLOAD — 311-45 — R302 — H302 AERATOR 2 OVERLOAD

R302 FAULT RELAY (6,H)

R301 FAULT RELAY (6,G) — X3 4 — 311-1 — H303 — X3 3 ALARM BEACON

SW304 ON OFF — 311-50 — X3 2 — L301 — X3 1 CUBICLE LIGHTS

L302

CONTACTOR (3,G) (8,F) — K301 311-41 311-43 — K302 — X2 1

CONTACTOR (3,H) (8,F)

R301 311-42 311-44 — R302 — X2 3

HOURS RUN METER 1

TIME CLOCK (5,E) — X2 4

AERATOR 1 FAULT RELAY (4,I) (8,F)

SCADA CONTROL PANEL

RUNNING

FAULT

2.5mm² COPPER PVC CABLE

AS CONSTRUCTED DETAILS

I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.

SIGNED: DATE: 11/06/13

NAME of SIGNATORY: GREG BOTT

RPEQ No. or LICENCE: 10036

COMPANY NAME: MPA Engineering Pty. Ltd.

START DATE: 1/7/12 FINISH DATE: 30/6/13

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QUEENSLAND Urban Utilities

AS BUILT

| No. | DATE | AMENDMENT | DWN | APD |
|---|---|---|---|---|
| 1 | 03/05/13 | AS BUILT | CX | EA |
| 0 | 11/04/13 | FOR CONSTRUCTION | CX | EA |
| B | 22/01/13 | FOR REVIEW | CX | EA |

FUNDING: FUNDED BY Q.U.U. (✓) EXTERNAL ( )
DESIGN W.O. No.
CONSTRUCT W.O. No.
Q.U.U. FILE No.

| | | | |
|---|---|---|---|
| DRAFTED | CLAIRE XU | | |
| DRAFTING CHK | PAUL KAJEWSKI | | |
| CAD FILE | 486-5-5-0105-159_1.dwg | | |
| GREG BOTT | 10036 | | |
| DESIGN | R.P.E.Q. No. | DATE | |
| GREG BOTT | 10036 | 11/06/13 | |
| DESIGN CHECK | R.P.E.Q. No. | DATE | |

APPROVED BY (CONSULTANT) SIGNATURE DATE

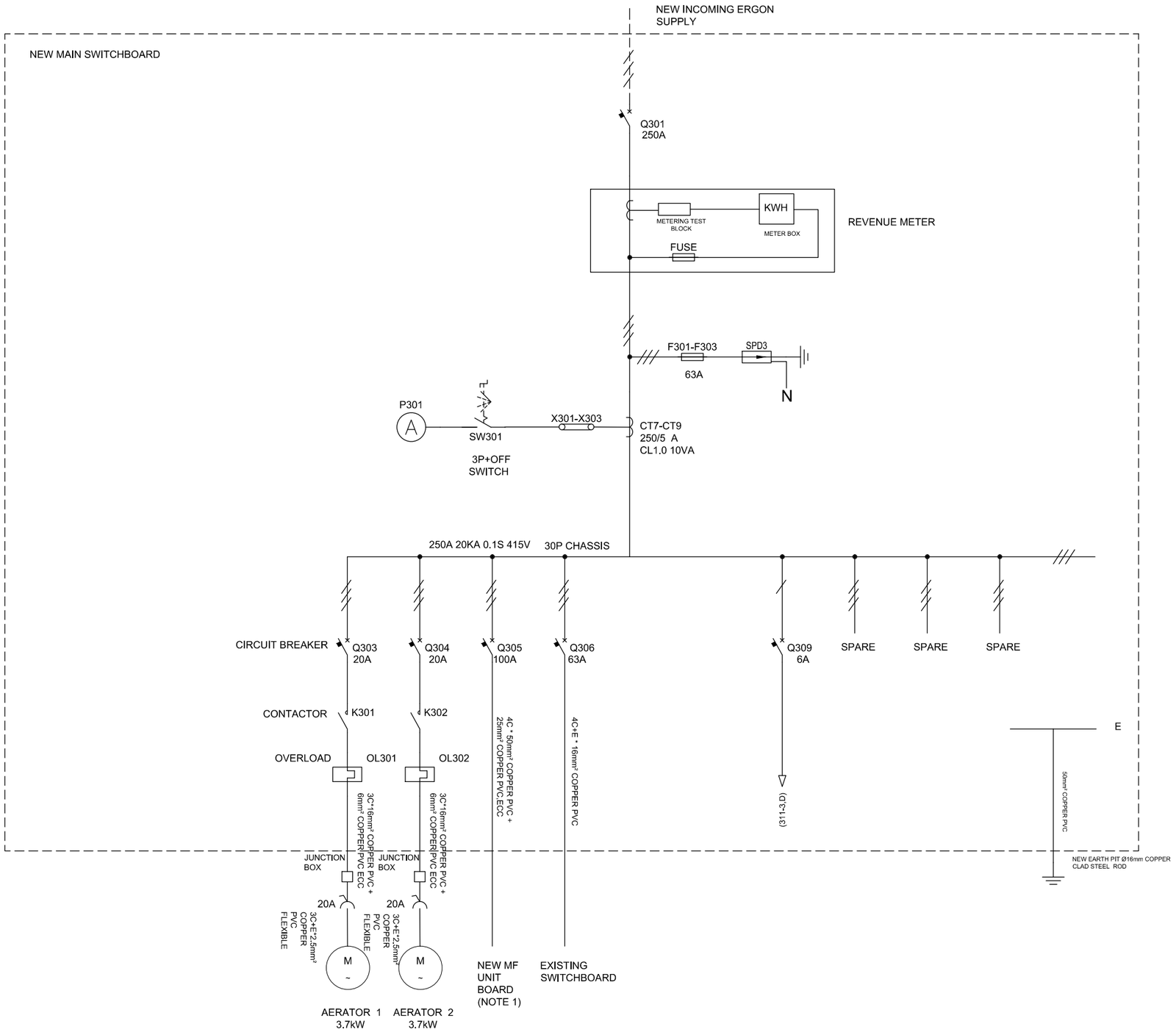
ASSET/PROJECT: QUU FOUR LAGOONS STP UPGRADES

DRAWING TITLE: LAIDLEY AERATOR CONTROL SCHEMATIC

SHEET No. 01 OF 01

QUEENSLAND URBAN UTILITIES DRAWING No. 486/5/5-0105-159 AMEND. 1

LAST PLOTTED BY DARRYN WILEY ON 17/07/13 AT 3:05 PM




NOTES:-

1: MF BUILDING LIGHTS FED FROM MF DB VIA 2.5mm² 2C+E CABLE & 20A RCBO.

AS CONSTRUCTED DETAILS

I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.

SIGNED: DATE: 11/06/13

NAME of SIGNATORY: GREG BOTT

RPEQ No. or LICENCE: 10036

COMPANY NAME: MPA Engineering Pty. Ltd.

START DATE: 1/7/12 FINISH DATE: 30/6/13

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QUEENSLAND Urban Utilities

AS BUILT

| No. | DATE | AMENDMENT | DWN | APD |
|---|---|---|---|---|
| 1 | 03/05/13 | AS BUILT | CX | EA |
| 0 | 11/04/13 | FOR CONSTRUCTION | CX | EA |
| 2 | 11/06/13 | AS BUILT | DJW | EA |

FUNDING
DESIGN W.O. No.
CONSTRUCT W.O. No.
FUNDED BY Q.U.U. (✓) EXTERNAL ( )

| | |
|---|---|
| DRAFTED | CLAIRE XU |
| DRAFTING CHK | PAUL KAJEWSKI |
| CAD FILE | 486-5-5-0105-158_2.dwg |
| Q.U.U. FILE No. | |

| | | |
|---|---|---|
| GREG BOTT | 10036 | |
| DESIGN | R.P.E.Q. No. | DATE |
| GREG BOTT | 10036 | 11/06/13 |
| DESIGN CHECK | R.P.E.Q. No. | DATE |

APPROVED BY (CONSULTANT) SIGNATURE DATE

ASSET/PROJECT
QUU FOUR LAGOONS STP UPGRADES

DRAWING TITLE
LAIDLEY
SINGLE LINE DIAGRAM
ELECTRICAL DISTRIBUTION SYSTEM

SHEET No. 01 OF 01

QUEENSLAND URBAN UTILITIES DRAWING No. 486/5/5-0105-158 AMEND. 2

LAST PLOTTED BY DARRYN WILEY ON 17/07/13 AT 3:05 PM