Helidon STP Treatment Wetlands Operation and Maintenance Manual

Project Reference No. AWWTAA003

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Helidon Treatment Wetland

Operation and Maintenance Manual

Prepared for

Queensland Urban Utilities

By

the WATER & CARBON group

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1 Introduction

This Operation and Maintenance Manual (O&M Manual) has been prepared in order to maintain the long-term health and functionality of the Helidon Treatment Wetland. This Manual has been developed in accordance with Queensland Urban Utilities and DEHP requirements.

1.1 Purpose of Document

This O&M Manual is intended to;

- Detail specific activities required for operating and maintaining the treatment wetland.
- Provide guidance on required timing of inspections.
- Provide direction for the changes in operation that will be required during operation of the treatment wetland system.
- Ensure operational & maintenance issues are identified and acted upon appropriately. This includes referring problems to external contractors and specialists.

The main objective of this manual is to provide the System Operator (written as Operator from herein) with enough knowledge and confidence to sustain a healthy treatment wetland over the long-term. The Operator must be aware that wetland ecosystems are naturally evolving and therefore operational parameters and quantities in this document will require reassessment as the system develops over time. Hence, procedures in this manual are to be reviewed in consultation with the Queensland Urban Utilities Service Delivery Leader (Scenic Rim Region) and updated accordingly.

1.2 Related Documents

The O&M Manual draws upon information provided in the Detailed Design Documentation and Work-as-Executed Plans. These documents should also be referred to for a broader perspective of management issues. In addition, the Operator should have a copy of the relevant wetland plant guides detailed in Appendix 6 Wetland Vegetation Guide.

1.3 Document Revision

This document is to be reviewed by the QUU Service Delivery Leader (Scenic Rim Region) and updated periodically. A new revision is to be published with all agreed modifications after completion of system establishment.

Operators are to form a major part of this review as their practical experience will be vital in determining required changes to the Manual. Reference must be made to all records including observation notes to identify areas that require attention. The version table at the front of this O&M Manual is to be updated with each revision.

1.4 Record Keeping

The keeping of informative, organised records is necessary and will enable efficient document revision. The following is a list of documents to be utilised for record keeping:

- Log book.
- Inspection checklists (Appendix 1)
- Wetland hydrology recording sheet (Appendix 2)
- Water quality recording sheet.(Appendix 3)
- Mosquito larvae recording sheet (Appendix 8)

1.5 Operation and Maintenance Tools

The Wetland Inspection Checklist, Wetland Hydrology Sheet, Water Quality Record Sheet, Observation and Monitoring Plan and Maintenance Schedule Recording Sheet (Appendices 1, 2, 3, 4, and 5) have been provided in conjunction with the O&M Manual as tools to help the Operator conduct thorough inspections and appropriately respond to observations. They are also intended to be used for record keeping and for future reference. The Overall Site Plan (486/5/5-0160-003) is provided as an illustrated overview of the operation of the Helidon Treatment Wetland.

1.6 Site Information

The Helidon Treatment Wetland is located on Back Flagstone Road, Helidon, QLD 4333.

1.7 Site Access

Main and secondary access points are shown on the Plan 486/5/5-0160-003. The plans show vehicle access tracks and pedestrian pathways.

1.8 Roles and Responsibilities

The aim of establishing clear roles and responsibilities is to ensure that the Parties can work concurrently to achieve the System Operation objectives and fulfil their respective environmental duty of care.

1.8.1 Operator

Within this document the term 'Operator' refers to the party responsible for operating and maintaining the Treatment Wetland. The Contractor (Civil works constructor) must operate and maintain the Treatment Wetland for a maintenance period after completion of construction. The maintenance period commences post practical completion of civil works and for this project is a duration of 24 months. The maintenance period commences June 2014.

The Operation and Maintenance of the Helidon Treatment Wetland is covered in detail within relevant sections of this manual, however typically includes (but is not limited to) the following:

- Routine inspections for monitoring the condition of the wetland and associated structures.
- Managing control and water flow from the Helidon STP Facultative Ponds to the Treatment Wetland.
- Managing the water level within the wetland.
- Managing weeds and controlling pest fauna.
- Mosquito monitoring.
- Managing odours, complaints and security maintenance.
- Maintaining all assets and signage within the wetland area.
- Ensuring safety of all people located within the boundary of the site.
- Ensuring appropriate personnel are skilled and trained to carry out required duties.
- Addressing any events that may impact on the system.
- Compliance monitoring and continual improvement of the system operations.

In managing the Helidon Treatment Wetland, the Operator shall:

- Operate at all times in accordance with all environmental or other laws and regulations in force at the date of this Agreement and comply with any changes in such laws and regulations and with any new laws and regulations.

- On becoming aware of any physical (i.e. water levels, water quality or other degradation) or operational (i.e. repairs, maintenance) changes occurring within the system that will affect the delivery of treated effluent from the Helidon STP, contact the duty operator and or Queensland Urban Utilites Supervisor at the Helidon STP and advise accordingly.
- Immediately refer any community or public relations issues to the QUU Community Engagement Officer.

Additionally, the initial Operator (i.e. Construction Contractor) will be required to adequately train the asset owner's operator (Trainee Operator) prior to handover of the project at the end of the contractual establishment period.

1.8.2 Contact list

Role	Name	Phone	Email
QUU Senior Operator	Troy Smith	0429 067 554	
QUU Service Delivery Leader	Mike Oakey	0447 206 089	michael.oakey@urbanutilities.com.au
QUU Project Manager	Will Campbell	07 3403 3320	Will.campbell@urbanutilities.com.au
Wetland Specialist	Rob McKenzie	07 3211 9997	r.mckenzie@waterandcarbon.com.au

1.9 Operator Qualifications and Training

The Contractor will adequately train the Operator prior to handover of the project at the end of the contractual maintenance period. In addition, any further handovers require the leaving Operator to adequately train the incoming Operator.

Prior to handover training of the Operator has been undertaken over the course of the establishment period. Operators have been provided with an understanding of the day to day operational tasks for the system. Operators have been given basic plant identification skills, information on operation of pipe manifolds and vertical riser outlets.

Prior to asset handover a workshop day will be provided to Operators who will be required to sign an attendance sheet indicating their participation in training. The training workshop will include a half day in a meeting room and half day on site and will cover the following:

- wetland plant and weed identification;
- understanding and managing plant health;
- appropriate weed management strategies;
- operation of pipe manifolds;
- wetland management flooding; and
- requirements for wetland drawdown.

Any Operator(s) appointed to the Treatment Wetland complex require the following skill set as a guide:

- Plant identification skills;
- Under the Agricultural Chemicals Distribution Control Act 1996 (ACDC Act) any worker distributing herbicides or chemicals must be licensed and hold a ACDC chemical spraying certificate;

- Essential skills/knowledge specific to constructed wetlands

Specialists can provide further training of the operator when deemed required by the QUU supervisor.

Any persons working at the treatment wetland complex must receive a site induction, any person operating the wetland must also be familiar with this manual and record keeping requirements for the site. Any contractors working on the site must sign in and out to the site office and provide a safe work methods statement.

1.10 Safety

The effluent supplied to the Treatment Wetland may contain pathogens (disease-causing organisms). However, it is considered that the numbers of pathogens in water leaving the Helidon STP is low and the risk of infection is also low provided simple precautions are taken.

These precautions include:

- Ensuring a hygiene protocol is followed when authorised persons have contact with the effluent during work operations.

When work operations are undertaken in the Treatment Wetland and handling of treated effluent is likely to occur, it is required that the following hygiene protocol be followed:

- Latex gloves are to be worn during water quality sampling.
- Rubber gloves or gardening gloves to be worn during weed and plant maintenance.
- Open wounds are to be protected from physical contact with treated effluent.
- Hands must be washed after operation and maintenance work is completed for the day and prior to eating or drinking.
- Any persons who might have cause to work at the site will be advised of the above precautions.

1.10.1 Operation and Maintenance Safety

The Operator requires the following items during treatment wetland operation and maintenance:

- Waders or wet weather boots for working within the wetland.
- Boots and long pants for working around the wetland.
- Proper sun protection such as hat, long sleeves and pants, glasses and sun screen.
- A first aid kit and emergency numbers.
- Snake (compression) bandage.
- Mobile phone or other remote communication device.
- Closed in foot wear and or gum boots.
- Disinfectant hand wash.

2 Project Background

Lagoon treatment enhancement works have been undertaken at Helidon Sewage Treatment Plant (STP). The enhancement works include modifications to the existing ponds and installation of a Free Water Surface (FWS) treatment wetland in order to bring the STP into compliance with current (Development Approval (DA)) effluent quality release limits.

2.1 Design Flows

The treatment enhancement works have been designed for the predicted Average Dry Weather Flow (ADWF) of 60 kL/day. The enhancements will also provide for management and treatment of wet weather flows of up to 4 times ADWF. A Peak Wet Weather Flow (PWWF) of 220 kL/day (Table 1).

Table 1: Average Dry Weather and Peak Wet Weather Flows for the Helidon STP.

ADWF (kL/day)	PWWF (kL/day)
60	220

2.2 Effluent Quality

As the amended infrastructure will provide an integrated process for wastewater treatment at the Helidon STP it is essential that necessary standards are achieved by the different system components. The wastewater treatment wetland performance is influenced by the quality of water discharged from the lagoons.

Thus a minimum effluent quality for the lagoons is required in order for design performance, and licence compliance, for the treatment wetland component of the system to be achieved. The required maximum influent quality concentrations to the wetland from the second facultative lagoon (Pond 2) to the treatment wetland are provided in Table 2.

Table 1. Maximum effluent discharge limits from the second facultative lagoon.

Parameter	Parameter
Flow (kL/day)	60
BOD_5 (mg/L)	120 (max)
TSS (mg/L)	140 (max)

Effluent quality from the treatment wetland has been designed to comply with the Helidon Development Approval release limits for BOD5 and TSS values shown in Table 2. In addition, pH, Dissolved Oxygen and faecal coliforms licence requirements will be met by the enhanced treatment process at Helidon.

Table 2: Helidon STP Development Approval Release Limits

Quality Characteristics	Release Limit	Limit Type
5-day Biochemical Oxygen Demand (inhibited)	20 mg/L	80th Percentile
5-day Biochemical Oxygen Demand (inhibited)	60mg/L	Maximum
Suspended Solids	60mg/L	80th Percentile
Suspended Solids	180 mg/L	Maximum
pH	6.5 to 8.5	Range
Dissolved Oxygen	6.0 mg/L	Minimum
Faecal Coliforms	4000 organisms per 100 mL as a maximum value (minimum of 5 samples taken at not less than half-hourly intervals in any one day, with 4 out of the 5 samples containing less than 4000 organisms per 100 mL)	

In addition to the Approval release Limits the following table indicates the predicted long term averages for the treatment enhancement works. These averages account for variations in outlet concentrations under a range of flow conditions. Tables 4 and 5 provide predicted long term average outlet concentrations for current and future flows.

Table 4: Predicted outlet concentrations, treatment wetland for current flows (60kL/day)

Current Flow: 60kL/day				
Parameter	**BOD_5**	**TSS**	**TN**	**TP**
Concentration into wetlands (mg/L) (80th percentile)	36	69	40	8
Modelled concentration out of Helidon constructed wetland (mg/L)	**8.8**	**9.2**	**5.0**	**6.1**

Table 5: Predicted outlet concentrations, treatment wetland for predicted ultimate flows (220kL/day)

Predicted Ultimate Flow: 220kL/day				
Parameter	**BOD_5**	**TSS**	**TN**	**TP**
Concentration into wetlands (mg/L) (80^{th} percentile)	36	69	40	8
Modelled concentration out of Helidon constructed wetland (mg/L)	**17**	**29**	**16**	**6.5**

3 Process Overview

Refer to the Pipe and Instrumentation Diagram (DRG 486/5/5-0160-014C) for the key components and layout of the amended treatment infrastructure.

Effluent flows into the second facultative lagoon (Pond 2) through a new outlet pipe. The existing connection between Lagoon 1 and 2 has been capped and abandoned. A new outlet pipe has been installed at the northern end of Pond 2 to enable the direction of flow through Pond 2 to be reversed. Transfer lines gravity feed effluent from Pond 2 to the pipe manifolds at the top of wetland Cells 1 and 2. Effluent flows are then distributed across the top of the wetland Cells across the planted beds to the outlets of the wetland cells.

Following the wetland cell outlets effluent is collected in the pump well for transfer to the chlorine dosing tank before discharge via the licensed sampling pit to the creek.

More detail on the system components is provided in the following sections.

3.1 System Components

The STP enhancement works include the following components:

1. Pond 1 and 2 baffles
2. Pond 2 outlets
3. Knife gate valves
4. Sluice valves (gate)
5. Transfer lines
6. Pipe manifolds
7. Treatment wetland cells 1 and 2
8. Wetland cell batters
9. Wetland cell berms
10. Wetland plants
11. Wetland outlets
12. Spillways
13. Pump well and Pumps
14. Contact tank
15. Disinfection system
16. Reed beds
17. Licensed sampling point

3.1.1 Pond 1 and 2 Stud Baffles

The discharge pipe into Pond 1 has been modified to increase dispersion and mixing. Two new floating stud baffles (5m long) have been installed in Ponds 1 and 2.

Remediation and installation of baffles was undertaken to improve function and performance of the ponds. The baffles function to increase the hydraulic retention time in the secondary lagoons. 100mm diameter baffle perforations have been installed in the baffles to maximise mixing and flow length in Pond 2.

Baffles are constructed of concrete and foam. Ring bolts anchor the baffles to chains that anchor the baffles to the pond walls. Pond baffles are installed in locations shown on DRG 486/5/5-0160-011E.

3.1.2 Pond 2 Outlet

The outlet from pond 2 has been modified and now includes a Tee pieces protected by submerged stone pitching. Pond 2 outlet is shown on DRG 486/5/5-0160-011E.

The pond outlets convey effluent and wet weather flows to wetland cells 1 and 2 (from the Helidon STP Pond 2) to the wetland inlet distributors.

3.1.3 Transfer Lines

A new transfer pipeline has been installed to gravity feed effluent from Pond 2 into each wetland cell. PN12.5 PE100 HDPE pipe work has been used for its physical strength performance under vehicle loads and other operational conditions.

Table 6 details the pipe internal diameters and locations.

Table 6: Specified pipe type and size (refer to DRG for locations 486/5/5-0159-009E).

Pipe Specification	Location (Refer DRG 486/5/5-0159-009E)	Description
DN180 DICL/PN12.5 PE100	A1 - A2	Gravity Transfer Line To Cell 1
DN90 PN12.5 PE100	A2 – A5	Gravity Transfer Line To Cell 1
DN90 PN12.5 PE100	A5 - A3 & A4	Gravity Transfer Line To Cell 1
DN140 PN12.5 PE100	A2 - A6	Gravity Transfer Line To Cell 1
DN125 PN12.5 PE100	A6 - A7	Gravity Transfer Line To Cell 2
DN90 PN12.5 PE100	A7 - A8 & A9	Gravity Transfer Line To Cell 2

3.1.4 Sluice Gate Valves

Sluice knife gates have been installed at the Helidon Treatment Wetlands, each sluice gate valve is located upstream of the inlet pipe manifolds (refer to DRG 486/5/5-160-011E). Knife gate valves allow the cells to be closed off for maintenance or cell drying.

An additional sluice gate valve has been installed at the bottom of Cell 2 (refer to DRG 486/5/5-160-011E).

Table 7: Asset Tags for Sluice Gate Valves, Refer to DRG 486/5/014C for the location of Sluice Gate Valves.

Asset Tag
VV-0613-003
VV-0614-003
VV-0614-004

3.1.5 Knife Gate Valves

Knife gate valves x 4 have been installed to clean out the transfer lines to each treatment wetland cell from Pond 2 as required. Two knife gate valves on the scour line have been installed for Cell 1

and two knife gate valves on the scour line for Cell 2 have been installed. Refer to DRG 486/5/014C for the location of Knife Gate Valves

Table 8: Asset Tags for Knife Gate Valves, Refer to DRG 486/5/014C for the location of Knife Gate Valves.

Asset Tag
VV-0613-001
VV-0613-002
VV-0613-003
VV-0613-004

3.1.6 Wetland Inlets - Pipe Manifolds

Flows from the transfer pipeline are split between each wetland cell and discharge through perforated inlet distributors (Refer DRG 486/5/5-0160-017E). The arrangement of the inflow works have been designed to provide an even distribution across the inlets over the range of flows. The wetland inlets consist of 6 pipe manifolds that evenly distribute the pond outflow across the head of each wetland cell (Figures 2 and 3).

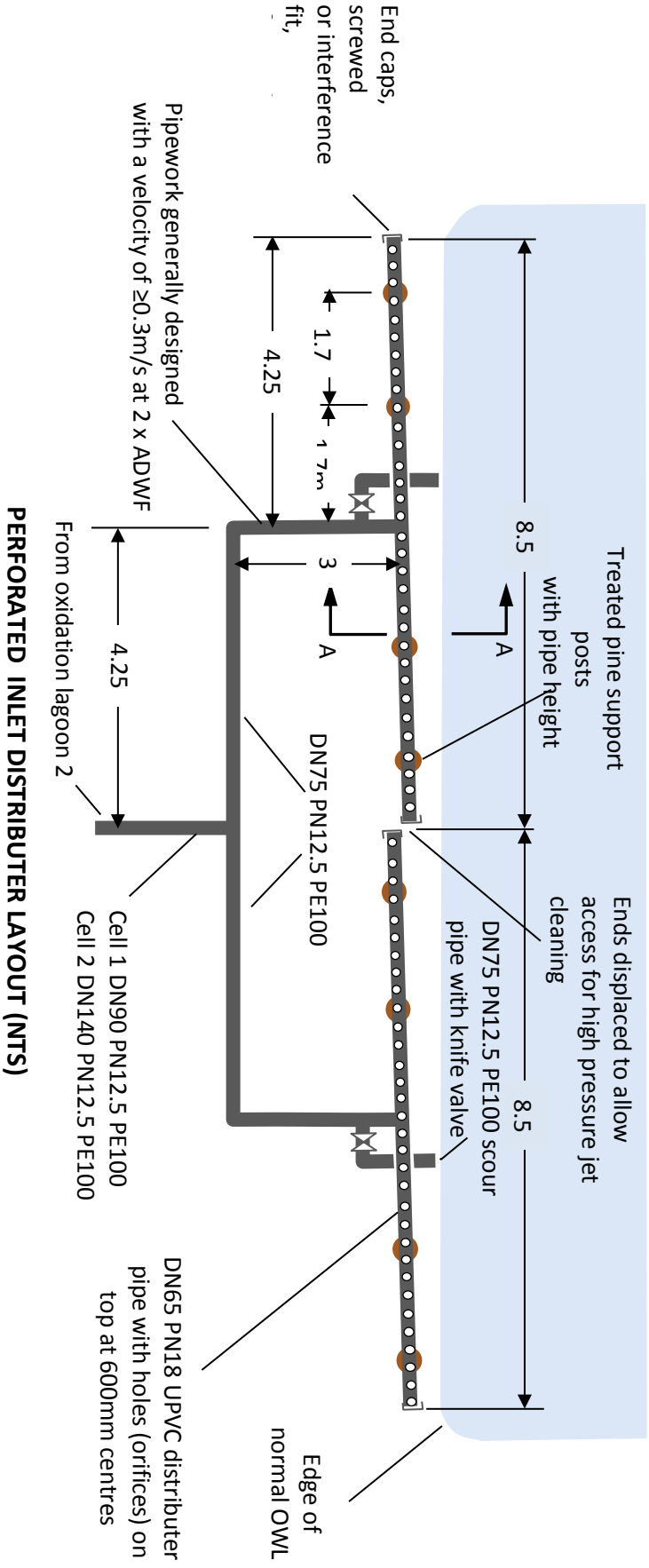

Figure 2: Inlet distributor layout, Helidon STP.

Inlet distributors are DN65 PN18 UPVC.

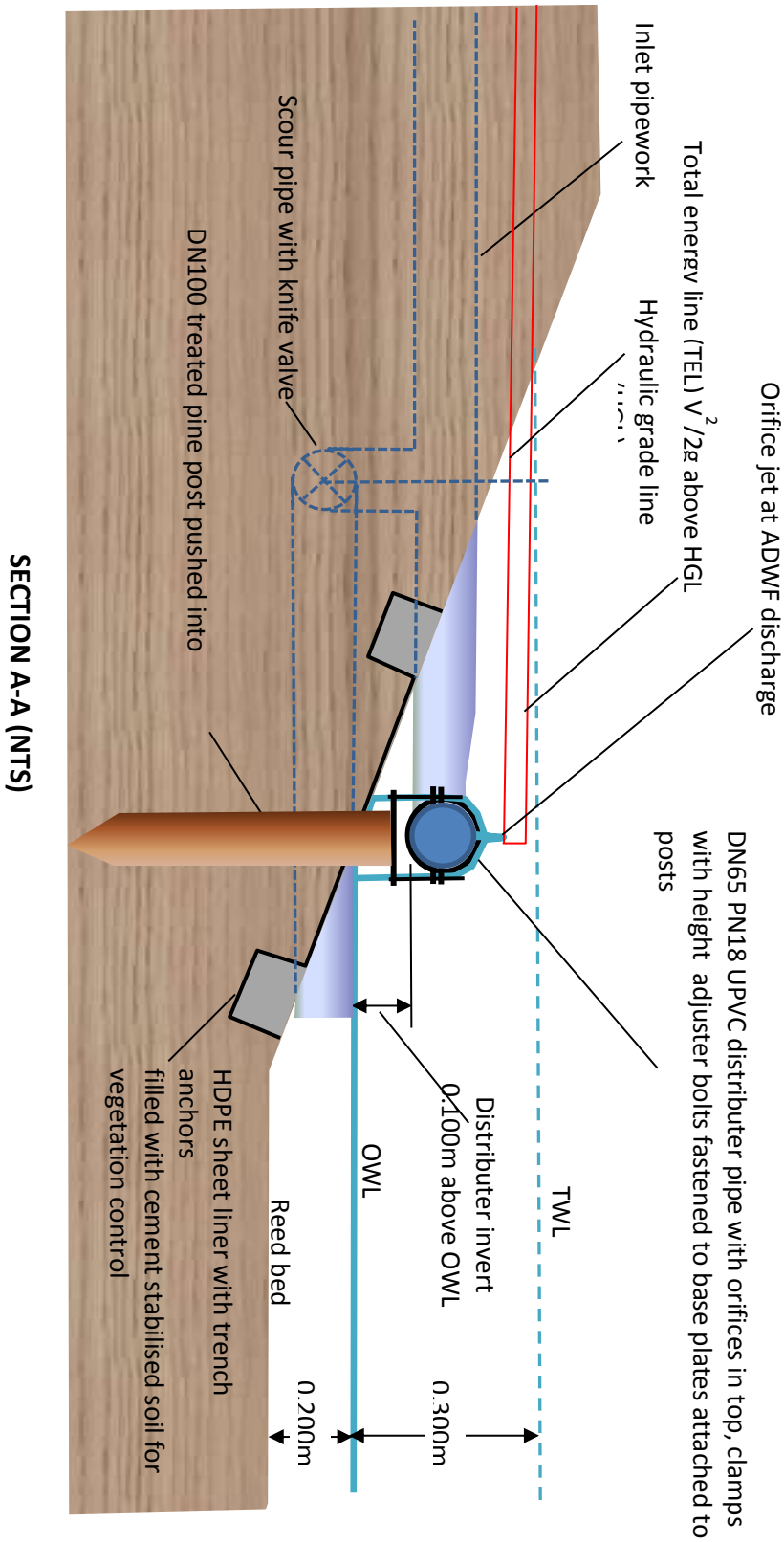

Figure 3: Pipe Manifold section view Helidon STP.

Table 9 details the type, size and locations of inlet pipe manifolds

Table 9: Specified pipe type and size (refer to DRG for locations 486/5/5-0160-009E).

Pipe Specification	Location (Refer DRG 486/5/5-0159-009E)	Description
DN65 PN18 UPVC	A9, A10, A11, A12	Inlet Distributor Manifolds
DN65 PN18 UPVC	A8 & A9	Inlet Distributor Manifolds

To facilitate cleaning the distributers include scour pipes and removable end caps have been installed to allow high pressure jetting.

3.1.7 Treatment Wetland Cells 1 and 2

Treatment wetlands are typically shallow, man-made impoundments planted with emergent, rooted vegetation. A constructed treatment wetland is designed to regulate water depth and residence time, two important factors in treatment wetland performance.

The plants in constructed treatment wetlands are not harvested to remove nutrients. Rather, the microbial flora (bacteria and fungi) that attach to the plants have the natural assimilative capacity to remove biodegradable organics and nitrogen

As the wastewater flows through the treatment wetland, it is treated by the processes of sedimentation, filtration, oxidation, reduction, adsorption and precipitation. Higher treatment performance has been shown with full vegetation where greater abundance and diversity of microbes colonise the more abundant surface area.

The Helidon STP now includes 2 treatment wetland cells (DRG 486/5/5-0160011 E). Table 10 details the key features of wetland Cells 1 and 2.

Table 10: Area, Volumes and Water Levels for Cells 1 and 2, Helidon STP.

	Cell 1	Cell 2
Area (m2)	2000	200
Average Volume (m3)	400	400
Maximum volume (m3)	1000	1000
Operating Water Level (mm)	200	200
Top Water Level (mm)	500	500

3.1.8 Wetland Plants

Plants within the wetland cells include a number of aquatic macrophyte species known to grow well in the conditions present in the wetland cells (water depth, nutrients, operational regime). The location and species of plants within the treatment wetland are detailed in the Helidon Planting Plan. The selected planted species have been planted in a series of bands. After the establishment period the treatment wetland cell floors will be fully vegetated with no areas of open water visible.

Table 11 details the plants within the wetland cells and their minimum and average plant densities.

Table 11: Plant species, minimum, and average stem densities.

Species	Minimum (no. of plants/m^2)	Average (no. of plants/m^2)
Baumea rubiginosa	500	1250
Baumea articulata	500	1250
Eleocharus sphacelata	1000	2500
Schoenoplectus validus	500	800

3.1.9 Wetland Berms

Berms are low profile earth embankments that function to hold water within the wetland cells (Refer to DRG 486/5/5-0160-015D). The top of berms is grassed for access around the wetland area. The berm batters have been planted with a number of sedge, trees and plants that are tolerant of the conditions present around the edge of the wetland.

3.1.10 Spillways

Spillways are structurally designed to convey storm flows that exceed the capacity of the wetland outlets. Scour protection is provided to minimise the risk of erosion during large storm events.

Spillways have been provided to convey Q100 flows to the receiving waterway via the discharge point in a controlled manor. Spillways are located Cell 1 and Cell 2 and at the end of Cell 2(Refer to DRG 486/5/5-0160-015D).

The Emergency Spillways are 2.5m wide with 1:5 (trafficable) side slopes. The spillways have been designed to convey 400kL/hr at a depth of 100mm. In the event of a blockage of all outlet risers simultaneously a 3-5 day detention has been provided within the wetland cells.

3.1.11 Wetland Outlets

Flows through the wetland have been designed to pass slowly through the densely planted vegetation. Flows are controlled via screened effluent risers. Vertical risers function to both control water level within the wetland and convey flows to downstream chlorine contact tank. Vertical risers are PVC pipes with swivelling elbows, they are simple to operate with a handle or rod. Water levels can be controlled exactly and easily, and reducer caps installed to control flow rates out of the wetland. A plan and cross section of the wetland outlet configuration is provided in DRG 486/5/5-0160-016E.

3.1.12 Pump Station

A 1400L pump well and pump has been installed at the end of Cell 2 (refer to DRG 486/5/5-0160-014C). The pump station includes one duty and one standby progressing cavity pump with rotors and stators suitable for long life discharging settled secondary treated wastewater effluent. The ultimate design delivery rate is 11.8L/s against a total head of 20.1m based on the highest possible inflow rate from the wetlands with them overflowing through their berm spillways.

DN80 PN12 UPVC suction pipes from an adjacent 1.8m ID 3.05m deep well have been installed. The pump well suction pipe from each unit has a maximum static lift of 2.7m. The minimum submergence of the suction pipe is 0.4m. A 0.5m deep working volume in the pump well of 1,270L

from pump start to stop limits the starts per hour to 8. Foot valves are to be avoided. The delivery main is an 108m long DN90 PN12.5 PE100 pipe to a chlorine contact tank. The overall maximum static lift from the pump stop level in the well to the tank FSL is 5.2m.

The pumps allow speed reduction by manual pulley and belt changeover to progress delivery flows over 3 times present levels. The pumps and control cabinet are weather proof. Proximity contacts are provided on the delivery non return valves to switch the pumps off in the event of prolonged dry running.

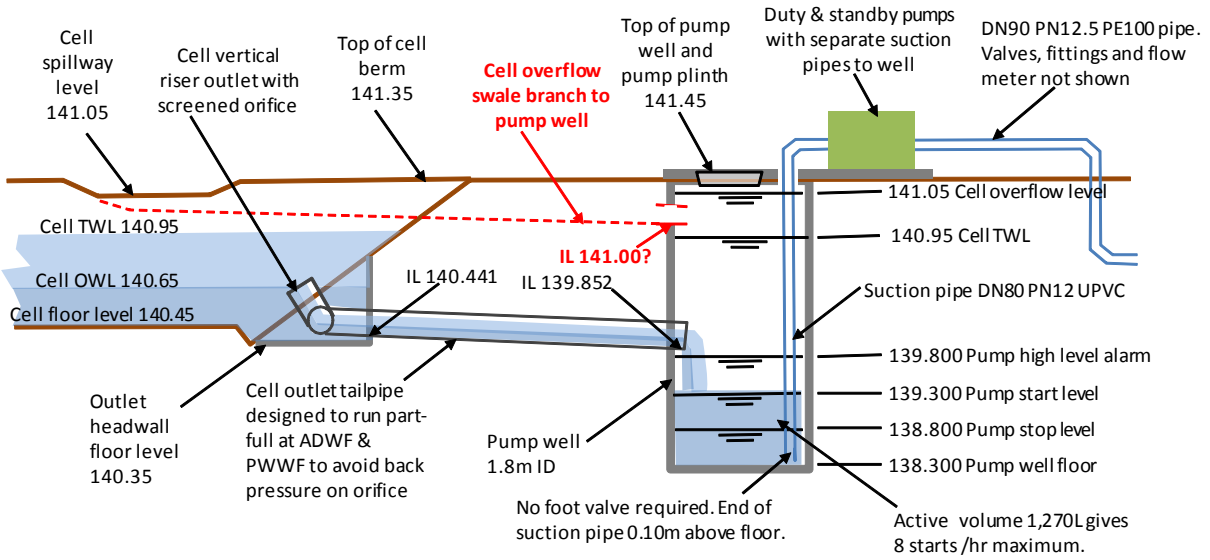

Figure 4: Helidon STP Transfer Pumping Station to Chlorine Tank

3.1.13 Contact Tank

Flows from each wetland cell outlet are pumped via a chlorine mixing line into the existing submerged contact tank. An additional wet weather flow pipe and pump has been installed to prevent overflow and surcharge of the chlorine dosing tank. Refer to DRG 486/5/5-0160-014C.

3.1.14 Flow Metre

The Proline Promag 50W magnetic flow meter has been installed to provide a flow based chlorine dosing process at the Helidon STP. In the Proline Promag 50W, 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.

The measuring ranges for the treated effluent velocities between 0.01 to 10 m/s (0.03 to 33 ft/s).

3.2 System Documentation and Operation and Maintenance Manuals

The following documents are provided in the appendices at the end of this manual:

- Appendix A: Flow Metre Manual
- Appendix B: Pump Manual
- Appendix C: Electrical Certificate
- Appendix D: Civil Certificate
- Appendix E: Plumbing Certificate

4 Water Quality Management and Monitoring

Water Quality monitoring programs are necessary for the site to ensure that the nominated operational and maintenance procedures are effective.

4.1 Maintenance Objectives

- Maintain high quality water throughout the treatment wetland.
- Achieve necessary water quality standards for discharge.
- Appropriately respond to and investigate water quality if trigger values are exceeded.

4.2 Water Quality Standards and Monitoring

Long term water quality analysis and monitoring is used to:

- Monitor the quality being delivered to Pond 2
- Ensure water quality standards are met at the discharge point from the treatment wetland

Table 3: Outflow water quality standards after wetland plant establishment.

BOD_5 (mg/L)	TSS (mg/L)	NH_4-N (mg/L)	NO_x-N (mg/L)	TN (mg/L)	TP (mg/L)	Faecal coliforms (cfu/100mL)
10	10	0.5	1	2.15	0.8	<100

Weekly monitoring of the effluent discharged from the wetland is undertaken to assist management in determining if the quality of waters flowing to the Creek are maintained. Monthly sampling of the treated effluent is undertaken for DEHP licence compliance.

4.2.1 Surface Water Monitoring Points

The Observation and Monitoring Plan (Appendix 4) indicates the monitoring points to be used for taking surface water quality samples. A total of 4 surface water quality points are shown located at the inlets and outlets of Cells 1 and 2. On a weekly basis the inflow and discharge from the operational wetland cells will be required. The location of the inflow and discharge points will vary as cells are shutdown periodically.

5 System Components Operations and Maintenance

The following is an outline of the guiding principles required to effectively operate and maintain the Helidon Treatment Wetland in respect of hydrology, vegetation and water quality.

Refer to the Pipe and Instrumentation Diagram (DRG 486/5/5-0160-014C) for the key components and layout of the amended treatment infrastructure. The Pipe and Instrumentation Diagram also shows the location of the system monitoring points.

The guiding principles to operate and maintain the Helidon wetland are provided below. Periodic review of this Manual should be undertaken to assess and update changes to wetland operations.

5.1 System and Wetland Management

5.1.1 Maintenance Objectives

- Manage effluent flows to the wetland to sustain system function and treatment performance
- Maintain plant health and plant cover (full vegetation) within the wetland cells and surrounding berms
- Minimise and control weeds within the wetland cells and surrounding berms
- Manage wetland hydrology for plant growth and treatment performance.
- Provide for seasonal oxidation in the wetland sediments.

5.1.2 Guiding Principles

The operation and management of a wetland is undertaken in response to environmental conditions and effluent flows. Regular observation and assessment of the system allows for the necessary operation and maintenance tasks to be identified early and pre-emptive actions undertaken.

The main treatment wetland management tasks are setting the hydrological operation and maintaining dense and healthy plant cover in the treatment wetland. By effectively managing the hydrological conditions necessary to support healthy plant cover and continuous growth the wetland will deliver the treatment performance requirements. In addition, early identification and detection of any weed species and appropriate weed removal is required.

5.2 Pond Baffles

The Pond 1 and 2 baffles do not require Operational control they function passively based on the flow of effluent into the ponds and wind action across the surface of the pond.

Maintenance requirements for the baffles involve ensuring that baffle integrity is maintained. If observations indicate short circuiting then pond baffles will require realignment. A boat will be required to access the floating baffles for realignment.

5.3 Pond 2 Circular Weir Outlets

The main operational and maintenance task associated with the Pond 2 outlets is checking for and removing any debris that may obstruct water movement into the wetland. This is carried out by removing the hat screen over the weir and cleaning the screen prior to placement back over the orifice. In addition, the circular weirs heights need to be checked to ensure permanent invert levels

have not changed and reduced the flow splitting of pond effluent between Wetland Cell 1 and 2. If this occurs a plumber will be required to reset the invert levels.

5.4 Sluice Valves (Gate)

Maintenance requirements on the sluice gate valves are to ensure they are in good working order. If problems are observed a plumber will be required to replace or fix the gate valves.

5.5 Knife Gate Valves

Maintenance requirements on the knife gate valves are to ensure they are in good working order. If problems are observed a plumber will be required to replace or fix the valves.

5.6 Wetland Inlets - Pipe manifolds

The main operational requirement for the inlets is to ensure all orifices are clean and functional. If orifices are blocked the end caps to the pipe manifold are removed and the blockage is cleaned.
The hydraulic design of the wetland inlets has been done to allow self-cleaning velocity in the pipeline to remove accumulated debris or biofilm accumulation
This requires surcharging Pond 2 and opening the scour line using the knife gate valve adjacent to the manifold (Figure 3).
If adequate flow from Pond 2 exists then simply open the scour lines using the knife gate valve. If flows are low then undertake a pond surcharge for 24hrs to 48hrs by closing sluice gate valve and then undertake scour cleaning by opening the appropriate knife gate valve.

The procedure for cleaning of the inlet pipe manifolds is as follows:

1. Fortnightly- basic scouring

- Remove the end caps at the end of the pipe manifolds until the water flow is clear and free from sludge.
- Scrub the pipe manifolds with the brush provided on site to remove algae and biofilm accumulation.
- Following scrubbing reinstall the caps to the end of the pipe manifolds and open the 2 knife gate valves (VV-0613-001, VV-0613-002, VV-0614-001, 110614-002) on both sides of the pipe manifolds to allow basic scouring of the main pipe.
- Close knife gate valves (VV-0613-001, VV-0613-002, VV-0614-001, 110614-002) after 10 minutes of scouring flow through the pipe manifolds.

2. Monthly - extended scouring

- Remove the end caps at the end of the pipe manifolds until the water flow is clear and free from sludge.
- Scrub the pipe manifolds with the brush provided on site to the remove algae and biofilm accumulation.
- Following scrubbing close sluice gate valve of cell 1 and cell 2 (VV-0613-003, VV-0614-003) to surcharge pond 2.
- Reopen sluice gate valves (VV-0613-003, VV-0614-003) and open scour lines using the knife gate valve adjacent to the manifold (Figure 3).
- Close knife valves after 10 min of scouring or when biofilm has been removed and clear water is flowing from the pipeline.

5.7 Outlets - Vertical Risers (Adjustable)

In normal operation the wetland outlet is set at the designated operational depth above the wetland floor (200mm) measured at the outlet headwall. However, the wetland requires water level adjustment for optimal health.

Vertical risers function to both control water level and convey flows out of the treatment system to the contact tank. The outlet locations in the wetland are as follows: 4 vertical risers (adjustable) control the water level of Cell1 (2 vertical risers) and Cell 2 (2 vertical risers).

Vertical risers are operated using a hooked rod and rotated backwards or forwards to adjust water level. All vertical risers should be set at the same level.

5.8 Berms

The main operational task for berm structures is to check for damage (erosion and cracking) and maintain healthy plant cover. Berms need to be assessed during inspections to ensure that any signs of damage such as erosion and cracking are identified and addressed. Berm tops require regular mowing. Weeds need to be identified and appropriate management undertaken for their removal and control on berm batters.

5.9 Spillways

Spillways are structurally designed to convey storm flows that exceed the capacity of the wetland outlets. Scour protection is provided to minimise the risk of erosion during large storm events. The Operator is required to ensure erosion is identified and rectified as required.

5.10 Vegetation

As the treatment wetland is a natural system it is likely that other plant species may colonise the treatment wetland system over time. It is also likely that the position and location of each species will change over time in response to environmental conditions within the wetland cells.

The maintenance of dense healthy plant cover and the control of introduced species is the most important part of managing the treatment wetland. Through appropriate hydrological control (detailed in the Section 5.9) the vegetation within the wetland cells can be managed for healthy growth and maintenance of treatment performance over the long term.

More detailed information on weeds identification and appropriate management strategies is provided in Appendix 6. Appendix 6 also provides detailed information on managing birds, and understanding and interpreting plant health.

Periodic advice and consultation with a wetland specialist is recommended for managing the wetland system over the long term, refer to Section 1.8.3 for contact details.

5.11 Flow metre

The operator will check and record flows on the flow meter. Calibration is to be undertaken by a specialist contractor.

5.12 Wetland Hydrological Operation

Wetland hydrological operation involves three distinct phases as follows:

1. Normal operating conditions – water level is set at 200mm in all wetland cells
2. Wetland drawdown – wetland cells are subject to controlled drying out
3. Wetland management flooding – water levels are increased

Water level changes and hydrological operations are undertaken in order to:

- Assess and repair engineered structures
- Stimulate plant growth
- Reduce the impact of high algae loads from the pond on the wetland
- Control weeds
- Deter target bird species
- Control mosquitoes
- Manage extended wet weather events

The following sections provide more information and detail on wetland hydrological operations.

5.12.1 Normal Conditions

The amount of water entering the system during normal conditions depends on direct rainfall, influent flow and evapotranspiration. This will vary seasonally throughout the year. During normal operation the Operator is required to set the wetland vertical risers (adjustable) at 200mm above the wetland floor. This applies to all wetland cells. To set the water level under Normal Conditions, stand on the Cell (1 or 2) Berm at the vertical riser (adjustable) outlet and adjust the lip of the vertical riser to 200mm on the RL gauge.

The treatment wetland tolerates natural fluctuations in water level. Thus water level in the treatment wetland cells increase or decrease (temporarily) in response to climatic conditions and flows from the STP. The Hydrological Record Sheet (Appendix 2) is to be used to monitor and report on water levels within the wetland.

It is necessary to ensure that effluent flows are maintained to the wetland cells. If there is insufficient water flowing to the wetland cells there is the risk of plant die back and loss of system performance and a breach of the discharge licence. Ensuring that regular inspection and cleaning of circular weir outlet and inlet pipe manifolds is undertaken will provide sufficient flows to the wetland cells and sustain wetland plants. The pipe infrastructure has been designed to provide adequate flow velocities for the range of influent flows received by the STP.

It is essential to ensure that adequate flow splitting occurs of effluent leaving the ponds and entering the wetland cells. By maintaining function and regular cleaning of the circular weir outlets and inlet pipe manifolds normal operation and hence treatment performance of the system.

Table 12 provides a summary of the observations, issues and causes for normal wetland operations.

Table 12: Troubleshooting Normal Conditions in wetland cells 1 and 2

Observation	Issue	Cause
No flow from one or more drilled holes in inlet	Blocked inlets	Build up of algae and debris in pipes
Development of channels and visible flow paths	Short circuiting	Blockage of inlet manifolds
Different water levels in Cells 1 and 2 and/or dry areas and plant die back	Maintaining adequate flow to wetland cells	Inadequate flow splitting between cells, insufficient influent flows to STP

5.12.2 Wet Weather Flow Conditions

The treatment wetland has the capacity to retain and treat wet weather flows from high rainfall and wet weather flows received from the Helidon STP Ponds. The treatment wetland outlet orifices restrict wet weather flows and allow the wetland to fill up to 500mm depth before discharge over the spillways. The wetland fill function allows for the capture and treatment of high flows.

No adjustment of water level within the treatment wetland cells is required to accept and treat wet weather flows. However, high water levels in the wetland are not to exceed 30days. If extended wet weather is experienced for 30 days the wetland outlets are to be dropped to 0mm for wetland drawdown. Monitoring is used to ensure that levels within the wetland cells are not above the 200mm operating water level for extended periods as this negatively impacts on plant health.

5.12.3 Wetland Drawdown (Cells 1, and 2)

Wetland drawdown is the process of drying the wetland cells to oxidise the root zone and invigorate plant growth. Free flowing water will be absent and water levels will drop quickly to below the soil surface following lowering of vertical risers (detailed below). During wetland drawdown no surface water is present in the wetland cells.

Due to the presence of excess of sludge in Pond 2, algae loads (TSS) entering the treatment wetland can be very high and exceed the capacity for treatment in the wetland in a short time frame. Wetland drawdown is used to dry out the accumulating sludge at the top of the wetland cells and maintain DEHP license compliance. It is recommended that until the sludge accumulation in Pond 2 is addressed that more frequent wetland drawdowns are required. Wetland drawdown should be undertaken in each cell 4 to 6 times per year.

The requirement for drawdown periods is determined by monitoring the level of sludge at the top of the cells. A sludge level over 100 mm measured 5m in from the inlets indicates that a drawdown period should be undertaken.

A two week period is sufficient to dry out the cell and increase plant growth. Failure to undertake wetland drawdown can result in a reduction of system treatment performance and a breach in DEHP license conditions.

Caution is required not to dry out the wetland substrate for extended periods as long periods without water can impact on the wetland plants resulting in loss off of plants. Hence a maximum timeframe of 2 weeks is specified for wetland drawdown.

Rainfall can increase the time that it takes to dry out the wetland cell. If rainfall occurs during a drawdown the drawdown period should be increased (by a maximum of 3-4 days).

The drawdown of the wetland should be carried out on Cells 1 and 2 at different times in order to allow the passage of effluent, and hence license compliance, through the wetland to be maintained

It is advisable to undertake drawdown when weather conditions are relatively dry and no significant wet weather events forecast as this allows for better management of effluent flows through the system when one cell is offline.

The weekly recording and observation of water levels in the wetland cell will provide the Operator with an understanding of the requirement for a managed drawdown. If the system has experienced periods without surface water present then a managed drawdown is not required.

However there are a number of situations that indicate a wetland drawdown is required, these include:

- Reduced wetland plant densities;
- Plant die back not associated with senescence;
- Aquatic floating weeds present in the wetland cells;
- Mosquito problems;
- Algae accumulation at top of wetland;
- Assessment and repair of engineered structures.

To undertake Drawdown the vertical riser outlets are lowered to the floor of the headwall (invert) and water drains out of the wetland and the level of water in the system is lowered. In addition, Wetland drawdown can be used to for problem mosquito infestations, for wetland maintenance or weed management.

The following table provides a list of triggers, causes and actions for wetland drawdown.

Table 13: Triggers, causes and associated actions for wetland drawdown.

Trigger	Cause	Action
Plant density reduced (refer to Table 9 for minimum plant densities), areas of water surface visible	Absence of wetland drying phase	Implement wetland drawdown
Plant die back not associated with seasonal senescence	Lack of plant root oxidation	Implement wetland drawdown
Aquatic floating weeds present in wetland cell	Seed dispersal by wind and birds	Implement wetland drawdown and undertake appropriate weed control in wetland cells (refer to Appendix 6)
Mosquito infestation	Areas of stagnant water	Implement wetland drawdown
Algae accumulation at top of wetland cells, >100mm of sludge at top of wetland cell	High algae levels in pond	Implement wetland drawdown (approximately 4-6 times/year)
Vertical riser outlet or other engineered structure failure/breakdown	Old age, blockage	Implement wetland drawdown and repair structure

Observation of wetland cells is critical during drawdown. Both cells are being subjected to changes and as such require monitoring. In the dry cell it is essential to ensure that the cell is not too dry for too long as it can effect plant growth and increase the risks of weeds in the wetland cells.

The drawdown sub soil should have some moisture in it and this can be assessed by simply observing wet soil or digging down below the soil surface and feeling if the substrate contains some moisture (rub soil between thumb and fingers). Plants should also be observed for browning off and wilting. If browning or wilting occurs it is essential that effluent is returned to the cell and the drawdown period ended.

The cell that is receiving increased flows can tolerate both increased flow rates and increased water levels for the period of drawdown (2 weeks). If however, a wetland cell experiences increased flows and increased water levels for extended periods it is possible that plant health and, hence treatment performance, could be impacted. If water levels are too high for too long a reduction in plant density is likely to be observed.

5.12.4 Wetland Terrestrial Weed Management Flooding

Water levels within the wetland cells can be raised and wetland management flooding undertaken periodically. Wetland management flooding is undertaken in response to the presence of terrestrial weed species within the wetland cells (Appendix 6). Following identification of a terrestrial weed within the wetland cell and determining that management flooding is an appropriate control strategy wetland flooding can be undertaken.

Wetland management flooding involves raising water levels above the normal operating water levels. Wetland flooding does not require alteration to inflow; simply raise the vertical riser to 500mm depth. Once vertical riser levels are increased the water levels within the wetland cell will gradually

rise to the new water level. The maximum water level depth for wetland management flooding is 500mm. Wetland management flooding should be applied to a single cell. Care should be taken to ensure normal wetland operation and hence treatment performance can still be sustained through the wetland complex.

By only undertaking management flooding for short periods (less than 20 days) and one cell only normal wetland operation and treatment performance can be sustained. If wetland flooding occurs over long periods (more than 30days) plants may impacted and reduce in cover (refer to Table 9). This will then reduce treatment performance of the system.

It is essential that wetland flooding be only undertaken for short periods. Observing the weed present and its response to increased water levels may allow for reducing the duration of weed management flooding. If the targeted weed species browns and dies back water levels should be returned to the normal operational setting (200mm). Increased water levels must not persist in the wetland cell(s) for durations greater than 30 days.

5.13 Wetland Observation and Inspection Points

The Operation and Monitoring Plan indicates the key areas for monitoring the health of the wetland. These inspection points are to be monitored weekly and the Operator is to use the checklist provided in Appendix 1 as a guide to assessing the health of the wetland.

During inspections the Operator is to assess the following:

1. Structural damage to engineered structures.
2. Erosion and/or cracks visible on berms.
3. Blockages to inlets and outlets.
4. Vegetation health, loss of vegetation and presence of weeds.
5. Water quality.
6. Presence of debris or rubbish.
7. Water levels and flow through the wetland.
8. Mosquito abundance.
9. Damage to access tracks and gravel roads.
10. Presence of pest fauna.
11. Identify safety issues.

The inspection points are as follows:

1. Pond outlets and wetland inlets into Cells 1 and 2
2. Vertical Risers (Cell 1 and 2)
3. Spillways
4. Sampling point and discharge to creek
5. Walkways and access tracks.

5.14 Photographic Points

The Observation and Monitoring Plan has a series of photographic points to be used for the long term observation of the wetland. Wetland Operators are to take photos using the same view every month. These photographs will indicate areas of growth, dieback and the overall wetland development. Digital photos should read (detail) the date on the image and location on the digital file name.

5.15 Maintenance Schedule

The Operator is responsible for undertaking the inspection schedule set out in the checklist (Appendix 1). The checklist provided in Appendix 1 is to be used during inspections and records kept. The Maintenance Schedule (Appendix 5) has also been to included to assist in the scheduling and follow up of maintenance tasks.

The following table outlines the weekly, monthly, and annual operation and maintenance tasks for the Helidon treatment wetland.

Component	Task	Frequency
Vegetation	Check for presence of weeds or unidentified plants and action as required. (Refer to Appendix 6)	Weekly
	Assess plant coverage in Cells 1 and 2 (100% cover required)	Weekly
	Assess vegetation health – check colour of leaves, wilting, dieback (plants must be healthy and free from disease)	Weekly
	Check for and assess water bird damage. Action as required.	Monthly
	Monitor and record (at photo points) plant coverage in Cells 1 and 2.	Monthly
Water Quality	Assess water colour and odour at outlets (water should be clear and free from odour).	Weekly
	Take water quality samples at monitoring points, send for analysis and record (Appendix 3 - Water Quality Recording Sheet)	Weekly
	Check for areas of stagnant water	Monthly
	Check for the presence of any scum or green coloured water	Monthly
	Check for and record abundance of mosquitoes (Refer to Appendix 7 and 8)	Monthly
Berms	Check for presence of weeds or unidentified plants and action as required. (Refer to Appendix 6)	Weekly
	Assess plant coverage on Cells 1 and 2 (100% cover required)	Weekly
	Assess vegetation health – check colour of leaves, wilting, dieback (plants must be healthy and free from disease)	Weekly
	Check for erosion and cracking and repair if required.	Monthly and following storms
Outlets	Check and remove any obstructions to water flow (Nil blockage required)	Weekly and following storms
	Assess vegetation health at Cell 1 and 2 outlet area – check colour of leaves, wilting, dieback	Weekly
	Ensure vertical riser caps are flowing and free from obstruction	Weekly
	Assess and check wetland outlets are in good working order	Monthly
Inlets	Check for and remove any sediment accumulation	Weekly and following storms
	Check for and remove any rubbish, debris and obstructions to water flow	Weekly and following storms

Component	Task	Frequency
	Assess and check wetland inlets are in good working order	Monthly
Hydrology	Record Cell 1 water level depth (Appendix 2 - Wetland Hydrology Record)	Weekly
	Record Cell 2 water level depth (Appendix 2- Wetland Hydrology Record)	Weekly
	Adjust water level depths to required level (200mm for Normal Conditions)	Seasonally
	Undertake and record wetland drawdown (Appendix 2 - Wetland Hydrology Record)	Annually
	Record and observe flow to wetland Cells	Weekly
Pump Station	Ensure power is on and pump is set to automatic	Weekly
Public safety	Check and identify and repair any damage to access and tracks	Weekly and following storms
	Check and identify and potential risks to safety	Weekly
Pest fauna	Check for the presence of any pest animal species such as cane toads, foxes and rabbits.	Monthly
Reporting	Prepare and complete summary report for QUU management	Quarterly

6 Instrumentation

Dual Sewer Pump Station

Model:	Dual Sewer Pump Station
Manufacturer:	Aline Pumps
Pump Controller	FPC-30040
Warranty period:	12 months
Service:	Aline Pumps http://www.alinepumps.com/ 53 Taylor St Bulimba QLD 4171 Phone: 1800 018 999 (02) 9544 9999

Dual Pumps

Manufacter:	Grundfos
Model:	EF30.50.11.2.50B
Service:	Aline Pumps http://www.alinepumps.com/ 53 Taylor St Bulimba QLD 4171 Phone: 1800 018 999 (02) 9544 9999

7 Operations & Maintenance Tools

This section provides a description and use of the Operations & Maintenance Tools:

- Inspection Checklist (Appendix 1)
- Wetland Hydrology Record (Appendix 2)
- Water Quality Recording Sheet (Appendix 3)
- Observation and Monitoring Plan (Appendix 4)
- Maintenance Schedule Recording Sheet (Appendix 5)
- Mosquito Larvae Record Sheet (Appendix 8)

Inspections are required; as a routine event, following large rainfall events and following a public complaint. When conducting an inspection, the Operator should carry copies of the Inspection Checklist and the Observation and Monitoring Plan. The Inspection Checklist lists the O&M issues at the irrigated forest and treatment wetland, a range of checklist items that need to be monitored and their required inspection frequencies. The Operator needs to take note of the type of inspection he or she is undertaking and, referring to the correct Required Inspection Frequency column, make observations of items in the checklist as necessary. Note that during a flood event or public complaint, the Operator must use his or her own judgment to decide what needs to be checked.

Once an item is identified as NOT OK, the Operator needs to provide a label (e.g. number, letter) on the Inspection Checklist under the correct checklist item (use other if observed problem is not on checklist). This label should then be used to identify the area of the problem on the Observation and Monitoring Plan where the Operator must make notes describing the observation, its extents and perceived cause or source. The Operator should also record any immediate action taken in response to the problem.

Following an inspection, the Operator should fill in the Inspection Checklist. Referring to the relevant section in the O&M Manual the Operator should devise a recommended action; this may include seeking advice from an external specialist. All recommended actions should be followed up on and completed.

Care must be taken to ensure that the Inspection Checklists, Observation and Monitoring Plan for each individual inspection are stored in the same place so that they can be easily located for future reference.

Appendix 1 – Inspection Checklist

INSPECTION CHECKLIST

Component	Task	Frequency	Condition and comments 1- Satisfactory 2 - Action required 3 - Satisfactory after action	Action	Initial and date	Further response required
Vegetation	Check for presence of weeds or unidentified plants and action as required. (Refer to Appendix 6)	Weekly				
	Assess plant coverage in Cells 1 and 2 (100% cover required)	Weekly				
	Assess vegetation health – check colour of leaves, wilting, dieback (plants must be healthy and free from disease)	Weekly				
	Check for and assess water bird damage. Action as required.	Monthly				
	Monitor and record (at photo points) plant coverage in Cells 1 and 2.	Monthly				
Water Quality	Assess water colour and odour at outlets (water should be clear and free from odour).	Weekly				
	Take water quality samples at monitoring points, send for analysis and record (Appendix 3 - Water Quality Recording Sheet)	Weekly				
	Check for areas of stagnant water	Monthly				
	Check for the presence of any scum or green coloured water	Monthly				
	Check for and record abundance of mosquitoes (Refer to Appendix 7 and 8)	Monthly				
Berms	Check for presence of weeds or unidentified plants and action as required. (Refer to Appendix 6)	Weekly				
	Assess plant coverage on Cells 1 and 2 (100% cover required)	Weekly				
	Assess vegetation health – check colour of leaves, wilting, dieback (plants must be healthy and free from disease)	Weekly				
	Check for erosion and cracking and repair if required.	Monthly and following storms				

INSPECTION CHECKLIST

Component	Task	Frequency	Condition and comments 1- Satisfactory 2 - Action required 3 - Satisfactory after action	Action	Initial and date	Further response required
Outlets	Check and remove any obstructions to water flow (Nil blockage required)	Weekly and following storms				
	Assess vegetation health at Cell 1 and 2 outlet area – check colour of leaves, wilting, dieback	Weekly				
	Ensure vertical riser caps are flowing and free from obstruction	Weekly				
	Assess and check wetland outlets are in good working order	Monthly				
Inlets	Check for and remove any sediment accumulation	Weekly and following storms				
	Check for and remove any rubbish, debris and obstructions to water flow	Weekly and following storms				
	Assess and check wetland inlets are in good working order	Monthly				
Hydrology	Record Cell 1 water level depth (Appendix 2 - Wetland Hydrology Record)	Weekly				
	Record Cell 2 water level depth (Appendix 2- Wetland Hydrology Record)	Weekly				
	Adjust water level depths to required level (200mm for Normal Conditions)	Seasonally				
	Undertake and record wetland drawdown (Appendix 2 - Wetland Hydrology Record	Annually				
	Record and observe flow to wetland Cells	Weekly				
Public safety	Check and identify and repair any damage to access and tracks	Weekly and following storms				
	Check and identify and potential risks to safety	Weekly				
Pest fauna	Check for the presence of any pest animal species such as cane toads, foxes and rabbits.	Monthly				

Appendix 2 - Wetland Hydrology Record

WETLAND HYDROLOGY RECORD

Common Information					STP Flow Meter Info					Wetland Water Level Recordings	
Date	Time (nearest ½ hour)									Cell 1 (mm)	Cell 2 (mm)

Appendix 3 – Water Quality Recording Sheet

Queensland Urban Utilities to provide and insert here

Appendix 4 – Observation and Monitoring Plan

Observation Reference No.	Observation: description, extent, perceived cause / source	Immediate action taken

Appendix 5 – Maintenance Schedule

Maintenance Schedule Date:
Prepared by:

Observation Reference No.	Recommended Action	Proposed Date of Completion	Action Taken	Date Completed

Appendix 6 – Wetland Vegetation Guide

Wetland Cells and Berms - Maintenance Objectives

- Weed control in all areas.
- Minimise and monitor damage to vegetation from water birds.
- Healthy plant populations maintained over the long term.

Background

After a period of plant establishment (initial 24 months) Cells 1 & 2 will be fully vegetated with a number of selected macrophyte species. Note that the suit of species likely to be found within the treatment wetland cells is quite distinct from surrounding areas. Other native plant species may colonise Cells 1 & 2 and this natural process should not be prevented, unless they are identified weeds. The selected species have been planted in defined blocks but the planted patterns will change over time in response to the particular soil, climate and water characteristics of the site.

A number of guides to wetland plants are available. Refer to firstly *Wetland Plants of Queensland – A Field Guide* (Stephens and Dowling, 2002) and *Waterplants in Australia: A Field Guide* (Sainty and Jacobs, 2003) for photos of the more common wetland plants to be found on the site.

A list of common weeds is provided in Wetland Plants of Queensland – A field guide. Identification of unknown plant species is required before undertaking any control program. Some grasses and many native sedges such as *Juncus* spp. can colonise the wetland providing ecological and treatment benefits.

The Weed Pocket Guide (1997), Department of Natural Resources, Queensland and Field Guide to the Weeds in Australia (3rd Edition) (C. Lamp and F. Collet, 2002 reprint) are not as up to date but are still useful resources.

Online resources can also provide useful information on identifying weeds. The following websites are also suggested reference tools:
www.weeds.org (Weeds Australia)
www.weeds.gov.au (Weeds of national significance)
www.saveourwatwaysnow.com.au (Community organisation list and photographs Weeds to whack)
www.DEHP.qld.gov.au (Weed spotters Queensland network)

Weed Control

Weeds are non-native plants that compete with native plants for dominance. Weeds reduce the level of biodiversity and may affect the performance of the wetland in meeting water quality requirements. Early intervention of weed colonisation is the preferred approach to maintaining a healthy wetland system. Operators should be trained to recognise the most common weeds in the area in order to maintain effective weed control.

Three main options are available for weed control are:

1. Manually removing weeds before abundant growth.
2. Hydrological control - Raising (terrestrial weeds) or reducing (aquatic weeds) the water level to manage weeds.
3. Chemical control

The most suitable control method will depend on the extent of the identified weed problem, the growing season and the life form of the species.

Under healthy wetland conditions when selected plant species are established the risk of weeds colonising the wetland cells or outlet channel is significantly reduced. Refer to *Appendix 1.6 – Vegetation Guide* for photos, descriptions and control techniques for the more likely weeds to be found on the site.

Wetland Planting - Water Bird Damage

Some waterbirds, particularly the purple swamphen (*Porphyrio porphyrio*) (Plate 1) and dusky moorhen (*Gallinula tenebrosa*) (Plate 2), are known to cause damage to seedlings and plants. Notably the risk to wetland plants is highest during the establishment phase. (Refer to establishment manual)

Plate 1: Purple Swamphen (Porphyrio porphyrio)

Plate 2: Dusky Moorhen (Gallinula tenebrosa)

If waterbirds significantly damage an area of plantings, firstly transplant clumps of well established plants from healthy sections of the wetland if possible. Otherwise replant with larger plants sourced from a nursery. Visitors to the area should be discouraged from feeding waterbirds.

Senescence

There is a risk of confusing plants in senescence (hibernation) with those that are dead or unhealthy. Senescence can occur over the winter months, but sometimes not at all. Although plants in senescence may appear dead or lose their foliage, closer inspection will show either green shoots at the base of the plant and/or a firmly anchored root system. The Operator is required to know or be trained in the difference between senescence and dead or unhealthy plants.

"Senescence" is the natural (ageing) or climatic condition of plants in which leaves and stems may turn brown and/or wilt. It will usually occur in patches, is often associated with very cold or very hot weather and re-growth will usually begin in a short time. The process is a natural and desirable part of ongoing wetland renewal. Senescence should be reported as a threat only if it occurs over large areas of the wetland at one time.

Plate 3 Senescent Bolboschoenus (brownish)

Plate 4 Healthy Phragmites (middle-ground)

Plate 5 Healthy Bolboschoenus (foreground)

Dieback
Dieback can be defined as an unusual decline in health of a significant area or number of plants.

Experience will assist in distinguishing dieback from senescence and in practice is not difficult.

There have been no known cases of large-scale disease or dieback in Australian wetland except where water levels and/or water quality have occurred outside the plants' known range of tolerance.

Dieback might occur where drying periods are far too long, or water levels are too high for too long, or in the case of an unknown disease or pest. Expert advice should be south if large-area dieback is suspected.

Common Weeds

Baccharis halimifolia (Groundsel)
Groundsel is a small densely branched shrub 2.5m high (up to 6m), a native of North America, it was first introduced as an ornamental. It is now found in swamps and is tolerant of a range of soil types and also frost.

Leaves are waxy and pale green, toothed and alternate (2.5-5cm long and 1-2.5cm wide). Flowers are small (5mm) cream or white and clustered in a hairy panicle.

Groundsel grows rapidly and reproduces by seed (dispersed by wind and birds) germinating when soil moisture is high.

Management strategies
Pull up, or dig out. Remove all pieces; bag and destroy.

Care should be taken to remove roots as it can reshoot.

Once established mechanical removal can be difficult due to strong roots.

Herbicides (cut stump, scrape and paint, spot spray) are effective but often require follow up.

Figure 1.6.1: Groundsel

Echinochloa crus-galli (Barnyard grass)
Barnyard grass is naturalised throughout much of Australia and its origin is uncertain. It is found in pastures, waterways, wetland and damp habitats.

It grows to 1m tall and is characterized by its erect panicle (to 20cm long). It flowers in summer and spreads via seed dispersed on wind, water and birds.

Management strategies
Pull up, or dig out. Remove all pieces; bag and destroy.

If treating barnyard grass with herbicide in an aquatic situation, be sure to only use products registered for that particular use. Glyphosate can be effective (spot spray).

Figure 1.6.2: Barnyard grass

Hymenachne amplexicaulis (Olive hymenachne)

Olive hymenachne is an emergent semi-aquatic grass 1-2.5m tall. It was introduced as a pasture species for wet areas and is now found on stream banks and wetland areas. Olive hymenachne is declared as a Class 2 species under the *Land Protection (Pest and Stock Route Management) Act 2002*. It is also classified as a weed of National Significance.

Olive hymenachne grows from seed spread by water and birds. It can also grow from stem fragments.

The leaves are up to 50cm long and 3cm wide with a characteristic clasp around the stem at the base of the leaf. Flowers are a cylindrical spike (sometimes branching) 20-40cm long, flowering occurs from April to June.

Management strategies

Pull up, or dig out. Remove all pieces; bag and destroy.

It is essential to remove all material due to its ability to shoot from roots or stem material.

If treating olive hymenache with herbicide in an aquatic situation, be sure to only use products registered for that particular use. Glyphosate can be effective (spot spray).

Figure 1.6.3: Olive hymenachne

Ludwigia peruviana (Peruvian primrose)

This semi-terrestrial shrub (to 4m) is native to South America and grows in partially submerged environments. It is can be found on the edges of streams and wetland systems. It produces a large number of seeds, easily transported by birds, and can also spread by fragments. The species is a declared Class 1 species under the Land Protection (Pest and Stock Route Management) Act 2002, thus its removal if detected is essential.

Peruvian primrose has alternate dark green leaves 4-12cm long and 1-3cm wide with a 4-5 petal flower. The lower surfaces of the leaves are hairy.

It can be confused with the similar native species Ludwigia peploides ssp. montividensis but is distinguished by its shrub habit. Ludwigia peploides ssp. montividensis has smaller shiny leaves and is generally creeping or floating rather than an upright shrub.

Management strategies
Pull up, or dig out. Remove all pieces; bag and destroy.

It is important to ensure that roots are also removed as it can reshoot from remaining root material;

If treating Peruvian primrose with herbicide in an aquatic situation, be sure to only use products registered for that particular use. Glyphosate can be effective (spot spray or scrape and paint) during the main growth season (prior to autumn).

Figure 1.6.4: Peruvian primrose

Myriophyllum aquaticum (Parrot's feather)

Myriophyllum aquaticum or Parrot's feather is a submerged to emergent plant found in floating and on edges of streams and wetland and is often associated with nutrient enriched water. It is spread by leaf fragments as seed is not produced by this plant within Australia (male and female flowers are produced by separate plants). This species is a declared Class 1 species under the *Land Protection (Pest and Stock Route Management) Act 2002.*

Parrot's feather has characteristic small blue-green feathery leaves arranged in whorls. The leaf blade is toothed, generally 2.5-3.5cm long and 0.5-0.8cm wide.

Management strategies

Pull up, or dig out. Remove all pieces; bag and destroy.

Water level control, both raising to drown out, and drying can be effective means of control.

Glyphosate can be effective (spot spray)

Figure 1.6.5: Parrot's feather

Panicum repens (Torpedo grass)

Torpedo grass is naturalised throughout much of the world and its origin is uncertain. It is found in wet pastures, waterways, wetland and damp habitats. It is of particular concern due to its rapid rate of spread and once established it is difficult to control. It is also tolerant of both wet and dry conditions.

It is a rhizomatous perennial that grows to 1.2m. It flowers in summer and the seedhead (26cm long) is a number of spikelets. It is spread by seed and underground rhizomes.

Management strategies

Pull up, or dig out. Remove all pieces; bag and destroy.

Water level control, raising to drown out, could be used for control but this has not currently been trialed.

Chemical control can be attempted (spot spray) but should be done in the peak growing season (spring summer) and follow up is essential.

Figure 1.6.6: Torpedo grass

Persicaria lapathifolia (Pale smartweed)

Erect or ascending annual or biennial herb growing to 0.8–1.8 m high. Flowers are white to pink and blossom in August to May. Pale smartweed colonises sandy mud, black mud, and coarse clay loam. Usually found in damp situations, floodplains, margins of pools, creeks & rivers.

Management strategies

Pull up, or dig out if smartweed becomes dominant species. Remove all selected pieces; bag and destroy;

Frost can be possibly be used if water levels are low but yet to be trialed;

If treating pale smartweed with herbicide in an aquatic situation, be sure to only use products registered for that particular use. Glyphosate can be effective at higher strength particularly with surfactant.

Figure 1.6.7: Pale Smartweed

Tradescantia fluminensis ("Trad" or “Wandering Jew”)

A fast growing fleshy and herbaceous South American ground creeper. This weed favours damp and shady areas particularly on the edge of nutrient-enriched waters. The weed can climb on wetland plants if plant populations are not dense. Healthy aquatic plants are resistant, but every instance of Tradescantia should be removed as soon as it is observed.

The stems are long and succulent, curving upwards at the tips. The leaves are shiny green, smooth and fleshy, sheathed where they join the stems. Small white flowers with 3 triangular petals in spring to summer. A similar native plant is *Commelina cyanea* (*Commelina diffusa*) which has blue flowers, not white.

Management strategies

Pull up, or dig out. Remove all pieces; bag and destroy;

Frost can be used as an effective control measure if water levels are low (i.e. during wetland drawdown);

Increasing water levels to drown Trad;

If treating Trad with herbicide in an aquatic situation, be sure to only use products registered for that particular use. Glyphosate can be effective at higher strength particularly with surfactant.

Figure 1.6.8: Trad

Sagittaria platyphyla (Sagittaria or arrowhead)

Saggitaria is a native of the U.S.A and Central America and was introduced as an ornamental garden plant. It is an emergent up to 1.2m tall and is spread by seed, rhizomes and tubers. It is grows in often nutrient rich conditions and can form dense infestations in drains, shallow creek sand wetland.

It has a large blade-like 28cm leaf 28cm long and 10cm wide with a prominent central vein. It has a small 3 petal white flower; flowering spring to autumn.

Management strategies

Pull up, or dig out. Remove all pieces; bag and destroy;

If treating Sagittaria with herbicide in an aquatic situation, be sure to only use products registered for that particular use. Glyphosate can be effective.

Figure 1.6.9: Sagittaria

Setaria sphacelata (Setaria)

Setaria was introduced as pasture plant. It is an aggressive perennial grass that is widely distributed in the local area and as tolerant of wet conditions is a threat to the Helidon treatment wetland area. It is an emergent 2-3m tall and is spread by seed. Leaves are bluish grey-green 7-25cm long and 3-10mm wide. It has a characteristic inflorescence in a dense panicle 7-50cm long (see image below).

Seeds are dispersed by birds, wind and water.

Management strategies

Pull up, or dig out. Remove all pieces particularly seed heads; bag and destroy;

If treating Sagittaria with herbicide in an aquatic situation, be sure to only use products registered for that particular use. Glyphosate can be effective for small infestations.

Figure 1.6.10: Setaria

Urochloa mutica or Brachiaria mutica (Para grass)

This weed is a fast-growing perennial African grass up to about 2m tall. The stems are hollow and robust, creeping in a prostrate growth habit. The stems stand erect towards the ends and sprout new roots wherever the nodes touch the ground. Leaf blades are hairy and dark green in colour.

They are usually up to 15 cm long and less than 1 cm wide, tapering to a long, fine point. The leaf sheaths are also hairy, particularly where they join the stem. Flower heads are up to 18 cm long and are made up of several spikes, each about 5 cm long. Seeds cluster thickly along each of these spikes, although Para grass seldom sets seed in southern Queensland.

Management strategies

Hand removal of Para grass whenever individual plants are observed;

Frost can be used if water levels are low;

Increasing water levels to drown Para grass, particularly if cut close to the ground first;

If treating Para grass with herbicide in an aquatic situation, be sure to only use products registered for that particular use. Not in waterways deeper than 60 cm.

Figure 1.6.11: Para Grass

Figure 1.6.12: Para Grass (yellowing, foreground)

Appendix 7 – Mosquitoes

Mosquito Control

Mosquito control if required can be managed with a drying phase targeted at the area of mosquito infestation. Mosquito infestations are not likely to be a problem once the wetland is well established. Dense plant growth, predatory macro invertebrates in the water column and lack of stagnant water inhibit the success of mosquito larvae. During the establishment phase, environmental conditions may exist for mosquito infestations.

During visual inspections the Operator will observe for adult mosquito populations throughout the site. If it considered that mosquito populations are potentially high (based on observation of clusters of wrigglers) and are possibly a public nuisance then a generic DAFOR (Dominant, Abundant, Frequent, Occasional, Rare) scale sampling program will be triggered. In addition, if community complaints are received in regards to mosquito infestations a generic DAFOR scale sampling program applied to mosquitos would also be triggered.

The DAFOR scale (Dominant, Abundant, Frequent, Occasional, Rare) is to be used once a mosquito infestation has been identified. The DAFOR scale would involve sampling mosquito larvae numbers at sampling points shown on the Wetland Plan. Three samples will be taken with a 200ml container at each sampling location and numbers of larvae in each sample recorded on the mosquito larvae record sheet provided in Appendix 4.

Table 5 shows the classification of the DAFOR scale to mean number of larvae at each sampling site.

Table 4: DAFOR scale relating mosquito larvae numbers

DAFOR scale	Mean number of larvae at sample site
Dominant	>100
Abundant	75 - 100
Frequent	25 -75
Occasional	5 -25
Rare	1 - 5

In the case of dominant, abundant, frequent numbers of mosquito larvae it is necessary to lower water levels.

Once the mosquito infestation has been located, a targeted lowering of water levels in the identified area is required. This following procedure is provided to lower water levels:

- Close Line 1 Penstock
- Berm twister outlets of the effected Tier/s or Cell are to be set at the minimum RL.
- After a period of 5 days, revert back to normal conditions.

The Operator in consultation with the Project Manager may decide, following careful monitoring, that a mosquito assessment by a specialist should be undertaken if the health risk to the public warrants this approach.

The DAFOR scale is a visual evaluation of mosquito abundance for a particular site. The following list provides the categories of the scale:

- Dominant: Mean number of mosquito larvae is greater than 100;
- Abundant: Mean number of mosquito larvae is between 75 to 100;
- Frequent: Mean number of mosquito larvae is between 25 to 75;
- Occasional: Mean number of mosquito larvae is between 5 to 25;
- Rare: Mean number of mosquito larvae is between 1 to 5.

Plate A2-1 Example of common characteristics of Mosquito larvae

Appendix 8 – Mosquito Larvae Record Sheet

he classification scheme for the mean number of larvae is shown in the following table.

DAFOR scale	Mean number of larvae at sample site
Dominant	>100
Abundant	75 - 100
Frequent	25 -75
Occasional	5 -25
Rare	1 - 5

Fill in the following records for each sampling site as marked.

Sample Site 1

Sample	Mosquito larvae numbers
1	
2	
3	
Mean	

Sample Site 2

Sample	Mosquito larvae numbers
1	
2	
3	
Mean	

Sample Site 3

Sample	Mosquito larvae numbers
1	

2	
3	
Mean	

Sample Site 4

Sample	Mosquito larvae numbers
1	
2	
3	
Mean	

Sample Site 5

Sample	Mosquito larvae numbers
1	
2	
3	
Mean	

Sample Site 6

Sample	Mosquito larvae numbers
1	
2	
3	
Mean	

Sample Site 7

Sample	Mosquito larvae numbers
1	
2	

3	
Mean	

Sample Site 8

Sample	Mosquito larvae numbers
1	
2	
3	
Mean	

Sample Site 9

Sample	Mosquito larvae numbers
1	
2	
3	
Mean	

Sample Site 10

Sample	Mosquito larvae numbers
1	
2	
3	
Mean	

Sample Site 11

Sample	Mosquito larvae numbers
1	
2	
3	

Mean	

Sample Site 12

Sample	Mosquito larvae numbers
1	
2	
3	
Mean	

Sample Site 13

Sample	Mosquito larvae numbers
1	
2	
3	
Mean	

Sample Site 14

Sample	Mosquito larvae numbers
1	
2	
3	
Mean	

Sample Site 15

Sample	Mosquito larvae numbers
1	
2	
3	
Mean	

Sample Site 16

Sample	Mosquito larvae numbers
1	
2	
3	
Mean	

Sample Site 17

Sample	Mosquito larvae numbers
1	
2	
3	
Mean	

Sample Site 18

Sample	Mosquito larvae numbers
1	
2	
3	
Mean	

Once all samples are taken, calculate mean number of mosquito larvae in each sampling site. If any mean value triggers the following categories of dominant, abundant, frequent on the DAFOR scale then appropriate water level management is required as per Section 2.1 of the O&M Manual.

Appendix A – Flow metre manual

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

Technical Information

Proline Promag 50W, 53W

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 ≥ 5 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 of the measuring pipe from polyurethane or hard rubber with the following drinking water permissions:
- KTW
- WRAS
- NSF
- ACS

Approvals for hazardous area:
- ATEX
- IECEx
- FM
- CSA
- NEPSI

Connection to process control system:
- HART
- PROFIBUS DP/PA
- FOUNDATION Fieldbus
- MODBUS RS485

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:
- Modular device and operating concept resulting in a higher degree of efficiency
- Software options for batching, electrode cleaning and for measuring pulsating flow
- 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

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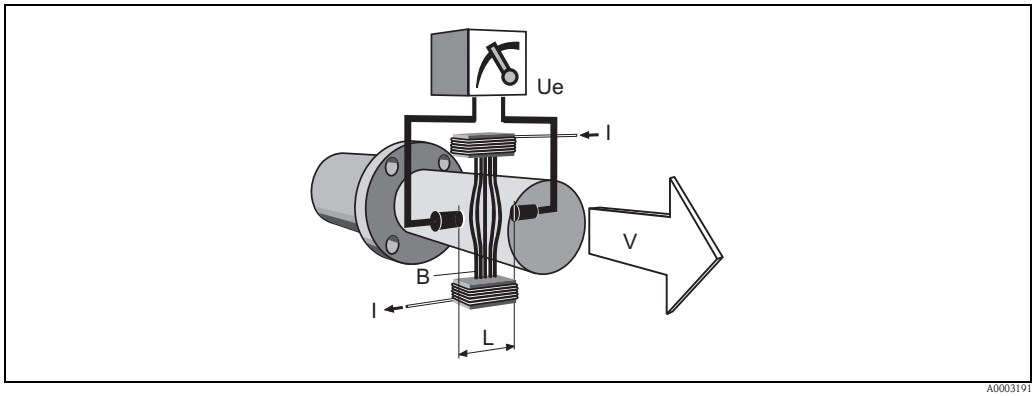
Function and system design

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.



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

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 50 (user interface with push buttons for operation, two-line display, illuminated)
- Promag 53 ("Touch Control" without opening the housing, four-line display, unilluminated)

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

Input

Measured variable

Flow velocity (proportional to induced voltage)

Measuring ranges

Measuring ranges for liquids
Typically v = 0.01 to 10 m/s (0.03 to 33 ft/s) with the specified accuracy

Operable flow range

Over 1000 : 1

Input signal

Status input (auxiliary input)
- U = 3 to 30 V DC, R_i = 5 kΩ, galvanically isolated
- Configurable for: totalizer(s) reset, measured value suppression, error-message reset

Status input (auxiliary input) with PROFIBUS DP and MODBUS RS485
- U = 3 to 30 V DC, R_i = 3 kΩ, galvanically isolated
- Switching level: 3 to 30 V DC, independent of polarity
- Configurable for: totalizer(s) reset, measured value suppression, error-message reset, batching start/stop (optional), batch totalizer reset (optional)

Current input (only Promag 53)
- active/passive selectable, galvanically isolated, full scale value selectable, resolution: 3 µA, temperature coefficient: typ. 0.005% o.r./°C (o.r. = of reading)
- active: 4 to 20 mA, $R_i \leq 150$ Ω, max. 24 V DC, short-circuit-proof
- passive: 0/4 to 20 mA, $R_i < 150$ Ω, max. 30 V DC

Output

Output signal

Promag 50

Current output
active/passive selectable, galvanically isolated, time constant selectable (0.01 to 100 s), full scale value selectable, temperature coefficient: typ. 0.005% o.r./°C (o.r. = of reading), resolution: 0.5 µA
- active: 0/4 to 20 mA, $R_L < 700$ Ω (HART: $R_L \geq 250$ Ω)
- passive: 4 to 20 mA, operating voltage V_S: 18 to 30 V DC, $R_i \geq 150$ Ω

Pulse/frequency output
passive, open collector, 30 V DC, 250 mA, galvanically isolated
- Frequency output: full scale frequency 2 to 1000 Hz (f_{max} = 1250 Hz), on/off ratio 1:1, pulse width max. 10s
- Pulse output: pulse value and pulse polarity selectable, max. pulse width configurable (0.5 to 2000 ms)

PROFIBUS DP interface
- Transmission technology (Physical Layer): RS485 in accordance with ANSI/TIA/EIA-485-A: 1998, galvanically isolated
- Profil version 3.0
- Data transmission rate: 9,6 kBaud to 12 MBaud
- Automatic data transmission rate recognition
- Function blocks: 1 × analog Input, 1 × totalizer
- Output data: volume flow, totalizer
- Input data: positive zero return (ON/OFF), totalizer control, value for local display
- Cyclic data transmission compatible with previous model Promag 33
- Bus address adjustable via miniature switches or local display (optional) at the measuring device

PROFIBUS PA interface
- Transmission technology (Physical Layer): IEC 61158-2 (MBP), galvanically isolated
- Profil version 3.0
- Current consumption: 11 mA
- Permissible supply voltage: 9 to 32 V
- Bus connection with integrated reverse polarity protection
- Error current FDE (Fault Disconnection Electronic): 0 mA
- Function blocks: 1 × analog input, 2 × totalizer
- Output data: volume flow, totalizer
- Input data: positive zero return (ON/OFF), control totalizer, value for local display
- Cyclic data transmission compatible with previous model Promag 33
- Bus address adjustable via miniature switches or local display (optional) at the measuring device

Promag 53

Current output
active/passive selectable, galvanically isolated, time constant selectable (0.01 to 100 s),
full scale value selectable, temperature coefficient: typ. 0.005% o.r./°C (o.r. = of reading), resolution: 0.5 µA
- active: 0/4 to 20 mA, R_L < 700 Ω (HART: $R_L \geq 250$ Ω)
- passive: 4 to 20 mA, operating voltage V_S: 18 to 30 V DC, $R_i \geq 150$ Ω

Pulse/frequency output
active/passive selectable, galvanically isolated (Ex i version: only passive)
- active: 24 V DC, 25 mA (max. 250 mA during 20 ms), R_L > 100 Ω
- passive: open collector, 30 V DC, 250 mA
- Frequency output: full scale frequency 2 to 10000 Hz (f_{max} = 12500 Hz), EEx-ia: 2 to 5000 Hz; on/off ratio 1:1, pulse width max. 10 s
- Pulse output: pulse value and pulse polarity selectable, max. pulse width configurable (0.05 to 2000 ms)

PROFIBUS DP interface
- Transmission technology (Physical Layer): RS485 in accordance with ANSI/TIA/EIA-485-A: 1998, galvanically isolated
- Profil version 3.0
- Data transmission rate: 9,6 kBaud to 12 MBaud
- Automatic data transmission rate recognition
- Function blocks: 2 × analog Input, 3 × totalizer
- Output data: volume flow, calculated mass flow, totalizer 1 to 3
- Input data: positive zero return (ON/OFF), totalizer control, value for local display
- Cyclic data transmission compatible with previous model Promag 33
- Bus address adjustable via miniature switches or local display (optional) at the measuring device
- Available output combination → 📄 8

PROFIBUS PA interface
- Transmission technology (Physical Layer): IEC 61158-2 (MBP), galvanically isolated
- Profil version 3.0
- Current consumption: 11 mA
- Permissible supply voltage: 9 to 32 V
- Bus connection with integrated reverse polarity protection
- Error current FDE (Fault Disconnection Electronic): 0 mA
- Function blocks: 2 × analog input, 3 × totalizer
- Output data: volume flow, calculated mass flow, totalizer 1 to 3
- Input data: positive zero return (ON/OFF), totalizer control, value for local display
- Cyclic data transmission compatible with previous model Promag 33
- Bus address adjustable via miniature switches or local display (optional) at the measuring device

MODBUS RS485 interface
- Transmission technology (Physical Layer): RS485 in accordance with ANSI/TIA/EIA-485-A: 1998, galvanically isolated
- MODBUS device type: Slave
- Adress range: 1 to 247
- Bus address adjustable via miniature switches or local display (optional) at the measuring device
- Supported MODBUS function codes: 03, 04, 06, 08, 16, 23
- Broadcast: supported with the function codes 06, 16, 23
- Übertragungsmodus: RTU oder ASCII
- Supported baudrate: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 Baud
- Response time:
  - Direct data access = typically 25 to 50 ms
  - Auto-scan buffer (data range) = typically 3 to 5 ms
- Available output combination → 📄 8

FOUNDATION Fieldbus interface
- FOUNDATION Fieldbus H1
- Transmission technology (Physical Layer): IEC 61158-2 (MBP), galvanically isolated
- ITK version 5.01
- Current consumption: 12 mA
- Error current FDE (Fault Disconnection Electronic): 0 mA
- Bus connection with integrated reverse polarity protection
- Function blocks:
  - 5 × Analog Input (execution time: 18 ms each)
  - 1 × PID (25 ms)
  - 1 × Digital Output (18 ms)
  - 1 × Signal Characterizer (20 ms)
  - 1 × Input Selector (20 ms)
  - 1 × Arithmetic (20 ms)
  - 1 × Integrator (18 ms)
- Output data: volume flow, calculated mass flow, temperature, totalizer 1 to 3
- Input data: positive zero return (ON/OFF), reset totalizer
- Link Master (LM) functionality is supported

Signal on alarm
- Current output → failure response selectable (e.g. in accordance with NAMUR recommendation NE 43)
- Pulse/frequency output → failure response selectable
- Status output (Promag 50) → non-conductive by fault or power supply failure
- Relay output (Promag 53) → de-energized by fault or power supply failure

Load

see "Output signal"

Low flow cutoff

Switch points for low flow cutoff are selectable.

Galvanic isolation

All circuits for inputs, outputs and power supply are galvanically isolated from each other.

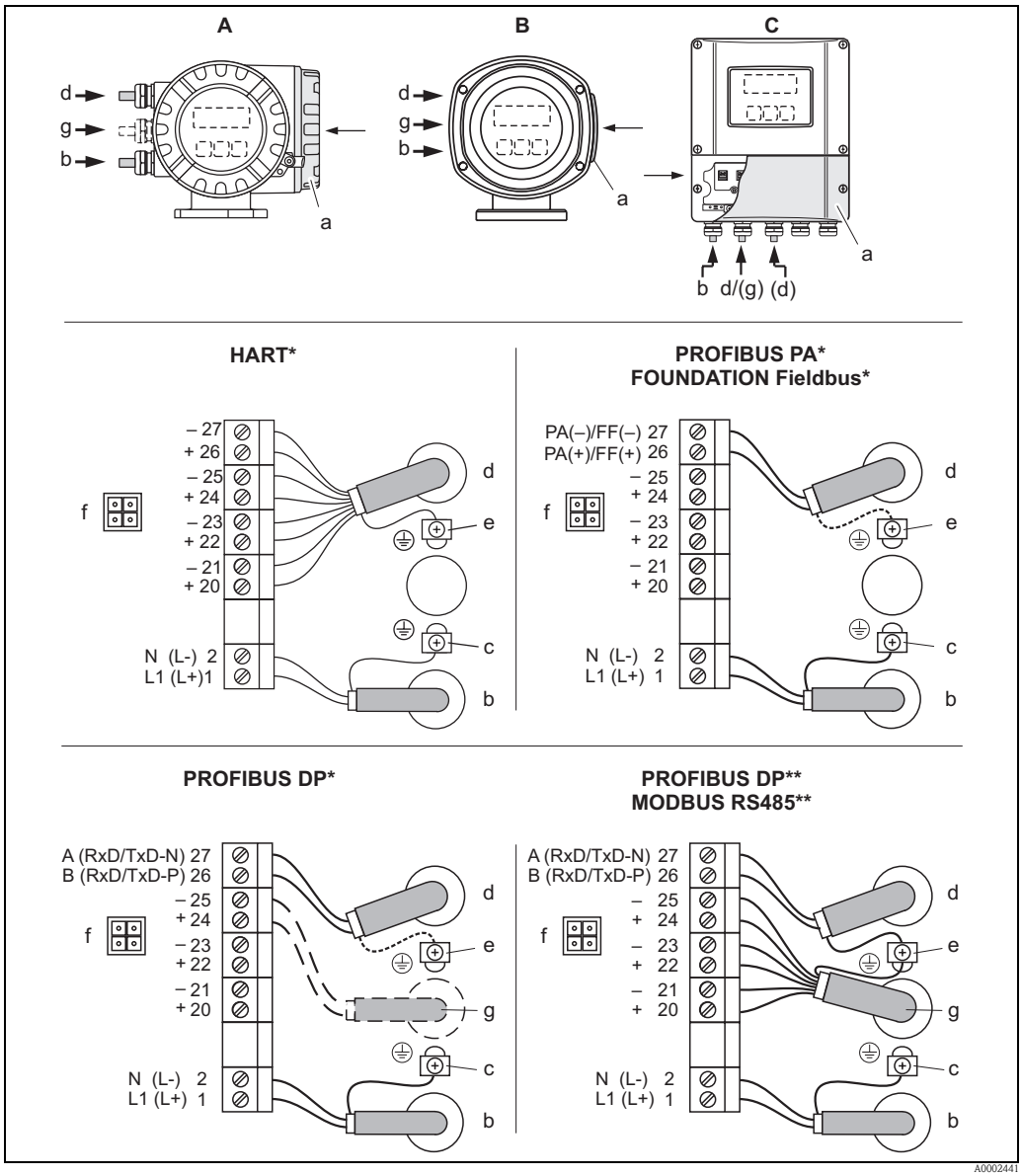
Switching output

Status output (Promag 50, Promag 53)
Open collector, max. 30 V DC / 250 mA, galvanically isolated.
Configurable for: error messages, Empty Pipe Detection (EPD), flow direction, limit values.

Relay outputs (Promag 53)
Normally closed (NC or break) or normally open (NO or make) contacts available
(default: relay 1 = NO, relay 2 = NC), max. 30 V / 0,5 A AC ; 60 V / 0,1 A DC, galvanically isolated.
Configurable for: error messages, Empty Pipe Detection (EPD), flow direction, limit values, batching contacts.

Power supply

Electrical connection, measuring unit



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

A View A (field housing)
B View B (stainless steel field housing)
C View C (wall-mount housing)

**)* fixed communication boards
***)* flexible communication boards
a Connection compartment cover
b Cable for power supply: 85 to 260 V AC / 20 to 55 V AC / 16 to 62 V DC
- Terminal No. 1: L1 for AC, L+ for DC
- Terminal No. 2: N for AC, L– for DC

c Ground terminal for protective conductor
d Signal cable: see "Electrical connection, terminal assignment" → 🖹 8
Fieldbus cable:
- Terminal No. 26: DP (B) / PA + / FF + / MODBUS RS485 (B) / (PA, FF: with polarity protection)
- Terminal No. 27: DP (A) / PA – / FF – / MODBUS RS485 (A) / (PA, FF: with polarity protection)

e Ground terminal for signal cable shield / Fieldbus cable / RS485 line
f Service adapter for connecting service interface FXA193 (Fieldcheck, FieldCare)
g Signal cable: see "Electrical connection, terminal assignment" → 🖹 8
Cable for external termination (only for PROFIBUS DP with fixed assignment communication board):
- Terminal No. 24: +5 V
- Terminal No. 25: DGND

Electrical connection, terminal assignment

Terminal assignment, Promag 50

Order variant	Terminal No. (inputs/outputs)			
	20 (+) / 21 (–)	**22 (+) / 23 (–)**	**24 (+) / 25 (–)**	**26 (+) / 27 (–)**
50***-**********W	–	–	–	Current output HART
50***-**********A	–	–	Frequency output	Current output HART
50***-**********D	Status input	Status output	Frequency output	Current output HART
50***-**********H	–	–	–	PROFIBUS PA
50***-**********J	–	–	+5 V (external termination)	PROFIBUS DP
50***-**********S	–	–	Frequency output, Ex i, passive	Current output, Ex i, passive, HART
50***-**********T	–	–	Frequency output, Ex i, passive	Current output, Ex i, passive, HART

Ground terminal → 🖹 7

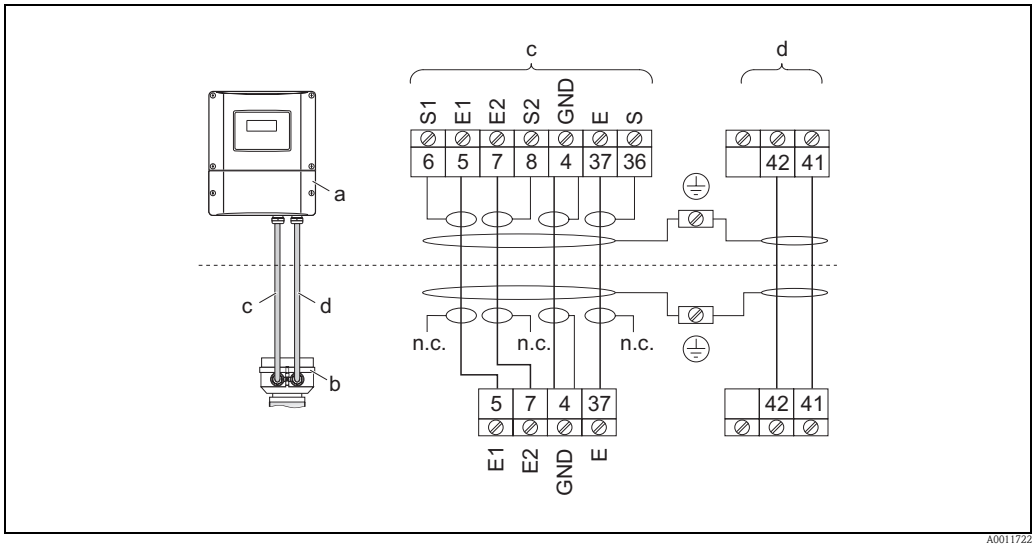
Terminal assignment, Promag 53

The inputs and outputs on the communication board can be either permanently assigned or variable, depending on the version ordered (see table). Replacements for modules which are defective or which have to be replaced can be ordered as accessories.

Order variant	Terminal No. (inputs/outputs)			
	20 (+) / 21 (–)	**22 (+) / 23 (–)**	**24 (+) / 25 (–)**	**26 (+) / 27 (–)**
Fixed communication boards (fixed assignment)				
53***-**********A	–	–	Frequency output	Current output HART
53***-**********B	Relay output 2	Relay output 1	Frequency output	Current output HART
53***-**********F	–	–	–	PROFIBUS PA, Ex i
53***-**********G	–	–	–	FOUNDATION Fieldbus, Ex i
53***-**********H	–	–	–	PROFIBUS PA
53***-**********J	–	–	–	PROFIBUS DP
53***-**********K	–	–	–	FOUNDATION Fieldbus
53***-**********Q	–	–	Status input	MODBUS RS485
53***-**********S	–	–	Frequency output, Ex i	Current output, Ex i, passive, HART
53***-**********T	–	–	Frequency output, Ex i	Current output, Ex i, passive, HART
Flexible communication boards				
53***-**********C	Relay output 2	Relay output 1	Frequency output	Current output HART
53***-**********D	Status input	Relay output	Frequency output	Current output HART
53***-**********L	Status input	Relay output 2	Relay output 1	Current output HART
53***-**********M	Status input	Frequency output	Frequency output	Current output HART
53***-**********N	Current output	Frequency output	Status input	MODBUS RS485
53***-**********P	Current output	Frequency output	Status input	PROFIBUS DP
53***-**********V	Relay output 2	Relay output 1	Status input	PROFIBUS DP
53***-**********2	Relay output	Current output	Frequency output	Current output HART
53***-**********4	Current input	Relay output	Frequency output	Current output HART
53***-**********7	Relay output 2	Relay output 1	Status input	MODBUS RS485

Ground terminal → 🖹 7

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
Terminal no. and cable colors: 6/5 = brown; 7/8 = white; 4 = green; 36/37 = yellow

Supply voltage (power supply)

- 85 to 260 V AC, 45 to 65 Hz
- 20 to 55 V AC, 45 to 65 Hz
- 16 to 62 V DC

PROFIBUS PA and FOUNDATION Fieldbus
- Non-Ex: 9 to 32 V DC
- Ex i: 9 to 24 V DC
- Ex d: 9 to 32 V DC

Cable entry

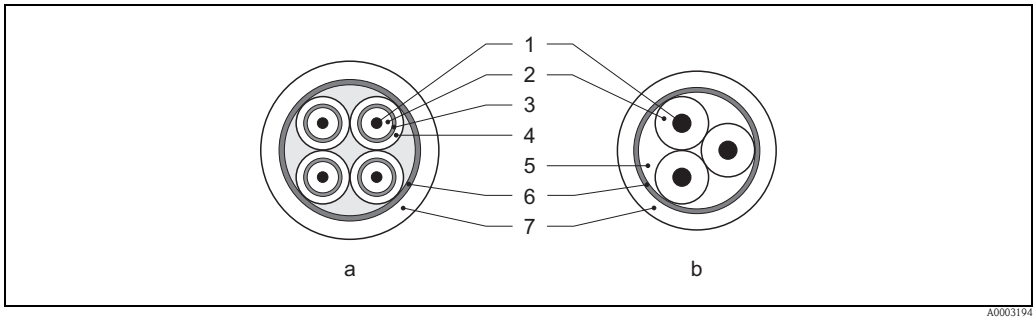
Power supply and signal cables (inputs/ outputs):
- Cable entry M20 × 1.5 (8 to 12 mm / 0.31 to 0.47")
- Sensor cable entry for armoured cables M20 × 1.5 (9.5 to 16 mm / 0.37 to 0.63")
- Thread for cable entries, ½" NPT, G ½"

Connecting cable for remote version:
- Cable entry M20 × 1.5 (8 to 12 mm / 0.31 to 0.47")
- Sensor cable entry for armoured cables M20 × 1.5 (9.5 to 16 mm / 0.37 to 0.63")
- 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 (–68 to +176 °F)
- Cable cross-section: max. 2.5 mm² (14 AWG)
- Test voltage for cable insulation: ≤ 1433 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
- With empty pipe detection (EPD): 4 × 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 (–68 to +176 °F)
- Cable cross-section: max. 2.5 mm² (14 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 and 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

- AC: < 15 VA (incl. sensor)
- DC: < 15 W (incl. sensor)

Switch-on current:
- Max. 3 A (< 5 ms) for 260 V AC
- Max. 13.5 A (< 50 ms) for 24 V DC

Power supply failure

Lasting min. ½ cycle frequency: EEPROM saves measuring system data
- EEPROM or T-DAT (Promag 53 only) retain the measuring system data in the event of a power supply failure
- S-DAT: exchangeable data storage chip which stores the data of the sensor (nominal diameter, serial number, calibration factor, zero point etc.)

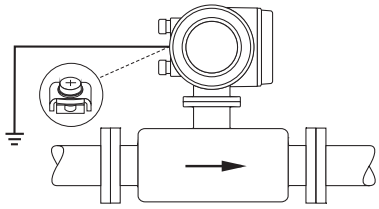
Potential equalization

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

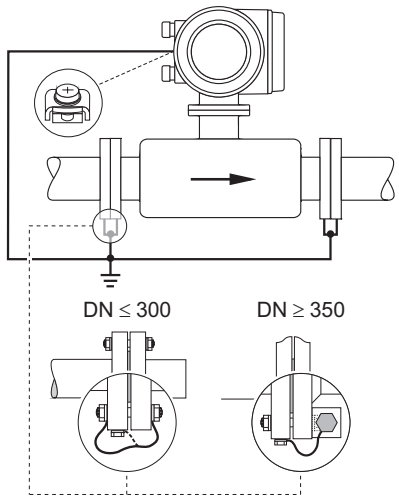
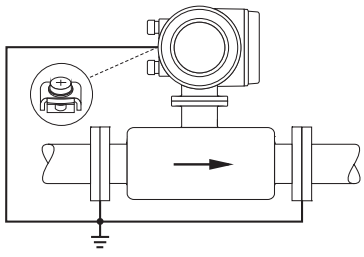
Perfect measurement is only ensured when the fluid and the sensor have the same electrical potential. This is ensured by the reference electrode integrated in the sensor as standard.

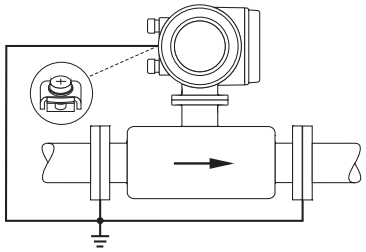
The following should also be taken into consideration for potential equalization:
- Internal grounding concepts in the company
- Operating conditions, such as the material/ grounding of the pipes (see table)

Standard situation

Operating conditions	Potential equalization
When using the measuring device in a: ■ Metal, grounded pipe Potential equalization takes place via the ground terminal of the transmitter. Note! When installing in metal pipes, we recommend you connect the ground terminal of the transmitter housing with the piping.	 A0011892 *Via the ground terminal of the transmitter*

Special situations

Operating conditions	Potential equalization
When using the measuring device in a: ■ Metal pipe that is not grounded This connection method also applies in situations where: ■ Customary potential equalization cannot be ensured. ■ Excessively high equalizing currents can be expected. 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. ■ DN ≤ 300 (12"): the ground cable is mounted directly on the conductive flange coating with the flange screws. ■ DN ≥ 350 (14"): the ground cable is mounted directly on the transportation metal support. Note! The ground cable for flange-to-flange connections can be ordered separately as an accessory from Endress+Hauser.	 A0011893 *Via the ground terminal of the transmitter and the flanges of the pipe*
When using the measuring device in a: ■ Plastic pipe ■ Pipe with insulating lining This connection method also applies in situations where: ■ Customary potential equalization cannot be ensured. ■ Excessively high equalizing currents can be expected. 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.	 A0011895 *Via the ground terminal of the transmitter and the optionally available ground disks*

Operating conditions	Potential equalization
When using the measuring device in a: ■ Pipe with a cathodic protection unit The device is installed potential-free in the pipe. 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. Note the following when installing: ■ The applicable regulations regarding potential-free installation must be observed. ■ There should be **no** electrically conductive connection between the pipe and the device. ■ The mounting material must withstand the applicable torques.	 A0011896 *Potential equalization and cathodic protection* *1 Power supply isolation transformer* *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

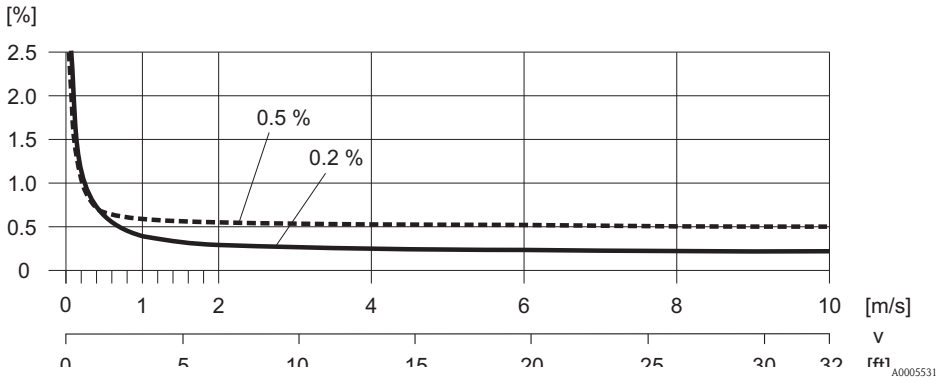
Installation conditions:
- Inlet run > 10 × DN
- Outlet run > 5 × DN
- Sensor and transmitter grounded.
- The sensor is centered in the pipe.

Maximum measured error

Promag 50:
- Current output: also typically ± 5 µA
- Pulse output: ±0.5% o.r. ± 1 mm/s (±0.5% o.r. ± 0.04 in/s)
  optional: ±0.2% o.r. ± 2 mm/s (±0.2% o.r. ± 0.08 in/s) (o.r. = of reading)

Promag 53:
- Current output: also typically ± 5 µA
- Pulse output: ±0.2% o.r. ± 2 mm/s (±0.2% o.r. ± 0.08 in/s) (o.r. = of reading)

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



Max. measured error in % of reading

Repeatability

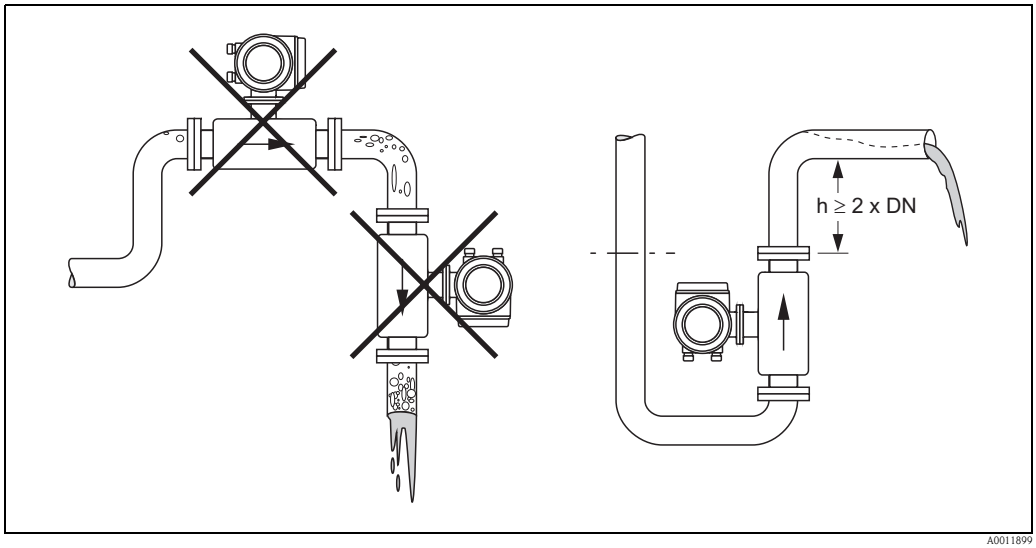
Max. ±0.1% o.r. ± 0.5 mm/s (±0.1% o.r. ± 0.02 in/s) (o.r. = of reading)

Operating conditions: Installations

Installation instructions

Mounting location

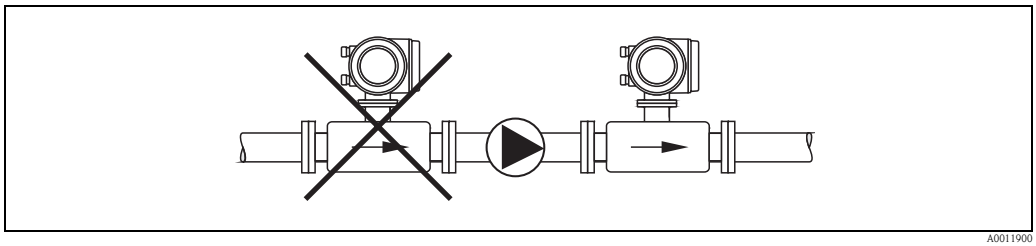
Entrained air or gas bubble formation in the measuring tube can result in an increase in measuring errors.
Avoid the following installation locations in the pipe:
- Highest point of a pipeline. Risk of air accumulating!
- Directly upstream from a free pipe outlet in a vertical pipeline.



Mounting location

Installation of pumps

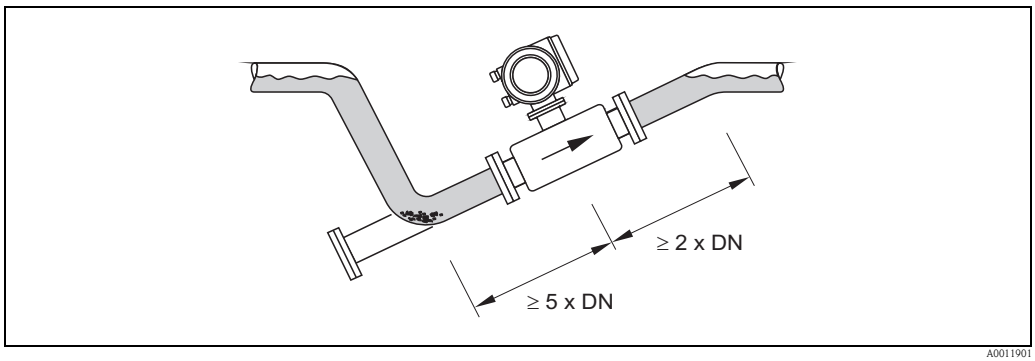
Sensors may not be installed on the pump suction side. This precaution is to avoid low pressure and the consequent risk of damage to the lining of the measuring tube. Information on the pressure tightness of the measuring tube lining → 🖹 21, Section "Pressure tightness".
Pulsation dampers may be needed when using piston pumps, piston diaphragm pumps or hose pumps. Information on the shock and vibration resistance of the measuring system → 🖹 20, Section "Shock and vibration resistance".



Installation of pumps

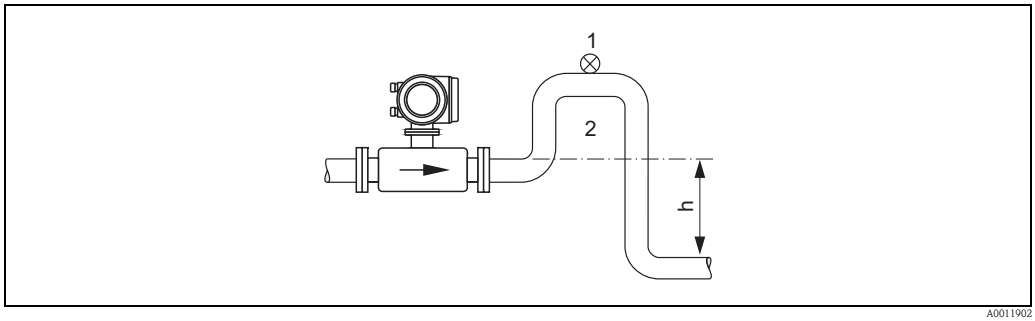
Partially filled pipes
Partially filled pipes with gradients necessitate a drain-type configuration.
The empty pipe detection function (EPD) provides additional security in detecting empty or partially filled pipes.

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 → 📄 21, Section "Pressure tightness".



Installation measures for vertical pipes

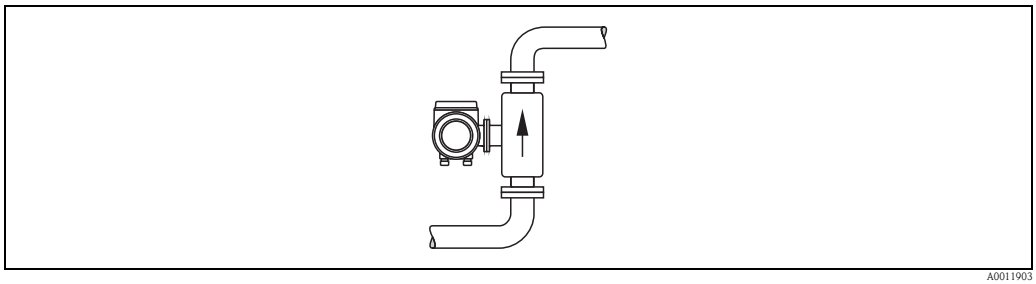
1 Vent valve
2 Pipe siphon
h Length of the down pipe

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.



A0011903

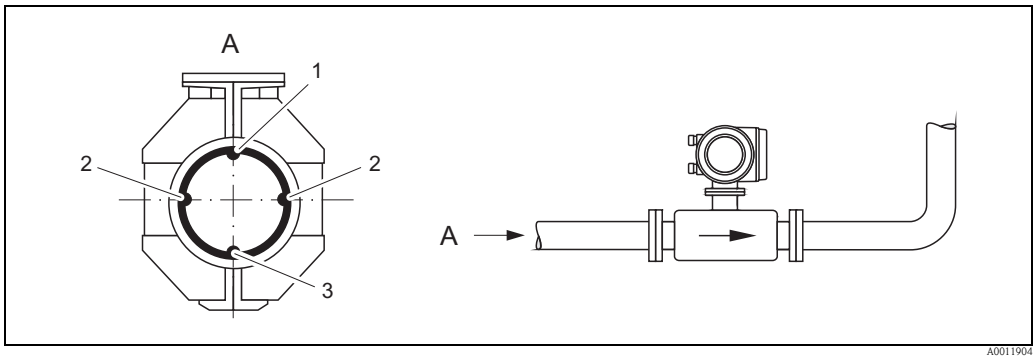
Vertical orientation

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.



A0011904

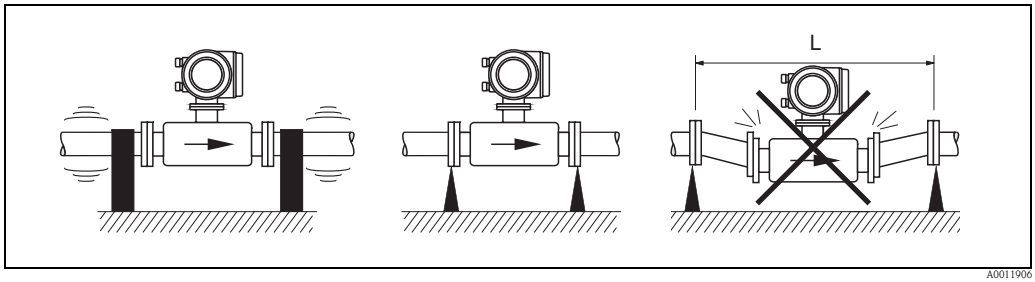
Horizontal orientation

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 → 20, Section "Shock and vibration resistance".



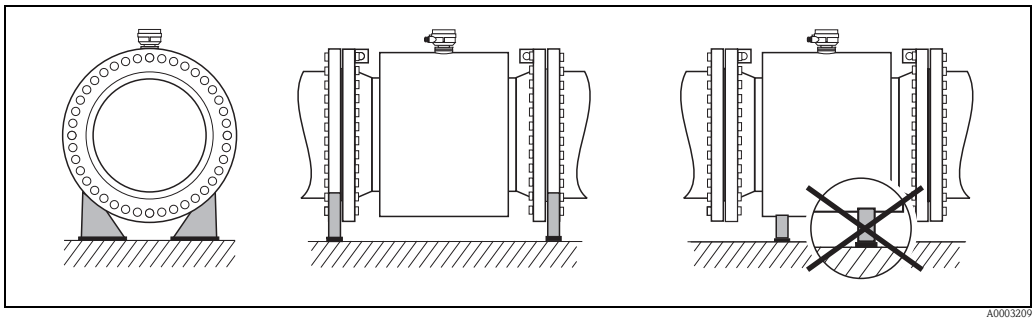
Measures to prevent vibration of the measuring device

L > 10 m (33 ft)

Foundations, supports

If the nominal diameter is DN ≥ 350, mount the transmitter on a foundation of adequate load-bearing strength.

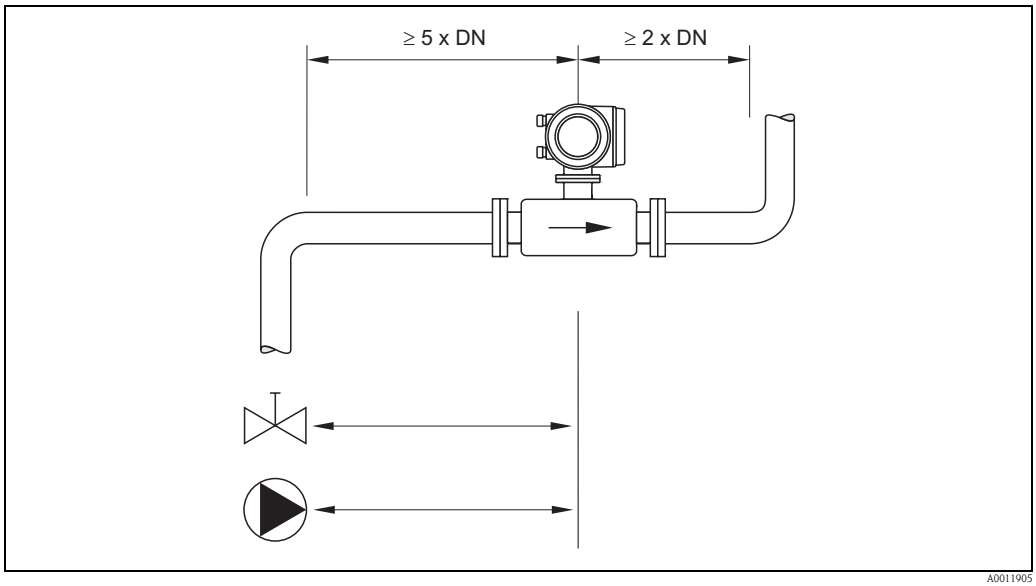
Caution!
Do not allow the casing to take the weight of the sensor. This would buckle the casing and damage the internal magnetic coils.



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



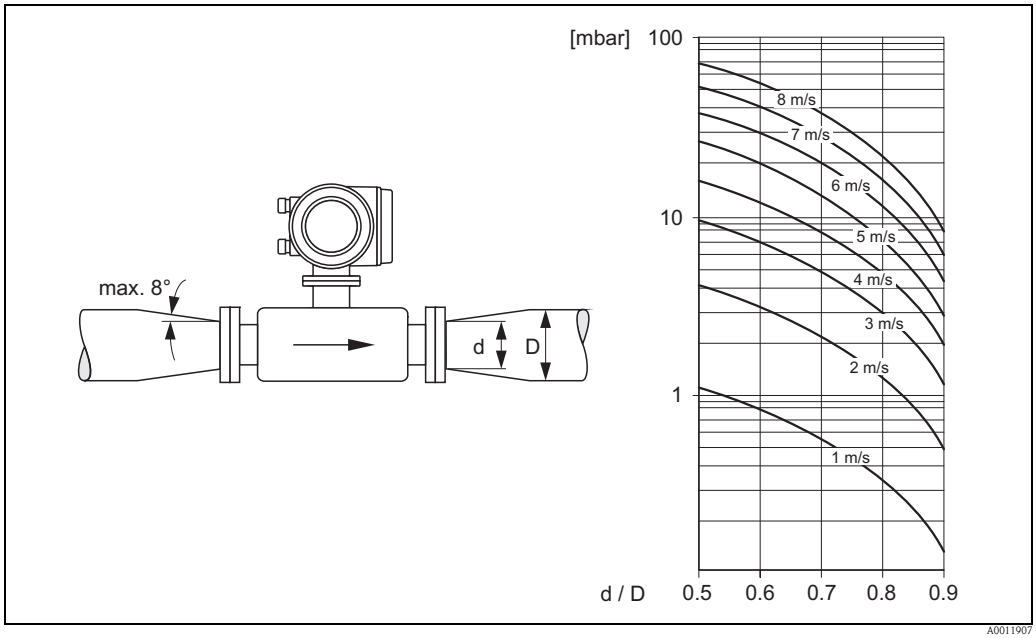
Inlet and outlet run

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.

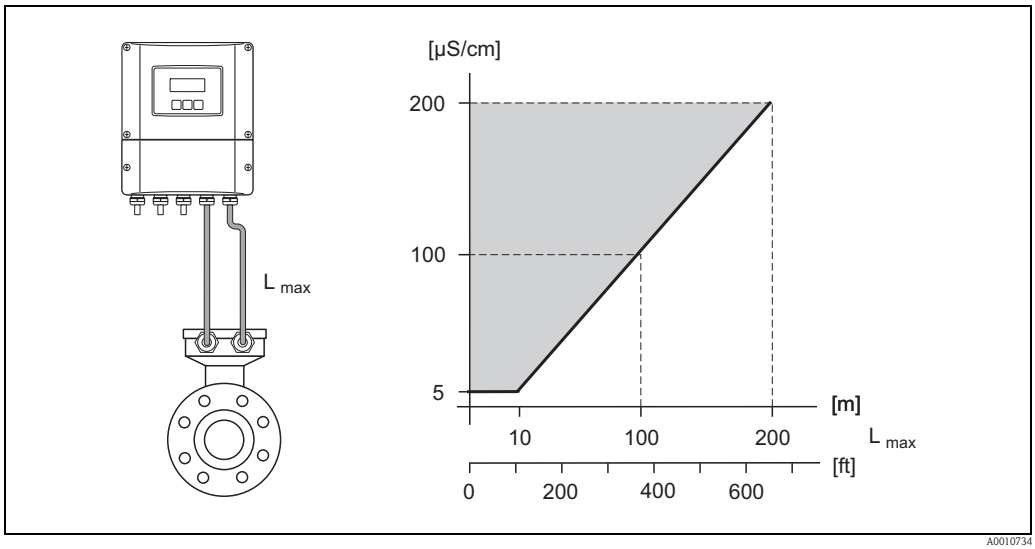


Pressure loss due to adapters

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 20 µS/cm is required for measuring demineralized water.
- 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
- Standard: –20 to +60 °C (–4 to +140 °F)
- Optional: –40 to +60 °C (–40 to +140 °F)

Note!
At ambient temperatures below –20 °C (–4 °F)the readability of the display may be impaired.

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
→ 21, 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.
- Do not remove the protective plates or caps on the process connections until the device is ready to install.

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 and NAMUR recommendation NE 21.

Operating conditions: Process

Medium temperature range

The permitted temperature depends on the lining of the measuring tube:
- 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:
- ≥ 5 µS/cm for fluids generally
- ≥ 20 µS/cm for demineralized water

Note!
In the remote version, the necessary minimum conductivity also depends on the cable length (→ 19, 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 1 to 24")
  - Class 300 (DN 1 to 6")
- AWWA
  - Class D (DN 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 400, 500, 600 / 3", 4", 6 to 16", 20", 24")
- AS 4087
  - PN 16 (DN 80, 100, 150 to 400, 500, 600 / 3", 4", 6 to 16", 20", 24")

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)		50 °C (122 °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

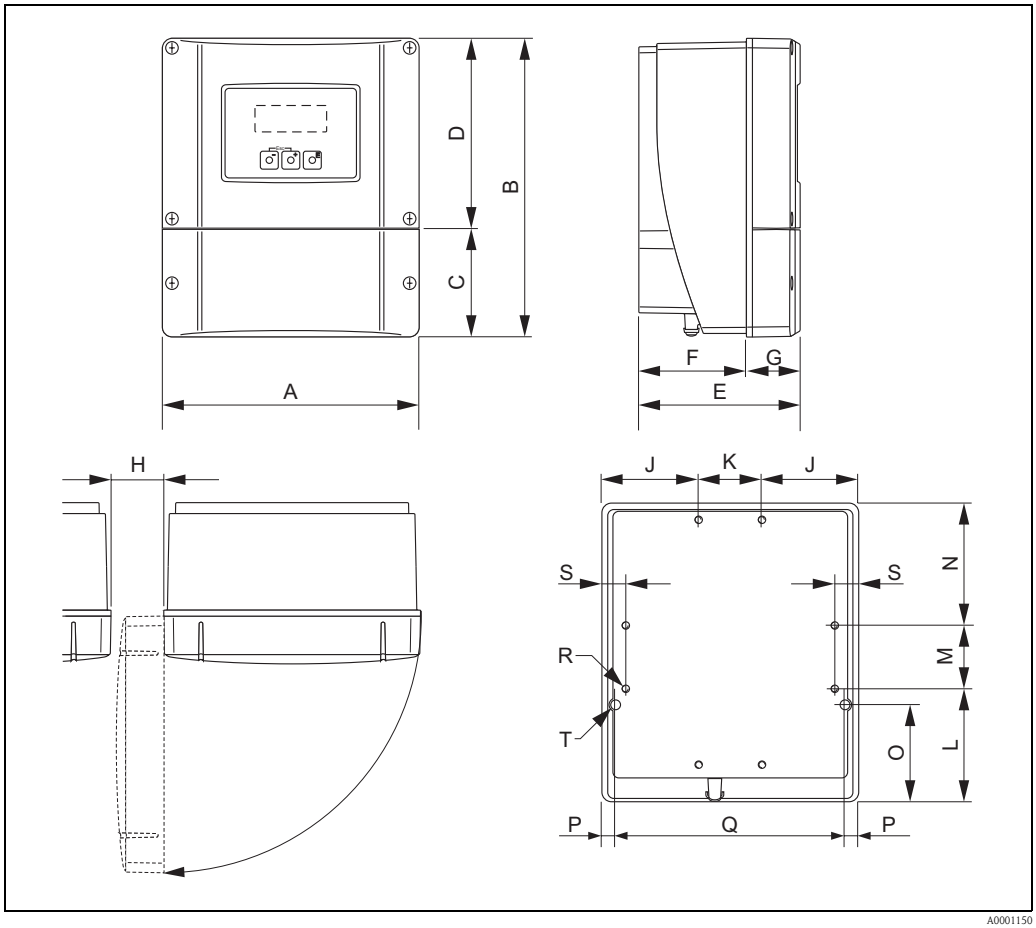
Pressure loss

- 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 (→ 🖹 18, Section "Adapters").

Mechanical construction

Design, dimensions

Transmitter remote version, wall-mount housing (non Ex-zone and II3G/Zone 2)



Dimensions (SI units)

A	B	C	D	E	F	G	H	J
215	250	90.5	159.5	135	90	45	> 50	81
K	L	M	N	O	P	Q	R	S
53	95	53	102	81.5	11.5	192	8 × M5	20

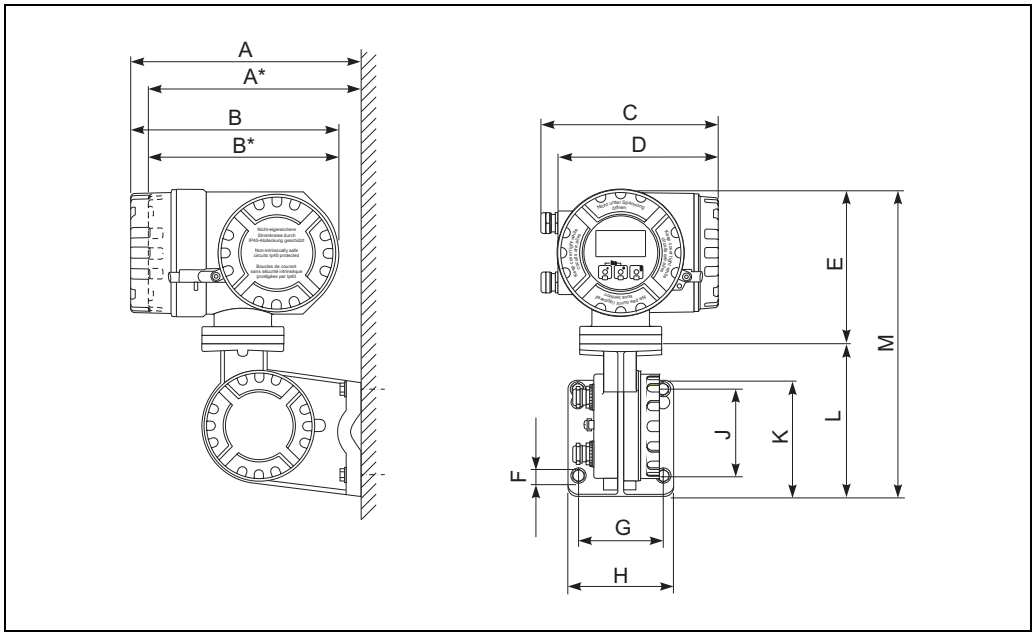
All dimensions in [mm]

Dimensions (US units)

A	B	C	D	E	F	G	H	J
8.46	9.84	3.56	6.27	5.31	3.54	1.77	> 1.97	3.18
K	L	M	N	O	P	Q	R	S
2.08	3.74	2.08	4.01	3.20	0.45	7.55	8 × M5	0.79

All dimensions in [inch]

Transmitter remote version, connection housing (II2GD/Zone 1)



Dimensions (SI units)

A	A*	B	B*	C	D	E	Ø F	G	H	J	K	L	M
265	242	240	217	206	186	178	8.6 (M8)	100	130	100	144	170	355

All dimensions in [mm]

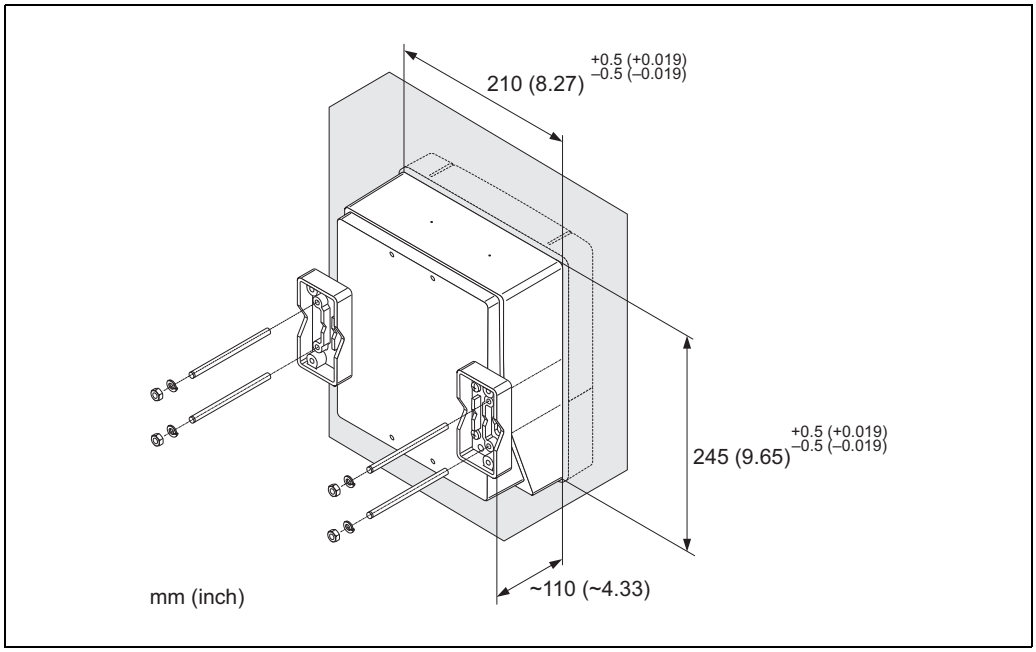
Dimensions (US units)

A	A*	B	B*	C	D	E	Ø F	G	H	J	K	L	M
10.4	9.53	9.45	8.54	8.11	7.32	7.01	0.34 (M8)	3.94	5.12	3.94	5.67	6.69	14.0

All dimensions in [inch]

There is a separate mounting kit for the wall-mounted housing. It can be ordered from Endress+Hauser as an accessory. The following installation variants are possible:
- Panel-mounted installation
- Pipe mounting

Installation in control panel



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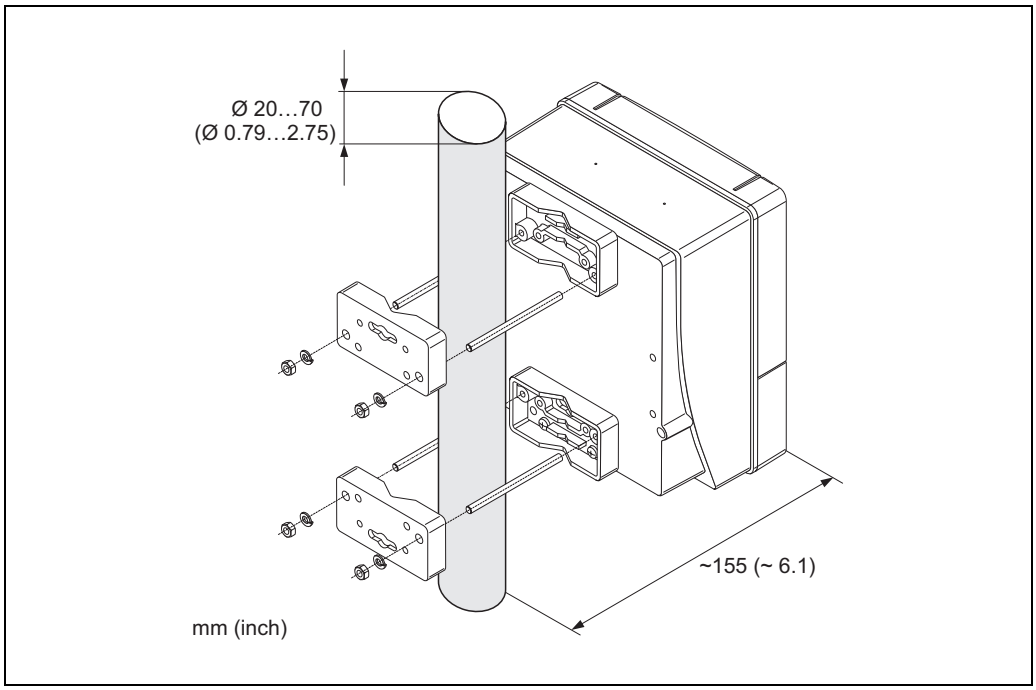
Pipe mounting



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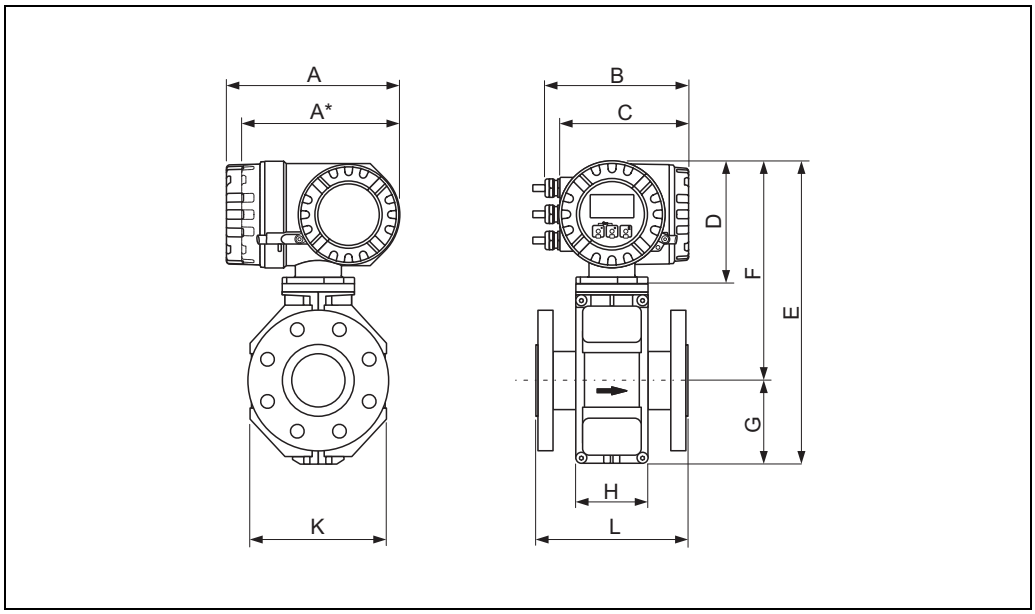
Compact version DN ≤ 300 (12")



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Dimensions (SI units)

DN EN (DIN) / JIS / AS [2]	L [1]	A	A*	B	C	D	E	F	G	H	K
25	200	227	207	187	168	160	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

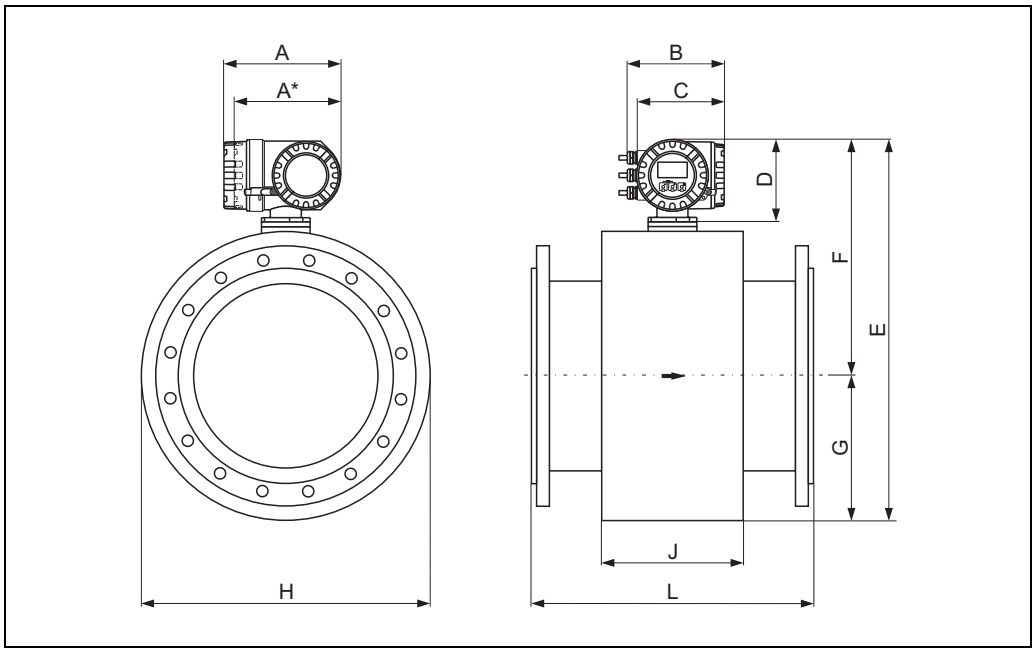
[1] The length is regardless of the pressure rating selected. Fitting length to DVGW.
[2] For flanges to AS, only the nominal diameters DN 80, 100 and 150 to 300 are available.
All dimensions in [mm]

Dimensions (US units)

DN ANSI	L [1]	A	A*	B	C	D	E	F	G	H	K
1"	7.87	8.94	8.15	7.36	6.61	6.30	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 (SI units)

DN EN (DIN) / AS [2]	L [1]	A	A*	B	C	D	E	F	G	H	J
350	550	227	207	187	168	160	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

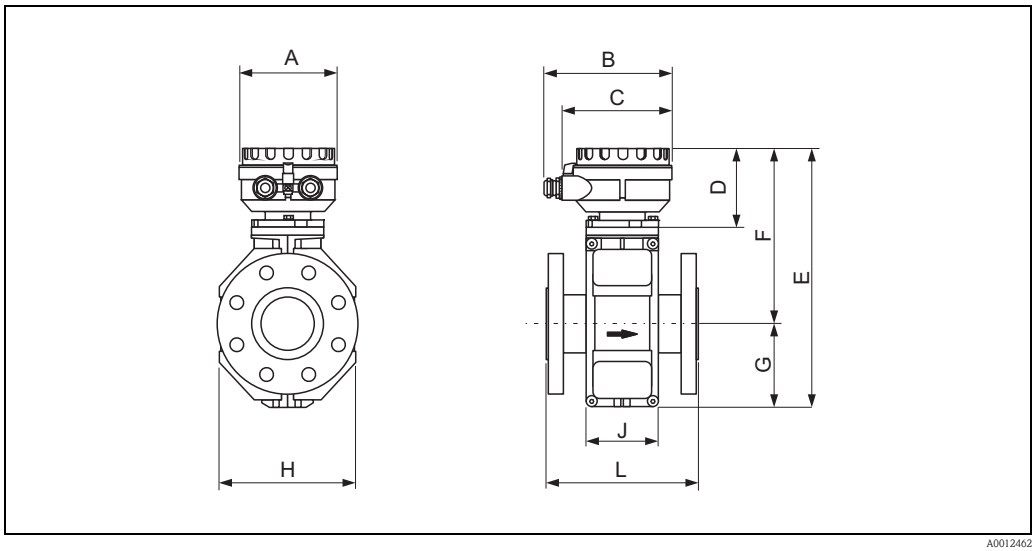
[1] The length is regardless of the pressure rating selected. Fitting length to DVGW.
[2] For flanges to AS, only DN 350, 400, 500 and 600 are available.
All dimensions in [mm]

Dimensions (US units)

DN ANSI / AWWA [2]	L [1]	A	A*	B	C	D	E	F	G	H	J
14"	21.6	8.94	8.15	7.36	6.61	6.30	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 ≤ 24" only to ANSI available, ≥ 28" only to AWWA available.
All dimensions in [inch]

Sensor, remote version DN ≤ 300 (12")



Dimensions (SI units)

DN 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

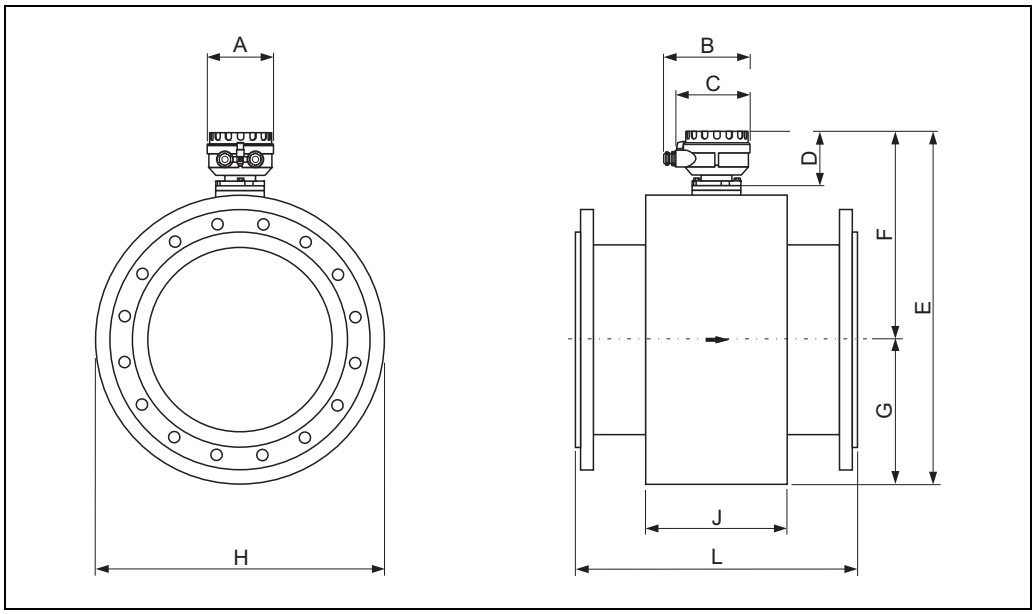
[1] The length is regardless of the pressure rating selected. Fitting length to DVGW.
[2] For flanges to AS, only the nominal diameters DN 80, 100 and 150 to 300 are available.
All dimensions in [mm]

Dimensions (US units)

DN 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	5.08	6.42	5.63	4.02	11.3	7.95	3.32	4.72	3.70
2"	7.87	5.08	6.42	5.63	4.02	11.3	7.95	3.32	4.72	3.70
3"	7.87	5.08	6.42	5.63	4.02	13.2	8.94	4.30	7.10	3.70
4"	9.84	5.08	6.42	5.63	4.02	13.2	8.94	4.30	7.10	3.70
6"	11.8	5.08	6.42	5.63	4.02	16.4	10.5	5.91	10.2	5.51
8"	13.8	5.08	6.42	5.63	4.02	18.6	11.5	7.10	12.8	6.14
10"	17.7	5.08	6.42	5.63	4.02	20.6	12.5	8.08	15.8	6.14
12"	19.7	5.08	6.42	5.63	4.02	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 (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

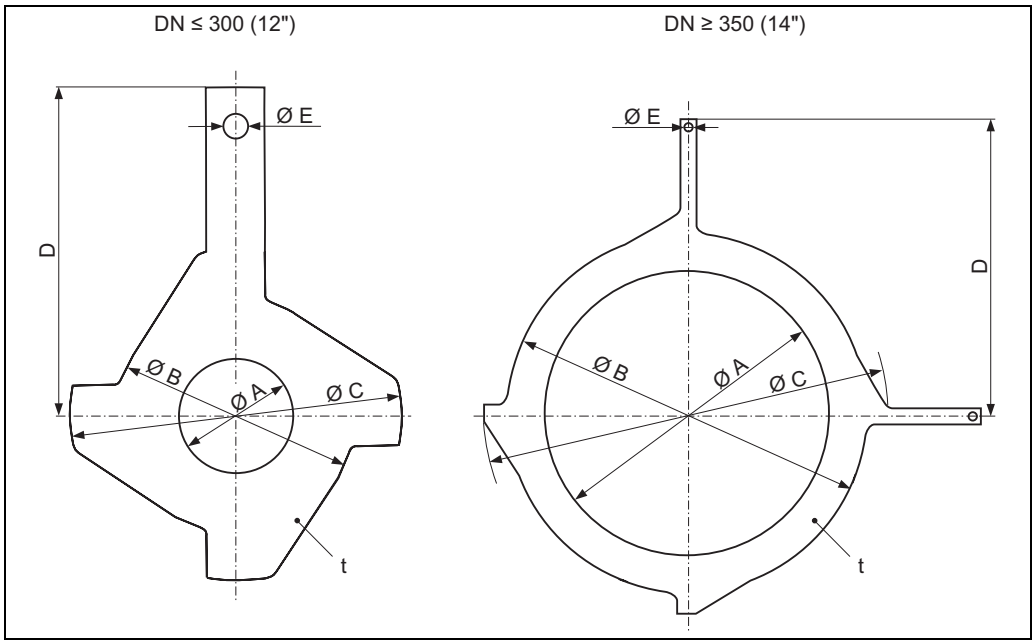
[1] The length is regardless of the pressure rating selected. Fitting length to DVGW.
[2] For flanges to AS, only DN 350, 400, 500 and 600 are available.
All dimensions in [mm]

Dimensions (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 ≤ 24" only to ANSI available, ≥ 28" 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

Nominal 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-mount housing
25	1"	PN 40	7.3	10K	7.3	Class 150	7.3	PN 40	5.3	10K	5.3	Class 150	5.3	6.0
32	–		8.0		7.3		–		6.0		5.3		–	
40	1½"		9.4		8.3		9.4		7.4		6.3		7.4	
50	2"		10.6		9.3		10.6		8.6		7.3		8.6	
65	–	PN 16	12		11.1		–	PN 16	10.0		9.1		–	
80	3"		14		112.5		14.0		12.0		10.5		12.0	
100	4"		16		14.7		16.0		14.0		12.7		14.0	
125	–		21.5		21.0		–		19.5		19.0		–	
150	6"		25.5		24.5		25.5		23.5		22.5		23.5	
200	8"	PN 10	45		41.9		45	PN 10	43		39.9		43	
250	10"		65		69.4		75		63		67.4		73	
300	12"		70		72.3		110		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): 3.4 kg
- Weight data valid for standard pressure ratings and without packaging material.

Weight in US units (only ANSI / AWWA)

Weight data in lbs						
Nominal diameter		Compact version		Remote version (without cable)		
				Sensor		Transmitter
[mm]	[inch]		ANSI /AWWA		ANSI / AWWA	Wall-mount housing
25	1"	Class 150	16.1	Class 150	11.7	13.2
40	1½"		20.7		16.3	
50	2"		23.4		19.0	
80	3"		30.9		26.5	
100	4"		35.3		30.9	
150	6"		56.2		51.8	
200	8"		99.2		94.8	
250	10"		165.4		161.0	
300	12"		242.6		238.1	
350	14"		385.9		381.5	
400	16"		452.0		447.6	
450	18"		562.3		557.9	
500	20"		628.4		624.0	
600	24"		893.0		888.6	
700	28"	Class D	882.0	Class D	877.6	
–	30"		1014.3		1009.9	
800	32"		1212.8		1208.3	
900	36"		1764.0		1759.6	
1000	40"		1984.5		1980.1	
–	42"		2425.5		2421.1	
1200	48"		3087.0		3082.6	
–	54"		4851.0		4846.6	
–	60"		5953.5		5949.1	
–	66"		8158.5		8154.1	
1800	72"		9040.5		9036.1	
–	78"		10143.0		10138.6	

- Transmitter (compact version): 7,5 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	–	–

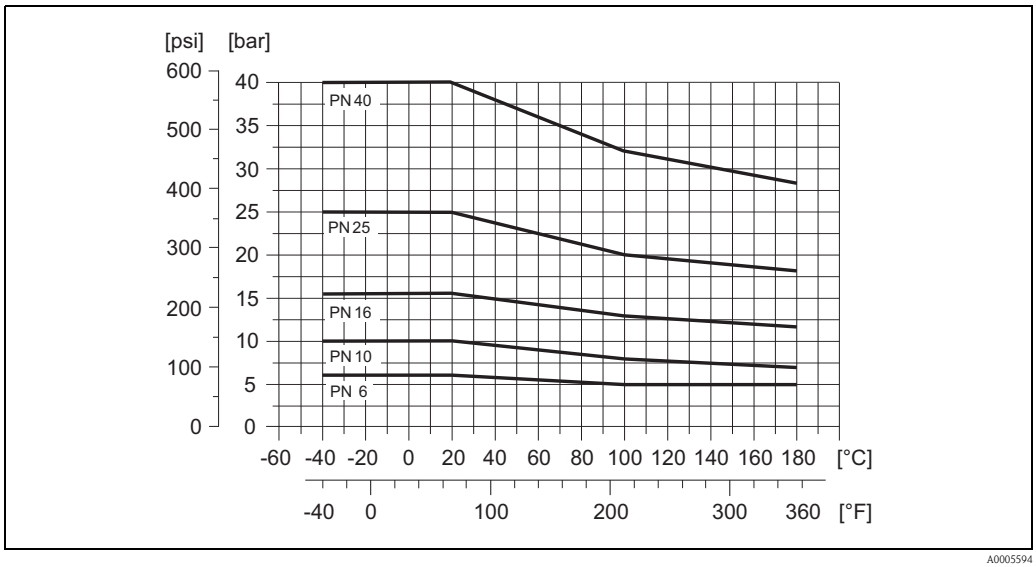
Material

- Transmitter housing
  - Compact housing: powder-coated die-cast aluminum
  - Wall-mount 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; (for flanges made of carbon steel with Al/Zn protective coating)
  - DN ≥ 350 (14"): stainless steel 1.4301 or 1.4306/304L; (for flanges made of carbon steel with Al/Zn protective coating)
- Electrodes: 1.4435, Alloy C-22, Tantalum
- Flanges
  - EN 1092-1 (DIN 2501): 1.4571/316L; RSt37-2 (S235JRG2); C22; FE 410W B (DN ≤ 300 (12"): with Al/Zn protective coating; DN ≥ 350 (14") with protective lacquering)
  - ANSI: A105; F316L (DN ≤ 300 (12"): with Al/Zn protective coating; DN ≥ 350 (14") with protective lacquering)
  - AWWA: 1.0425
  - JIS: RSt37-2 (S235JRG2); HII; 1.0425/316L (DN ≤ 300 (12"): with Al/Zn protective coating; DN ≥ 350 (14") with protective lacquering)
  - AS 2129
    - DN 150 to 300, 600 (6 to 12", 24"): A105 or RSt37-2 (S235JRG2)
    - DN 50, 80, 100, 350, 400, 500 (2", 3", 4", 14", 16", 20"): A105 or St44-2 (S275JR)
  - AS 4087: A105 or St44-2 (S275JR)
- Seals: to DIN EN 1514-1
- Ground disks: 1.4435/316L, Alloy C-22, Tantalum

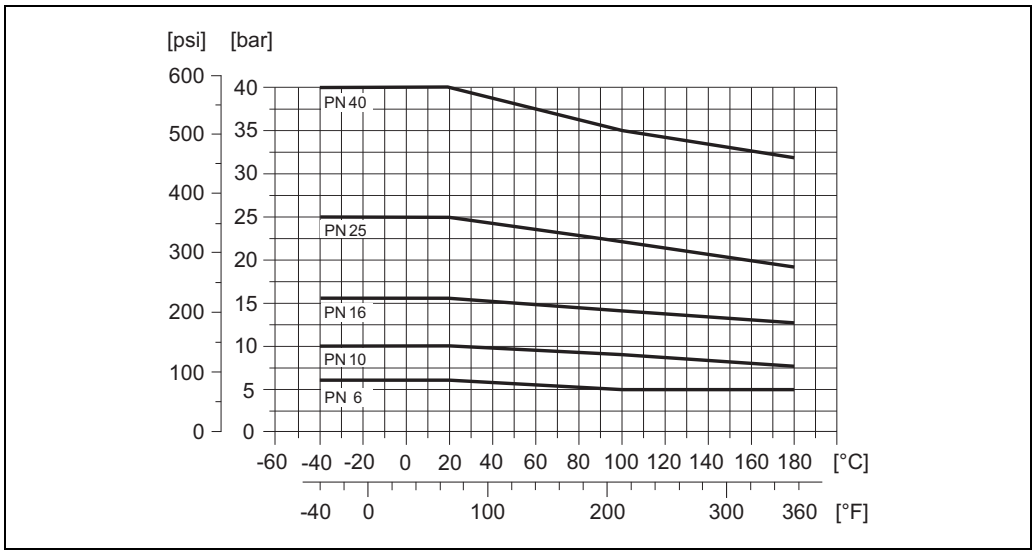
Material load diagram

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 (→ 21).

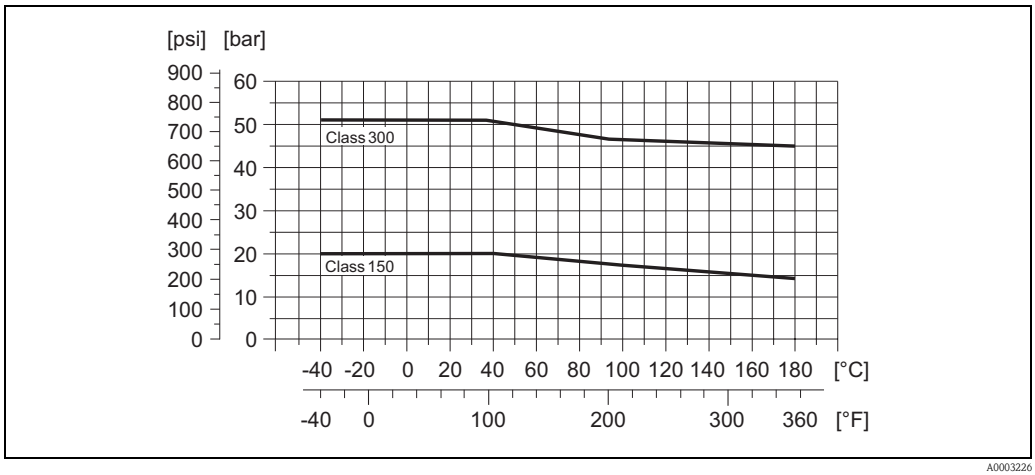
Flange connection to EN 1092-1 (DIN 2501)
Material: RSt37-2 (S235JRG2) / C22 / Fe 410W B



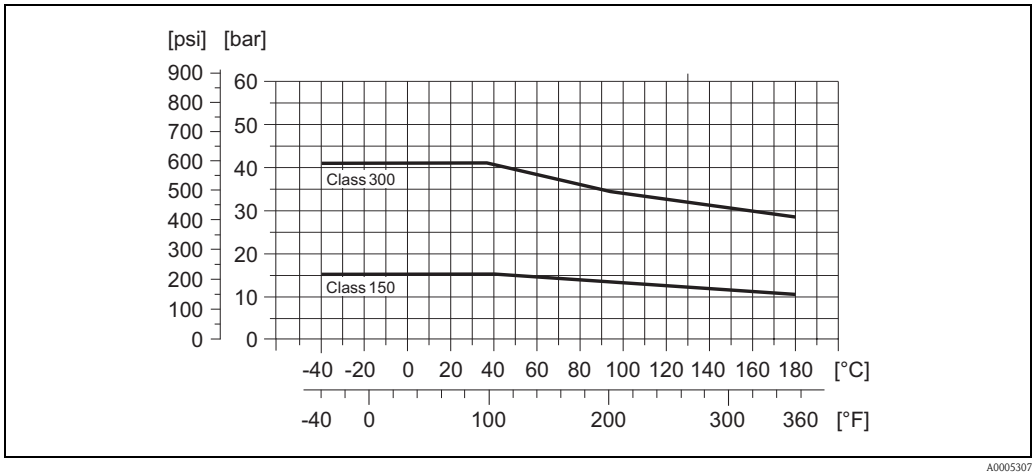
Flange connection to EN 1092-1 (DIN 2501)
Material: 316L / 1.4571



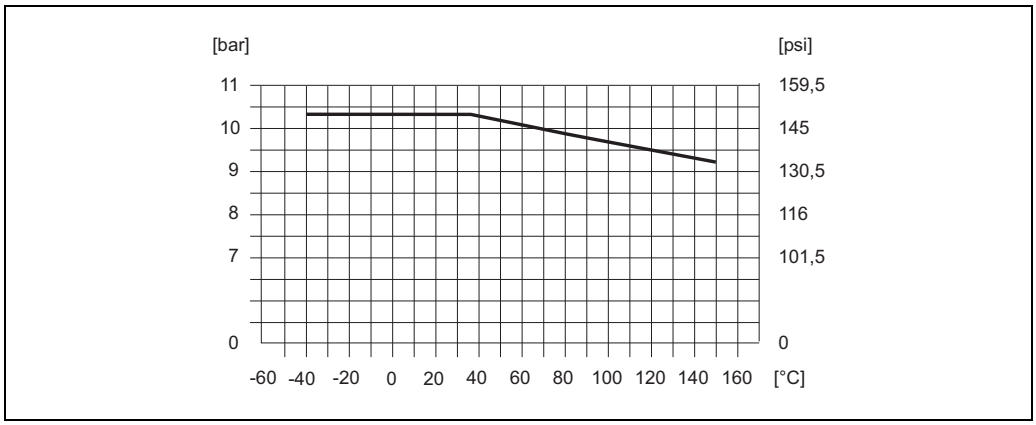
Flange connection to ANSI B16.5
Material: A 105



Flange connection to ANSI B16.5
Material: F316L

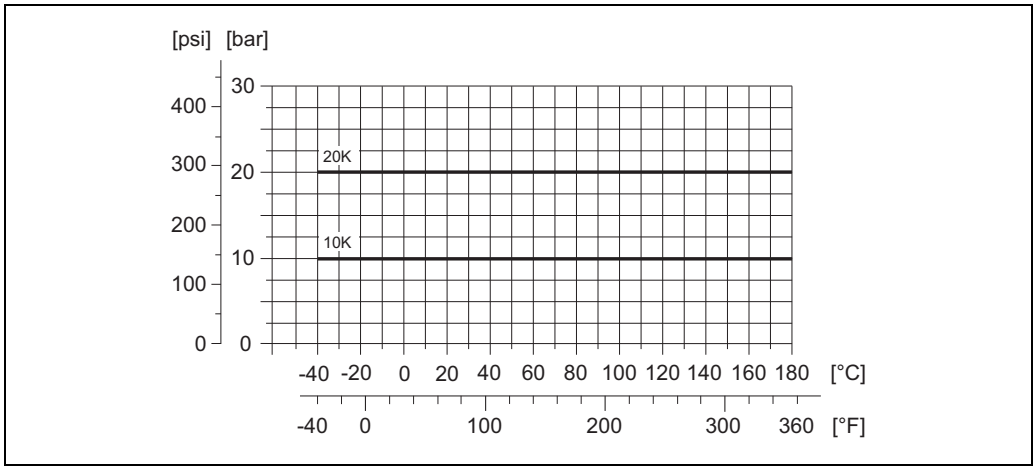


Flange connection to AWWA C 207, Class D
Material: 1.0425



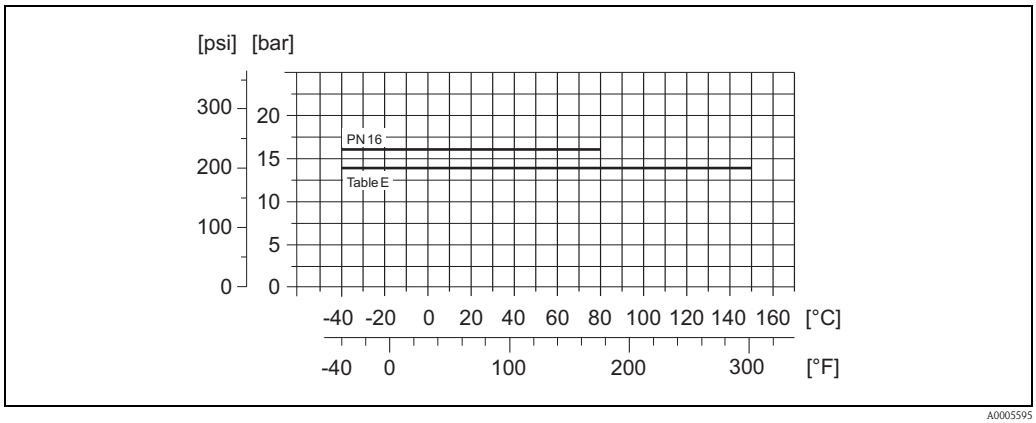
A0005592

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



A0003228

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



A0005595

Fitted electrodes

Measuring electrodes, reference electrodes and empty pipe detection electrodes:
- Standard available with 1.4435, Alloy C-22, tantalum
- Optional: exchangeable measuring electrodes made of 1.4435 (DN 350 to 2000 / 14 to 78")

Process connections

Flange connection:
- EN 1092-1 (DIN 2501), DN ≤ 300 (12") form A, DN ≥ 350 (14") form B
  (Dimensions to DIN 2501, DN 65 PN 16 and DN 600 (24") PN 16 exclusively to EN 1092-1)
- ANSI B16.5
- AWWA C 207, Class D
- JIS B2220
- AS 2129 Table E
- AS 4087 PN 16

Surface roughness

- Elektroden
  – 1.4435, Alloy C-22, tantal: ≤ 0.3 to 0.5 µm (≤ 11.8 to 19.7 µin)

(all data refer to parts in contact with medium)

Human interface

Display elements

- Liquid crystal display: backlit, two lines (Promag 50) or four lines (Promag 53) with 16 characters per line
- Custom configurations for presenting different measured-value and status variables
- Totalizer
  - Promag 50: 2 totalizers
  - Promag 53: 3 totalizers

Operating elements

Unified operation concept for both types of transmitter:

Promag 50:
- Local operation via three keys (−, +, E)
- Quick Setup menus for straightforward commissioning

Promag 53:
- Local operation via three keys (−, +, E)
- Application-specific Quick Setup menus for straightforward commissioning

Language groups

Language groups available for operation in different countries:

Promag 50, Promag 53:
- Western Europe and America (WEA):
  English, German, Spanish, Italian, French, Dutch, Portuguese
- Eastern Europe and Scandinavia (EES):
  English, Russian, Polish, Norwegian, Finnish, Swedish, Czech
- South and east Asia (SEA):
  English, Japanese, Indonesian

Promag 53:
- China (CN):
  English, Chinese

You can change the language group via the operating program "FieldCare".

Remote operation

- Promag 50: Remote control via HART, PROFIBUS DP/PA
- Promag 53: Remote control via HART, PROFIBUS DP/PA, MODBUS RS485, FOUNDATION Fieldbus

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)".

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.

Ex approval

Information about currently available Ex versions (ATEX, IECEx, FM, CSA, NEPSI) 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
  Degrees of protection by housing (IP code)
- EN 61010
  Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures.
- IEC/EN 61326
  “Emission in accordance with requirements for Class A”.
  Electromagnetic compatibility (EMC requirements)
- NAMUR NE 21:
  Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment.
- NAMUR NE 43:
  Standardization of the signal level for the breakdown information of digital transmitters with analog output signal.
- NAMUR NE 53:
  Software of field devices and signal-processing devices with digital electronics.
- ANSI/ISA-S82.01
  Safety Standard for Electrical and Electronic Test, Measuring, Controlling and related Equipment - General Requirements Pollution degree 2, Installation Category II.
- CAN/CSA-C22.2 No. 1010.1-92
  Safety requirements for Electrical Equipment for Measurement and Control and Laboratory Use. Pollution degree 2, Installation Category II

FOUNDATION Fieldbus certification

The flow device has successfully passed all the test procedures carried out and is certified and registered by the Fieldbus Foundation. The device thus meets all the requirements of the following specifications:

- Certified to FOUNDATION Fieldbus Specification
- The device meets all the specifications of the FOUNDATION Fieldbus H1.
- Interoperability Test Kit (ITK), revision status 5.01 (device certification number: on request)
- The device can also be operated with certified devices of other manufacturers
- Physical Layer Conformance Test of the Fieldbus Foundation

MODBUS RS485 certification

The measuring device meets all the requirements of the MODBUS/TCP conformity test and has the “MODBUS/TCP Conformance Test Policy, Version 2.0”. The measuring device has successfully passed all the test procedures carried out and is certified by the “MODBUS/TCP Conformance Test Laboratory” of the University of Michigan.

PROFIBUS DP/PA certification

The flow device has successfully passed all the test procedures carried out and is certified and registered by the PNO (PROFIBUS User Organisation). The device thus meets all the requirements of the following specifications:

- Certified to PROFIBUS PA, profile version 3.0 (device certification number: on request)
- The device can also be operated with certified devices of other manufacturers (interoperability)

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

- Flow Measurement (FA005D/06)
- Operating Instructions Promag Promag 50 (BA046D/06 and BA049D/06)
- Operating Instructions Promag Promag 50 PROFIBUS PA (BA055D/06 and BA056D/06)
- Operating Instructions Promag Promag 53 (BA047D/06 and BA048D/06)
- Operating Instructions Promag Promag 53 FOUNDATION Fieldbus (BA051D/06 and BA052D/06)
- Operating Instructions Promag Promag 53 MODBUS RS485 (BA117D/06 and BA118D/06)
- Operating Instructions Promag Promag 53 PROFIBUS DP/PA (BA053D/06 and BA054D/06)
- Supplementary documentation on Ex-ratings: ATEX, IECEx, FM, CSA, NEPSI

Registered trademarks

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

PROFIBUS®
Registered trademark of the PROFIBUS Nutzerorganisation e.V., Karlsruhe, D

FOUNDATION™ Fieldbus
Registered trademark of the Fieldbus Foundation, Austin, USA

MODBUS®
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Endress+Hauser

People for Process Automation

TI046D/06/en/11.09
71106269
FM+SGML6.0 ProMoDo

Appendix B – Pump manual

USER MANUAL

Submersible Pump System

Aline

PUMPING WITH INNOVATION

INSTALLATION, CARE AND MAINTENANCE OF YOUR

ALINE

SUBMERSIBLE PUMP

THIS SECTION CONTAINS IMPORTANT SAFETY AND WARRANTY INFORMATION ABOUT YOUR PUMP. PLEASE READ IT CAREFULLY BEFORE INSTALLATION OR OPERATION. PLEASE ALSO ENSURE THAT ALL RELEVANT PARTIES RECEIVE A COPY.

WARNING

1. Only qualified and competent tradespeople should attempt installation or other work on your Aline submersible pump and its associated equipment.

2. All necessary care should be taken to avoid electric shock. Do not work on or touch your electric submersible pump, or anything in electrical contact with it (e.g. water in pit), unless the system has first been electrically isolated.

3. Do not enter pit without all necessary safety equipment for confined spaces.

4. Do not leave open pit unattended or unbarricaded.

5. Incorrect operation or application of you Aline submersible pump could cause personal injury or damage to the pump.

TAKING DELIVERY OF YOUR ALINE SUBMERSIBLE PUMP

1. PLEASE ENSURE ALL PARTS ORDERED/REQUESTED HAVE BEEN DELIVERED AND DELIVERY PAPERWORK AND INSTRUCTION MANUALS ARE COMPLETE.

2. INSPECT PUMPS AND EQUIPMENT FOR ANY SIGNS OF DAMAGE.

3. TAKE NOTICE OF ANY WARNING STICKERS/LABELS.

STORAGE

1. STORE YOUR EQUIPMENT SECURELY IN AN AREA PROTECTED FROM DAMAGE BY VANDALS, WEATHER, OR OTHER CONSTRUCTION PERSONS OR EQUIPMENT.

2. AVOID LONG-TERM STORAGE OF THE PUMPS IN THE PIT DURING CONSTRUCTION PERIOD OR PRIOR TO COMMISSIONING.

3. **DO NOT ALLOW ELECTRICAL LEADS TO BECOME IMMERSED IN WATER**.

INSTALLATION

THE INSTALLATION OF YOUR ALINE PUMPING EQUIPMENT MUST ONLY BE CARRIED OUT BY SUITABLY QUALIFIED AND COMPETENT TRADESPERSONS.

BEFORE BEGINNING INSTALLATION PROCEDURES, THESE INSTALLATION AND OPERATING INSTRUCTIONS SHOULD BE STUDIED CAREFULLY. THE INSTALLATION SHOULD ALSO BE IN ACCORDANCE WITH LOCAL REGULATIONS AND ACCEPTED CODES OF GOOD PRACTICE.

PITS AND TANKS

For tanks and pits supplied as part of your Aline package, please refer to the Aline Packaged Pump Station manual supplied.

In general, the pit should be dimensioned according to the relation between the water flow into the pit and the pump capacity. Also, consideration should be made of physical dimensions of the pump and enough room allowed for any control gear; float switches etc., to operate freely when determining both the pit depth and area.

The pit walls, floor and ceiling must be constructed of a suitably solid material or designed to prevent silt, mud, rock or other foreign objects from entering the pit.

Pit lids and grates must also be designed to prevent entry of silt, mud, rocks or other foreign objects.

Be sure to provide adequate access to the pumps and their associated valves etc.

Pits with sealed or gas-tight lids must be adequately vented by a dedicated vent pipe direct to the tank.

PUMP POSITIONING

The pump should be mounted on a firm solid surface away from inlet pipes etc., and if possible, elevated by 100mm from the base of the pit. Do not hang pump from discharge pipework, lifting chain or electrical cable.

Secure the pump with a lifting chain or other suitable means to the top of the pit at the manhole to prevent pump from tipping over or "walking" on the pit floor and to provide a means of lifting the pump out of the pit. **N.B. The pump should never be lifted by the electrical cable.**

Allow enough free cable in pit to enable pump to be lifted out of the manhole without electrical disconnection. This free cable should be coiled neatly and attached to the lifting chain at the top of the pit.

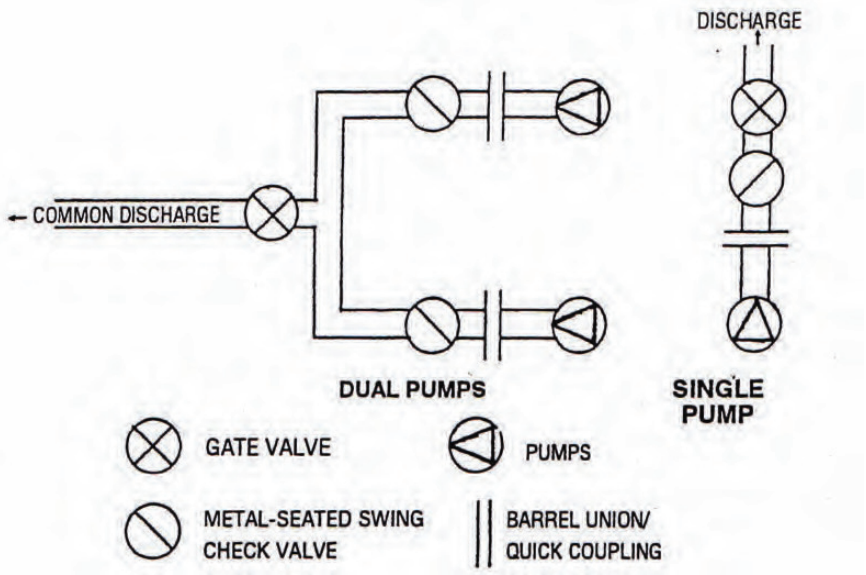
N.B. The pit should be cleaned totally of silt, mud and other foreign objects prior to pump installation and be kept clean following this (see **Care and Maintenance**).

PIPEWORK

Rigid PVC pipework (minimum Class 9 pressure pipe) should be used in preference to flexible hose. Non pressure-rated pipe or hose should not be used.

An isolating valve must be provided in the common discharge line and a metal-seated swing check valve and barrel union/quick coupling must be provided on each individual pump discharge line before connection to the common discharge line (see **Figure [i]**).

Figure [i]

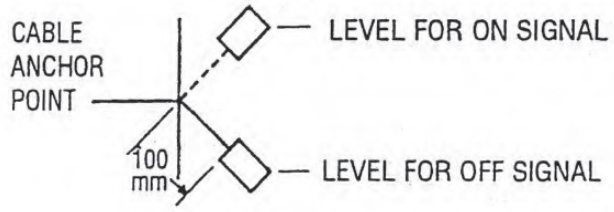


The valves and unions must be located as close as practical to the top of the pit at the manhole.
Pipe size should generally be calculated by system flow rate and length of run employing accepted methods and principles. However, pipework should be at least the same size as pump discharge connection.

PUMP CONTROLS

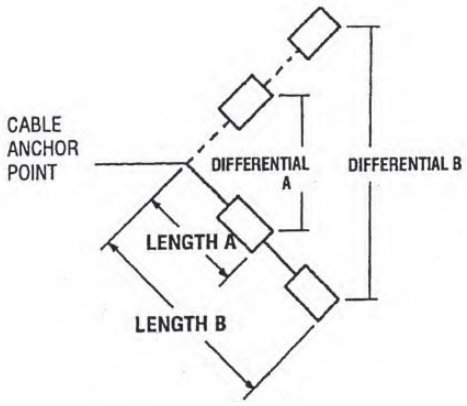
GENERAL:
Care should be taken to ensure that the adjustment of the float level controls is correct. Cycling (excessive starting and stopping) and dry-running void warranty.
FLOAT SWITCH TYPES:
Differential: These float switches operate when tilted at approximately 45° up or down. They can be used as direct on-line controls for single phase up to 10 amps or as signal controls.
For use as signal controls, differential floats should be anchored approximately 100mm from the float head as shown in **Figure [ii]**.

Figure [ii]



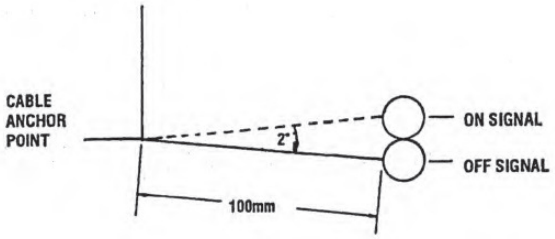
Be careful to position the float switch according to whether it is to provide an "On" signal or an "Off" signal. For use as direct on-line or differential control, the length of cable from the head to the anchor point determines the depth of the differential (see **Figure [iii]**).

Figure [iii]



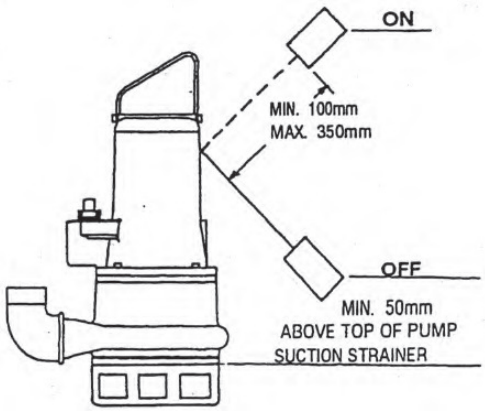
Ensure that the float will not tangle on any other equipment in the pit.
Some differential floats may have provision for normally closed operation or normally open operation. Read manufacturer's literature or test with a continuity tester to determine this.
****Ensure that all unused active conductors are terminated safely****
CR Type: These float switches are only used as signal controls. They work on a differential of 2° and therefore should be anchored at the position of the required signal (see **Figure [iv]**).

Figure [iv]



Single Pump Integrated Float Switch: Ensure that the float switch cable is attached to the pump by the clip/bracket provided. The float switch should be adjusted as per the manufacturer's specification. However, a standard arrangement is shown in **Figure [v]** as a guide.

Figure [v]



Single Pump, Separate Float Switch: The float switch should be free to move as for integrated float switch and adjusted similarly with the addition that, where a mounting clip/bracket is not provided, the float switch cable should be anchored securely by cable tie or similar at the pivot point to the discharge pipework, body of the pump or other similar suitable anchoring point. Consideration should be made for the ease of removal of the float switch from the pit for inspection in the case of the pit flooding. Excess cable should be coiled neatly and attached to a suitable point at the manhole.

DUAL PUMP KITS:

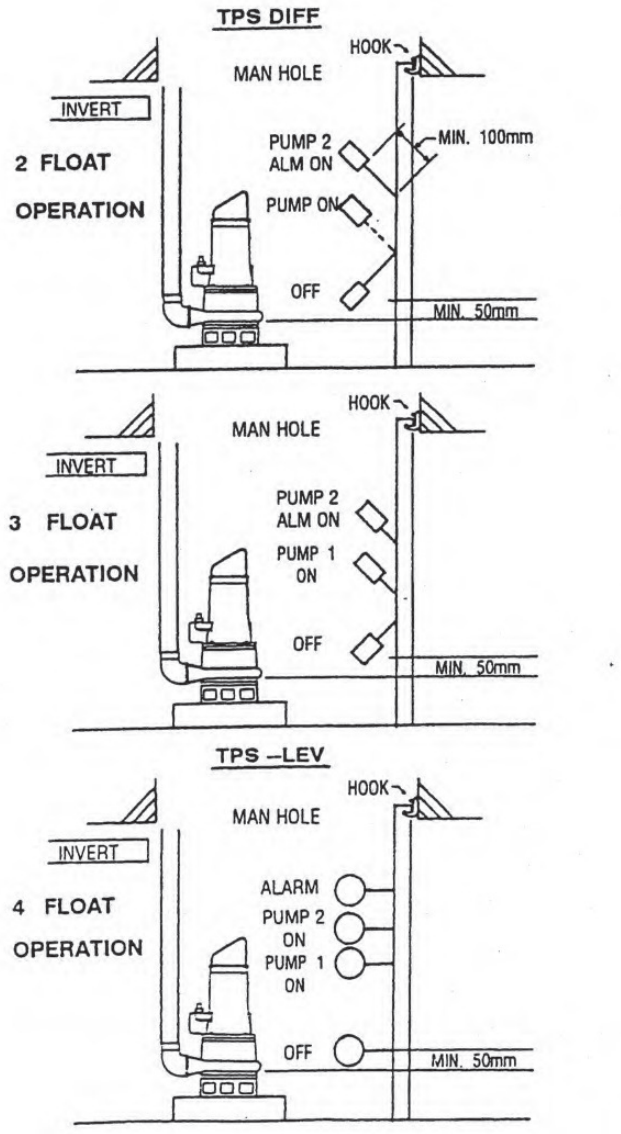
For installers supplying their own control gear or connecting pumps to original control gear;
It is your own responsibility to ensure that the control gear is suitably set up to protect the pumps from cycling and dry-running.

Generally, dual pump kits supplied with Aline standard control gear are provided complete with float switches mounted in a conduit or bracket manufactured to the approximate dimensions supplied. This float set should be checked for accuracy of dimensions and float switch adjustment and adjusted as necessary (see **Figure [vi]**).

Mount the conduit on a hook or similar bracket at the manhole ensuring that the conduit is held securely but is easily removable from the pit as a complete unit for maintenance. Be careful to position the float set away from obstructions to allow free movement of the float switches. Allow enough loose cable in the pit for the float set to be completely removed from the pit manhole. Coil this neatly and attach at the manhole.

Warning: Do not allow the liquid level to drop below the suction inlet of the pump. Dry-running voids Warranty.

Figure [vi]



ELECTRICAL CONNECTION

ELECTRICAL WORK MUST ONLY BE PERFORMED BY QUALIFIED AND COMPETENT PERSONNEL.
ELECTRICAL CONNECTION SHOULD BE CARRIED OUT IN ACCORDANCE WITH LOCAL REGULATIONS.
READ ALL WIRING DIAGRAMS AND INSTRUCTION SHEETS SUPPLIED BEFORE ATTEMPTING ELECTRICAL CONNECTION. IF IN DOUBT, CONTACT ALINE FOR ADVICE AND COPIES OF WIRING DIAGRAMS OR INSTRUCTION SHEETS.

SUPPLY: Ensure available power supply complies with electrical data on pump and control panel nameplates.
Power should be supplied via a main isolating switch. If the pump is not installed close to the switch it must be of a lockable type.
Three-phase pumps must be connected through a hand-resettable thermal overload (generally incorporated into standard Aline control panels).
It is advisable for single-phase pumps to also be supplied via a hand-resettable thermal overload.
All internally fitted thermal overloads and thermistors must be connected as per manufacturer's' instructions.
A clearly-marked dedicated circuit of an adequate capacity must be used. Pay careful attention to voltage drop regulations.
CONTROL PANELS: Connection to control panels must be made as per instruction sheets and wiring diagrams supplied. Generally float switch cables supplied in conduit as a set are marked by tags on the end of the cable.
All unused wires are to be terminated in insulated connectors.
Mount control panels in a vibration-free position as close as practical to the pit. Allow at least 1m x 1m clear-standing space in front of control panel and position well away from possible damage by vehicles/machinery etc.
Thermal overloads fitted should be adjusted to full load amps noted on pump nameplate.
For three-phase pumps, check direction of rotation. Correct rotation is clockwise, looking down on top of pump. Swap any two phases to change rotation. To visually inspect direction of impeller rotation, it may be necessary to remove the suction strainer.
Keep clear of unprotected impeller.
CONDUITS: All wiring from control panel to pit must be in approved conduit or trunking.
Conduits from pit to control panel must be adequately sized with a minimum amount of bends to allow easy insertion/withdrawal of wires. Minimum 2 x 32mm or 1 x 50mm conduit with long radius bends is standard procedure for dual systems to 1.5kw.
All conduits entering control panel must be sealed internally with silicon or similar to prevent ingress of moisture or fumes from pit.
CABLES: DO NOT ALLOW CABLE ENDS TO BE SUBMERSED.
Joints in cables must be made by an approved submersible splice. Only extend cables with cable of equal or greater submersion rating and current carrying capacity.
Leave enough slack cable in pit to allow easy and complete removal of equipment from pit. Ensure that this loose cable is secured at the pit manhole to prevent float switch fouling or entry into pump impeller.

COMMISSIONING

A commissioning service is offered by Aline and its agents for systems installed in specified areas. This may or may not have been included in the price of the system. Please read your quotation carefully to determine this.

A Commissioning Application Form must be filled out and returned to Aline three days prior to commissioning (see Annexure A). Extra charges for commissioning will be made for installations not conforming with this booklet.

GENERAL COMMISSIONING PROCEDURE

1. Double-check all aspects and details covered by this booklet.
2. Check all electrical connections are complete and correct.
3. Check adequacy of power supply. Switch on all isolating switches.
4. Double-check pump rotation (three-phase only).
5. Check amp draw of motors. Compare to pump nameplate details
6. Ensure pit is clear of silt, mud, building debris and other foreign objects.
7. Double-check thermal overload setting.
8. Run through complete system operation ensuring that the pumps switch off before running dry or sucking air.
9. Return all selector switches to Auto position.

OPERATION

In general, with correct control settings, your Aline submersible pump system should operate automatically.

Do not allow anything to enter the system pipework or pit which the pump is not designed to pump.

STORMWATER/SUBSOIL DRAINAGE PUMPS

Unless otherwise specified in writing, these pumps are only designed to pump slightly silty water - not leaves, twigs, large quantities of mud, gravel or other foreign objects.

SEWAGE PUMPS

These pumps are only designed to pump liquids and soft solids classified as normal sewage. Under no circumstances should articles of clothing, sanitary items, rags or other foreign objects be allowed to enter the system pipework or pit.

Make sure regular maintenance is carried out on the entire system.

TROUBLE-SHOOTING GUIDE

Pump Motor does not run

1. Water level in pit below off float level.
2. Power failure - check isolating switches and circuit breakers or fuses.
3. Thermal motor protection set too low - adjust and reset.
4. Loose terminal connection.
5. Float Switch movement obstructed.

Motor trips circuit breakers or thermal overload after short time of operation

1. Temperature of pumped liquid too high.
2. Impeller jammed or partly jammed by foreign objects.
3. Phase failure.
4. Voltage too low.
5. Thermal overload set too low.
6. Impeller corroded to cover plate from lack of use or moisture entry during storage.

Pump runs but does not pump

1. Gate valve closed.
2. Suction strainer or discharge line blocked.
3. Pump too small for application.
4. Incorrect direction of rotation.
5. Air lock in pump - check that pump does not suck air before switching off. Vent discharge line below check valve.

Pump will not switch off after emptying tank

1. Off float switch adjusted too low.
2. Incorrect wiring.
3. Float switch fused.
4. Off float switch movement obstructed.

Repeat banging sound after pump switches off or tank continues emptying after pump switches off

1. Discharge line syphoning - check that discharge point is not lower than pump.

CARE AND MAINTENANCE

ONLY QUALIFIED AND COMPETENT PERSONNEL SHOULD ATTEMPT TO CARRY OUT MAINTENANCE WORKS ON YOUR SUBMERSIBLE PUMP SYSTEM.

Installation conditions will determine regularity of maintenance intervals. However, all installations should be serviced once every six months. More regular servicing is required for applications where there are abrasive particles in the water, excessive silt or debris entering the pit, or where the pumps are subject to heavy usage.

It is a good idea to keep a close eye on you newly-installed system until the time of the first maintenance service, to determine if more regular servicing is required.
Particular care should be taken to keep the pit clean while construction works are in progress.
MAINTENANCE SCHEDULE: Additional to any requirements in manufacturer's manual -

1. Be careful to avoid electric shock. Isolate pumps and controls before starting work.
2. Check external conditions of pumps and control gear.
3. Check pumps for wear.
4. Check condition of electrical equipment.
5. Check pit for sludge built-up/presence of foreign objects - remove if necessary.
6. Check that pump cables are securely tied up and that float switch movement is not obstructed.
7. Check system operation.

WARRANTY

Your Aline Submersible Pump and associated fittings and equipment supplied by Aline Pumps are guaranteed to be free from defects in material or workmanship for a period of twelve months from the purchase date, as per our **Terms & Conditions of Sale**. This does not cover incorrect installation or application, or any other circumstances beyond the control of Aline Pumps. Nor are any consequential damages covered.

The Aline **Warranty** is only redeemable to the original purchaser of the equipment unless authorised otherwise by our service staff and covers only parts and labour associated with repair of the defective item in our workshop; i.e. labour or parts associated with travel to site or removal of pumps from pits is not covered. This is particularly applicable to units installed incorrectly.

Serial No. or Invoice No. must be supplied with all Warranty claims.

Freight and insurance for all goods returned for Warranty inspection must be prepaid.
Installation, application or operation not in compliance with this booklet or any other information supplied, either verbally or in writing, immediately voids this **Warranty**.

Aline reserves the right to inspect any Warranty claim before authorising rectification work to be carried out under Warranty. Any item not directly manufactured or imported by Aline is subject to all warranty conditions of the respective manufacturer or importer and, in most cases, requires inspection by the manufacturer or importer.

Failure to carry out proper maintenance works at suitably regular intervals voids this **Warranty**.
This **Warranty** does not cover any pump installed in any situation for which it is not specified in writing unless the pump has been supplied to a written specification.

userguide

sewagepumpingsystem

Use and Care

The Aline Pump Station is designed to handle routine and domestic sewage. Solid waste materials should not enter the Sewage Pumping System.
Regulatory agencies advise that the following items should ***NEVER*** be introduced into any sewer, either directly or through a kitchen waste disposal.

- Glass
- Metal
- Nappies
- Socks, rags or cloth
- Plastic objects (eg: toys, utensils etc)
- Sanitary napkins or tampons or similar products

In addition you must ***NEVER*** introduce into any sewer:

- Explosives
- Flammable material
- Lubricating Oil and/or Grease
- Chemicals
- Gasoline

The presence of any of the above materials in the system may lead to pump faults and/or failure.

Power failure

Your sewage pump cannot dispose of waste water or provide an alarm signal without electrical power. If electrical power service is interrupted, keep water usage to a minimum.

industrial pumps and equipment
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PUMPING WITH INNOVATION

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DP 10, 0.9-2.6 kW
EF 30, 0.6-1.5 kW

Installation and operating instructions

GB D F I E P GR NL S FIN DK
PL RU H SI HR SER BG CZ SK TR LT
LV

DP 10, 0.9-2.6 kW
EF 30, 0.6-1.5 kW

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Original installation and operating instructions.

GB

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Warning

Prior to installation, read these installation and operating instructions. Installation and operation must comply with local regulations and accepted codes of good practice.

Warning

The use of this product requires experience with and knowledge of the product.
Persons with reduced physical, sensory or mental capabilities must not use this product, unless they are under supervision or have been instructed in the use of the product by a person responsible for their safety.
Children must not use or play with this product.

1. Symbols used in this document

Warning

If these safety instructions are not observed, it may result in personal injury!

Warning

If these instructions are not observed, it may lead to electric shock with consequent risk of serious personal injury or death.

Warning

These instructions must be observed for explosion-proof pumps. It is advisable also to follow these instructions for standard pumps.

Caution ***If these safety instructions are not observed, it may result in malfunction or damage to the equipment!***

Note ***Notes or instructions that make the job easier and ensure safe operation.***

2. General description

This booklet includes instructions for installation, operation and maintenance of Grundfos DP and EF submersible drainage and effluent pumps with motors of 0.6 to 2.6 kW. Grundfos DP and EF drainage and effluent pumps are portable and designed for pumping domestic and industrial drainage and effluent.

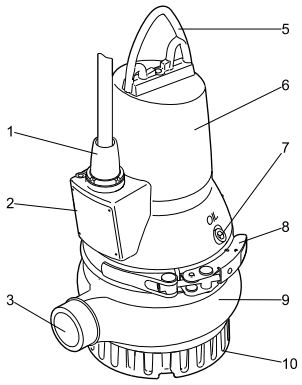
Two types of pumps are available:

- DP 10.50 and DP 10.65 drainage pumps with semi-open type of impeller
- EF 30.50 effluent pump with semi-open type of impeller.

The pumps are designed for free-standing installation. DP 10.65.26 pumps can be installed on an auto-coupling system.

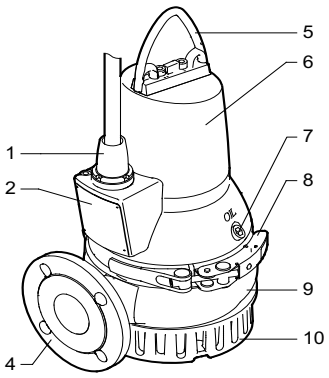
The pumps can be controlled via the Grundfos LC, LCD 107, LC, LCD 108, LC, LCD 110 pump controllers or the Grundfos CU 100 control box. See installation and operating instructions for the selected controller.

2.1 Product drawings



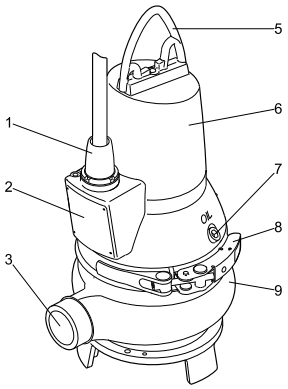
TM02 7339 3009

Fig. 1 DP 10.50 pump



TM02 7340 3203

Fig. 2 DP 10.65 pump



TM02 7341 3009

Fig. 3 EF 30.50 pump

Explanation to figures 1, 2 and 3:

Pos.	Description
1	Cable plug
2	Nameplate
3	Discharge port Rp 2
4	Discharge flange DN 65, PN 10
5	Lifting bracket
6	Stator housing
7	Oil screw
8	Clamp
9	Pump housing
10	Suction strainer (DP pumps only)

2.2 Applications

DP 10 pumps are designed for pumping these liquids:

- drainage and surface water
- groundwater
- industrial process water without solids or fibres.

EF 30 pumps are designed for pumping these liquids:

- drainage and surface water with small impurities
- effluent with fibres, e.g. from laundries
- effluent without discharge from toilets
- effluent from commercial buildings without discharge from toilets.

The compact design makes the pumps suitable for both temporary and permanent installation.

2.3 Operating conditions

The DP and EF pumps are designed for intermittent operation (S3). When completely submerged, the pumps can also operate continuously (S1).
See *9.2 Operating modes*.

The Grundfos EF pumps are suitable for pumping effluent and other liquids with solids up to 30 mm.

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Installation depth

Maximum 10 metres below liquid level.

Operating pressure

Maximum: 6 bar.

Intermittent operation

Maximum 20 starts per hour.

pH value

DP and EF pumps in permanent installations can be used for pumping liquids with a pH value between 4 and 10.

Liquid temperature

0 °C to + 40 °C.

For short periods (maximum 15 minutes) a temperature of up to +60 °C is permissible (non-Ex versions only).

Warning

Explosion-proof pumps must never pump liquids with a temperature higher than +40 °C.

Density and viscosity of pumped liquid

When pumping liquids with a density and/or a kinematic viscosity higher than that of water, use motors with correspondingly higher outputs.

3. Delivery and handling

The pump may be transported and stored in a vertical or horizontal position. Make sure that it cannot roll or fall over.

3.1 Transportation

All lifting equipment must be rated for the purpose and checked for damage before any attempts to lift the pump. The lifting equipment rating must under no circumstances be exceeded. The pump weight is stated on the pump nameplate.

Warning

Always lift the pump by its lifting bracket or by means of a fork-lift truck if the pump is fixed on a pallet.
Never lift the pump by means of the motor cable or the hose/pipe.

The polyurethane-embedded plug prevents water from penetrating into the motor via the motor cable.

3.2 Storage

During long periods of storage, the pump must be protected against moisture and heat.

After a long period of storage, the pump should be inspected before it is put into operation. Make sure that the impeller can rotate freely. Pay special attention to the the condition of the shaft seals and the cable entry.

4. Identification

4.1 Nameplate

The nameplate states the operating data and approvals applying to the pump. The nameplate is fixed with rivets to the side of the motor housing close to the cable entry.

Fix the additional nameplate supplied with the pump close to the tank.

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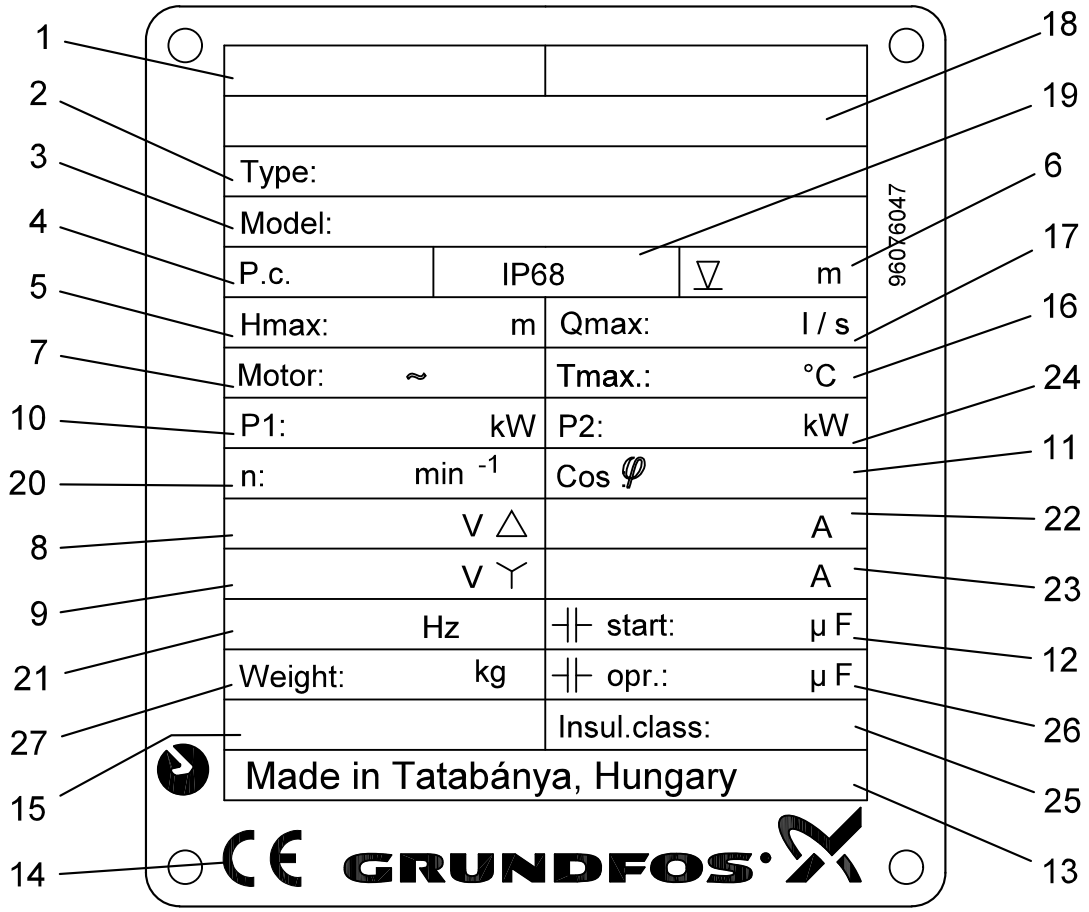

Fig. 4 Nameplate

Pos.	Description	Pos.	Description
1	Ex mark	15	EN approval
2	Type designation	16	Maximum liquid temperature
3	Product number	17	Maximum flow rate
4	Production code (year/week)	18	Explosion protection
5	Maximum head	19	Enclosure class to IEC
6	Maximum installation depth	20	Rated speed
7	Number of phases	21	Frequency
8	Rated voltage, Δ	22	Rated current, Δ
9	Rated voltage, Y	23	Rated current, Y
10	Rated power input	24	Shaft power
11	Power factor	25	Insulation class
12	Starting capacitor	26	Run capacitor
13	Country of production	27	Weight without cable
14	CE mark		

4.2 Type Key

Please note that not all combination options are available.

GB

Code	Example	DP	10	.50	.15		.EX	.2	.1	.5	02		

Type range
DP Grundfos drainage pump
EF Grundfos effluent pump

Pump passage
10 Maximum solids size [mm]

Pump discharge
50 Nominal diameter of pump discharge port [mm]

Output power, P2
15 P2 = Code number from type designation/10 [kW]

Equipment
[ ] Standard (without equipment)
A Pump equipped with a control box CU 100

Ex version
[ ] Standard version of submersible drainage pumps
Ex Pump designed to the ATEX standard indicated or Australian standard, AS 2430.1

Number of poles
2 2-pole, 3000 min^{-1}, 50 Hz

Number of phases
1 Single-phase motor
[ ] Three-phase motor

Mains frequency
5 50 Hz

Voltage and starting method
02 230 V, DOL
0B 400-415 V, DOL
0C 230-240 V, DOL

Generation
[ ] 1st generation
A 2nd generation
B 3rd generation, etc
The pumps belonging to the individual generations differ in design but are similar in terms of power rating.

Material in pump
[ ] Standard material in pump

5. Approvals

The standard version of DP and EF pumps has been tested by VDE, and the explosion-proof version approved by KEMA according to the ATEX directive.

5.1 Approval standards

The standard variants are approved by LGA (notified body under the Construction Products Directive) according to EN 12050-1 or EN 12050-2 as specified on the pump nameplate.

5.2 Explanation to the Ex approval

The explosion protection classification of the pump is CE 0344 Ⓔx II 2 G Ex d IIB T4 X.

Directive/ standard	Code		Description
ATEX	CE 0344	=	CE marking of conformity according to the ATEX directive 94/9/EC, Annex X. 0344 is the number of the notified body which has certified the quality system for ATEX.
	Ⓔx	=	Marking of explosion protection
	II	=	Equipment group according to the ATEX directive, Annex II, point 2.2, defining the requirements applicable to the equipment in this group
	2	=	Equipment category according to the ATEX directive, Annex II, point 2.2, defining the requirements applicable to the equipment in this category
	G	=	Explosive atmospheres caused by gases, vapours or mists
Harmonized European standard EN 60079-0	Ex	=	The equipment conforms to harmonized European standard
	d	=	Flame-proof enclosure according to EN 60079-1: 2007
	II	=	Suitable for use in explosive atmospheres (not mines)
	B	=	Classification of gases, see EN 60079-0: 2006, Annex A. Gas group B includes gas group A.
	T4	=	Maximum surface temperature is 135 °C
	X	=	The letter X in the certificate number indicates that the equipment is subject to special conditions for safe use. The conditions are mentioned in the certificate and the installation and operating instructions.

5.2.1 Australia

Ex variants for Australia are approved as Ex nC II T3 X according to IEC 79-15 (corresponding to AS 2380.9).

Standard	Code		Description
IEC 79-15: 1987	Ex	=	Area classification according to AS 2430.1
	n	=	Non-sparking according to AS 2380.9: 1991, section 3 (IEC 79-15: 1987)
	C	=	The environment is adequately protected against sparking components
	II	=	Suitable for use in explosive atmospheres (not mines)
	T3	=	Maximum surface temperature is 200 °C
	X	=	The letter X in the certificate number indicates that the equipment is subject to special conditions for safe use. The conditions are mentioned in the certificate and the installation and operating instructions.

6. Safety

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Warning

Pump installation in tanks must be carried out by specially trained persons.

Work in or near tanks must be carried out according to local regulations.

Warning

Persons must not enter the installation area when the atmosphere is explosive.

Warning

It must be possible to lock the mains switch in position 0. Type and requirements as specified in EN 60204-1, 5.3.2.

Warning

The use of this product requires experience with and knowledge of the product.

Persons with reduced physical, sensory or mental capabilities must not use this product, unless they are under supervision or have been instructed in the use of the product by a person responsible for their safety.

Children must not use or play with this product.

For safety reasons, all work in tanks must be supervised by a person outside the pump tank.

Note

It is advisable to make all maintenance and service work when the pump is placed outside the tank.

Tanks for submersible drainage and effluent pumps may contain drainage or effluent with toxic and/or disease-causing substances. Therefore, all persons involved must wear appropriate personal protective equipment and clothing, and all work on and near the pump must be carried out under strict observance of the hygiene regulations in force.

Warning

Make sure that the lifting bracket is tightened before attempting to lift the pump. Tighten if necessary. Carelessness during lifting or transportation may cause injury to personnel or damage to the pump.

6.1 Potentially explosive environments

Use explosion-proof pumps for applications in potentially explosive environments.

Warning

DP and EF pumps must under no circumstance pump combustible liquids.

Warning

The classification of the installation site must be approved by the local fire-fighting authorities in each individual case.

Warning

The explosion protection classification of the pump is CE Ex II 2 G, Ex d IIB T4 X. The classification of the installation site must be approved by the local fire-fighting authorities in each individual case.

Warning

Special conditions for safe use of DP and EF explosion-proof pumps:

1. Bolts used for replacement must be class A2-70 or better according to EN/ISO 3506-1.
2. The level of pumped liquid must be controlled by two stop level switches connected to the motor control circuit. The minimum level depends on the installation type and is specified in these installation and operating instructions.
3. Make sure the permanently attached cable is suitably mechanically protected and terminated in a suitable terminal board placed outside the potentially explosive area.
4. The thermal protection in the stator windings has a nominal cut-out temperature of 150 °C guaranteeing the disconnection of the power supply; the resetting of the supply is manual.

7. Installation

Caution ***Prior to installation, make sure the tank bottom is even.***

Warning

Before beginning the installation, switch off the power supply and lock the mains switch in position 0.

Any external voltage connected to the pump must be switched off before working on the pump.

Fit the extra nameplate supplied with the pump at the installation site or keep it in the cover of this booklet.

All safety regulations must be observed at the installation site, e.g. the use of blowers for fresh-air supply to the tank.

Prior to installation, check the oil level in the oil chamber. See section *10. Maintenance and service*.

The pumps are suitable for different installation types which are described in sections *7.1 Submerged installation on auto-coupling* and *7.2 Free-standing submerged installation*.

The pump housings have an Rp 2 discharge port or a DN 65, PN 10 flange.

Note ***The pumps are designed for intermittent operation. When completely submerged in the pumped liquid, the pumps can also operate continuously. See section 12. Technical data.***

Warning

Do not put your hands or any tool into the pump suction or discharge port after the pump has been connected to the power supply, unless the pump has been switched off by removing the fuses or switching off the mains switch. It must be ensured that the power supply cannot be accidentally switched on.

Caution ***We recommend to always use Grundfos accessories to avoid malfuncions due to incorrect installation.***

Warning

Only use the lifting bracket for lifting the pump. Do not use it to hold the pump when in operation.

7.1 Submerged installation on auto-coupling

DP 10.65.26 pumps for permanent installation can be installed on a stationary auto-coupling guide rail system or a “hookup” auto-coupling system.

Both auto-coupling systems facilitate maintenance and service as the pump can easily be lifted out of the tank.

DP 10.65.26 pumps have a cast DN 65, PN 10 discharge flange.

Warning

Before beginning installation procedures, make sure that the atmosphere in the tank is not potentially explosive.

Note ***Make sure that the pipework is installed without the use of undue force.***
No loads from the pipework weight must be carried by the pump.
We recommend the use of loose flanges to ease the installation and to avoid pipe tension at flanges and bolts.

Note ***Do not use elastic elements or bellows in the pipework; these elements should never be used as a means to align the pipework.***

Auto-coupling guide rail system

See fig. B, page 505.

Proceed as follows:

1. Drill mounting holes for the guide rail bracket on the inside of the tank and fasten the guide rail bracket provisionally with two screws.
2. Place the auto-coupling base unit on the bottom of the tank. Use a plumb line to establish the correct positioning. Fasten the auto coupling with expansion bolts. If the bottom of the tank is uneven, the auto-coupling base unit must be supported so that it is level when being fastened.
3. Assemble the discharge line in accordance with the generally accepted procedures and without exposing the line to distortion or tension.
4. Place the guide rails on the auto-coupling base unit and adjust the length of the rails accurately to the guide rail bracket at the top of the tank.
5. Unscrew the provisionally fastened guide rail bracket, fit it on top of the guide rails and finally fasten it firmly to the tank wall.

Note ***The guide rails must not have any axial play as this would cause noise during pump operation.***

6. Clean out debris from the tank before lowering the pump into the tank.
7. Fit the guide claw to the discharge port of the pump.

8. Slide the guide claw between the guide rails and lower the pump into the tank by means of a chain secured to the lifting bracket of the pump. When the pump reaches the auto-coupling base unit, the pump will automatically connect tightly.
9. Hang up the end of the chain on a suitable hook at the top of the tank and in such a way that the chain cannot come into contact with the pump housing.
10. Adjust the length of the motor cable by coiling it up on a relief fitting to ensure that the cable is not damaged during operation. Fasten the relief fitting to a suitable hook at the top of the tank. Make sure that the cables are not sharply bent or pinched.
11. Connect the motor cable and the monitoring cable, if any.

Note ***The free end of the cable must not be submerged as water may penetrate through the cable into the motor.***

Hookup auto-coupling system

See fig. C, page 506.

Proceed as follows:

1. Fit the crossbar in the tank.
2. Fit the stationary part of the auto coupling on top of the crossbar.
3. Fit the adapted piece of pipe for the movable part of the hookup auto coupling to the pump discharge port.
4. Fasten a shackle and a chain to the movable part of the hookup auto coupling.
5. Clean out debris from the tank before lowering the pump.
6. Lower the pump into the tank by means of the chain secured to the lifting bracket. When the movable part of the auto coupling reaches the stationary part, the two will automatically connect tightly.
7. Hang up the end of the chain on a suitable hook at the top of the tank and in such a way that the chain cannot come into contact with the pump housing.
8. Adjust the length of the motor cable by coiling it up on a relief fitting to ensure that the cable is not damaged during operation. Fasten the relief fitting to a suitable hook at the top of the tank. Make sure that the cables are not sharply bent or pinched.
9. Connect the motor cable and the monitoring cable, if any.

Note ***The free end of the cable must not be submerged as water may penetrate through the cable into the motor.***

7.2 Free-standing submerged installation

Pumps for free-standing submerged installation can stand freely on the bottom of the tank or the like. See fig. D, page 507, and fig. E, page 508.

In order to facilitate service on the pump, fit a flexible union or coupling to the elbow on the discharge line for easy separation.

If a hose is used, make sure that the hose does not buckle and that the inside diameter of the hose matches that of the discharge port.

If a rigid pipe is used, fit the union or coupling, non-return valve and isolating valve in the order mentioned, when viewed from the pump.

If the pump is installed in muddy conditions or on uneven ground, we recommend to support the pump on bricks or a similar support.

Proceed as follows:

1. Fit a 90 ° elbow to the pump discharge port and connect the discharge pipe/hose.
2. Lower the pump into the liquid by means of a chain secured to the lifting bracket of the pump. We recommend to place the pump on a plane, solid foundation. Make sure that the pump is hanging from the chain and **not** the cable.
3. Hang up the end of the chain on a suitable hook at the top of the tank and in such a way that the chain cannot come into contact with the pump housing.
4. Adjust the length of the motor cable by coiling it up on a relief fitting to ensure that the cable is not damaged during operation. Fasten the relief fitting to a suitable hook. Make sure that the cables are not sharply bent or pinched.
5. Connect the motor cable and the monitoring cable, if any.

Note ***The free end of the cable must not be submerged as water may penetrate through the cable into the motor.***

8. Electrical connection

Warning

Connect the pump to an external mains switch which ensures all-pole disconnection with a contact separation according to EN 60204-1, 5.3.2.

It must be possible to lock the mains switch in position 0. Type and requirements as specified in EN 60204-1, 5.3.2.

The electrical connection must be carried out in accordance with local regulations.

Warning

The pumps must be connected to a control box with a motor protection relay with IEC trip class 10 or 15.

Warning

Pumps for hazardous locations must be connected to a control box with a motor protection relay with IEC trip class 10.

Warning

Do not install Grundfos control boxes, pump controllers, Ex barriers and the free end of the power cable in potentially explosive environments.

The explosion protection classification of the pump is CE Ex II 2 G, Ex d IIB T4 X. The classification of the installation site must be approved by the local fire-fighting authorities in each individual case.

On explosion-proof pumps, make sure that an external earth conductor is connected to the external earth terminal on the pump using a conductor with a secure cable clamp. Clean the surface of the external earth connection and mount the cable clamp.

The cross section of the earth conductor must be at least 4 mm^2, e.g. type H07 V2-K (PVT 90 °) yellow/green.

Make sure that the earth connection is protected against corrosion.

Make sure that all protective equipment has been connected correctly.

Float switches used in potentially explosive environments must be approved for this application. They must be connected to the Grundfos LC, LCD 108 pump controller via the intrinsically safe LC-Ex4 barrier to ensure a safe circuit.

Warning

If the supply cable is damaged, it must be replaced by the manufacturer, its service agent or a similarly qualified person.

Caution

Set the motor-protective circuit breaker to the rated current of the pump. The rated current is stated on the pump nameplate.

Warning

If the pump has an Ex mark on the nameplate, make sure that the pump is connected in accordance with the instructions given in this booklet.

The supply voltage and frequency are marked on the pump nameplate. The voltage tolerance must be within –10 %/+6 % of the rated voltage. Make sure that the motor is suitable for the power supply available at the installation site.

All pumps are supplied with 10 m cable and a free cable end.

The pump must be connected to one of these two controller types:

- a control box with motor-protective circuit breaker, such as Grundfos CU 100 control box
- a Grundfos LC, LCD 107, LC, LCD 108 or LC, LCD 110 pump controller.

See fig. 5 or 6 and the installation and operating instructions for the selected control box or pump controller.

In potentially explosive environments you have two options:

- Use float switches made for Ex environment and a safety barrier in combination with either DC, DCD or LC, LCD 108.
- Use air bells in combination with LC, LCD 107.

Warning

Before installation and the first start-up of the pump, check the condition of the cable visually to avoid short circuits.

For more information about the function of the thermal switches, see *8.4 Thermal switches*.

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8.1 Wiring diagrams

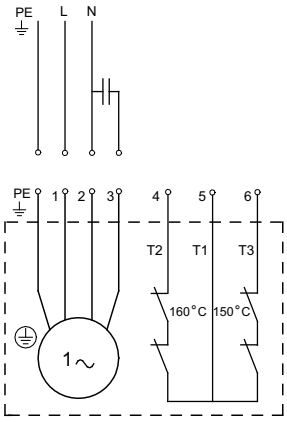

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Fig. 5 Wiring diagram for single-phase pumps

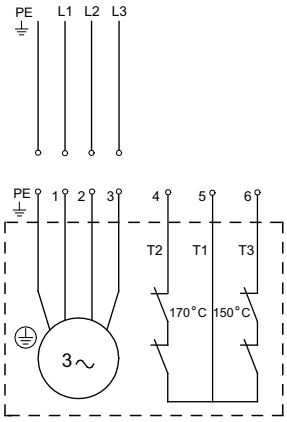

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Fig. 6 Wiring diagram for three-phase pumps

8.2 CU 100 control box

The CU 100 control box incorporates a motor-protective circuit breaker and is available with level switch and cable.

Single-phase pumps: A run capacitor must be connected to the control box.

For capacitor size, see the table:

Pump type	Run capacitor	
	[μF]	[V]
DP and EF	30	450

Start and stop levels: The difference in level between start and stop can be adjusted by changing the free cable length.

Long free cable = large difference in level
Short free cable = small difference in level.

Note ***Both the two following points must be observed.***

- To prevent air intake and vibrations, install the **stop level switch** in such a way that the pump is stopped before the liquid level is lowered below the upper edge of the clamp on the pump.
- Install the **start level switch** in such a way that the pump is started at the required level; however, the pump must always be started before the liquid level reaches the bottom inlet pipe to the tank.

Warning

The CU 100 control box must not be used for Ex applications.
See section 8.3 Pump controllers.

Warning

The pump must not run dry.

An additional level switch must be installed to ensure that the pump is stopped in case the stop level switch is not operating. See fig. 7.

The pump must be stopped when the liquid level reaches the upper edge of the clamp on the pump.

Float switches used in potentially explosive environments must be approved for this application.
They must be connected to the Grundfos DC, DCD or LC, LCD 108 pump controller via an intrinsically safe barrier to ensure a safe circuit.

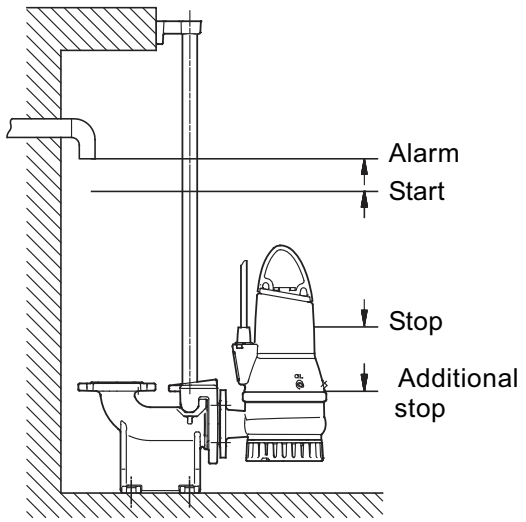

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Fig. 7 Start and stop levels

8.3 Pump controllers

The following LC and LCD pump controllers are available:

LC controllers are for one-pump-installations and LCD controllers are for two-pump-installations.

- LC 107 and LCD 107 with air bells
- LC 108 and LCD 108 with float switches
- LC 110 and LCD 110 with electrodes.

In the following description, "level switches" can be air bells, float switches or electrodes, depending on the pump controller selected.

Controllers for single-phase pumps incorporate capacitors.

The **LC** controller is fitted with two or three level switches: One for start and the other for stop of pump. The third level switch, which is optional, is for high-level alarm.

The **LCD** controller is fitted with three or four level switches: One for common stop and two for start of the pumps. The fourth level switch, which is optional, is for high-level alarm.

When installing the level switches, observe the following points:

- To prevent air intake and vibrations, install the **stop level switch** in such a way that the pump is stopped before the liquid level is lowered below the middle of the motor housing.
- Install the **start level switch** in such a way that the pump is started at the required level; however, the pump must always be started before the liquid level reaches the bottom inlet pipe to the tank.
- If installed, always install the **high-level alarm switch** about 10 cm above the start level switch; however, the alarm must always be given before the liquid level reaches the inlet pipe to the tank.

For further information, see the installation and operating instructions for the pump controller selected.

Warning

The pump must not run dry.

An additional level switch must be installed to ensure that the pump is stopped in case the stop level switch is not operating.

The pump must be stopped when the liquid level reaches the upper edge of the clamp on the pump.

Float switches used in potentially explosive environments must be approved for this application. They must be connected to the Grundfos DC, DCD or LC, LCD 108 pump controller via an intrinsically safe barrier to ensure a safe circuit.

8.4 Thermal switches

All pumps have two sets of thermal switches incorporated in the stator windings.

Thermal switch, circuit 1 (T1-T3), breaks the circuit at a winding temperature of approx. 150 °C.

Note ***This thermal switch must be connected for all pumps.***

Thermal switch, circuit 2 (T1-T2), breaks the circuit at a winding temperature of approx. 170 °C (three-phase pumps) or 160 °C (single-phase pumps).

Warning

After thermal cutout, explosion-proof pumps must be restarted manually. The thermal switch (circuit 2) must be connected for manual restarting of these pumps.

Maximum operating current of the thermal switches is 0.5 A at 500 VAC and cos φ 0.6. The switches must be able to break a coil in the supply circuit.

In the case of **standard pumps**, both thermal switches can (when closing the circuit after cooling) generate automatic restarting of the pump via the controller.

Warning

The separate motor-protective circuit breaker/control box must not be installed in potentially explosive environments.

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8.5 Frequency converter operation

For frequency converter operation please observe the following information.

Requirements must be fulfilled.

Recommendations ought to be fulfilled.

Consequences should be considered.

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8.5.1 Requirements

- The thermal protection of the motor must be connected.
- Peak voltage and dU/dt must be in accordance with the table below. The values stated are maximum values supplied to motor terminals. The cable influence has not been taken into account. See data sheet for the frequency converter used regarding the actual values and cable influence on the peak voltage and dU/dt.

Max. repetitive peak voltage (V)	Max. dU/dt U_N 400 V (V/μ sec.)
650	2000

- If the pump is an Ex-approved pump, check if the Ex certificate of the specific pump allows the use of frequency converter.
- Set the frequency converter U/f ratio according to the motor data.
- Local regulations/standards must be fulfilled.

8.5.2 Recommendations

Before installing a frequency converter, calculate the lowest allowable frequency in the installation in order to avoid zero flow.

- Do not reduce the motor speed to less than 30 % of rated speed.
- Keep the flow velocity above 1 m/sec.
- Let the pump run at rated speed at least once a day in order to prevent sedimentation in the piping system.
- Do not exceed the frequency indicated on the nameplate. In this case there is risk of motor overload.
- Keep the motor cable as short as possible. The peak voltage will increase with the length of the motor cable. See data sheet for the frequency converter used.
- Use input and output filters on the frequency converter. See data sheet for the frequency converter used.
- Use screened motor cable if there is a risk that electrical noise can disturb other electrical equipment. See data sheet for the frequency converter used.

8.5.3 Consequences

When operating the pump via a frequency converter, please be aware of these possible consequences:

- The locked-rotor torque will be lower. How much lower will depend on the frequency converter type. See the installation and operating instructions for the frequency converter used for information on the locked-rotor torque available.
- The working condition of bearings and shaft seal may be affected. The possible effect will depend on the application. The actual effect cannot be predicted.
- The acoustic noise level may increase. See the installation and operating instructions for the frequency converter used for advice as to how to reduce the acoustic noise.

9. Start-up

Warning

Before starting work on the pump, make sure that the fuses have been removed or the mains switch has been switched off. It must be ensured that the power supply cannot be accidentally switched on.

Make sure that all protective equipment has been connected correctly.

The pump must not run dry.

Warning

The pump must not be started if the atmosphere in the tank is potentially explosive.

Warning

It may lead to personal injuries or death to open the clamp while the pump is operating.

9.1 General start-up procedure

Proceed as follows:

1. Remove the fuses and check that the impeller can rotate freely. Turn the impeller by hand.
2. Check the condition of the oil in the oil chamber. See also section *10.5 Oil change*.
3. Check whether the monitoring units, if used, are operating satisfactorily.
4. Check the setting of the air bells, float switches or electrodes.
5. Open the isolating valves, if fitted.
6. Lower the pump into the liquid and insert the fuses.
7. Check that the system has been filled with liquid and vented. The pump is self-venting.
8. Start the pump.

Caution ***In case of abnormal noise or vibrations from the pump, other pump failure or power supply failure, stop the pump immediately. Do not attempt to restart the pump until the cause of the fault has been found and the fault corrected.***

After one week of operation or after replacement of the shaft seal, check the condition of the oil in the chamber. See section *10. Maintenance and service* for procedure.

9.2 Operating modes

The pumps are designed for intermittent operation (S3). When completely submerged, the pumps can also operate continuously (S1).

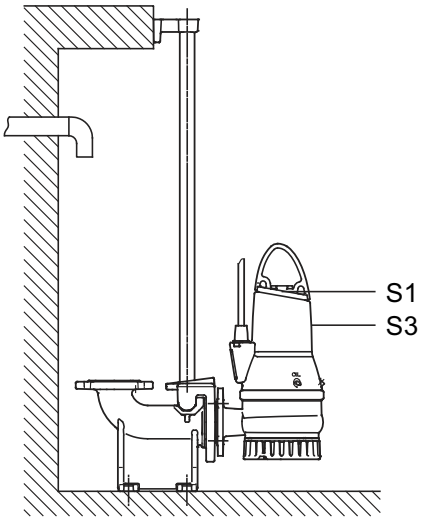

Fig. 8 Operating levels

- **S3, intermittent operation**
  Operating mode S3 means that within 10 minutes the pump must be in operation for 4 minutes and stopped for 6 minutes. See fig. 9. In this operating mode, the pump is partly submerged in the pumped liquid, i.e. the liquid level reaches at minimum the middle of the motor. See fig. 8.

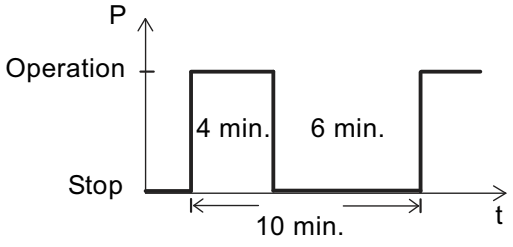

Fig. 9 S3 operation

- **S1, continuous operation**
  In this operating mode, the pump can operate continuously without being stopped for cooling. Being completely submerged, the pump is sufficiently cooled by the surrounding liquid. See fig. 8.

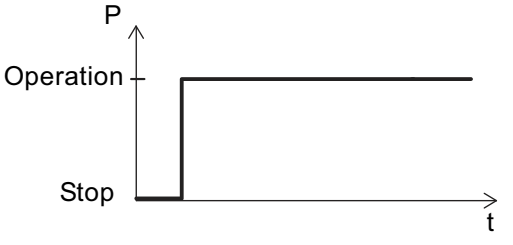

Fig. 10 S1 operation

9.3 Direction of rotation

Note

The pump may be started for a very short period without being submerged to check the direction of rotation.

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All **single-phase** pumps are factory-wired for the correct direction of rotation.

Before starting up **three-phase** pumps, check the direction of rotation.

An arrow on the motor housing indicates the correct direction of rotation.

Correct direction of rotation is clockwise when viewed from above. When started, the pump will jerk in the opposite direction of the direction of rotation.

If the direction of rotation is wrong, interchange any two of the phases in the power supply cable.

See fig. 5 or 6.

Checking the direction of rotation

The direction of rotation should be checked in one of the following ways every time the pump is connected to a new installation.

Procedure 1:

1. Start the pump and check the flow of liquid or the discharge pressure.
2. Stop the pump and interchange any two of the phases in the power supply cable.
3. Restart the pump and check the quantity of liquid or the discharge pressure.
4. Stop the pump.
5. Compare the results taken under points 1 and 3. The connection which gives the larger quantity of liquid or the higher pressure is the correct direction of rotation.

Procedure 2:

1. Let the pump hang from a lifting device, e.g. the hoist used for lowering the pump into the tank.
2. Start and stop the pump while observing the movement (jerk) of the pump.
3. If connected correctly, the pump will jerk in the opposite direction of the direction of rotation. See fig. 11.
4. If the direction of rotation is wrong, interchange any two of the phases in the power supply cable. See fig. 5 or 6.

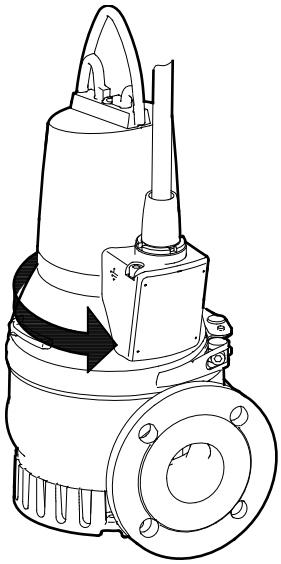

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Fig. 11 Jerk direction

10. Maintenance and service

Warning

Before starting work on the pump, make sure that the fuses have been removed or the mains switch has been switched off. It must be ensured that the power supply cannot be accidentally switched on.

All rotating parts must have stopped moving.

Warning

Except for service on the pump parts, all other service work must be carried out by Grundfos or a service workshop authorized by Grundfos.

Before carrying out maintenance and service, make sure that the pump has been thoroughly flushed with clean water. Rinse the pump parts in water after dismantling.

Warning

When loosening the screws of the oil chamber, note that pressure may have built up in the chamber. Do not remove the screws until the pressure has been fully relieved.

10.1 Inspection

Pumps running normal operation should be checked every 3000 operating hours or at least once a year. If the dry solids content of the pumped liquid is very high or sandy, check the pump at shorter intervals.

Check the following points:

- **Power consumption**
  See pump nameplate.
- **Oil level and oil condition**
  When the pump is new or after replacement of the shaft seal, check the oil level after one week of operation.
  If the pump has been in operation for a long period of time, if the oil is drained off shortly after the pump has been stopped, and if the oil is greyish white like milk, it contains water.
  If there is more than 20 % extra liquid (water) in the oil chamber, the shaft seal is defective.
  See section *10.4 Replacing the shaft seal*. In any case the oil should be changed after 3000 operating hours or once a year.
  Use Shell Ondina 917 oil or similar type.
  See sections *10.5 Oil change* and *10.6 Service kits*.
  The table states the quantity of oil in the oil chamber:

Pump type	Quantity of oil in oil chamber[l]
DP and EF pumps up to 1.5 kW	0.17
DP pumps, 2.6 kW	0.42

Note ***Used oil must be disposed of in accordance with local regulations.***

- **Cable entry**
  Make sure that the cable entry is watertight and that the cables are not sharply bent and/or pinched.
  See section *10.6 Service kits*.
- **Pump parts**
  Check impeller, pump housing, etc. for possible wear. Replace defective parts.
  See section *10.6 Service kits*.
- **Ball bearings**
  Check the shaft for noisy or heavy operation (turn the shaft by hand). Replace defective ball bearings.
  A general overhaul of the pump is usually required in case of defective ball bearings or poor motor function. This work must be carried out by Grundfos or a service workshop authorized by Grundfos.

10.2 Adjusting the impeller clearance

For position numbers, see page 516, 517 or 518.

Proceed as follows:

1. **DP pumps only:**
   Loosen and remove the screws (pos. 188c) holding the suction strainer (pos. 84). Remove the strainer.
2. **All pumps:**
   Loosen the locking screws (pos. 188b).
3. Loosen the adjusting screws (pos. 189) and push the wear plate (pos. 162) until it touches the impeller.
4. Tighten the adjusting screws so that the wear plate still touches the impeller. Then loosen all the adjusting screws about half a turn.

Note ***The impeller must be able to rotate freely without touching the wear plate.***

5. Tighten the locking screws.
6. Rotate the impeller by hand to check that it is not touching the wear plate.
7. **DP pumps only:**
   Fit the suction strainer and tighten the screws (pos. 188c).

See also section *10.3 Cleaning the pump housing*.

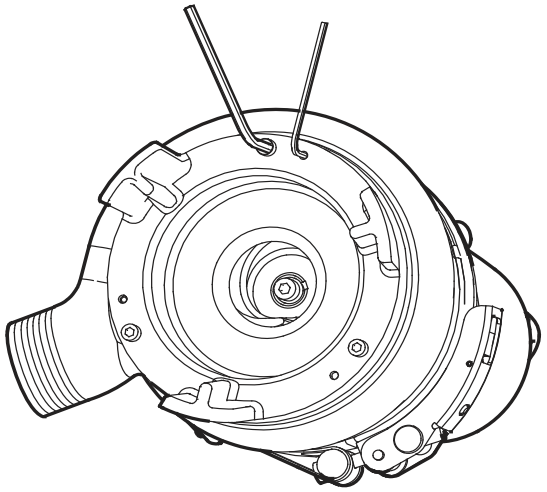

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Fig. 12 Pump viewed from suction port

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10.3 Cleaning the pump housing

For position numbers, see page 516, 517 or 518.

Proceed as follows:

Dismantling

1. Stand the pump upright.
2. Loosen and remove the clamp (pos. 92) joining pump housing and motor.
3. Lift the motor part out of the pump housing (pos. 50). As the impeller is fastened to the shaft end, the impeller is removed together with the motor part.
4. Clean the pump housing and the impeller.

Assembly

1. Place the motor part with impeller in the pump housing.
2. Fit and tighten the clamp.

See also section *10.4 Replacing the shaft seal*.

10.4 Replacing the shaft seal

As described in section *10.1 Inspection*, the oil check will reveal whether the shaft seal is intact.

If the oil contains more than 20 % water, it is an indication that the shaft seal is defective and must be replaced. If the shaft seal is not replaced, the motor will be damaged .

For position numbers, see page 516, 517 or 518.

Proceed as follows:

1. Loosen and remove the clamp (pos. 92) joining pump housing and motor.
2. Lift the motor part out of the pump housing (pos. 50). As the impeller is fastened to the shaft end, the impeller is removed together with the motor part.
3. Remove the screw (pos. 188a) from the shaft end.
4. Remove the impeller (pos. 49) from the shaft.
5. If it was not already done, drain the oil from the oil chamber.
   See section *10.5 Oil change*.

The shaft seal is a complete unit for all pumps.

6. Remove the screws (pos. 188a) securing the shaft seal (pos. 105).
7. Lift the shaft seal (pos. 105) out of the oil chamber using the lever principle, the two dismounting holes in the shaft seal carrier (pos. 58) and two screwdrivers.
8. Check the bush (pos. 103).
   If the bush is worn and must be replaced, the pump must be checked by Grundfos or a service workshop authorized by Grundfos.
   If the bush is intact, proceed as follows:

1. Check and clean the oil chamber.
2. Lubricate the faces in contact with the shaft seal with oil.
3. Insert the new shaft seal (pos. 105) using the plastic bush included in the kit.
4. Tighten the screws (pos. 188a) securing the shaft seal to 16 Nm.
5. Fit the impeller. Make sure that the key (pos. 9a) is fitted correctly.
6. Fit and tighten the screw (pos. 188a) securing the impeller to 22 Nm.
7. Place the motor part with impeller in the pump housing (pos. 50).
8. Fit and tighten the clamp (pos. 92).
9. Fill the oil chamber with oil. See section *10.5 Oil change*.

For adjustment of impeller clearance, see section *10.2 Adjusting the impeller clearance*.

10.5 Oil change

After 3000 operating hours or once a year, change the oil in the oil chamber as described below.

If the shaft seal has been changed, the oil must be changed as well. See section *10.4 Replacing the shaft seal*.

Draining of oil

Warning

When loosening the screws of the oil chamber, note that pressure may have built up in the chamber. Do not remove the screws until the pressure has been fully relieved.

1. Loosen and remove both oil screws to allow all the oil to drain from the chamber.
2. Check the oil for water and impurities. If the shaft seal has been removed, the oil will give a good indication of the condition of the shaft seal.

Note ***Used oil must be disposed of in accordance with local regulations.***

Oil filling, pump lying down

See fig. 13.

1. Place the pump in such a position that it is lying on the motor housing and the discharge flange with the oil screws pointing upwards.
2. Fill oil into the oil chamber through the upper hole until it starts running out of the lower hole. The oil level is now correct.
   For oil quantity, see section *10.1 Inspection*.
3. Fit both oil screws using the packing material included in the kit.
   See section *10.6 Service kits*.

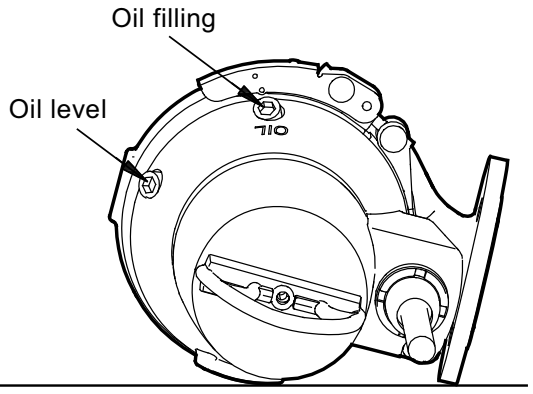


Fig. 13 Oil filling holes

Oil filling, pump in upright position

1. Place the pump on a plane, horizontal surface.
2. Fill oil into the oil chamber through one of the holes until it starts running out of the other hole.
   For oil quantity, see section *10.1 Inspection*.
3. Fit both oil screws using the packing material included in the kit.
   See section *10.6 Service kits*.

10.6 Service kits

Warning

Before starting work on the pump, make sure that the fuses have been removed or the mains switch has been switched off. It must be ensured that the power supply cannot be accidentally switched on.

All rotating parts must have stopped moving.

GB

The following service kits are available for all pumps.

Service kit	Contents	Pump type	Material	Order number
Shaft seal	Shaft seal complete	0.6 kW - 1.5 kW	BQQP	96106536
			BQQV	96645161
		2.6 kW	BQQP	96076123
			BQQV	96645275
O-ring	O-rings and gaskets for oil screws	0.6 kW - 1.5 kW	NBR	96115107
			FKM	96646049
		2.6 kW	NBR	96115108
			FKM	96646060
Impeller	Impeller complete with adjusting screw, shaft screw and key	EF 30.50.06		96115101
		EF 30.50.09		96115109
		EF 30.50.11		96115102
		EF 30.50.15		96115103
		DP 10.50.09		96115104
		DP 10.50.15		96115105
		DP 10.65.26		96115106
Oil	1 litre of oil, type Shell Ondina 917. See section *10. Maintenance and service* for required quantity in oil chamber.	All types		96076171

Note

A possible replacement of the cable must be carried out by Grundfos or a service workshop authorized by Grundfos.

10.7 Contaminated pumps

Warning

If a pump has been used for a liquid which is injurious to health or toxic, the pump will be classified as contaminated.

If Grundfos is requested to service the pump, Grundfos must be contacted with details about the pumped liquid, etc. *before* the pump is returned for service. Otherwise Grundfos can refuse to accept the pump for service.

Possible costs of returning the pump are paid by the customer.

However, any application for service (no matter to whom it may be made) must include details about the pumped liquid if the pump has been used for liquids which are injurious to health or toxic.

The pump must be cleaned in the best possible way before it is returned.

11. Fault finding

Warning

Before attempting to diagnose any fault, make sure that the fuses have been removed or the mains switch has been switched off. It must be ensured that the power supply cannot be accidentally switched on.

All rotating parts must have stopped moving.

Warning

All regulations applying to pumps installed in potentially explosive environments must be observed.

It must be ensured that no work is carried out in potentially explosive atmosphere.

Fault	Cause	Remedy
1. Motor does not start. Fuses blow or motor-protective circuit breaker trips out immediately. **Caution:** Do not start again!	a) Supply failure; short-circuit; earth-leakage fault in cable or motor winding.	Have the cable and motor checked and repaired by a qualified electrician.
	b) Fuses blow due to use of wrong type of fuse.	Install fuses of the correct type.
	c) Impeller blocked by impurities.	Clean the impeller.
	d) Air bell, float switch or electrode out of adjustment or defective.	Readjust or replace the air bells, float switches or electrodes.
2. Pump operates, but motor-protective circuit breaker trips out after a short while.	a) Low setting of thermal relay in motor-protective circuit breaker.	Set the relay in accordance with the specifications on the nameplate.
	b) Increased current consumption due to large voltage drop.	Measure the voltage between two motor phases. Tolerance: – 10 %/+ 6 %. Reestablish correct voltage supply.
	c) Impeller blocked by impurities. Increased current consumption in all three phases.	Clean the impeller.
	d) Adjustment of impeller clearance incorrect.	Readjust the impeller. See section *10.2 Adjusting the impeller clearance*, fig. 10.
3. The pump's thermal switch trips out after the pump has been operating for some time.	a) Too high liquid temperature.	Reduce the liquid temperature.
	b) Too high liquid viscosity.	Dilute the liquid.
	c) Wrong electrical connection (If the pump is star-connected to a delta connection, the result will be very low undervoltage).	Check and correct the electrical installation.
4. Pump operates at below-standard performance and power consumption.	a) Impeller blocked by impurities.	Clean the impeller.
	b) Wrong direction of rotation.	Check the direction of rotation and possibly interchange any two phases of the incoming supply cable. See section *9.3 Direction of rotation*.
5. Pump operates, but gives no liquid.	a) Discharge valve closed or blocked.	Check the discharge valve and possibly open and/or clean.
	b) Non-return valve blocked.	Clean the non-return valve.
	c) Air in pump.	Vent the pump.

Appendix C – Electrical certificate

FORM 16 Certificate

NOTE

This is to be used for the purposes of section 10(c) and 239 of the *Building Act 1975* and/or sections 32, 35B, 43, 44 and 47 of the *Building Regulation 2006*.

1. Indicate the type of certificate

The stages of assessable building work are listed in section 24 of the *Building Regulation 2006* or as conditioned by the building certifier.

An aspect of building work is part of a stage (e.g. waterproofing).

☑ **Aspect Certificate**

Scope of the work

Scope of the work covered by the licence class under the *Queensland Building Services Authority Regulation 2003* for the aspect being certified, eg scope of work for a waterproofing licence is "installing waterproofing materials or systems for preventing moisture penetration". An aspect being certified may include "wet area sealing to showers".

Electrical

2. Property description

The description must identify all land the subject of the application.

The lot & plan details (eg. SP / RP) are shown on title documents or a rates notice.

If the plan is not registered by title, provide previous lot and plan details.

Street address *(Include no., street, suburb / locality & postcode)*

Flagstone Rd Helidon Postcode 4309

Lot & plan details *(Attach list if necessary)*

In which local government area is the land situated?

Lockyer Valley Regional Council

3. Building / structure description

Building description

Sewerage Treatment Plant

Class of building / structure

Sewerage Treatment Plant

4. Description of component/s certified

Clearly describe the extent of work covered by this certificate, e.g. all structural aspects of the steel roof beams.

Description of components certified *(tick as applicable)*

☑ Electrical wiring in accordance with AS 3000 Wiring Rules

☐ Installation of 40% energy efficient lighting in accordance with Acceptable Solution 'A4" of superseded QDC MP4.1 (Publication date 16/11/2007) prior 1st March 2009.

☐ Installation of hard wired smoke alarms in accordance with BCA Part 3.7.2.

5. Basis of certification

Detail the basis for giving the certificate and the extent to which tests, specifications, rules, standards, codes of practice and other publications, were relied upon.

Australian Standard AS 3000 Wiring Rules
Queensland Development Code MP401 *Sustainable buildings* (QDC MP4.1)
Building Code of Australia Volume 2 Part 3.7.2 *Smoke alarms* (BCA Part 3.7.2)
Australian Standard AS3786-1993 *Smoke Alarms*

6. Reference documentation

Clearly identify any relevant documentation, e.g. numbered structural engineering plans.

N/A

7. Building certifier reference number and development approval number

Building certifier reference number

N/A

Development approval number

N/A

8. Building Certifier or competent person or QBSA licensee details

A **competent person** must be assessed as competent before carrying out the inspection.

The builder for the work cannot give a stage certificate of inspection.

A competent person is assessed by the building certifier for the work as competent to practice in an aspect of the building and specification design, because of the individual's skill, experience and qualifications. The competent person must be registered or licensed under a law applying in the State to practice the aspect.

If no relevant law requires the individual to be licensed or registered, the certifier must assess the individual as having appropriate experience, qualifications or skills to be able to give the help.

If the chief executive issues any guidelines for assessing a competent person, the building certifier must use the guidelines when assessing the person.

Name *(in full)*

Damien Peter Peppin

Company name *if applicable*

Town Services & Storage Pty Ltd

Contact person

Phone no. *business hours*

3367 12 64

Mobile no.

0409 99 20 20

Fax no.

Email address

damienpeppin@optusnet.com.au

Postal address

P.O.Box 3708 South Brisbane Postcode 4101

Licence class

Electrical Contractor's

Licence number

65772

Date approval to inspect received from building certifier

20/12/2013

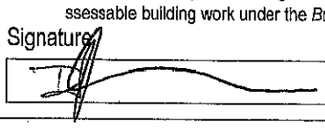
9. Signature of building certifier, competent person or QBSA licensee

Note: A building certifier must sign this form for temporary swimming pool fencing under section 239(2) (b) of the *Building Act 1975*.

☑ **Aspect Certificate**

O A person who may under s43 give a QBSA licensee certificate for the aspect if it complies with the requirements for self ssessable building work under the *Building Regulation 2006* s44.

Signature



Date

01/03/2014

Appendix D – Civil certificate

Inspection Certificate / Aspect Certificate / QBSA Licensee Aspect Certificate

16

NOTE

This form is to be used for the purposes of section 10(c) and 239 of the *Building Act 1975* and/or sections 32, 35B, 43, 44 and 47 of the *Building Regulation 2006*.

1. Indicate the type of certificate

The stages of assessable building work are listed in section 24 of the *Building Regulation 2006* or as conditioned by the building certifier.

An aspect of building work is part of a stage (e.g. waterproofing).

X **Inspection Certificate** for

☐ Stage of building work (for single detached class 1a or class 10 building or structure)

(indicate the stage) _____

X Aspect of building work

(indicate the aspect) Civil Earthworks _____

☐ **QBSA Licensee Aspect Certificate**

Scope of the work

Scope of the work covered by the licence class under the *Queensland Building Services Authority Regulation 2003* for the aspect being certified, e.g. scope of work for a waterproofing licence is "installing waterproofing materials or systems for preventing moisture penetration". An aspect being certified may include "wet area sealing to showers".

2. Property description

The description must identify all land the subject of the application.

The lot & plan details (eg. SP / RP) are shown on title documents or a rates notice. If the plan is not registered by title, provide previous lot and plan details.

Street address *(Include no., street, suburb / locality & postcode)*

Black Flagstone Road

Helidon Qld Postcode

Lot & plan details *(Attach list if necessary)*

Lot 100 RP 900696

In which local government area is the land situated?

Lockyer Valley Regional Council

3. Building/structure description

Building/structure description	Class of building / structure
N/A	

4. Description of component/s certified

Clearly describe the extent of work covered by this certificate, e.g. all structural aspects of the steel roof beams.

Earthworks and wetland cells

LOCAL GOVERNMENT USE ONLY

DATE RECEIVED		REFERENCE NUMBER/S		Approved form 16 Version 3, 11/11

5. Basis of certification

Detail the basis for giving the certificate and the extent to which tests, specifications, rules, standards, codes of practice and other publications, were relied upon.

Engineering Plans 486_5_5-0160-001 to 011

Compaction Certificates

The Water and Carbon Group – Pipeline Hydraulic Design Calculations

6. Reference documentation

Clearly identify any relevant documentation, e.g. numbered structural engineering plans.

Engineering Plans 486_5_5-0160-001 to 011

7. Building certifier reference number and development approval number

Building certifier reference number

Development approval number

8. Building Certifier, competent person or QBSA licensee details

A **competent person** must be assessed as competent before carrying out the inspection.

The builder for the work cannot give a stage certificate of inspection.

A competent person is assessed by the building certifier for the work as competent to practice in an aspect of the building and specification design, because of the individual's skill, experience and qualifications. The competent person must be registered or licensed under a law applying in the State to practice the aspect.

If no relevant law requires the individual to be licensed or registered, the certifier must assess the individual as having appropriate experience, qualifications or skills to be able to give the help.

If the chief executive issues any guidelines for assessing a competent person, the building certifier must use the guidelines when assessing the person.

Name (*in full*)

Gregory M Applin

Company name *if applicable*

Concept Engineering Design and Proj Mgmt

Contact person

Gregory M Applin

Phone no. *business hours*

3371 3229

Mobile no.

0414 768 109

Fax no.

N/A

Email address

greg@concepteng.com.au

Postal address

PO Box 881

Toowong Qld Postcode 4066

Licence class

RPEQ

Licence number

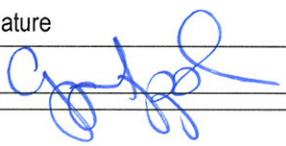
6073

Date approval to inspect received from building certifier

9. Signature of building certifier, competent person or QBSA licensee

Note: A building certifier must sign this form for temporary swimming pool fencing under section 4 of Schedule 1 of QDC MP 3.4.

Signature



Date

14.02.2013

Appendix E – Plumbing certificate

Inspection Certificate / Aspect Certificate / QBSA Licensee Aspect Certificate

16

NOTE

This form is to be used for the purposes of section 10(c) and 239 of the *Building Act 1975* and/or sections 32, 35B, 43, 44 and 47 of the *Building Regulation 2006*.

1. Indicate the type of certificate

The stages of assessable building work are listed in section 24 of the *Building Regulation 2006* or as conditioned by the building certifier.

An aspect of building work is part of a stage (e.g. waterproofing).

■ **Inspection Certificate** for

☐ Stage of building work (for single detached class 1a or class 10 building or structure)

(indicate the stage) _____

■ Aspect of building work

(indicate the aspect) Plumbing and Drainage

■ **QBSA Licensee Aspect Certificate**

Scope of the work

Scope of the work covered by the licence class under the *Queensland Building Services Authority Regulation 2003* for the aspect being certified, e.g. scope of work for a waterproofing licence is "installing waterproofing materials or systems for preventing moisture penetration". An aspect being certified may include "wet area sealing to showers".

Stage 1 Drainage

2. Property description

The description must identify all land the subject of the application.

The lot & plan details (eg. SP / RP) are shown on title documents or a rates notice. If the plan is not registered by title, provide previous lot and plan details.

Street address *(Include no., street, suburb / locality & postcode)*

Black Flagstone Road, Helidon Qld

Postcode 4344

Lot & plan details *(Attach list if necessary)*

In which local government area is the land situated?

Lockyer Valley Regional Council

3. Building/structure description

Building/structure description	Class of building / structure

4. Description of component/s certified

Clearly describe the extent of work covered by this certificate, e.g. all structural aspects of the steel roof beams.

All drainage work as per drawings and specifications.

LOCAL GOVERNMENT USE ONLY

DATE RECEIVED		REFERENCE NUMBER/S		Approved form 16 Version 3. 11/11

5. Basis of certification

Detail the basis for giving the certificate and the extent to which tests, specifications, rules, standards, codes of practice and other publications, were relied upon.

AS 3500

Local Council Regulations

6. Reference documentation

Clearly identify any relevant documentation, e.g. numbered structural engineering plans.

7. Building certifier reference number and development approval number

Building certifier reference number

Development approval number

8. Building Certifier, competent person or QBSA licensee details

A competent person must be assessed as competent before carrying out the inspection.

The builder for the work cannot give a stage certificate of inspection.

A competent person is assessed by the building certifier for the work as competent to practice in an aspect of the building and specification design, because of the individual's skill, experience and qualifications. The competent person must be registered or licensed under a law applying in the State to practice the aspect.

If no relevant law requires the individual to be licensed or registered, the certifier must assess the individual as having appropriate experience, qualifications or skills to be able to give the help.

If the chief executive issues any guidelines for assessing a competent person, the building certifier must use the guidelines when assessing the person.

Name (*in full*)

Matthew John Ostrofski

Company name *if applicable*

Tru-Flow Services Pty Ltd

Contact person

Matt Ostrofski

Phone no. *business hours*

0428 176 505

Mobile no.

0428 176 505

Fax no.

3813 0209

Email address

office@truflowservices.com.au

Postal address

PO Box 2032

NORTH IPSWICH QLD Postcode 4305

Licence class

Plumbing, Drainage & Gas

Licence number

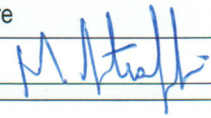
1199207

Date approval to inspect received from building certifier

9. Signature of building certifier, competent person or QBSA licensee

Note: A building certifier must sign this form for temporary swimming pool fencing under section 4 of Schedule 1 of QDC MP 3.4.

Signature



Date