



OPERATIONS AND MAINTENANCE MANUALS

Regional Lagoons Manuals > ST59 Kalbar > Electrical

Builder
Thomas Coffey

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Introduction

Supply and install new switchboard and electrical power to new constructed buildings

- Design and construction of new CT metering switchboard
- Installation of electrical power to new MF and PH buildings
- Installation of new Florescent lights in Buildings

Assets

Asset ID	#AST6	Parent ID	
Description	Switchboard	Service	(5.0) Electrical Distribution
Subservice	(SWB) SWITCHBOARD_MCC	Site	(ST059) Kalbar
Process	(1100.0) GENERAL	Sub	(1150) SEWERAGE
Location Description	Kalbar	Make	CT switchboard
Model	250A	Serial Number	
Supplier		Quantity	1
Retail Price \$	32	Install Date	Jul 10, 2013
Wty Expiry Date	Jul 10, 2013	Life Expectancy (yrs)	25
Reference Information	Note: The factory warranty is 12 months from installation so this item will be covered by the Principal Contractor until the end of the 12 month defect liability period.		

Asset ID	#AST10	Parent ID	
Description	Lights	Service	(9.0) Other Equipment
Subservice	(HYD) HYDRAULIC_SYS	Site	(ST059) Kalbar
Process	(0000) WATER DISTRIBUTION (Non sewerage treatment or pumping processes)	Sub	
Location Description	Newly constructed MF building	Make	Clipsal
Model	WEATHERPROOF IP65 T8 2X36W	Serial Number	
Supplier		Quantity	4
Retail Price \$	60	Install Date	
Wty Expiry Date		Life Expectancy (yrs)	5
Reference Information			

Asset ID	#AST21	Parent ID	
Description	Flow Meter	Service	(6.0) Control and Instrumentation
Subservice	(FM_) FLOW_METER	Site	(ST059) Kalbar
Process	(2700.0) EFFLUENT REUSE	Sub	(2710) EFFLUENT TREATMENT AND DELIVERY
Location Description	Kalbar C02 dosing building	Make	Endress & Hauser
Model	Proline Promag 50	Serial Number	
Supplier	Endress & Hauser	Quantity	1
Retail Price \$	4500	Install Date	May 8, 2013
Wty Expiry Date		Life Expectancy (yrs)	15
Reference Information	Note: The factory warranty is 12 months from installation so this item will be covered by the Principal Contractor until the end of the 12 month defect liability period.		

Maintenance

Electrical Components

1 - Monthly

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

3 - Monthly

- The following tasks were supplied by AIRAH and are indicative only.
- Check and inspect for faulty meters and/or control switches.

12 - Monthly

Switchboard and Wiring

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

For Servicing The Following Assets

#AST6, #AST10

Operations & Tech Data

Promag 50 Operating Instructions

Service : (1.0) Site, Process or Subprocess

Subservice : (SP_) SEWER_PS

Note: Factory set password for this flowmeter is 50.

Linked Documents

 [Promag 50 Operating Instructions.pdf](#)

Proline Promag 50 Technical Data

Service : (1.0) Site, Process or Subprocess

Subservice : (SP_) SEWER_PS

Linked Documents

 [Proline Promag 50 Technical Data.pdf](#)



Level



Pressure



Flow



Temperature



Liquid
Analysis



Registration



Systems
Components



Services

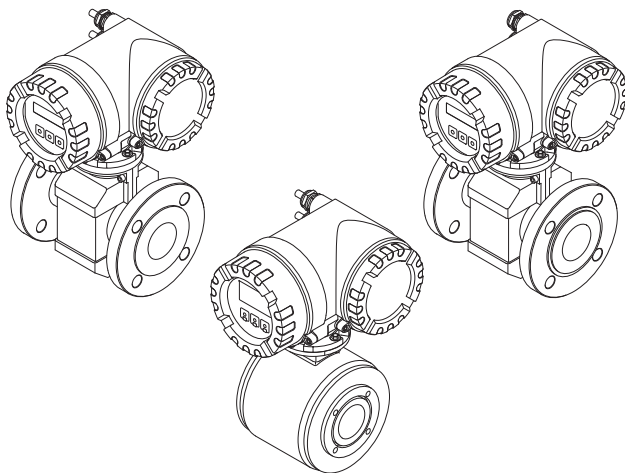


Solutions

Brief Operating Instructions

Proline Promag 50

Electromagnetic Flow Measuring System



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

The complete device documentation consists of:

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

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1 Safety instructions

1.1 Designated use

- The measuring device is to be used only for measuring the flow of conductive liquids in closed pipes. A minimum conductivity of 20 $\mu\text{S}/\text{cm}$ is required for measuring demineralized water. Most liquids can be measured as of a minimum conductivity of 5 $\mu\text{S}/\text{cm}$.
- Any use other than that described here compromises the safety of persons and the entire measuring system and is, therefore, not permitted.
- The manufacturer is not liable for damage caused by improper or non-designated use.

1.2 Installation, commissioning and operation

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

1.3 Operational safety

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

- All parts of the device must be included in the potential equalization of the system.
- Cables, certified cable glands and certified dummy plugs must be suitable to withstand the prevailing operating conditions, such as the temperature range of the process. Housing apertures that are not used must be sealed with dummy plugs.
- The device should only be used for fluids to which all the wetted parts of the device are sufficiently resistant. With regard to special fluids, including fluids used for cleaning, Endress+Hauser will be happy to assist in clarifying the corrosion-resistant properties of wetted materials.

However, minor changes in temperature, concentration or in the degree of contamination in the process may result in variations in corrosion resistance.

For this reason, Endress+Hauser does not accept any responsibility with regard to the corrosion resistance of wetted materials in a specific application. The user is responsible for the choice of suitable wetted materials in the process.




- When hot fluid passes through the measuring tube, the surface temperature of the housing increases. In the case of the sensor, in particular, users should expect temperatures that can be close to the fluid temperature. If the temperature of the fluid is high, implement sufficient measures to prevent burning or scalding.

■ Hazardous areas

Measuring devices for use in hazardous areas are labeled accordingly on the nameplate.

Relevant national regulations must be observed when operating the device in hazardous areas.

The Ex documentation on the CD-ROM is an integral part of the entire device documentation.

The installation regulations, connection data and safety instructions provided in the Ex documentation must be observed. The symbol and name on the front page provides information on the approval and certification (e.g.  Europe,  USA,  Canada). The nameplate also bears the documentation number of this Ex documentation (XA***D/./..).

- For measuring systems used in SIL 2 applications, the separate manual on functional safety (on the CD-ROM) must be observed.

■ Hygienic applications

Measuring devices for hygienic applications have their own special labeling. Relevant national regulations must be observed when using these devices.

■ Pressure instruments

Measuring devices for use in systems that need to be monitored are labeled accordingly on the nameplate. Relevant national regulations must be observed when using these devices. The documentation on the CD-ROM for pressure instruments in systems that need to be monitored is an integral part of the entire device documentation. The installation regulations, connection data and safety instructions provided in the Ex documentation must be observed.

- Endress+Hauser will be happy to assist in clarifying any questions on approvals, their application and implementation.

1.4 Safety conventions



Warning!

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



Caution!

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



Note!

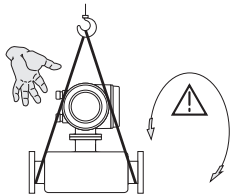
"Note" indicates an action or procedure which, if not performed correctly, can have an indirect effect on operation or trigger an unexpected response on the part of the device.

2 Installation

2.1 Transporting to the measuring point

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

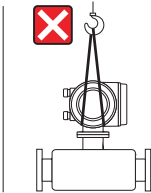
2.1.1 Transporting flanged devices DN ≤ 300 (≤ 12")



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

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



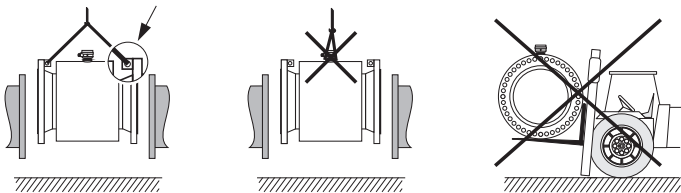
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Do not lift measuring devices by the transmitter housing or the connection housing in the case of the remote version. Do not use chains as they could damage the housing.

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

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

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



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2.2 Installation conditions

2.2.1 Dimensions

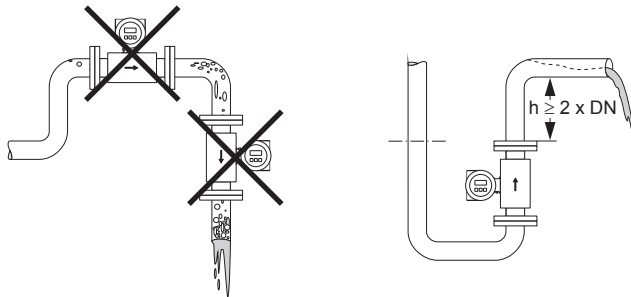
For the dimensions of the measuring device, see the associated Technical Information on the CD-ROM.

2.2.2 Mounting location

The accumulation of air or formation of gas bubbles in the measuring tube can result in an increase in measuring errors.

For this reason avoid the following mounting locations in the pipe:

- At the highest point of a pipeline. Risk of air accumulating!
- Directly upstream from a free pipe outlet in a down pipe.

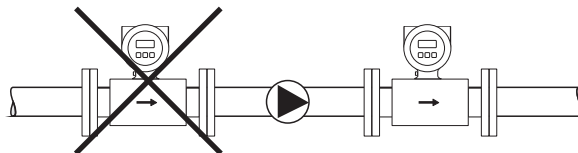


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Installation of pumps

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


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

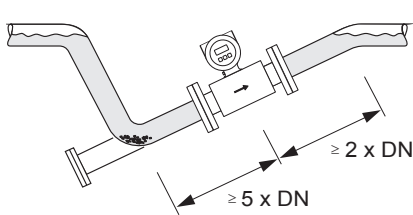


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Partially filled pipes

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

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

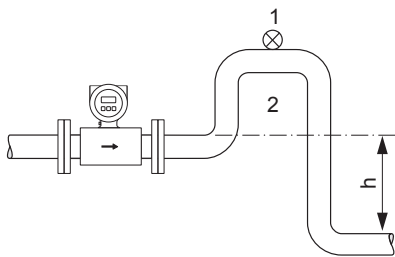


Installation in a partially filled pipe

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Down pipes

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



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

- 1. Vent valve
- 2. Siphon

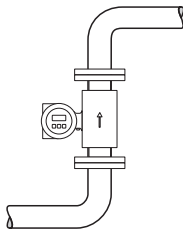
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2.2.3 Orientation

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

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

Vertical orientation



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

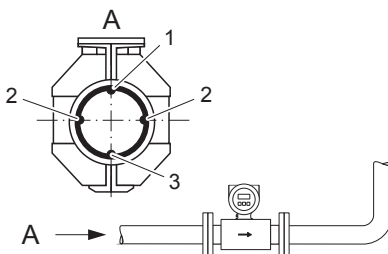
A0008158

Horizontal orientation

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

⚠ Caution!

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

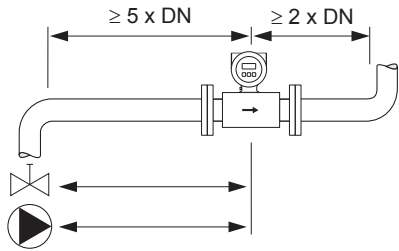


1. EPD electrode for empty pipe detection (not for Promag H, DN 2 to 15, 1/12" to 1/2").
2. Measuring electrodes for signal detection
3. Reference electrode for potential equalization (not for Promag H)

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Inlet and outlet runs

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



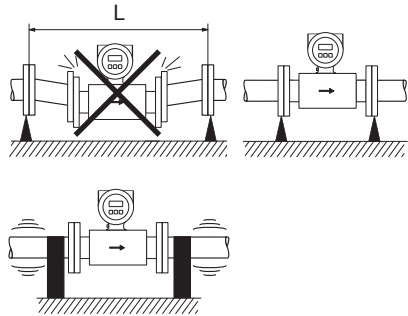
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The following inlet and outlet runs must be observed in order to meet accuracy specifications:

- Inlet run: $\geq 5 \times \text{DN}$
- Outlet run: $\geq 2 \times \text{DN}$


2.2.4 Vibrations

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



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Measures to prevent device vibration
($L > 10 \text{ m}/33 \text{ ft}$)

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

2.2.5 Foundations, supports

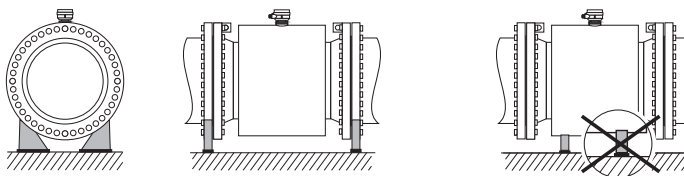
If the nominal diameter is $DN \geq 350$ ($\geq 14"$), mount the sensor on a foundation of adequate load-bearing strength.



Caution!

Risk of damage! Do not support the weight of the sensor on the metal casing.

This would buckle the casing and damage the internal magnetic coils.

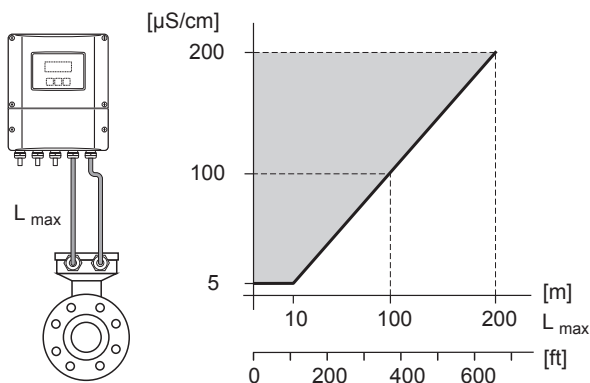


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2.2.6 Length of connecting cable

Comply with the following instructions in order to ensure correct measuring results:

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

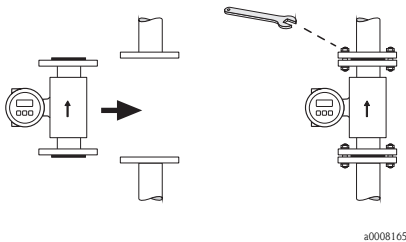


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2.3 Installing the Promag L sensor

Caution!

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



Note!

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

The sensor is installed between the two pipe flanges:

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

2.3.1 Seals

Comply with the following instructions when installing seals:

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

Caution!

Risk of short circuit!

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

2.3.2 Ground cable

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

2.3.3 Screw tightening torques (Promag L)

Please note the following:

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

Promag L tightening torques for EN (DIN)

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

Nominal diameter	EN (DIN)		Max. tightening torque		
			Hard rubber	Polyurethane	PTFE
[mm]	Pressure rating [bar]	Threaded fasteners	[Nm]	[Nm]	[Nm]
1400	PN 10	36 × M 39	654	618	-
1400	PN 16	36 × M 45	729	762	-
1600	PN 6	40 × M 33	440	417	-
1600	PN 10	40 × M 45	946	893	-
1600	PN 16	40 × M 52	1007	1100	-
1800	PN 6	44 × M 36	547	521	-
1800	PN 10	44 × M 45	961	895	-
1800	PN 16	44 × M 52	1108	1003	-
2000	PN 6	48 × M 39	629	605	-
2000	PN 10	48 × M 45	1047	1092	-
2000	PN 16	48 × M 56	1324	1261	-
2200	PN 6	52 × M 39	698	-	-
2200	PN 10	52 × M 52	1217	-	-
2400	PN 6	56 × M 39	768	-	-
2400	PN 10	56 × M 52	1229	-	-
* Designed acc. to EN 1092-1 (not to DIN 2501)					

Promag L tightening torques for ANSI

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

Promag L tightening torques for AWWA

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

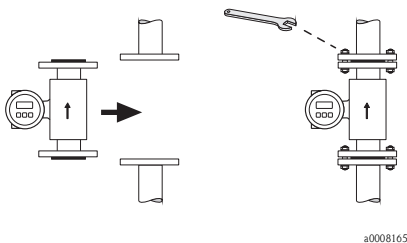
Promag L tightening torques for AS 2129

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

Promag L tightening torques for AS 4087

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

2.4 Installing the W sensor



Note!

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

The sensor is installed between the two pipe flanges:

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

2.4.1 Seals

Comply with the following instructions when installing seals:

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



Caution!

Risk of short circuit!

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

2.4.2 Ground cable

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

2.4.3 Screw tightening torques (Promag W)

Please note the following:

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

Promag W tightening torques for EN (DIN)

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

Nominal diameter [mm]	EN (DIN)	Threaded fasteners	Max. tightening torque [Nm]	
	Pressure rating [bar]		Hard rubber	Polyurethane
450	PN 16	20 × M 27	198	196
450	PN 25	20 × M 33	256	253
500	PN 6	20 × M 20	119	123
500	PN 10	20 × M 24	155	171
500	PN 16	20 × M 30	275	300
500	PN 25	20 × M 33	317	360
600	PN 6	20 × M 24	139	147
600	PN 10	20 × M 27	206	219
600 *	PN 16	20 × M 33	415	443
600	PN 25	20 × M 36	431	516
700	PN 6	24 × M 24	148	139
700	PN 10	24 × M 27	246	246
700	PN 16	24 × M 33	278	318
700	PN 25	24 × M 39	449	507
800	PN 6	24 × M 27	206	182
800	PN 10	24 × M 30	331	316
800	PN 16	24 × M 36	369	385
800	PN 25	24 × M 45	664	721
900	PN 6	24 × M 27	230	637
900	PN 10	28 × M 30	316	307
900	PN 16	28 × M 36	353	398
900	PN 25	28 × M 45	690	716
1000	PN 6	28 × M 27	218	208
1000	PN 10	28 × M 33	402	405
1000	PN 16	28 × M 39	502	518
1000	PN 25	28 × M 52	970	971
1200	PN 6	32 × M 30	319	299
1200	PN 10	32 × M 36	564	568
1200	PN 16	32 × M 45	701	753
1400	PN 6	36 × M 33	430	398
1400	PN 10	36 × M 39	654	618
1400	PN 16	36 × M 45	729	762
1600	PN 6	40 × M 33	440	417
1600	PN 10	40 × M 45	946	893
1600	PN 16	40 × M 52	1007	1100
1800	PN 6	44 × M 36	547	521
1800	PN 10	44 × M 45	961	895
1800	PN 16	44 × M 52	1108	1003
2000	PN 6	48 × M 39	629	605
2000	PN 10	48 × M 45	1047	1092
2000	PN 16	48 × M 56	1324	1261
* Designed acc. to EN 1092-1 (not to DIN 2501)				

Promag W tightening torques for ANSI

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

Promag W tightening torques for JIS

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

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

Promag W tightening torques for AWWA

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

Promag W tightening torques for AS 2129

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

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

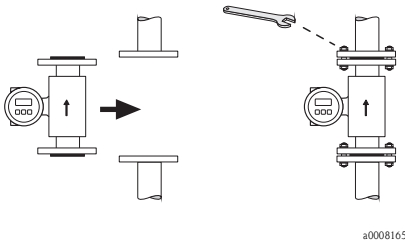
Promag W tightening torques for AS 4087

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

2.5 Installing the Promag P sensor

☞ Caution!

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



✎ Note!

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

The sensor is installed between the two pipe flanges:

- The requisite torques must be observed → 25
- If grounding disks are used, follow the mounting instructions which will be enclosed with the shipment.

2.5.1 Seals

Comply with the following instructions when installing seals:

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

☞ Caution!

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

2.5.2 Ground cable

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

2.5.3 Installing the high-temperature version (with PFA lining)

The high-temperature version has a housing support for the thermal separation of sensor and transmitter. The high-temperature version is always used for applications in which high ambient temperatures are encountered **in conjunction with** high fluid temperatures. The high-temperature version is obligatory if the fluid temperature exceeds +150 °C.



Note!

You will find information on permissible temperature ranges in the Operating Instructions of the CD-ROM

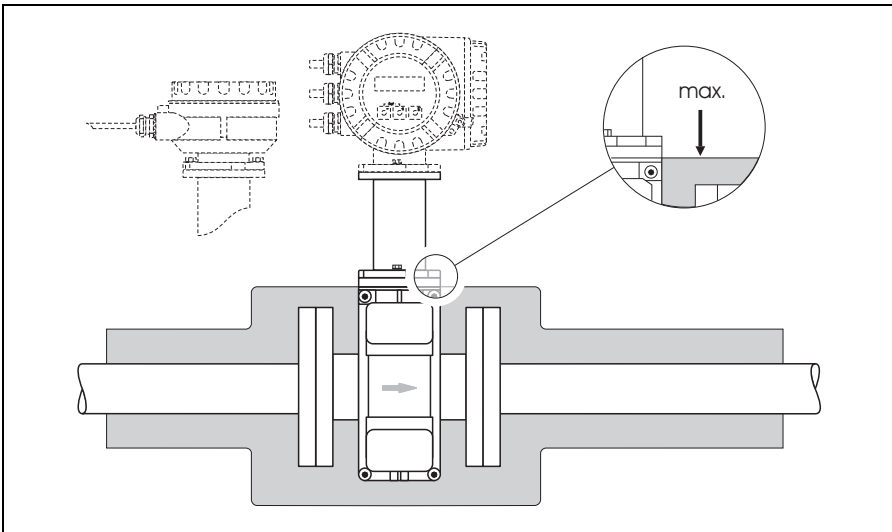
Insulation

Pipes generally have to be insulated if they carry very hot fluids, in order to avoid energy losses and to prevent accidental contact with pipes at temperatures that could cause injury. Guidelines regulating the insulation of pipes have to be taken into account.



Caution!

Risk of measuring electronics overheating. The housing support dissipates heat and its entire surface area must remain uncovered. Make sure that the sensor insulation does not extend past the top of the two sensor shells.



2.5.4 Tightening torques for threaded fasteners (Promag P)

Please note the following:

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

Promag P tightening torques for EN (DIN)

Nominal diameter [mm]	EN (DIN) Pressure rating [bar]	Threaded fasteners	Max. tightening torque [Nm]	
			PTFE	PFA
15	PN 40	4 × M 12	11	–
25	PN 40	4 × M 12	26	20
32	PN 40	4 × M 16	41	35
40	PN 40	4 × M 16	52	47
50	PN 40	4 × M 16	65	59
65 *	PN 16	8 × M 16	43	40
65	PN 40	8 × M 16	43	40
80	PN 16	8 × M 16	53	48
80	PN 40	8 × M 16	53	48
100	PN 16	8 × M 16	57	51
100	PN 40	8 × M 20	78	70
125	PN 16	8 × M 16	75	67
125	PN 40	8 × M 24	111	99
150	PN 16	8 × M 20	99	85
150	PN 40	8 × M 24	136	120
200	PN 10	8 × M 20	141	101
200	PN 16	12 × M 20	94	67
200	PN 25	12 × M 24	138	105
250	PN 10	12 × M 20	110	–
250	PN 16	12 × M 24	131	–
250	PN 25	12 × M 27	200	–
300	PN 10	12 × M 20	125	–
300	PN 16	12 × M 24	179	–
300	PN 25	16 × M 27	204	–
350	PN 10	16 × M 20	188	–
350	PN 16	16 × M 24	254	–
350	PN 25	16 × M 30	380	–
400	PN 10	16 × M 24	260	–
400	PN 16	16 × M 27	330	–
400	PN 25	16 × M 33	488	–
450	PN 10	20 × M 24	235	–
450	PN 16	20 × M 27	300	–

Nominal diameter [mm]	EN (DIN) Pressure rating [bar]	Threaded fasteners	Max. tightening torque [Nm]	
			PTFE	PFA
450	PN 25	20 × M 33	385	–
500	PN 10	20 × M 24	265	–
500	PN 16	20 × M 30	448	–
500	PN 25	20 × M 33	533	–
600	PN 10	20 × M 27	345	–
600 *	PN 16	20 × M 33	658	–
600	PN 25	20 × M 36	731	–
* Designed acc. to EN 1092-1 (not to DIN 2501)				

Promag P tightening torques for ANSI

Nominal diameter		ANSI Pressure rating [lbs]	Threaded fasteners	Max. tightening torque			
				PTFE		PFA	
[mm]	[inch]			[Nm]	[lbf · ft]	[Nm]	[lbf · ft]
15	½"	Class 150	4 × ½"	6	4	–	–
15	½"	Class 300	4 × ½"	6	4	–	–
25	1"	Class 150	4 × ½"	11	8	10	7
25	1"	Class 300	4 × 5/8"	14	10	12	9
40	1 ½"	Class 150	4 × ½"	24	18	21	15
40	1 ½"	Class 300	4 × ¾"	34	25	31	23
50	2"	Class 150	4 × 5/8"	47	35	44	32
50	2"	Class 300	8 × 5/8"	23	17	22	16
80	3"	Class 150	4 × 5/8"	79	58	67	49
80	3"	Class 300	8 × ¾"	47	35	42	31
100	4"	Class 150	8 × 5/8"	56	41	50	37
100	4"	Class 300	8 × ¾"	67	49	59	44
150	6"	Class 150	8 × ¾"	106	78	86	63
150	6"	Class 300	12 × ¾"	73	54	67	49
200	8"	Class 150	8 × ¾"	143	105	109	80
250	10"	Class 150	12 × 7/8"	135	100	–	–
300	12"	Class 150	12 × 7/8"	178	131	–	–
350	14"	Class 150	12 × 1"	260	192	–	–
400	16"	Class 150	16 × 1"	246	181	–	–
450	18"	Class 150	16 × 1 1/8"	371	274	–	–
500	20"	Class 150	20 × 1 1/8"	341	252	–	–
600	24"	Class 150	20 × 1 ¼"	477	352	–	–

Promag P tightening torques for JIS

Nominal diameter [mm]	JIS Pressure rating	Threaded fasteners	Max. tightening torque [Nm]	
			PTFE	PFA
25	10K	4 × M 16	32	27
25	20K	4 × M 16	32	27
32	10K	4 × M 16	38	–
32	20K	4 × M 16	38	–
40	10K	4 × M 16	41	37
40	20K	4 × M 16	41	37
50	10K	4 × M 16	54	46
50	20K	8 × M 16	27	23
65	10K	4 × M 16	74	63
65	20K	8 × M 16	37	31
80	10K	8 × M 16	38	32
80	20K	8 × M 20	57	46
100	10K	8 × M 16	47	38
100	20K	8 × M 20	75	58
125	10K	8 × M 20	80	66
125	20K	8 × M 22	121	103
150	10K	8 × M 20	99	81
150	20K	12 × M 22	108	72
200	10K	12 × M 20	82	54
200	20K	12 × M 22	121	88
250	10K	12 × M 22	133	–
250	20K	12 × M 24	212	–
300	10K	16 × M 22	99	–
300	20K	16 × M 24	183	–

Promag P tightening torques for AS 2129

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

Promag P tightening torques for AS 4087

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

2.6 Installing the Promag H sensor

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



Caution!

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

2.6.1 Seals

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



Caution!

- The screws must be securely tightened in the case of metal process connections. Together with the sensor, the process connection forms a metal connection that ensures defined seal compression.
- With regard to process connections made of plastic material, comply with the max. torques for lubricated threads (7 Nm / 5.2 lbf ft). A seal must always be used between the connection and counterflange for plastic flanges.
- The seals should be replaced periodically depending on the application, particularly if molded seals are used (aseptic version)! The intervals between seal replacement depend on the frequency of the cleaning cycles and the fluid and cleaning temperatures. Replacement seals can be ordered as an accessory.

2.6.2 Using and mounting grounding rings (DN 2 to 25, 1/12" to 1")

In the case of process connections made of plastic (e.g. flange connections or adhesive couplings), potential equalization between the sensor and fluid must be ensured via additional grounding rings.

If grounding rings are missing, this can affect accuracy or result in the destruction of the sensor due to electrochemical electrode reduction.

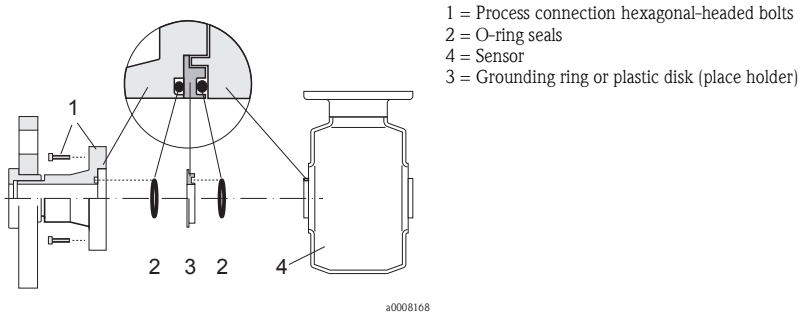


Caution!

- Depending on the order option, appropriate plastic disks are used instead of grounding rings for the process connections. These plastic disks only act as a kind of "place holder" and do not have any potential equalization function whatsoever. In addition, they also assume an important sealing function at the sensor/connection interface. Thus, these plastic disks/seals should never be removed and should always be mounted for process connections without metal grounding rings!
- Grounding rings can be ordered separately from Endress+Hauser as an accessory. When ordering, make sure that the grounding rings are compatible with the electrode material. Otherwise there is the risk that electrodes can be damaged by electrochemical corrosion! For information on materials, see the Operating Instructions on the CD-ROM.

- Grounding rings, incl. seals, are mounted inside the process connections.
 The face-to-face length is not affected.

Installing the grounding rings



- a. Release the 4 or 6 hexagonal-headed bolts (1) and remove the process connection from the sensor (4).
- b. Remove the plastic disk (3) including the two O-ring seals (2) from the process connection.
- c. Insert one of the O-ring seals (2) back into the groove of the process connection.
- d. Place the metal grounding ring (3) into the process connection as illustrated.
- e. Now insert the second O-ring seal (2) into the groove of the grounding ring.
- f. Mount the process connection back onto the sensor. In doing so, make sure to observe the max. torques for lubricated threads (7 Nm) (5.2 lbf ft).

2.6.3 Welding the sensor into the pipe (weld nipples)



Caution!

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

- a. Secure the sensor with a few welding points in the pipe.
 A welding jig suitable for this purpose can be ordered separately as an accessory.
- b. Release the screws on the process connection flange and remove the sensor, including the seal, from the pipe.
- c. Weld the process connection into the pipe.
- d. Mount the sensor back into the pipe.
 In doing so, make sure the seals are clean and correctly positioned.



Note!

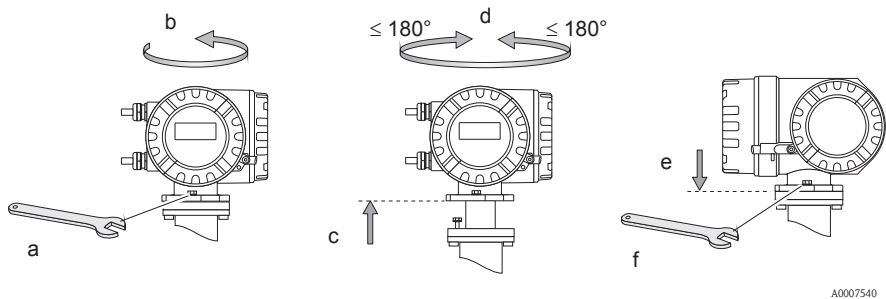
- When welding is performed correctly with thin-walled pipes carrying food, the seal is not damaged by the heat even when it is mounted. It is recommended, however, to disassemble the sensor and seal.
- For the disassembly work, it must be possible to open the pipe approx. 8 mm (0.31 in) in total.

2.7 Installing the transmitter housing

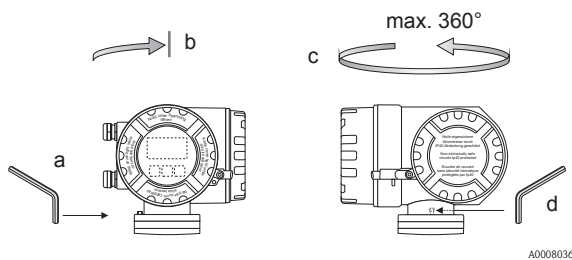
2.7.1 Turning the transmitter housing

Turning the aluminum field housing

Aluminum field housing for non-Ex area



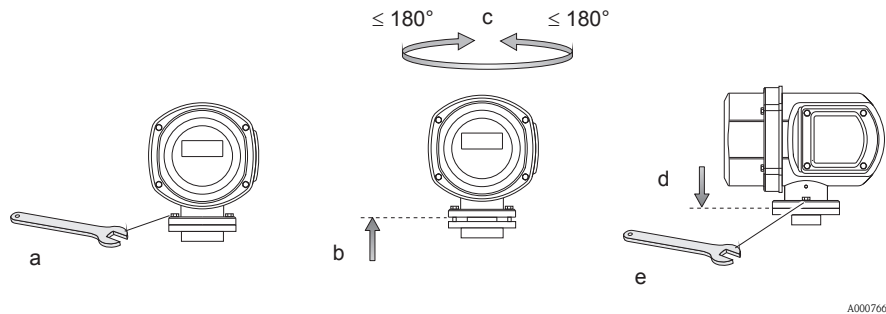
Aluminum field housing for Zone 1 or Class I Div. 1



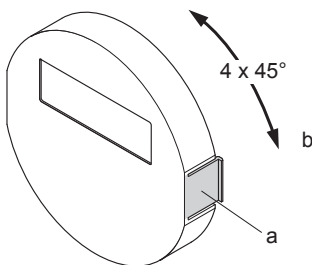
For Zone 1 or Class I Div. 1:

- Release the setscrew.
- Turn the transmitter housing gently clockwise until the stop (end of the thread).
- Turn the transmitter counterclockwise (max. 360°) to the desired position.
- Retighten the setscrew.

Turning the stainless steel field housing



2.7.2 Turning the onsite display



- a. Press in the side latches on the display module and remove the module from the cover plate of the electronics compartment.
- b. Turn the display to the desired position (max. $4 \times 45^\circ$ in both directions) and reset it onto the cover plate of the electronics compartment.

A0007541

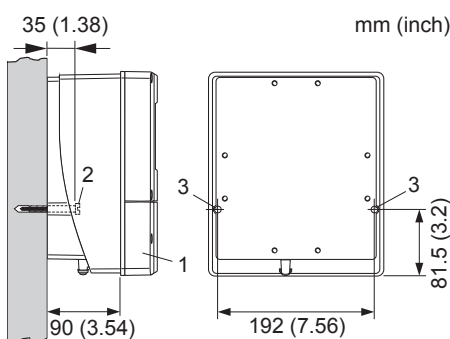
2.7.3 Installing the wall-mount housing



Caution!

- Make sure that the ambient temperature does not exceed the permitted range.
- Always install the wall-mount housing in such a way that the cable entries point downwards.

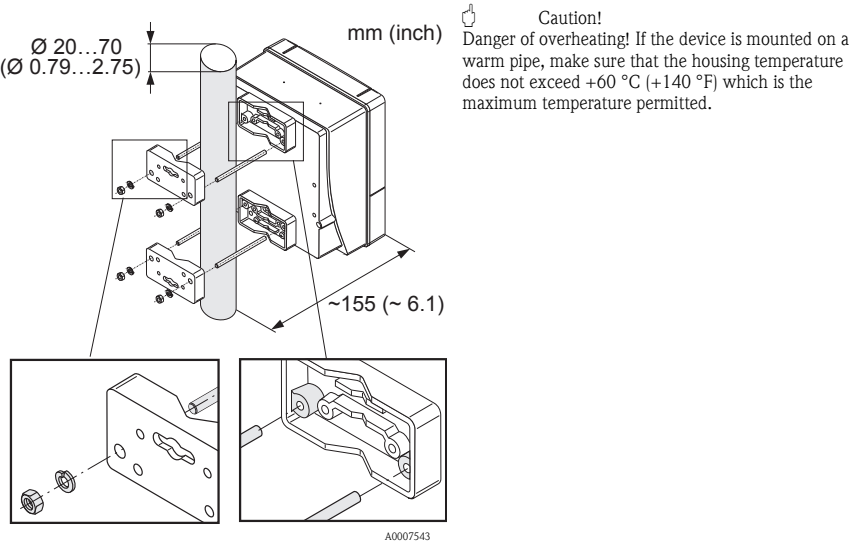
Mounted directly on the wall



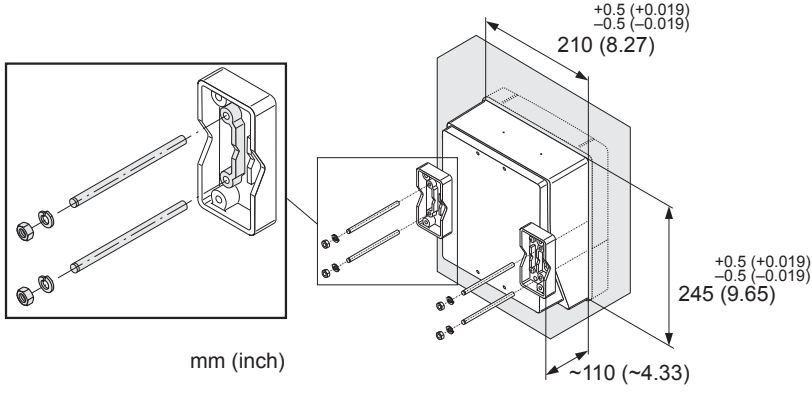
A0007542

1. Connection compartment
2. Securing screws M6 (max. $\varnothing 6.5$ mm (0.25"); screw head max. $\varnothing 10.5$ mm (0.4"))
3. Housing bores for securing screws

Pipe mounting



Panel mounting



2.8 Post-installation check

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

3 Wiring

**Warning!**

Risk of electric shock! Components carry dangerous voltages.

- Never mount or wire the measuring device while it is connected to the power supply.
- Before connecting the power supply, check the safety equipment.
- Route the power supply and signal cables so they are securely seated.
- Seal the cable entries and covers tight.

**Caution!**

Risk of damaging the electronic components!

- Connect the power supply in accordance with the connection data on the nameplate.
- Connect the signal cable in accordance with the connection data in the Operating Instructions or the Ex documentation on the CD-ROM.

In addition, for the remote version**Caution!**

Risk of damaging the electronic components!

- Only connect sensors and transmitters with the same serial number.
- Observe the cable specifications of the connecting cable → Operating Instructions on the CD-ROM.

**Note!**

Install the connecting cable securely to prevent movement.

In addition, for measuring devices with fieldbus communication**Caution!**

Risk of damaging the electronic components!

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

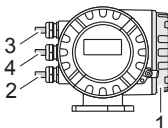
In addition, for Ex-certified measuring devices**Warning!**

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

3.1 Connecting the various housing types

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

3.1.1 Compact version

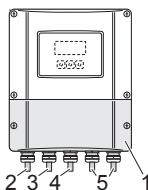


A0007545

Transmitter connection:

- 1 Connection diagram inside the connection compartment cover
- 2 Power supply cable
- 3 Signal cable or fieldbus cable
- 4 Optional

3.1.2 Remote version (transmitter): non-Ex Zone, Ex Zone 2, Class I Div. 2



A0012690

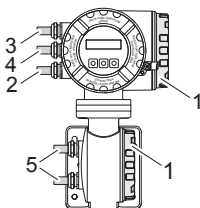
Transmitter connection:

- 1 Connection diagram inside the connection compartment cover
- 2 Power supply cable
- 3 Signal cable
- 4 Fieldbus cable

Connecting the connecting cable (→ 36):

- 5 Sensor/transmitter connecting cable

3.1.3 Remote version (transmitter): Ex Zone 1, Class I Div. 1



A0008218

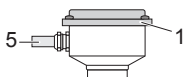
Transmitter connection:

- 1 Connection diagram inside the connection compartment cover
- 2 Power supply cable
- 3 Signal cable or fieldbus cable
- 4 Optional

Connecting the connecting cable (→ 36):

- 5 Sensor/transmitter connecting cable

3.1.4 Remote version (sensor)



A0008037

Transmitter connection:

- 1 Connection diagram inside the connection compartment cover

Connecting cable connection:

- 5 Sensor/transmitter connecting cable

3.2 Connecting the remote version connecting cable

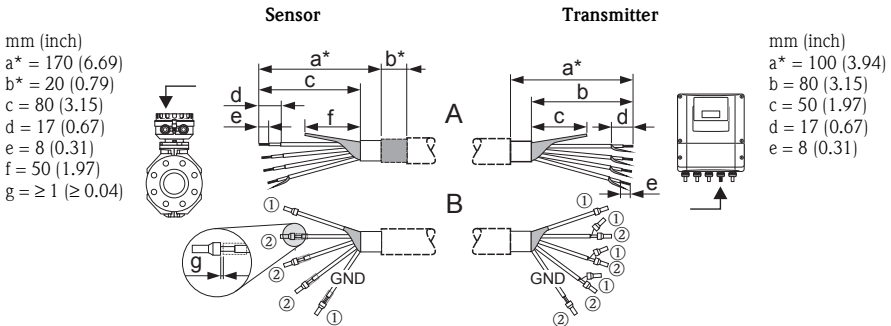
3.2.1 Connecting cable for Promag W, P and L

Connecting cable termination

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

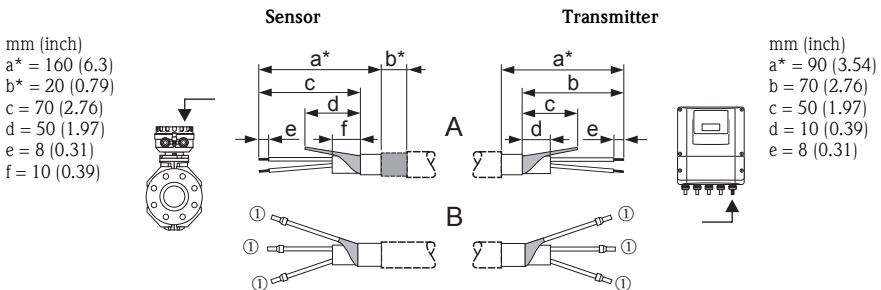
Signal cable termination

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



Coil current cable termination

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



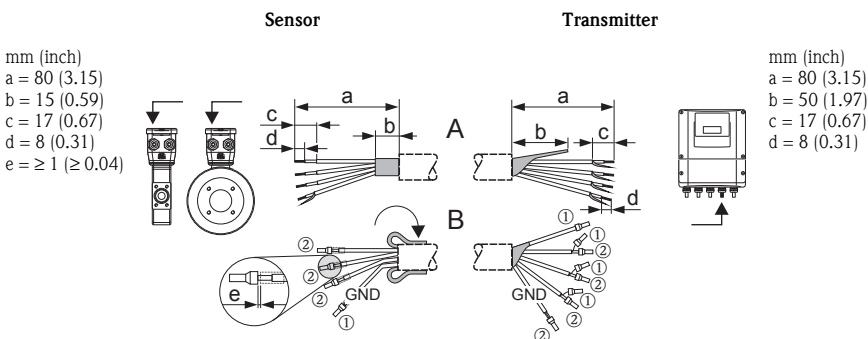
3.2.2 Promag H connecting cable

Connecting cable termination

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

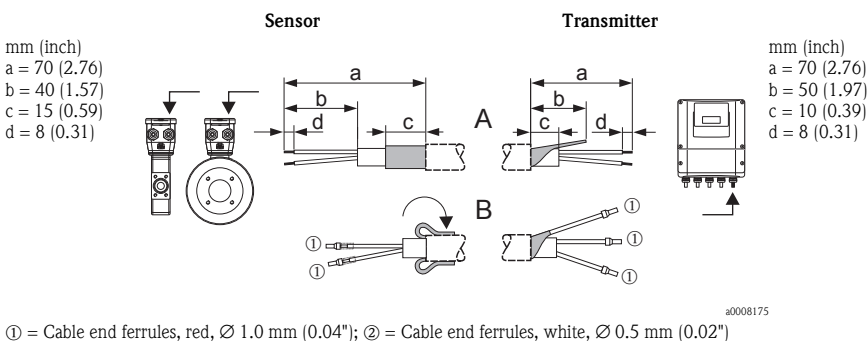
Signal cable termination

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

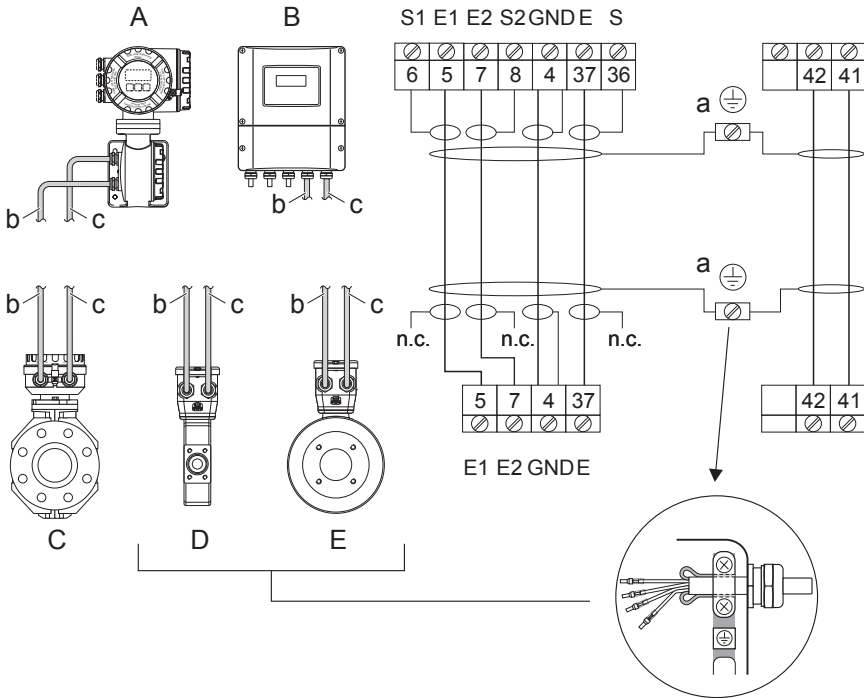


Coil current cable termination

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



3.2.3 Connecting cable connection



A0008180

A Transmitter housing on connection housing, remote version

B Wall-mount housing on connection housing, remote version

C Sensor connection housing, remote version for Promag W, P, L

D Sensor connection housing, remote version for Promag H, DN ≤ 25

E Sensor connection housing, remote version for Promag H, DN ≥ 40

a Ground terminals (are provided for potential equalization connection)

b Coil circuit connecting cable

c Signal circuit connecting cable (electrodes)

n.c. = not connected, isolated cable shields

Cable colors for terminal numbers:

5/6 = brown

7/8 = white

4 = green

36/37 = yellow

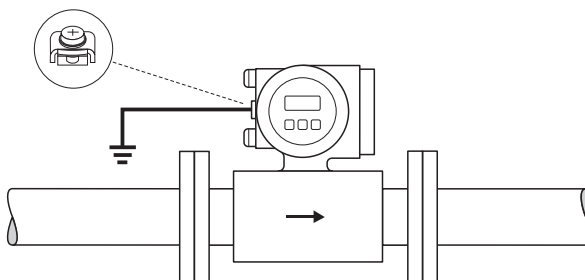
3.3 Potential equalization

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

- Promag L, Promag W and Promag P
Reference electrode available as standard.
- Promag H
 - No reference electrode available. There is always an electrical connection to the fluid via the metal process connection.
 - In the case of plastic process connections, potential equalization must be ensured through the use of grounding rings.

Standard situation

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



A0004375



Note!

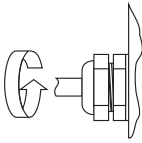
Potential equalization for other areas of application → Operating Instructions on the CD-ROM.

3.4 Degree of protection

The devices meet all the requirements for IP 67.

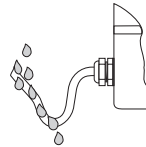
After mounting in the field or service work, the following points have to be observed to ensure that IP 67 protection is retained:

- Install the measuring device in such a way that the cable entries do not point upwards.
- Do not remove the seal from the cable entry.
- Remove all unused cable entries and plug them with suitable/certified drain plugs.
- Use cable entries and drain plugs with a long-term operating temperature range in accordance with the temperature specified on the nameplate.



A0007549

Tighten the cable entries correctly.



A0007550

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

3.5 Post-connection check

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

In addition, for measuring devices with fieldbus communication:

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

4 Hardware settings

This section only deals with the hardware settings needed for commissioning. All other settings (e.g. output configuration, write protection, etc.) are described in the associated Operating Instructions on the CD-ROM.



Note!


No hardware settings are needed for measuring devices with HART or FOUNDATION Fieldbus-type communication.

4.1 Device address

Has to be set for measuring devices with the following communication methods:

- PROFIBUS DP/PA

The device address can be configured via:


- Miniature switches → see description below
- Local operation → see **Software settings section** →  48

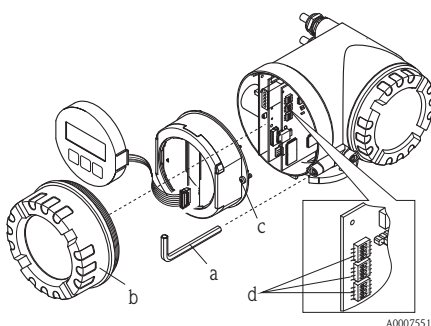
Addressing via miniature switches



Warning!

Risk of electric shock! Risk of damaging the electronic components!

- All the safety instructions for the measuring device must be observed and all the warnings heeded →  34.
- Use a workspace, working environment and tools purposely designed for electrostatically sensitive devices.



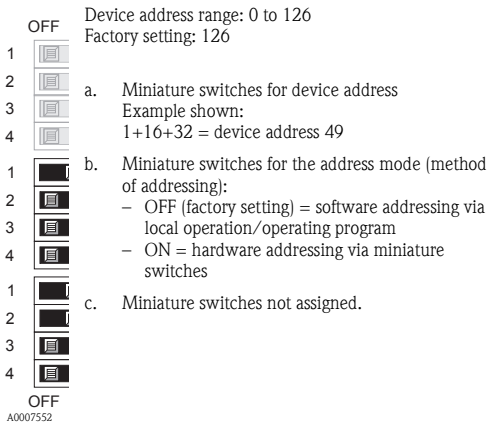
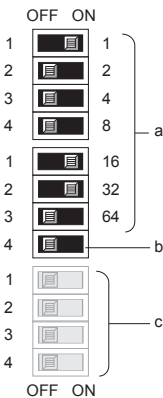
Warning!

Switch off the power supply before opening the device.

- Loosen the cheese head screw of the securing clamp with an Allen key (3 mm)
- Unscrew cover of the electronics compartment from the transmitter housing.
- Loosen the securing screws of the display module and remove the onsite display (if present).
- Set the position of the miniature switches on the I/O board using a sharp pointed object.

Installation is the reverse of the removal procedure.

PROFIBUS



4.2 Terminating resistors



Note!

If the measuring device is used at the end of a bus segment, termination is required. This can be performed in the measuring device by setting the terminating resistors on the I/O board. Generally, however, it is recommended to use an external bus terminator and not perform termination at the measuring device itself.

Has to be set for measuring devices with the following communication methods:

- PROFIBUS DP

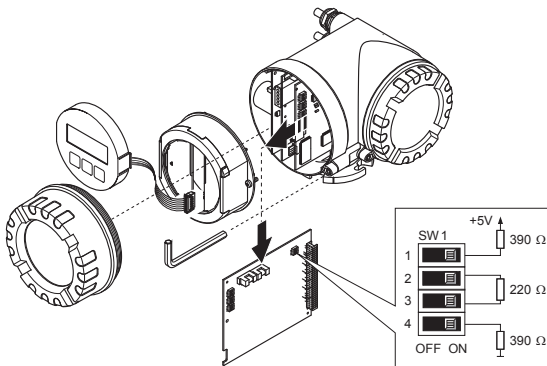
- Baudrate ≤ 1.5 MBaud → Termination can be performed at the measuring device, see graphic
- Baudrate > 1.5 MBaud → An external bus terminator must be used



Warning!

Risk of electric shock! Risk of damaging the electronic components!

- All the safety instructions for the measuring device must be observed and all the warnings heeded → 34.
- Use a workspace, working environment and tools purposely designed for electrostatically sensitive devices.



Setting the terminating switch SW1 on the I/O board:
ON - ON - ON - ON

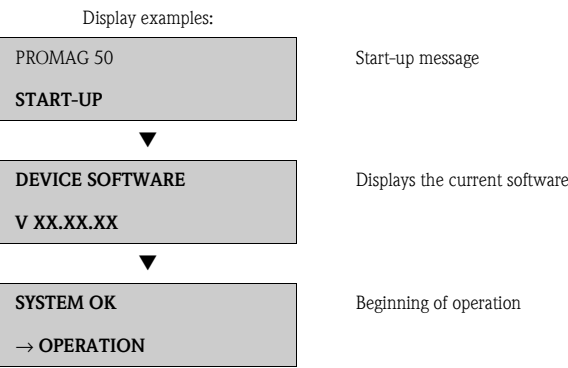
A0007556

5 Commissioning

5.1 Switching on the measuring device

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

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



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

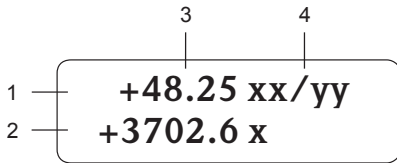


Note!

If an error occurs during startup, this is indicated by an error message. The error messages that occur most frequently when a measuring device is commissioned are described in the Troubleshooting section → 48.

5.2 Operation

5.2.1 Display elements

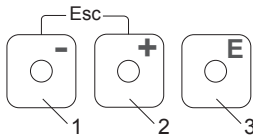


Display lines/fields

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

A0007557

5.2.2 Operating elements



Operating keys

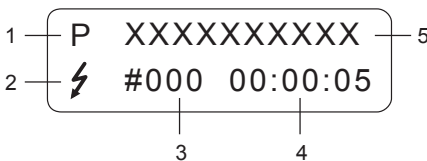
1. (-) Minus key for entering, selecting
2. (+) Plus key for entering, selecting
3. Enter key for calling the function matrix, saving

When the +/- keys are pressed simultaneously (Esc):

- Exit the function matrix step-by-step:
- > 3 sec. = cancel data input and return to the measured value display

A0007559

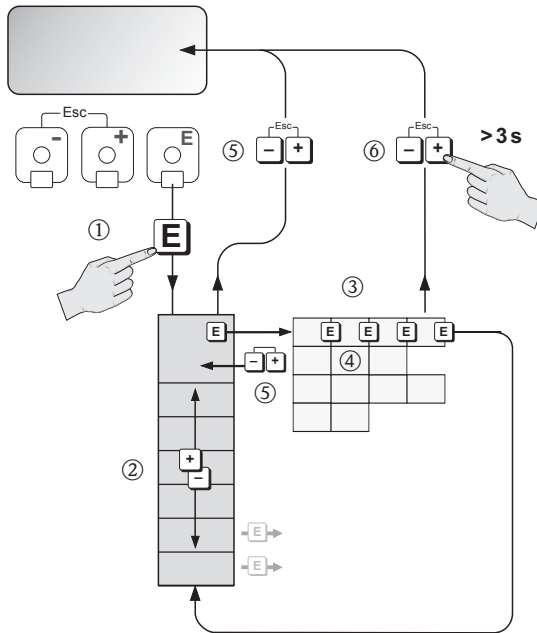
5.2.3 Displaying error messages



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

A0007561

5.3 Navigating within the function matrix















A0007562

1. → Enter the function matrix (starting with measured value display)
2. → Select the group (e.g. OPERATION)
 → Confirm selection
3. → Select function (e.g. LANGUAGE)
4. → Enter code **50** (only for the first time you access the function matrix)
 → Confirm entry
- Change function/selection (e.g. ENGLISH)
 → Confirm selection
5. → Return to measured value display step by step
6. > 3 s → Return immediately to measured value display

5.4 Calling the Commissioning Quick Setup

All the functions needed for commissioning are called up automatically with the Quick Setup. The functions can be changed and adapted to the process in question.

1.  → Enter the function matrix (starting with measured value display)
2.  → Select the group QUICK SETUP
 → Confirm selection
3. QUICK SETUP COMMISSIONING function appears.
4. Intermediate step if configuration is blocked:
 → Enter the code **50** (confirm with ) and thus enable configuration
5.  → Go to Commissioning Quick Setup
6.  → Select YES
 → Confirm selection
7.  → Start Commissioning Quick Setup
8. Configure the individual functions/settings:
 - Via -key, select option or enter number
 - Via -key, confirm entry and go to next function
 - Via -key, return to Setup Commissioning function (settings already made are retained)



Note!

Observe the following when performing the Quick Setup:

- Configuration selection: Select the ACTUAL SETTING option
- Unit selection: This is not offered again for selection after configuring a unit
- Output selection: This is not offered again for selection after configuring an output
- Automatic configuration of the display: select YES
 - Main line = Mass flow
 - Additional line = Totalizer 1
 - Information line = Operating/system conditions
- If asked whether additional Quick Setups should be executed: select NO

All the available functions of the measuring device and their configuration options as well as additional Quick Setups, if available, are described in detail in the "Description of Device Functions" Operating Instructions. The related Operating Instructions can be found on the CD-ROM.

The measuring device is ready for operation on completion of the Quick Setup.

5.5 Software settings

5.5.1 Device address

Has to be set for measuring devices with the following communication methods:

- PROFIBUS DP/PA → device address range 0 to 126, factory setting 126

The device address can be configured via:

- Miniature switches → see Hardware settings → 41
- Local operation → see description below



Note!

The COMMISSIONING SETUP must be executed before setting the device address.

Calling the Communication Quick Setup

1. → Enter the function matrix (starting with measured value display)
2. → Select the group QUICK SETUP
 → Confirm selection
3. → Select the QUICK SETUP COMMUNICATION function
4. Intermediate step if configuration is blocked: → Enter the code **50**
(confirm with) and thus enable the configuration
5. → Go to Communication Quick Setup
6. → Select YES; → confirm selection
7. → Start Communication Quick Setup
8. Configure the individual functions/settings:
 - Via -key, select option or enter number
 - Via -key, confirm entry and go to next function
 - Via -key, return to Setup Commissioning function
(settings already made are retained)

All the available functions of the measuring device and their configuration options as well as additional Quick Setups, if available, are described in detail in the "Description of Device Functions" Operating Instructions. The related Operating Instructions can be found on the CD-ROM.

The measuring device is ready for operation on completion of the Quick Setup.

5.6 Troubleshooting

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



Note!

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

www.endress.com/worldwide

Endress+Hauser 
People for Process Automation



Level



Pressure



Flow



Temperature

Liquid
Analysis

Registration

Systems
Components

Services



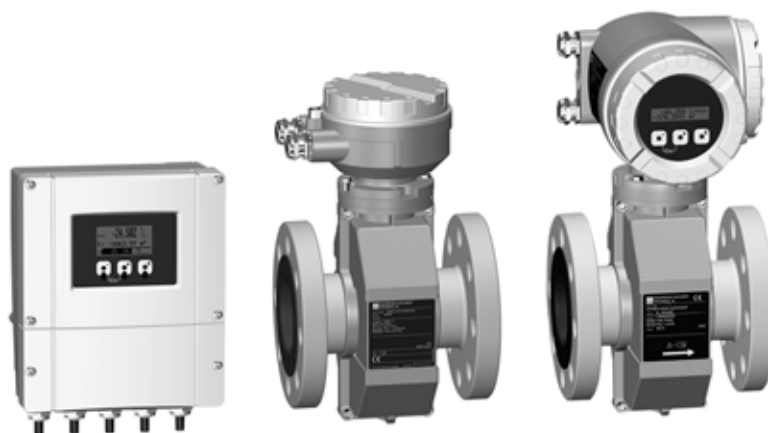
Solutions

Technical Information

Proline Promag 50W, 53W

Electromagnetic Flow Measuring System

Flow measurement in water or wastewater applications



Application

Electromagnetic flowmeter for bidirectional measurement of liquids with a minimum conductivity of $\geq 5 \mu\text{S}/\text{cm}$:

- Drinking water
- Wastewater
- Wastewater sludge
- Flow measurement up to $110,000 \text{ m}^3/\text{h}$
- Fluid temperature up to $+80 \text{ }^\circ\text{C}$
- Process pressures up to 40 bar
- Fitting lengths to DVGW/ISO

Application-specific lining materials:

- Polyurethane and hard rubber

Approvals for hazardous area:

- ATEX, FM, CSA

Lined measuring pipes with materials approved for drinking water:

- KTW, WRAS, NSF, ACS, etc.

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 electrode cleaning
- Uniform operating concept

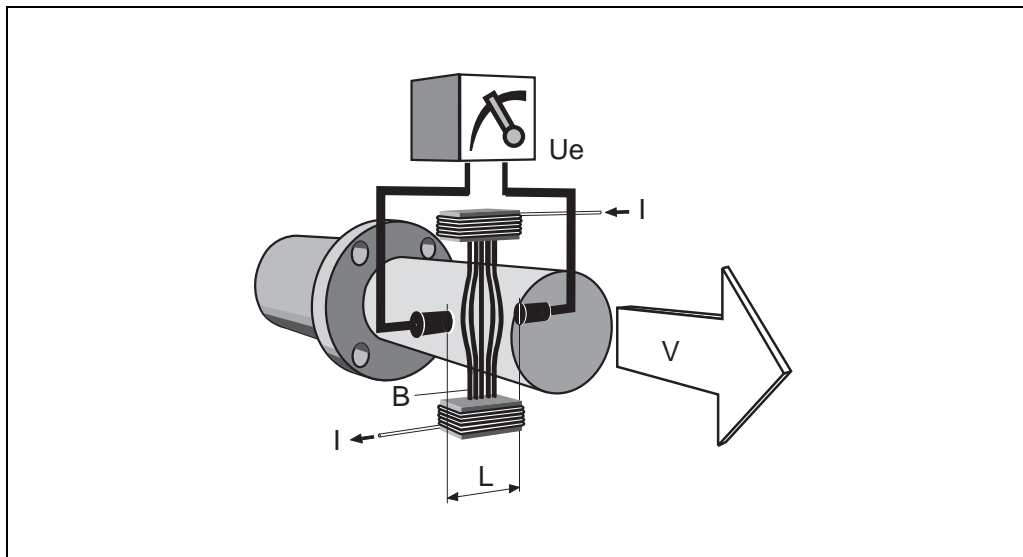
The tried-and-tested **Promag sensors** offer:

- No pressure loss
- Not sensitive to vibrations
- Simple installation and commissioning

Function and system design

Measuring principle

Faraday's law of induction states that a voltage is induced in a conductor moving in a magnetic field. In electromagnetic measuring, the flowing medium corresponds to the moving conductor. The induced voltage is proportional to the flow velocity and is detected by two measuring electrodes and transmitted to the amplifier. Flow volume is computed on the basis of the pipe's diameter. The constant magnetic field is generated by a switched direct current of alternating polarity.



A0003191

$$U_e = B \cdot L \cdot v$$

$$Q = A \cdot v$$

U_e = induced voltage

B = magnetic induction (magnetic field)

L = electrode gap

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 single mechanical unit.
- Remote version: transmitter and sensor are installed separately.

Transmitter:

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

Sensor:

- DN 25...2000

Input

Measured variable	Flow rate (proportional to induced voltage)
Measuring range	Typically $v = 0.01 \dots 10$ m/s with the specified measuring accuracy
Operable flow range	Over 1000 : 1
Input signal	<p>Status input (auxiliary input): $U = 3 \dots 30$ V DC, $R_i = 5$ kΩ, galvanically isolated. Configurable for: totalizer(s) reset, measured value suppression, error-message reset.</p> <p>Status input (auxiliary input) with PROFIBUS DP and MODBUS RS485: $U = 3 \dots 30$ V DC, $R_i = 3$ kΩ, galvanically isolated Switching level: $3 \dots 30$ V DC, independent of polarity Configurable for: totalizer(s) reset, measured value suppression, error-message reset, batching start/stop (optional), batch totalizer reset (optional)</p> <p>Current input (for Promag 53 only): Active/passive selectable, galvanically isolated, full scale value selectable, resolution: 3 μA, temperature coefficient: typ. 0.005% o.r./$^{\circ}$C (o.r. = of reading) active: $4 \dots 20$ mA, $R_i \leq 150$ Ω, $U_{out} = 24$ V DC, short-circuit-proof passive: $0/4 \dots 20$ mA, $R_i \leq 150$ Ω, $U_{max} = 30$ V DC</p>

Output

Output signal	<p>Promag 50</p> <p>Current output: active/passive selectable, galvanically isolated, time constant selectable ($0.01 \dots 100$ s), full scale value selectable, temperature coefficient: typ. 0.005% o.r./$^{\circ}$C (o.r. = of reading), resolution: 0.5 μA</p> <ul style="list-style-type: none"> ■ active: $0/4 \dots 20$ mA, $R_L < 700$ Ω (HART: $R_L \geq 250$ Ω) ■ passive: $4 \dots 20$ mA, operating voltage V_S $18 \dots 30$ V DC, $R_i \leq 150$ Ω <p>Pulse/frequency output: passive, open collector, 30 V DC, 250 mA, galvanically isolated.</p> <ul style="list-style-type: none"> ■ Frequency output: full scale frequency $2 \dots 1000$ Hz ($f_{max} = 1250$ Hz), on/off ratio 1:1, pulse width max. 10 s. ■ Pulse output: pulse value and pulse polarity selectable, max. pulse width configurable ($0.5 \dots 2000$ ms) <p>PROFIBUS DP interface:</p> <ul style="list-style-type: none"> ■ Transmission technology (Physical Layer): RS485 in accordance with ANSI/TIA/EIA-485-A: 1998, galvanically isolated ■ Profile version 3.0 ■ Data transmission rate: 9.6 kBaud $\dots 12$ MBaud ■ Automatic data transmission rate recognition ■ Function blocks: 1 x analog input, 3 x 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
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PROFIBUS PA interface:

- Transmission technology (Physical Layer): IEC 61158-2 (MBP), galvanically isolated
- Profile version 3.0
- Current consumption: 11 mA
- Permissible supply voltage: 9...32 V
- Bus connection with integrated reverse polarity protection
- Error current FDE (Fault Disconnection Electronic): 0 mA
- Function blocks: 1 x analog input, 1 x 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...100 s), full scale value selectable, temperature coefficient: typically 0.005% o.r./°C (o.r. = of reading), resolution: 0.5 μ A

- active: 0/4...20 mA, $R_L < 700 \Omega$ (HART: $R_L \geq 250 \Omega$)
- passive: 4...20 mA, operating voltage V_S 18...30 V DC, $R_i \leq 150 \Omega$

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), $R_L > 100 \Omega$
- passive: open collector, 30 V DC, 250 mA
- Frequency output: full scale frequency 2...10000 Hz ($f_{\max} = 12500$ Hz), EEx-ia: 2...5000 Hz; on/off ratio 1:1; pulse width max. 10 s.
- Pulse output: pulse value and pulse polarity adjustable, pulse width configurable (0.05...2000 ms)

PROFIBUS DP interface:

- Transmission technology (Physical Layer): RS485 in accordance with ANSI/TIA/EIA-485-A: 1998, galvanically isolated
- Profile version 3.0
- Data transmission rate: 9.6 kBaud...12 MBaud
- Automatic data transmission rate recognition
- Function blocks: 2 x analog input, 3 x totalizer
- Output data: volume flow, calculated mass flow, totalizer 1...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 → Page 7 ff.

PROFIBUS PA interface:

- Transmission technology (Physical Layer): IEC 61158-2 (MBP), galvanically isolated
- Profile version 3.0
- Current consumption: 11 mA
- Permissible supply voltage: 9...32 V
- Bus connection with integrated reverse polarity protection
- Error current FDE (Fault Disconnection Electronic): 0 mA
- Function blocks: 2 x analog input, 3 x totalizer
- Output data: volume flow, calculated mass flow, totalizer 1...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 interface:

- Transmission technology (Physical Layer): RS485 in accordance with ANSI/TIA/EIA-485-A: 1998, galvanically isolated
- MODBUS device type: Slave
- Address range: 1...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
- Transmission mode: RTU oder ASCII
- Supported baudrate: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 Baud
- Response time:
 - Direct data access = typically 25...50 ms
 - Auto-scan buffer (data range) = typically 3...5 ms
- Available output combination → Page 7 ff.

FOUNDATION Fieldbus interface:

- FOUNDATION Fieldbus H1
- Transmission technology (Physical Layer): IEC 61158-2 (MBP), galvanically isolated
- ITK version 4.01
- Current consumption: 12 mA
- Error current FDE (Fault Disconnection Electronic): 0 mA
- Bus connection with integrated reverse polarity protection
- Function blocks: 5 x analog input, 1 x discrete output, 1 x PID
- Output data: volume flow, calculated mass flow, temperature, totalizer 1...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 accord. with NAMUR Recom. 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"

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.

Low flow cutoff

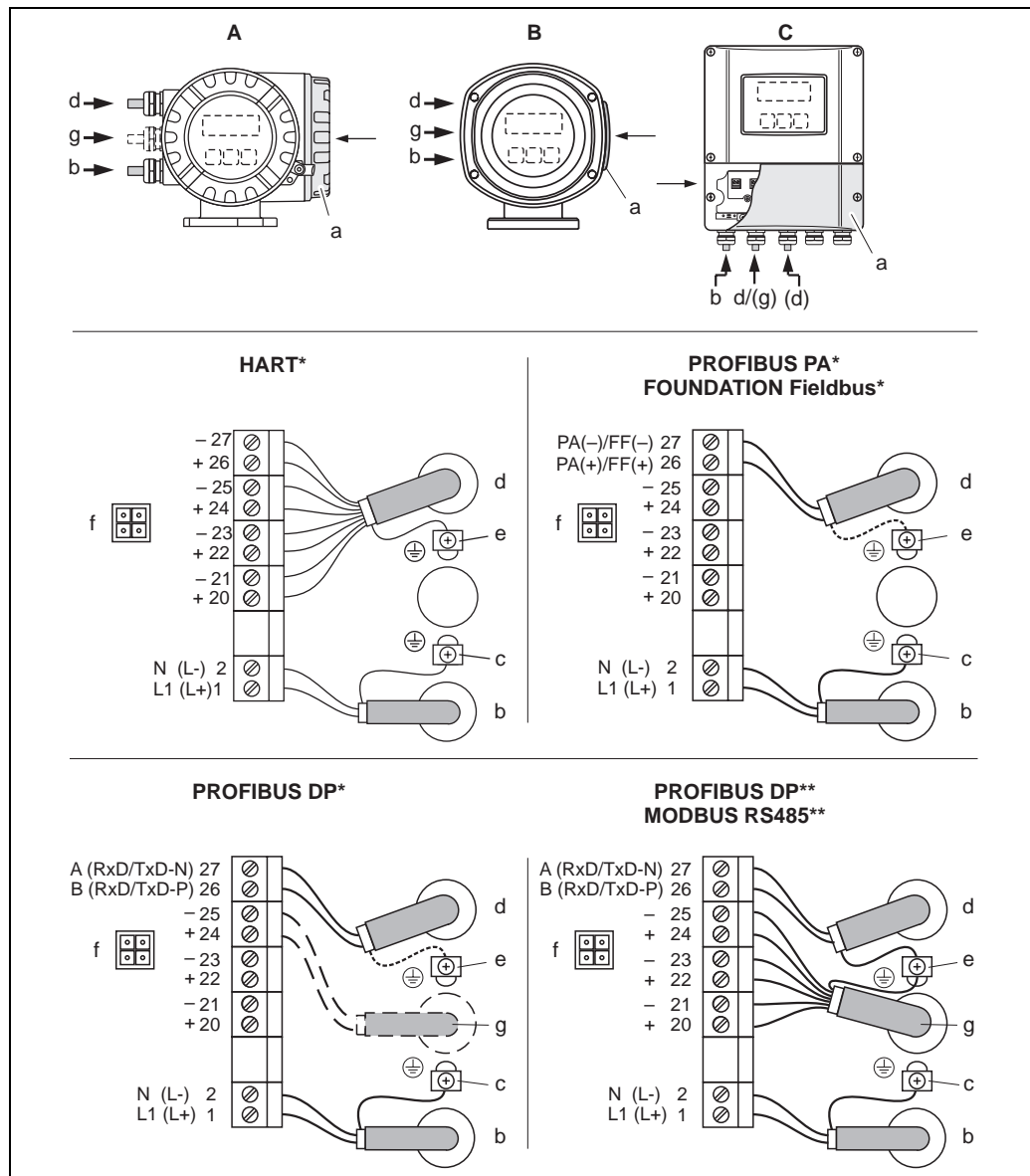
Switch points for low flow cutoff are selectable

Galvanic isolation

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

Power supply

Electrical connection Measuring unit



Anschließen des Messumformers, Leitungsquerschnitt max. 2,5 mm²

A View A (field housing)

B View B (stainless steel field housing)

C View C (wall-mount housing)

*) not changeable communication board

**) changeable communication board

a Cover of the connection compartment

b Cable for power supply: 85...260 V AC, 20...55 V AC, 16...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 Terminal assignment → Page 7 ff.

Fieldbus cable:

Terminal No. 26: DP (A) / PA (+) / FF (+) / MODBUS RS485 (A) / (PA, FF: with reverse polarity protection)

Terminal No. 27: DP (B) / PA (-) / FF (-) / MODBUS RS485 (B) / (PA, FF: with reverse polarity protection)

e Ground terminal for signal-cable shield / Fieldbus cable / RS485 line

f Service connector for connecting service interface FXA 193 (Fieldcheck, Tof Tool - Fieldtool Package)

g Signal cable: see Terminal assignment → Page 7 ff.

Cable for external termination (only for PROFIBUS DP with fixed assignment communication board):

Terminal No. 24: +5 V

Terminal No. 25: DGND

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 active, HART
50***_*****T	–	–	Frequency output Ex i, passive	Current output Ex i passive, HART
Ground connection, power supply → Page 6				

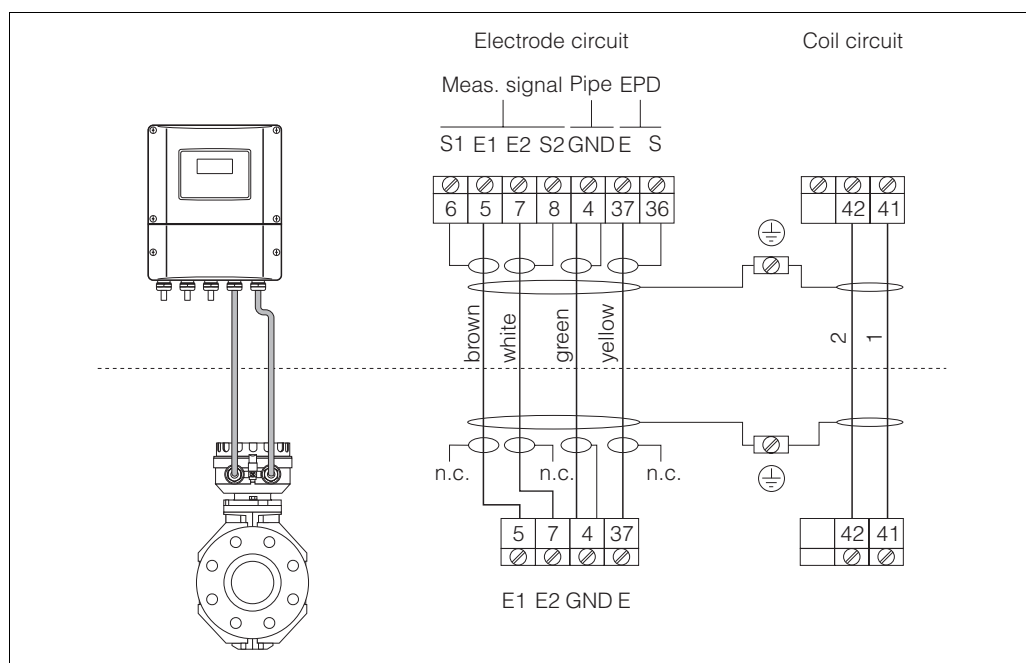
Terminal assignment, Promag 53

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 (-)
<i>Fixed communication boards (fixed assignment)</i>				
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 active, HART
53***_*****T	–	–	Frequency output Ex i	Current output Ex i passive, HART
<i>Flexible communication boards</i>				
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

Order variant	Terminal No. (inputs / outputs)			
	20 (+) / 21 (-)	22 (+) / 23 (-)	24 (+) / 25 (-)	26 (+) / 27 (-)
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 connection, power supply → Page 6				

Electrical connection remote version



F06-5xFxxxxx-04-xx-xx-en-001

n.c. = isolated cable shields, not connected

Cable entry

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

- Cable entry M20 x 1.5 (8...12 mm)
- Sensor cable entry for armoured cables M20 x 1.5 (9.5...16 mm)
- Threads for cable entries 1/2" NPT, G 1/2"

Connecting cable for remote version:

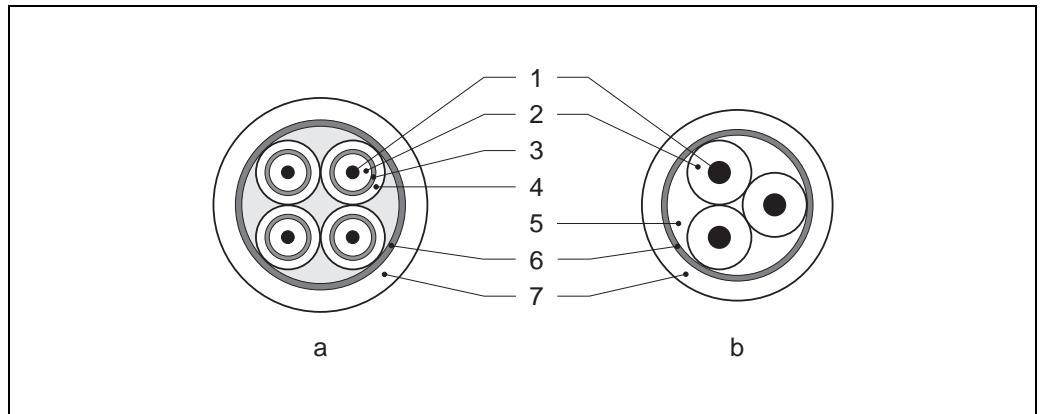
- Cable entry M20 x 1.5 (8...12 mm)
- Sensor cable entry for armoured cables M20 x 1.5 (9.5...16 mm)
- Threads for cable entries 1/2" NPT, G 1/2"

**Cable specifications
remote version****Coil cable:**

- 2 x 0.75 mm² PVC cable with common, braided copper shield (Ø approx. 7 mm)
- Conductor resistance: $\leq 37 \Omega/\text{km}$
- Capacitance: core/core, shield grounded: $\leq 120 \text{ pF/m}$
- Permanent operating temperature: $-20 \dots +80 \text{ }^\circ\text{C}$
- Cable cross-section: max. 2.5 mm²

Signal cable:

- 3 x 0.38 mm² PVC cable with common, braided copper shield (Ø approx. 7 mm) and individually shielded cores.
- With Empty Pipe Detection (EPD): 4 x 0.38 mm² PVC cable with common, braided copper shield (Ø approx. 7 mm) and individually shielded cores.
- Conductor resistance: $\leq 50 \Omega/\text{km}$
- Capacitance: core/shield: $\leq 420 \text{ pF/m}$
- Permanent operating temperature: $-20 \dots +80 \text{ }^\circ\text{C}$
- Cable cross-section: max. 2.5 mm²



a = signal cable, b = coil current cable (cross-section: max. 2.5 mm²)

*1 = core, 2 = core insulation, 3 = core shield, 4 = core jacket, 5 = core strengthening,
6 = cable shield, 7 = outer jacket*

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Optionally, Endress+Hauser also supplies reinforced connecting cables with an additional, metal strengthening braid. We recommend such cables for the following cases:

- Cables laid underground
- Danger of rodent attack
- Device used with ingress protection IP 68

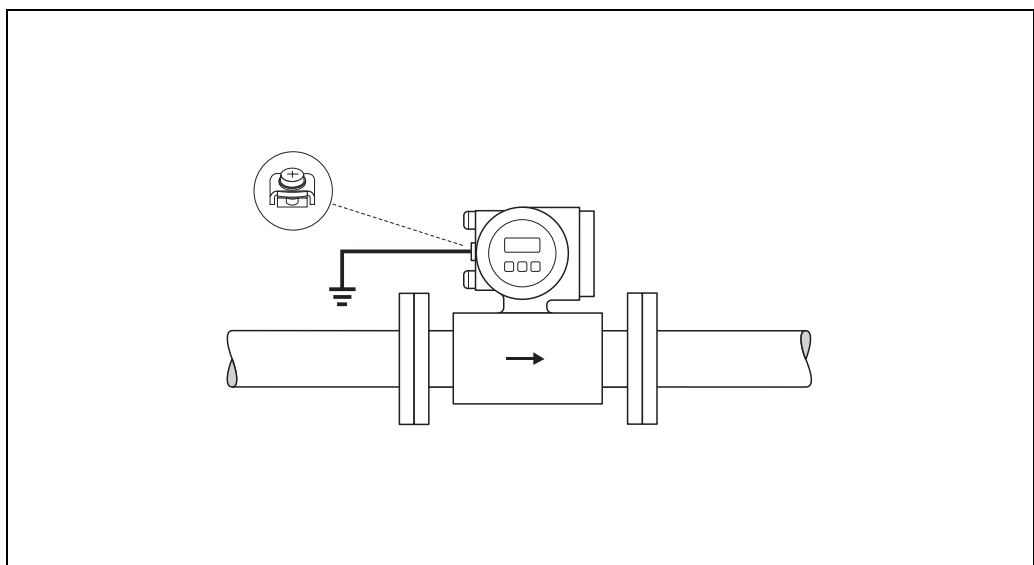
Operation in zones of severe electrical interference:

The measuring device complies with the general safety requirements in accordance with EN 61010, the EMC requirements of EN 61326/A1, and NAMUR Recommendation NE 21.

Caution!

Grounding is by means of the ground terminals provided for the purpose inside the connection housing. Keep the stripped and twisted lengths of cable shield to the terminals as short as possible.

Supply voltage	85...260 V AC, 45...65 Hz 20...55 V AC, 45...65 Hz 16...62 V DC PROFIBUS PA and FOUNDATION Fieldbus Non-Ex: 9...32 V DC Ex i: 9...24 V DC Ex d: 9...32 V DC
Power consumption	AC: <15 VA (including sensor) DC: <15 W (including sensor) Switch-on current: ■ max. 13.5 A (< 50 ms) at 24 V DC ■ max. 3 A (< 5 ms) at 260 V AC
Power supply failure	Lasting min. 1 power cycle: ■ 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 equalisation	Standard case Perfect measurement is only ensured when the medium and the sensor have the same electrical potential. Most Promag sensors have a standard installed reference electrode which guarantees the required connection. This usually means that additional potential matching measures are unnecessary. Note! For installation in metal pipes, it is advisable to connect the ground terminal of the transmitter housing to the piping. Also, observe company-internal grounding guidelines.



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Caution!

For sensors without reference electrodes or without metal process terminals, carry out potential matching as per the instructions for special cases described below. These special measures are particularly important when standard grounding practice cannot be ensured or extremely strong matching currents are expected.

Metal, ungrounded piping

In order to prevent outside influences on measurement, it is advisable to use ground cables to connect each sensor flange to its corresponding pipe flange and ground the flanges. Connect the transmitter or sensor connection housing, as applicable, to ground potential means of the ground terminal provided for the purpose.

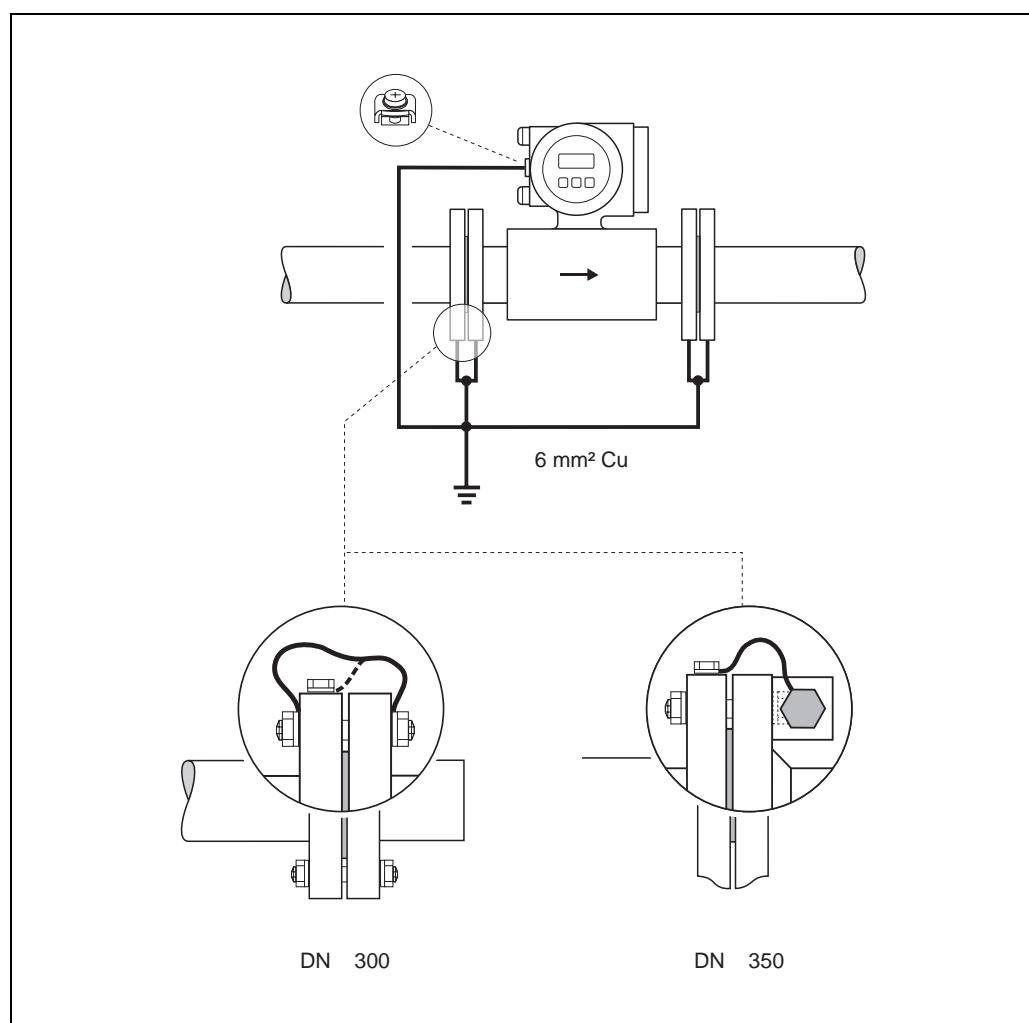
Caution!

Also, observe company-internal grounding guidelines.

Note!

The ground cable for flange-to-flange connections can be ordered separately as an accessory from Endress+Hauser.

- $DN \leq 300$: The ground cable is in direct connection with the conductive flange coating and is secured by the flange screws.
- $DN \geq 350$: The ground cable connects directly to the metal transport bracket.



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Plastic pipes and isolating lined pipes

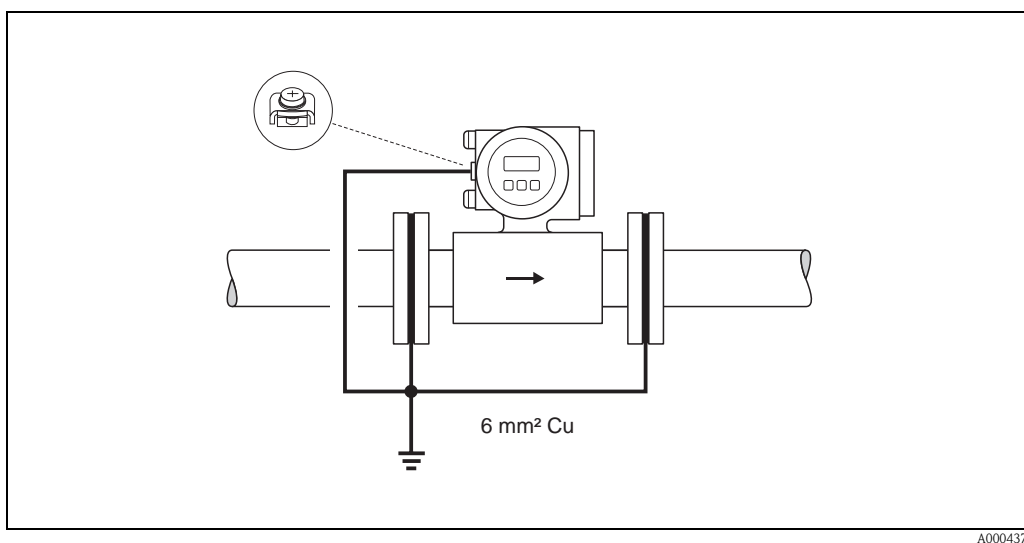
Normally, potential is matched using the reference electrodes in the measuring tube. However, in exceptional cases it is possible that, due to the grounding plan of a system, large matching currents flow over the reference electrodes. This can lead to destruction of the sensor, e.g. through electrochemical decomposition of the electrodes. In such cases, e.g. for fibre-glass or PVC piping, it is recommended that you use additional ground disks for potential matching.

When using ground disks, note the following points:

- Ground disks (DN 15...300) can be ordered separately from Endress+Hauser as an accessory.
- Ground disks (incl. seals) increase the installation length. You can find the dimensions of ground disks on Page 30.

Caution!

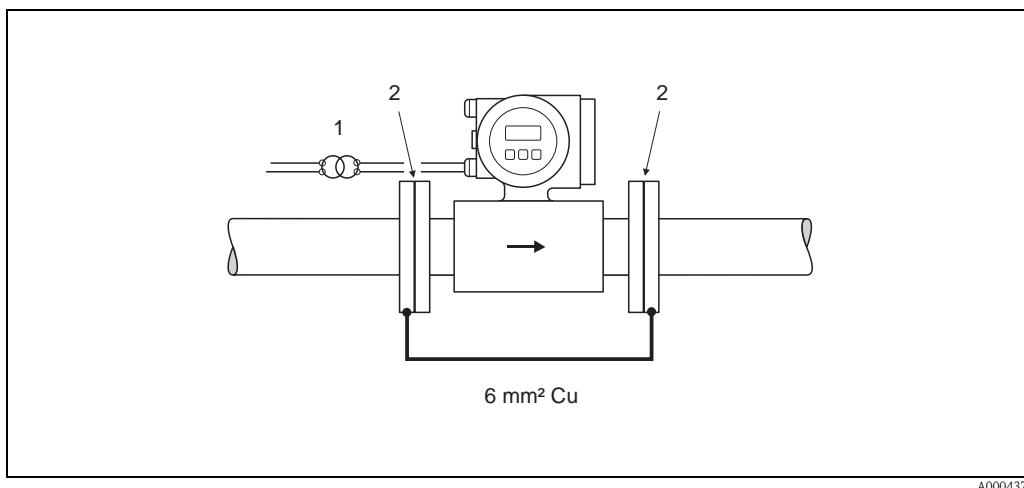
- Risk of damage from electrochemical corrosion. Note the electrochemical insulation rating, if the ground disks and measuring electrodes are made of different materials.
- Also, observe company-internal grounding guidelines.



Pipes with cathodic protection

In such cases, install the measuring instrument without potential in the piping:

- When installing the measuring device, make sure that there is an electrical connection between the two piping runs (copper wire, 6 mm²).
- Make sure that the installation materials do not establish a conductive connection to the measuring device and that the installation materials withstand the tightening torques applied when the threaded fasteners are tightened.
- Also comply with the regulations applicable to potential-free installation.



1 = isolating transformer, 2 = electrically insulated

Performance characteristics

Reference operating conditions

To DIN EN 29104 and VDI/VDE 2641:

- Medium temperature: $+28\text{ °C} \pm 2\text{ K}$
- Ambient temperature: $+22\text{ °C} \pm 2\text{ K}$
- Warm-up period: 30 minutes

Installation:

- Inlet run $>10 \times \text{DN}$
- Outlet run $> 5 \times \text{DN}$
- Sensor and transmitter grounded.
- Sensor centred relative to the pipe.

Maximum measured error

Promag 50:

Pulse output: $\pm 0.5\%$ o.r. $\pm 1\text{ mm/s}$ (o.r. = of reading)

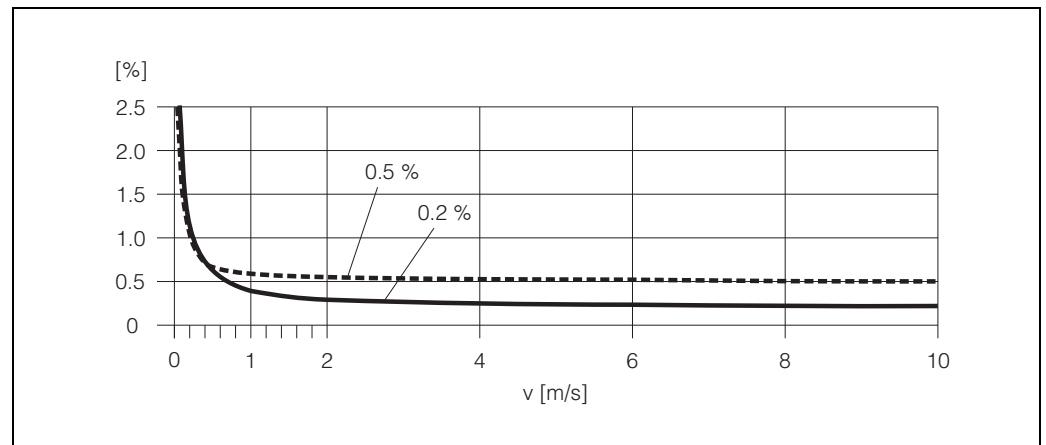
Current output: plus typically $\pm 5\text{ }\mu\text{A}$

Promag 53:

Pulse output: $\pm 0.2\%$ o.r. $\pm 2\text{ mm/s}$ (o.r. = of reading)

Current output: plus typically $\pm 5\text{ }\mu\text{A}$

Supply voltage fluctuations have no effect within the specified range.



Max. measured error in % of reading

F06-5xxxxxxx-05-xx-xx-xx-000

Repeatability

max. $\pm 0.1\%$ o.r. $\pm 0.5\text{ mm/s}$ (o.r. = of reading)

Operating conditions

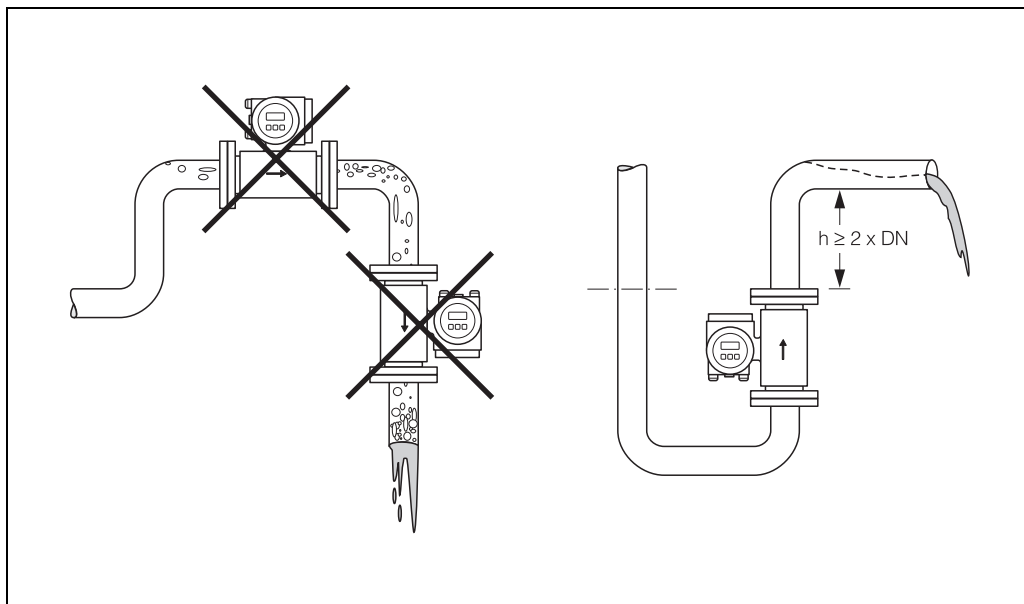
Installation conditions

Installation instructions

Mounting location

Correct measuring is possible only if the pipe is full. Avoid the following locations:

- Highest point of a pipeline. Risk of air accumulating
- Directly upstream of a free pipe outlet in a vertical pipe.

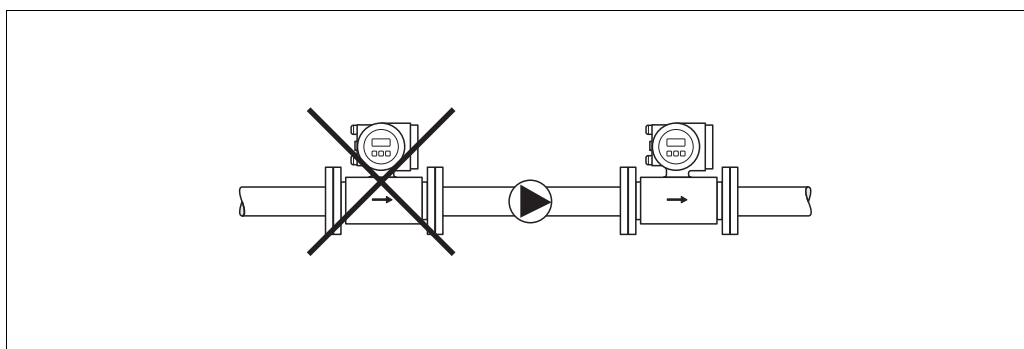


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Installation of pumps

Do not install the sensor on the intake side of a pump. This precaution is to avoid low pressure and the consequent risk of damage to the lining of the measuring tube. Information on the lining's resistance to partial vacuum can be found on Page 20.

It might be necessary to install pulse dampers in systems incorporating reciprocating, diaphragm or peristaltic pumps. Information on the measuring system's resistance to vibration and shock can be found on Page 20.



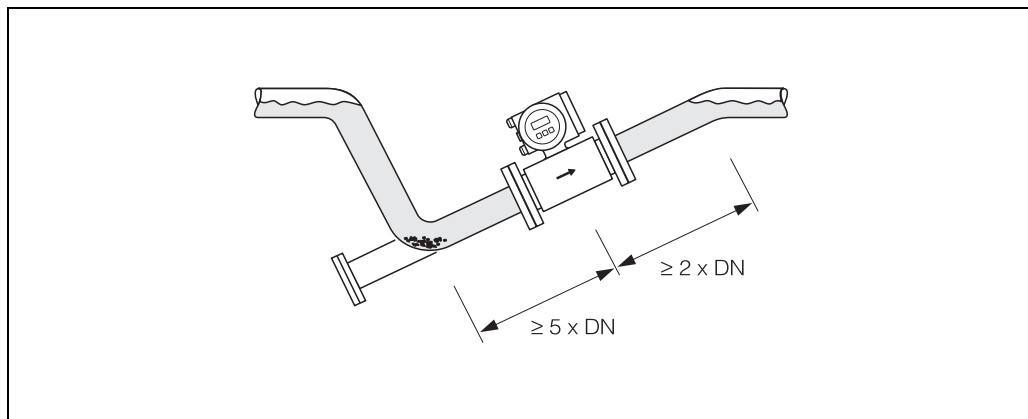
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Partially filled pipes

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

Caution!

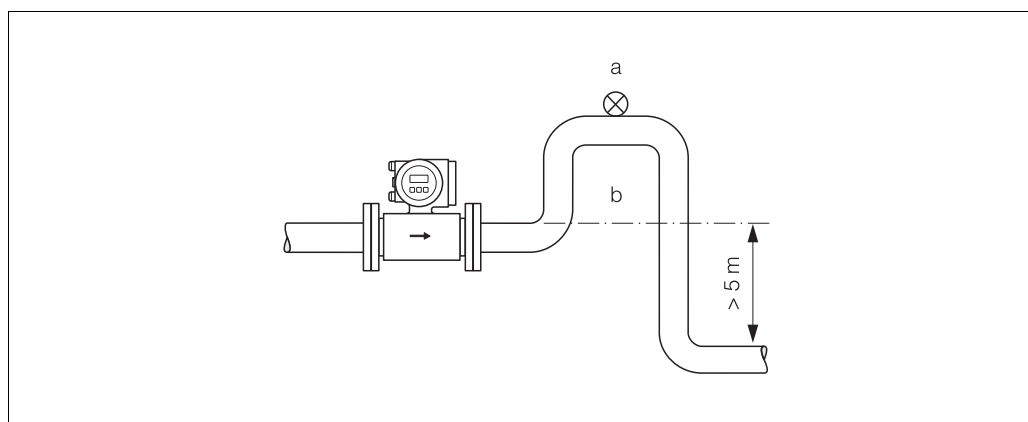
Risk of solids accumulating. Do not install the sensor at the lowest point in the drain. It is advisable to install a cleaning valve.



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Vertical pipes

Install a siphon (b) or a vent valve (a) downstream of the sensor in vertical pipes longer than 5 meters. This precaution is to avoid low pressure and the consequent risk of damage to the lining of the measuring tube. These measures also prevent the system losing prime, which could cause air inclusions. Information on the lining's resistance to partial vacuum can be found on Page 20.



F06-5xxxxxxx-11-00-00-xx-003

a = vent valve, b = siphon

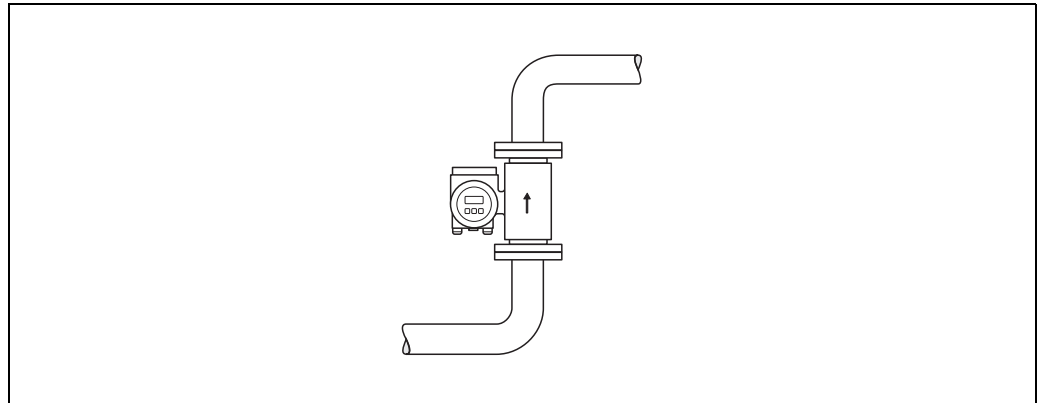
Orientation

An optimum orientation helps avoid gas and air accumulations and deposits in the measuring tube. Promag, nevertheless, supplies a range of options and accessories for correct measuring of problematic mediums:

- Electrode Cleaning Circuitry (ECC) to remove electrically conductive deposits in the measuring tube, e.g. in accretive mediums.
- Empty Pipe Detection (EPD) for recognition of partially filled measuring tubes, or for degassing mediums or for applications with fluctuating process pressure.
- Exchangeable measuring electrodes for abrasive mediums.

Vertical orientation:

This orientation is ideal for self-emptying piping systems and for use in conjunction with Empty Pipe Detection.



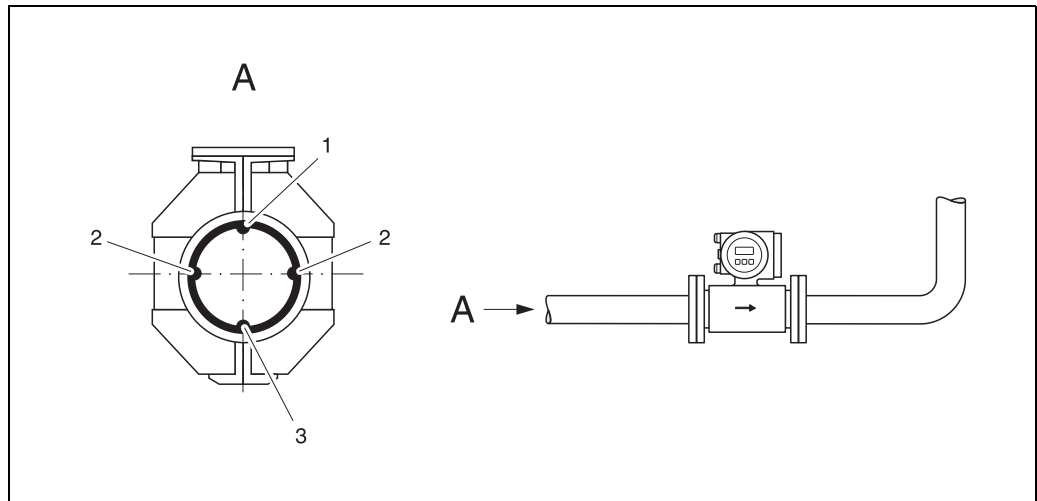
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Horizontal orientation:

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

Caution!

Empty Pipe Detection functions correctly only when the measuring device is installed horizontally and the transmitter housing is facing upward. Otherwise there is no guarantee that Empty Pipe Detection will respond if the measuring tube is only partially filled or empty.



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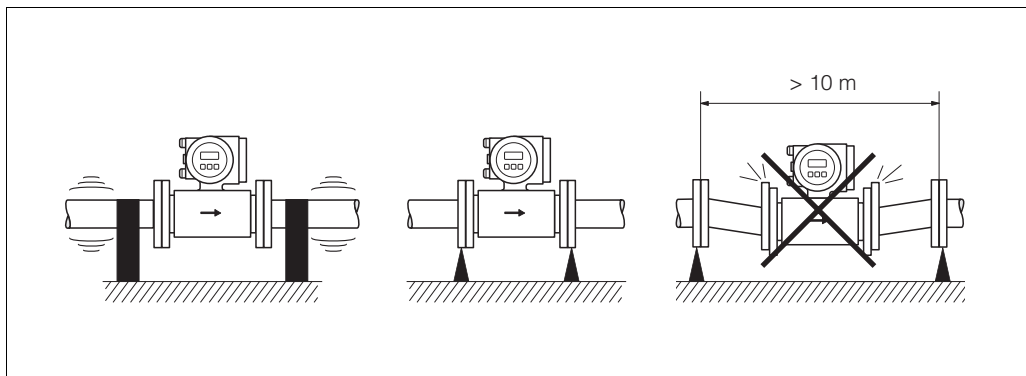
- 1 = EPD electrode (Empty Pipe Detection)
 2 = Measuring electrodes (signal detection)
 3 = Reference electrode (potential equalisation)

Vibrations

Secure the piping and the sensor if vibration is severe.

Caution!

It is advisable to install sensor and transmitter separately if vibration is excessively severe. Information on resistance to vibration and shock can be found on page 20.



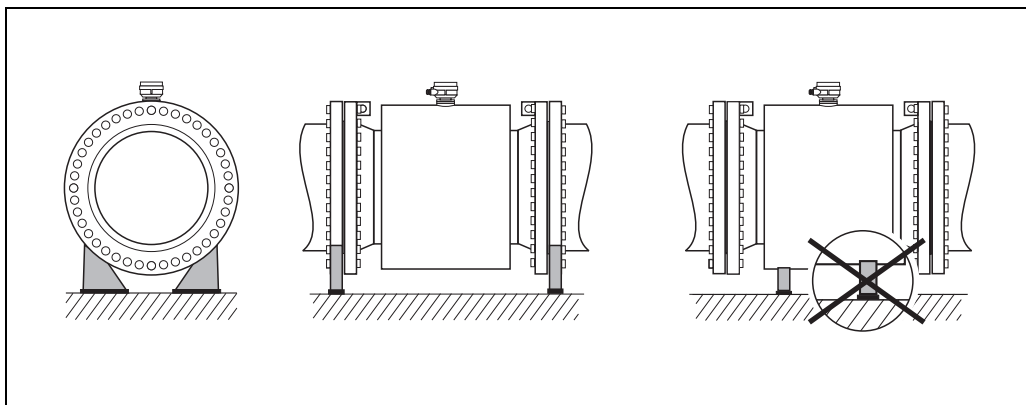
F06-5xxxxxx-11-00-00-xx-006

Foundations, supports

If the nominal diameter is $DN \geq 350$, 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.

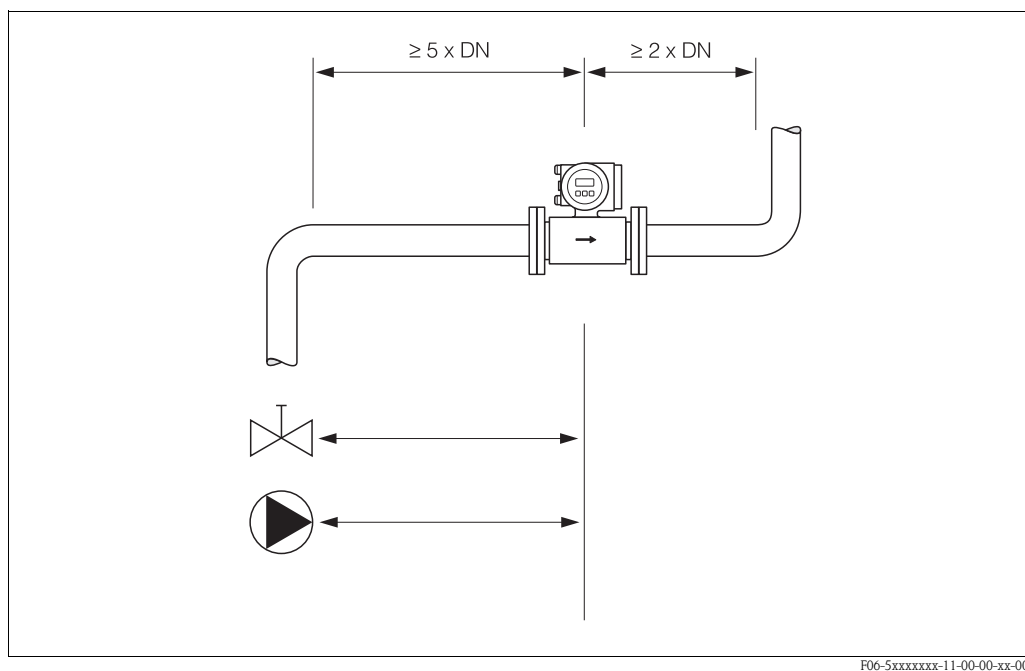


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Inlet and outlet runs

If possible, install the sensor well clear of fittings such as valves, T-pieces, elbows, etc. Compliance with the following requirements for the inlet and outlet runs is necessary in order to ensure measuring accuracy:

- Inlet run $\geq 5 \times \text{DN}$
- Outlet run $\geq 2 \times \text{DN}$



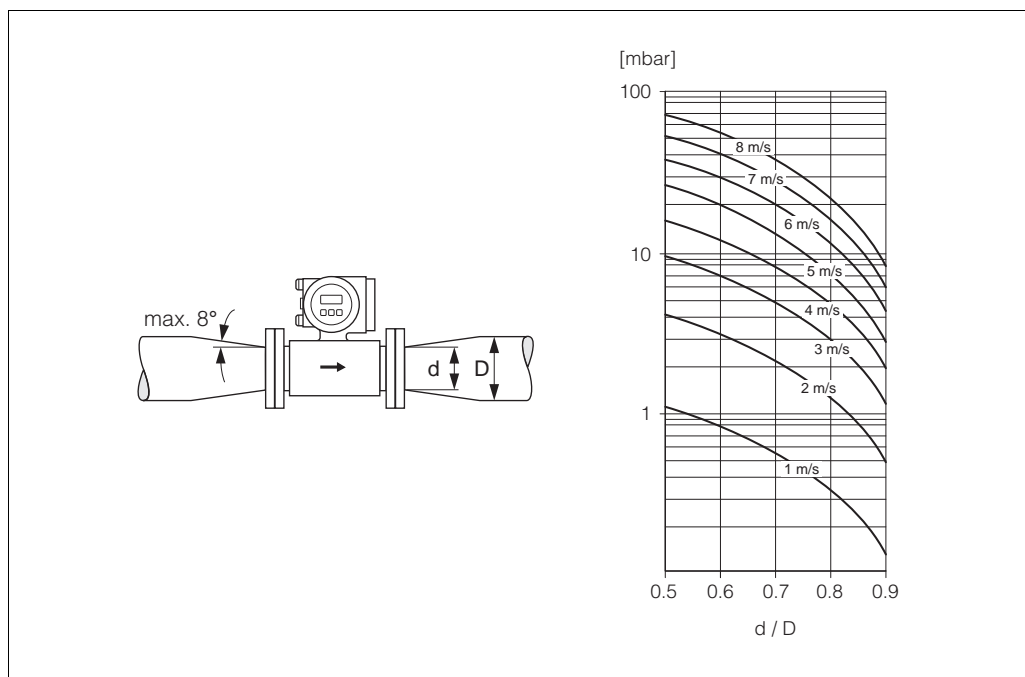
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Adapters

Suitable adapters to DIN EN 545 (double flange junction sections) 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. The nomogram applies only to fluids of viscosity similar to water.

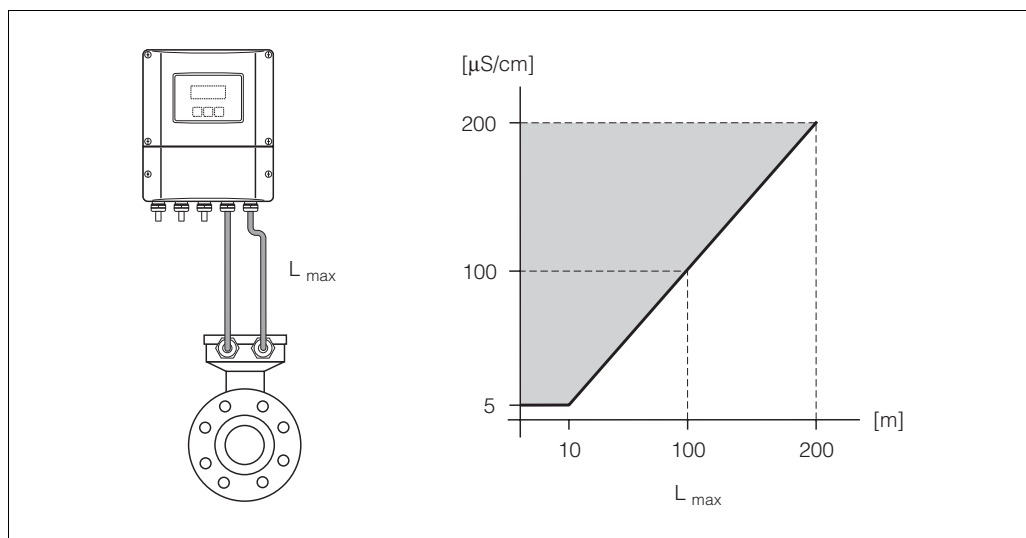
1. Calculate the ratio of the diameters d/D .
2. From the nomogram read off the pressure loss as a function of flow velocity (downstream from the reduction) and the d/D ratio.



F06-5xxxxxxx-05-05-xx-xx-000

Length of connecting cable

Permissible cable length L_{max} depends on the conductivity of the medium. A minimum conductivity of $20 \mu\text{S/cm}$ is required for measuring demineralized water.



F06-5xxxxxxx-05-xx-xx-xx-006

Gray shaded area = permissible range for medium conductivity

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

Medium conductivity in $[\mu\text{S/cm}]$

In order to ensure measuring accuracy, moreover, comply with the following instructions when installing the remote version:

- Secure the cable run or route the cable in a conduit. Movement of the cable can falsify the measuring signal, particularly if the conductivity of the medium is low.
- Route the cable well clear of electrical machines and switching elements.
- Ensure potential equalisation between sensor and transmitter, if necessary.

Environment**Ambient temperature**

Transmitter:

- Standard: $-20 \dots +60 \text{ }^\circ\text{C}$
- Optional: $-40 \dots +60 \text{ }^\circ\text{C}$

Note!

At ambient temperatures below $-20 \text{ }^\circ\text{C}$ the readability of the display may be impaired.

Sensor:

- Flange material carbon steel: $-10 \dots +60 \text{ }^\circ\text{C}$
- Flange material stainless steel: $-40 \dots +60 \text{ }^\circ\text{C}$

Caution!

It is not allowed to use the device beyond the min. and max. lining specified temperature values (→ "Medium temperature range").

Note the following points:

- Install the device at a shady location. Avoid direct sunlight, particularly in warm climatic regions.
- If both fluid and ambient temperatures are high, install the transmitter at a remote location from the sensor (→ "Medium temperature range").

Storage temperature

- The storage temperature corresponds to the ambient temperature range of the transmitter and sensor (see "Ambient temperature").
- The measuring device must be protected against direct sunlight during storage in order to avoid unacceptably high surface temperatures.
- Choose a storage location 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 you are ready to install the device.

Degree of protection	■ Standard: IP 67 (NEMA 4X) for transmitter and sensor
	■ Optional: IP 68 (NEMA 6P) for sensor in remote version

Shock and vibration resistance	Acceleration up to 2 g by analogy with IEC 60068-2-6.
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Electromagnetic compatibility (EMC)	To EN 61326/A1 and NAMUR recommendation NE 21.
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Process conditions

Medium temperature range	The permissible medium temperature depends on the measuring-tube lining:
	<ul style="list-style-type: none"> ■ 0...+80 °C for hard rubber (DN 65...2000) ■ -20...+50 °C for polyurethane (DN 25...1000)

Conductivity	Minimum conductivity:
	≥ 5 µS/cm for liquids generally
	≥ 20 µS/cm for demineralised water

Note that in the case of the remote version, the minimum conductivity is also influenced by the length of the connecting cable → see “Length of connecting cable”

Medium pressure range (nominal pressure)	EN 1092-1 (DIN 2501):
	PN 6 (DN 1200...2000)
	PN 10 (DN 200...2000)
	PN 16 (DN 65...2000)
	PN 25 (DN 200...1000)
	PN 40 (DN 25...150)
	ANSI B16.5:
	Class 150 (1...24")
	Class 300 (1...6")
	AWWA:
	Class D (28...78")
	JIS B2238:
	10K (DN 50...300)
	20K (DN 25...300)
	AS 2129:
	Table E (DN 80, 100, 150...400, 500, 600)
	AS 4087:
	Cl. 14 (DN 80, 100, 150...400, 500, 600)

Pressure tightness (liner)

Nominal diameter		Measuring tube lining	Resistance to partial vacuum of measuring tube lining						
[mm]	[inch]		Limit values for abs. pressure [mbar] at various fluid temperatures						
			25 °C	50 °C	80 °C	100 °C	130 °C	150 °C	180 °C
25...1000	1...40"	Polyurethane	0	0	–	–	–	–	–
65...2000	3...78"	Hard rubber	0	0	0	–	–	–	–

Limiting flow

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

- $v < 2$ m/s: for abrasive mediums such as potter's clay, lime milk, ore slurry, etc.
- $v > 2$ m/s: for accretive mediums such as wastewater sludge, etc.

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

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

Pressure loss

- No pressure loss if the sensor is installed in a pipe of the same nominal diameter.
- Pressure losses for configurations incorporating adapters to DIN EN 545 → Page 18

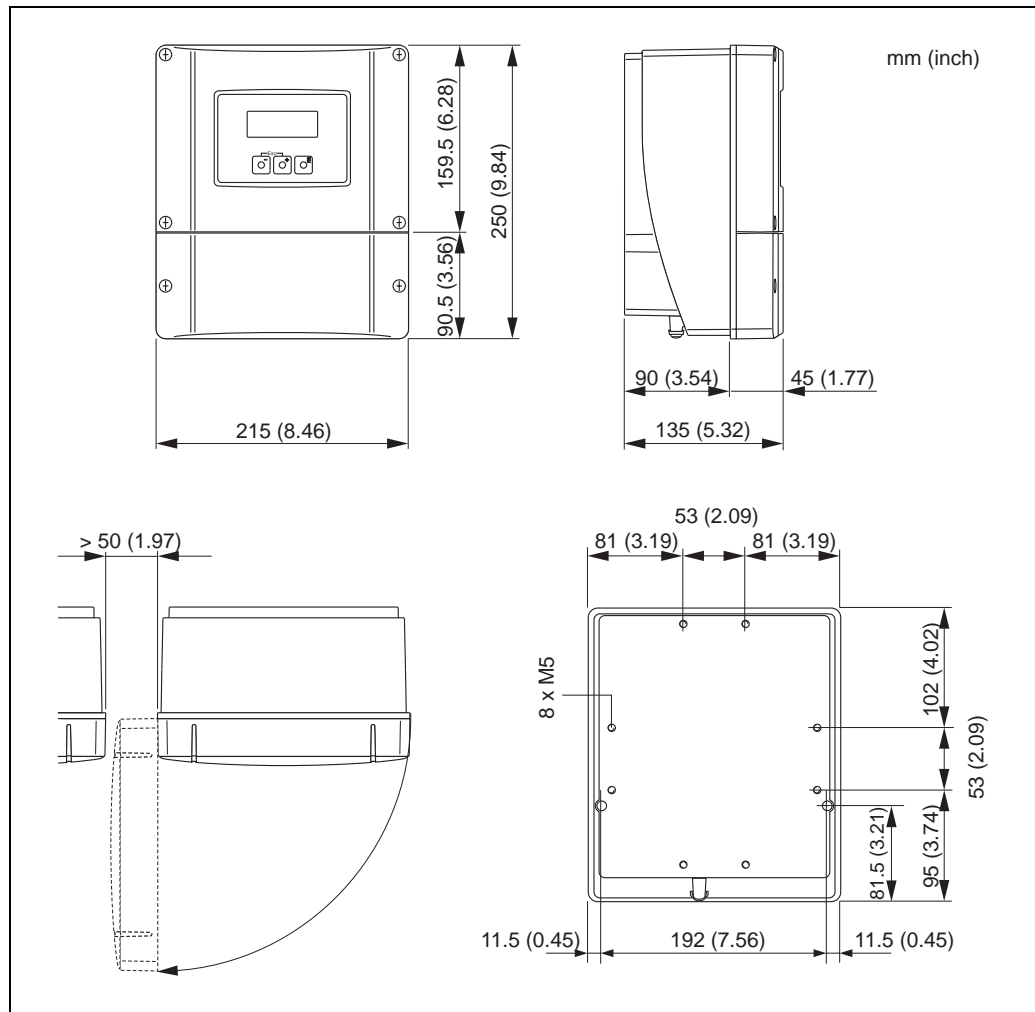
Measuring-tube specifications

Nominal Diameter		Pressure rating						Inside diameter of measuring tube	
[mm]	[inch]	EN (DIN) [bar]	AS 2129	AS 4087	ANSI [lbs]	AWWA	JIS	Hard rubber	Polyurethane
25	1"	PN 40	–	–	Cl 150	–	20K	–	24
32	–	PN 40	–	–	–	–	20K	–	32
40	1 1/2"	PN 40	–	–	Cl 150	–	20K	–	38
50	2"	PN 40	–	–	Cl 150	–	10K	–	50
65	–	PN 16	–	–	–	–	10K	66	66
80	3"	PN 16	Table E	Cl.14	Cl 150	–	10K	79	79
100	4"	PN 16	Table E	Cl.14	Cl 150	–	10K	102	102
125	–	PN 16	–	–	–	–	10K	127	127
150	6"	PN 16	Table E	Cl.14	Cl 150	–	10K	156	156
200	8"	PN 10	Table E	Cl.14	Cl 150	–	10K	204	204
250	10"	PN 10	Table E	Cl.14	Cl 150	–	10K	258	258
300	12"	PN 10	Table E	Cl.14	Cl 150	–	10K	309	309
350	14"	PN 10	Table E	Cl.14	Cl 150	–	–	342	342
400	16"	PN 10	Table E	Cl.14	Cl 150	–	–	392	392
450	18"	PN 10	–	–	Cl 150	–	–	437	437
500	20"	PN 10	Table E	Cl.14	Cl 150	–	–	492	492
600	24"	PN 10	Table E	Cl.14	Cl 150	–	–	594	594
700	28"	PN 10	–	–	–	Class D	–	692	692
–	30"	–	–	–	–	Class D	–	742	742
800	32"	PN 10	–	–	–	Class D	–	794	794
900	36"	PN 10	–	–	–	Class D	–	891	891
1000	40"	PN 10	–	–	–	Class D	–	994	994
–	42"	–	–	–	–	Class D	–	1043	1043
1200	48"	PN 6	–	–	–	Class D	–	1197	1197
–	54"	–	–	–	–	Class D	–	1339	1339
1400	–	PN 6	–	–	–	–	–	1402	1402
–	60"	–	–	–	–	Class D	–	1492	1492
1600	–	PN 6	–	–	–	–	–	1600	1600
–	66"	–	–	–	–	Class D	–	1638	1638
1800	72"	PN 6	–	–	–	Class D	–	1786	1786
2000	78"	PN 6	–	–	–	Class D	–	1989	1989

Mechanical construction

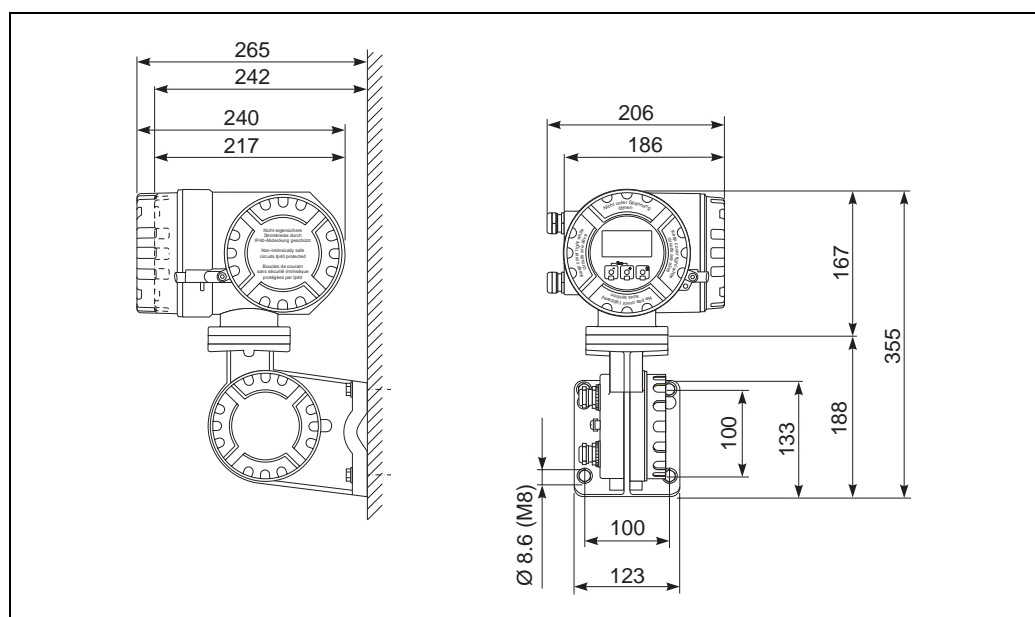
Design / dimensions

Dimensions: Wall-mount housing (non hazardous area and II3G / zone 2)



A0001150

Dimensions: Remote field housing (II2GD / zone 1)

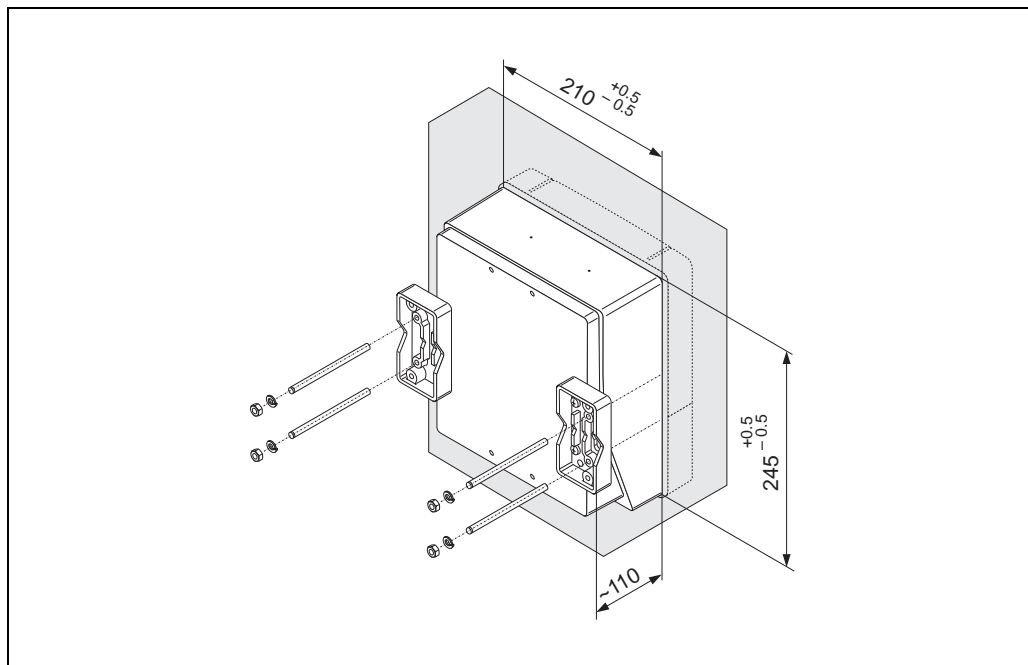


A0002128

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:

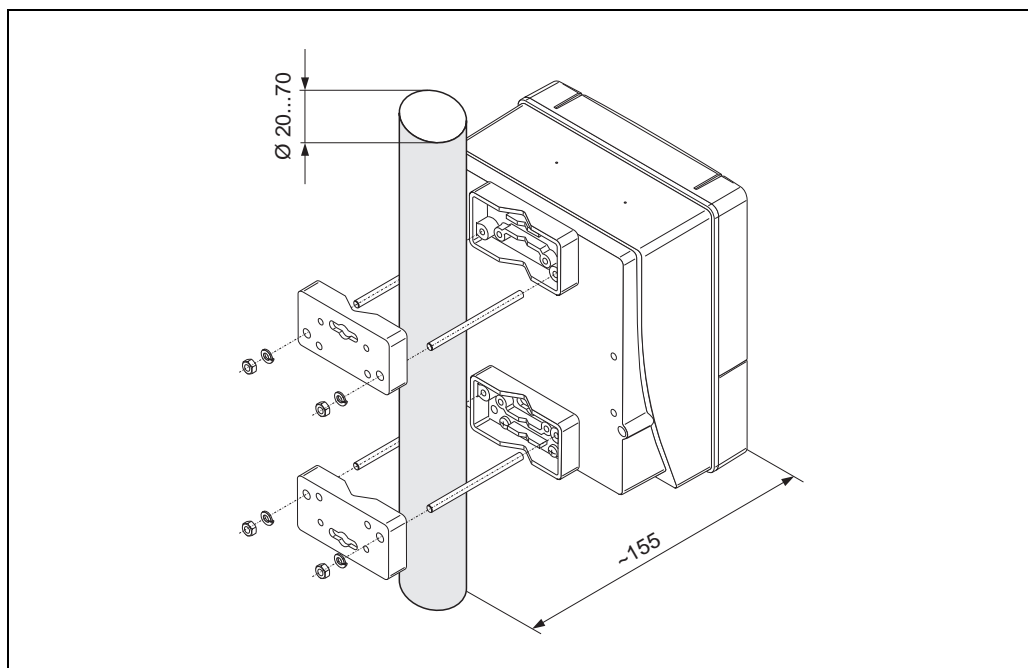
- Panel-mounted installation
- Pipe mounting

Panel-mounted installation

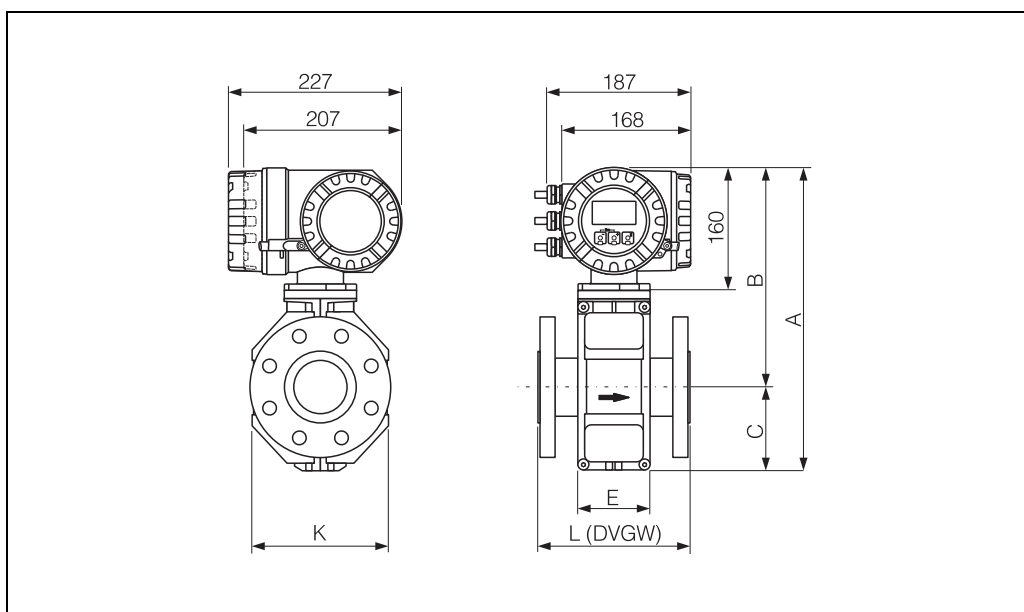


A0001131

Pipe mounting



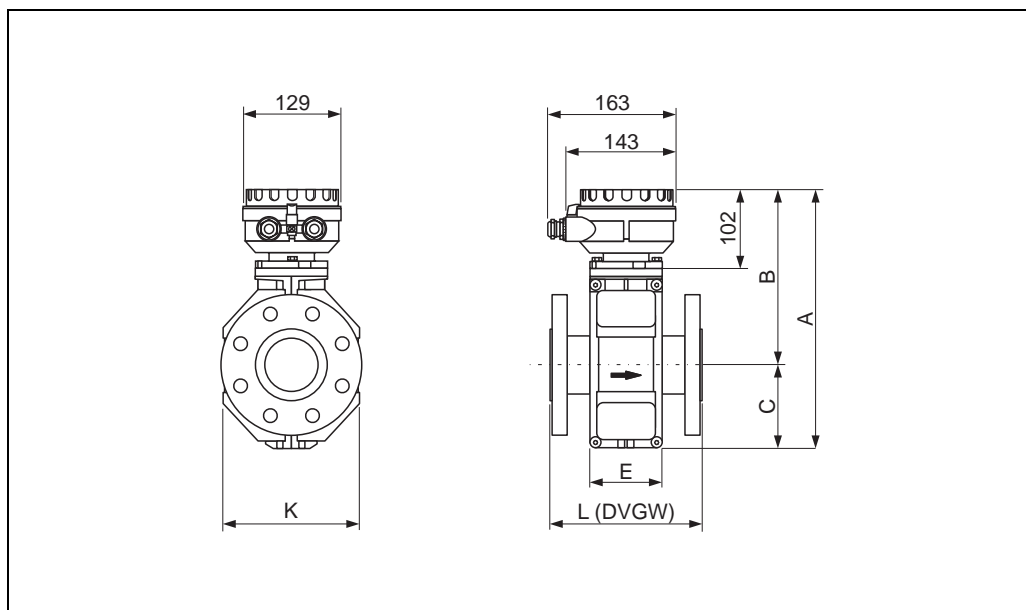
A0001132

Compact version DN ≤ 300

F06-53Fxxxxx-06-00-xx-xx-000

DN		L	A	B	C	K	E
EN (DIN) / JIS / AS* [mm]	ANSI [inch]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
25	1"	200	341	257	84	120	94
32	—	200	341	257	84	120	94
40	1 1/2"	200	341	257	84	120	94
50	2"	200	341	257	84	120	94
65	—	200	391	282	109	180	94
80	3"	200	391	282	109	180	94
100	4"	250	391	282	109	180	94
125	—	250	472	322	150	260	140
150	6"	300	472	322	150	260	140
200	8"	350	527	347	180	324	156
250	10"	450	577	372	205	400	156
300	12"	500	627	397	230	460	166

The fitting length (L) is always the same, regardless of the pressure rating.
 * Only DN 80, 100 and 150...300 are available if flanges according to AS are used.

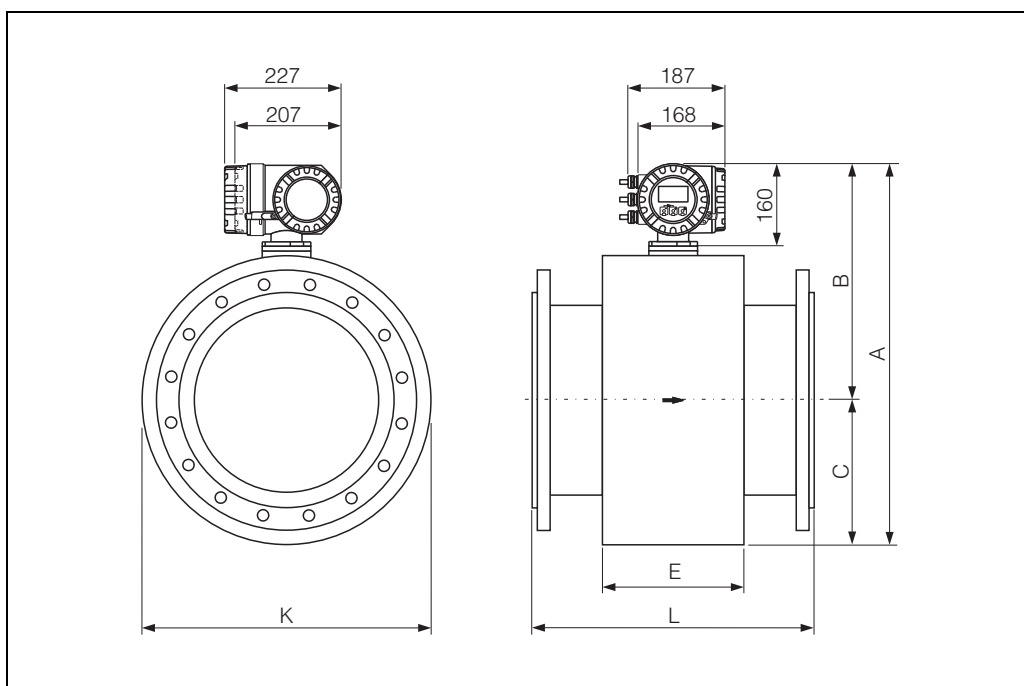
Remote version DN ≤ 300

A0003219

DN		L	A	B	C	K	E
EN (DIN) / JIS / AS* [mm]	ANSI [inch]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
25	1"	200	286	202	84	120	94
32	—	200	286	202	84	120	94
40	1 1/2"	200	286	202	84	120	94
50	2"	200	286	202	84	120	94
65	—	200	336	227	109	180	94
80	3"	200	336	227	109	180	94
100	4"	250	336	227	109	180	94
125	—	250	417	267	150	260	140
150	6"	300	417	267	150	260	140
200	8"	350	472	292	180	324	156
250	10"	450	522	317	205	400	156
300	12"	500	572	342	230	460	166

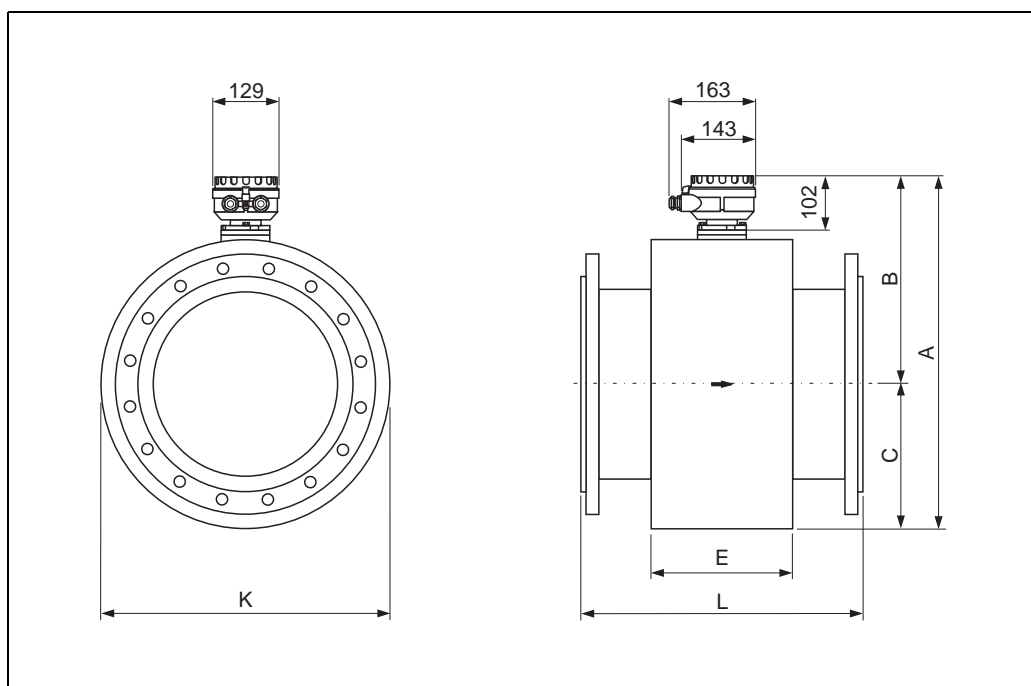
The fitting length (L) is always the same, regardless of the pressure rating.

* Only DN 80, 100 and 150...300 are available if flanges according to AS are used.

Compact version DN ≥ 350

F06-xxFxxxxx-06-05-xx-xx-000

DN		L	A	B	C	K	E
EN (DIN) / AS ¹⁾ [mm]	ANSI / AWWA ²⁾ [inch]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
350	14"	550	738.5	456.5	282.0	564	276
400	16"	600	790.5	482.5	308.0	616	276
450	18"	650	840.5	507.5	333.0	666	292
500	20"	650	891.5	533.0	358.5	717	292
600	24"	780	995.5	585.0	410.5	821	402
700	28"	910	1198.5	686.5	512.0	1024	589
750	30"	975	1198.5	686.5	512.0	1024	626
800	32"	1040	1241.5	708.0	533.5	1067	647
900	36"	1170	1394.5	784.5	610.0	1220	785
1000	40"	1300	1546.5	860.5	686.0	1372	862
1050	42"	1365	1598.5	886.5	712.0	1424	912
1200	48"	1560	1796.5	985.5	811.0	1622	992
1350	54"	1755	1998.5	1086.5	912.0	1824	1252
1400	56"	1820	2148.5	1161.5	987.0	1974	1252
1500	60"	1950	2196.5	1185.5	1011.0	2022	1392
1600	64"	2080	2286.5	1230.5	1056.0	2112	1482
1650	66"	2145	2360.5	1267.5	1093.0	2186	1482
1800	72"	2340	2550.5	1362.5	1188.0	2376	1632
2000	78"	2600	2650.5	1412.5	1238.0	2476	1732
The fitting length (L) is always the same, regardless of the pressure rating.							
¹⁾ Only DN 350, 400, 500 and 600 are available if flanges according to AS are used.							
²⁾ DN < 700 only to ANSI, DN > 600 only to AWWA.							

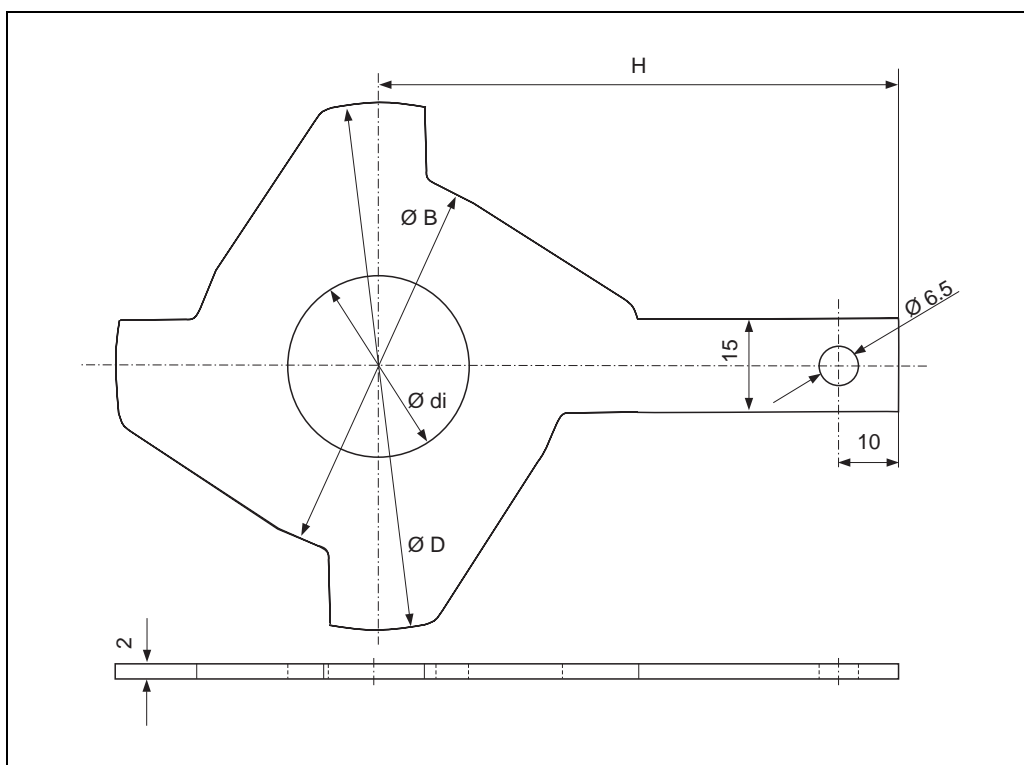
Remote version DN ≥ 350

A0003220

DN		L	A	B	C	K	E
EN (DIN) / AS ¹⁾ [mm]	ANSI / AWWA ²⁾ [inch]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
350	14"	550	683.5	401.5	282.0	564	276
400	16"	600	735.5	427.5	308.0	616	276
450	18"	650	785.5	452.5	333.0	666	292
500	20"	650	836.5	478.0	358.5	717	292
600	24"	780	940.5	530.0	410.5	821	402
700	28"	910	1143.5	631.5	512.0	1024	589
750	30"	975	1143.5	631.5	512.0	1024	626
800	32"	1040	1186.5	653.0	533.5	1067	647
900	36"	1170	1339.5	729.5	610.0	1220	785
1000	40"	1300	1491.5	805.5	686.0	1372	862
1050	42"	1365	1543.5	831.5	712.0	1424	912
1200	48"	1560	1741.5	930.5	811.0	1622	992
1350	54"	1755	1943.5	1031.5	912.0	1824	1252
1400	56"	1820	2093.5	1106.5	987.0	1974	1252
1500	60"	1950	2141.5	1130.5	1011.0	2022	1392
1600	64"	2080	2231.5	1175.5	1056.0	2112	1482
1650	66"	2145	2305.5	1212.5	1093.0	2186	1482
1800	72"	2340	2495.5	1307.5	1188.0	2376	1632
2000	78"	2600	2595.5	1357.5	1238.0	2476	1732

The fitting length (L) is always the same, regardless of the pressure rating.

¹⁾ Only DN 350, 400, 500 and 600 are available if flanges according to AS are used.²⁾ DN < 700 only to ANSI, DN > 600 only to AWWA.

Ground disk (DN 25...300)

DN ¹⁾		di	B	D	H
EN (DIN) / JIS / AS ⁴⁾	ANSI	[mm]	[mm]	[mm]	[mm]
25	1"	26	62	77.5	87.5
32	—	35	80	87.5	94.5
40	1 1/2"	41	82	101	103
50	2"	52	101	115.5	108
65	—	68	121	131.5	118
80	3"	80	131	154.5	135
100	4"	104	156	186.5	153
125	—	130	187	206.5	160
150	6"	158	217	256	184
200	8"	206	267	288	205
250	10"	260	328	359	240
300 ²⁾	12" ²⁾	312	375	413	273
300 ³⁾	12" ³⁾	310	375	404	268

¹⁾ Ground disks can, with the exception of DN 300, be used for all flange norms / pressure ratings.

²⁾ PN 10/16, Cl. 150

³⁾ PN 25, JIS 10K/20K

⁴⁾ DN 32, 40, 65 and 125 are not available if flanges according to AS are used.

Weight

Weight data in kg

Nominal diameter		Compact version			Remote version (without cable)				
		EN (DIN) / AS*	JIS	ANSI/AWWA	EN (DIN) / AS*	Sensor		ANSI/AWWA	Wall housing
[mm]	[inch]					JIS			
25	1"	PN 40	7.3	7.3	PN 40	5.3	5.3	5.3	6.0
32	1 1/4"		8.0	7.3		6.0	5.3	–	6.0
40	1 1/2"		9.4	8.3		7.4	6.3	7.4	6.0
50	2"	PN 16	10.6	9.3	PN 16	8.6	7.3	8.6	6.0
65	2 1/2"		12.0	11.1		10.0	9.1	–	6.0
80	3"		14.0	12.5		12.0	10.5	12.0	6.0
100	4"		16.0	14.7		14.0	12.7	14.0	6.0
125	5"		21.5	21.0		19.5	19.0	–	6.0
150	6"	PN 10	25.5	24.5	PN 10	23.5	22.5	23.5	6.0
200	8"		45	41.9		43	39.9	43	6.0
250	10"		65	69.4		63	67.4	73	6.0
300	12"		70	72.3		68	70.3	108	6.0
350	14"		115			113		173	6.0
400	16"	PN 10	135		PN 10	133		203	6.0
450	18"		175			173		253	6.0
500	20"		175			173		283	6.0
600	24"		235			233		403	6.0
700	28"		355			353		398	6.0
–	30"	PN 6	–		PN 6	–		458	6.0
800	32"		435			433		548	6.0
900	36"		575			573		798	6.0
1000	40"		700			698		898	6.0
–	42"		–			–		1098	6.0
1200	48"		850			848		1398	6.0
–	54"		–			–		2198	6.0
1400	–		1300			1298		–	6.0
–	60"		–			–		2698	6.0
1600	–		1700			1698		–	6.0
–	66"	PN 6	–			–		3698	6.0
1800	72"		2200			2198		4098	6.0
–	78"		–			–		4598	6.0
2000	–		2800			2798		–	6.0

Transmitter Promag (compact version): 3.4 kg

(Weight data valid for standard pressure ratings and without packaging material)

* Only DN 80, 100, 150...400, 500 and 600 are available if flanges according to AS are used.

Materials

Transmitter housing:

- Compact housing: powder coated die-cast aluminium
- Wall-mounted housing: powder coated die-cast aluminium

Sensor housing:

- DN 25...300: powder-coated die-cast aluminium
- DN 350...2000: painted steel (Amerlock 400)

Measuring tube:

- DN < 350: stainless steel 1.4301 or 1.4306/304L; non-stainless flange material with Al/Zn protective coating
- DN > 300: stainless steel 1.4301/304; non-stainless flange material with Amerlock 400 paint

Flange:

- EN 1092-1 (DIN 2501): 316L / 1.4571; RSt37-2 (S235JRG2) / C22 / FE 410W B
(with flanges made of carbon steel: DN < 350 with Al/Zn protective coating;
DN > 300 with Amerlock 400 paint)
- ANSI: A105, F316L
(with flanges made of carbon steel: DN < 350 with Al/Zn protective coating;
DN > 300 with Amerlock 400 paint)
- AWWA: 1.0425 (with Amerlock 400 paint)
- JIS: RSt37-2 (S235JRG2) / H II / 1.0425 / 316L
(with flanges made of carbon steel: DN < 350 with Al/Zn protective coating;
DN > 300 with Amerlock 400 paint)
- AS 2129: (DN 150, 200, 250, 300, 600) A105 or RSt37-2 (S235JRG2)
(DN 80, 100, 350, 400, 500) A105 or St44-2 (S275JR)
(with flanges made of carbon steel: DN < 350 with Al/Zn protective coating;
DN > 300 with Amerlock 400 paint)
- AS 4087: A105 or St44-2 (S275JR)
(with flanges made of carbon steel: DN < 350 with Al/Zn protective coating;
DN > 300 with Amerlock 400 paint)

Ground disks: 1.4435/316L or Alloy C-22

Electrodes: 1.4435 or Alloy C-22, tantalum

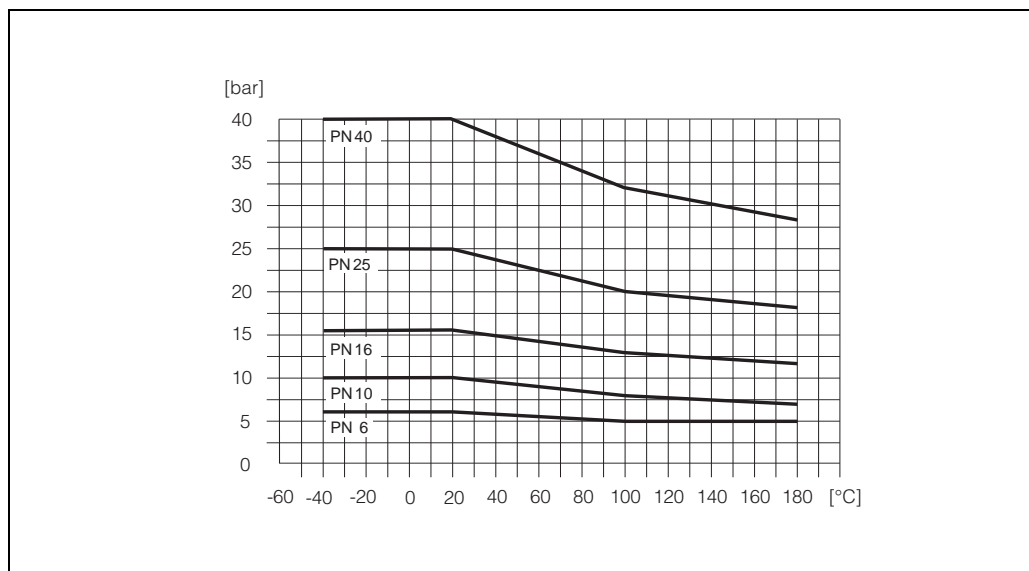
Seals: Seals to DIN EN 1514-1

Material load diagrams**Caution!**

The following diagrams contain material load curves (reference curves) for various process connections relating to the fluid temperature. But the maximal permissible fluid temperature always depends on the lining material of the sensor and/or of the sealing material (Page 20).

Flange connection to EN 1092-1 (DIN 2501)

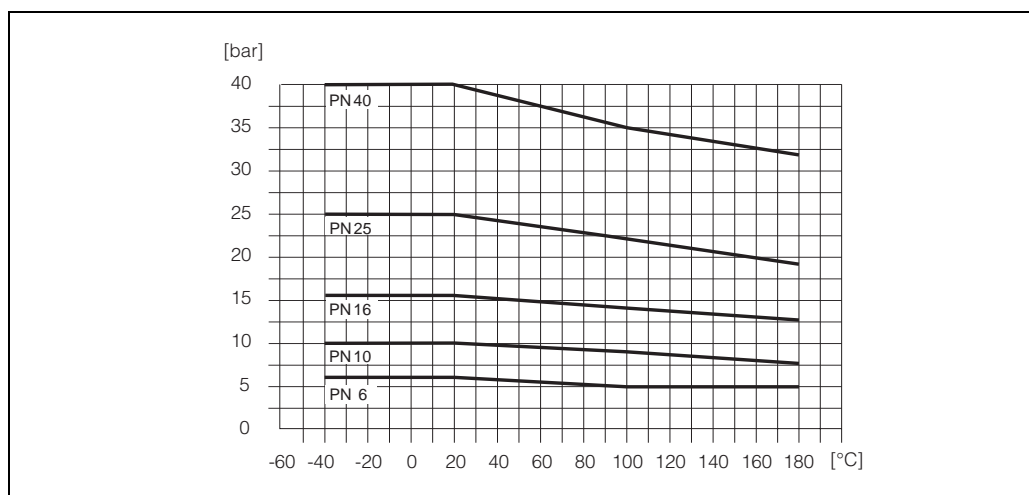
Material: RSt37-2 (S235JRG2) / C22 / FE 410W B



F06-xxFxxxxx-05-xx-xx-xx-000

Flange connection to EN 1092-1 (DIN 2501)

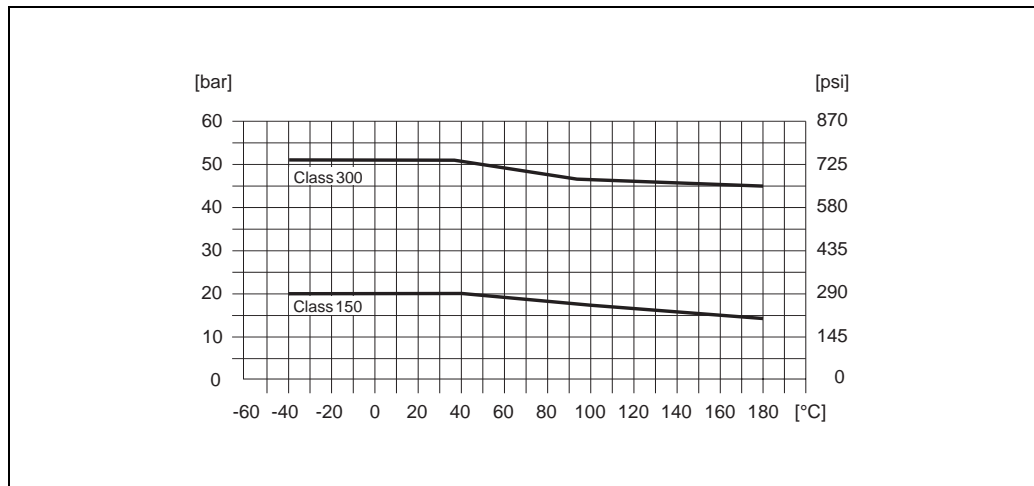
Material: 316L / 1.4571



F06-xxFxxxxx-05-xx-xx-xx-001

Flange connection to ANSI B16.5

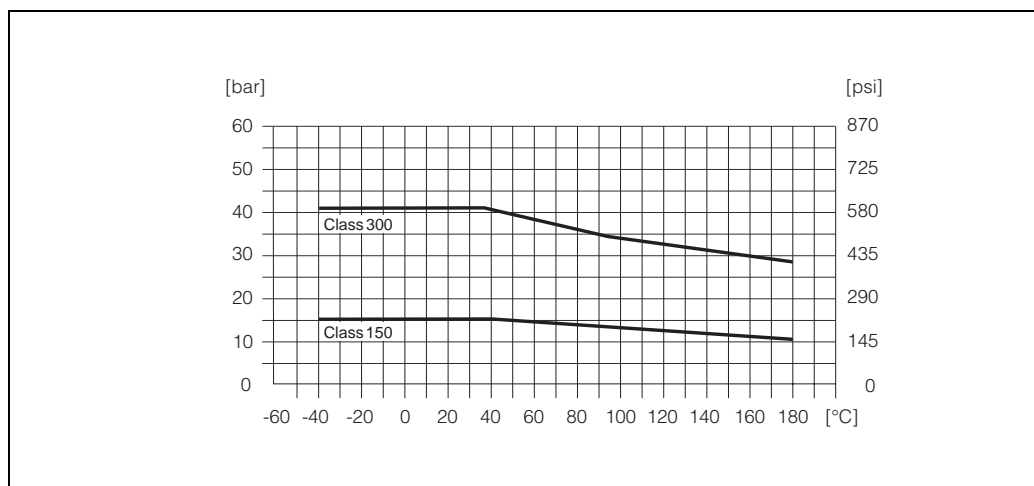
Material: A105



A0003226

Flange connection to ANSI B16.5

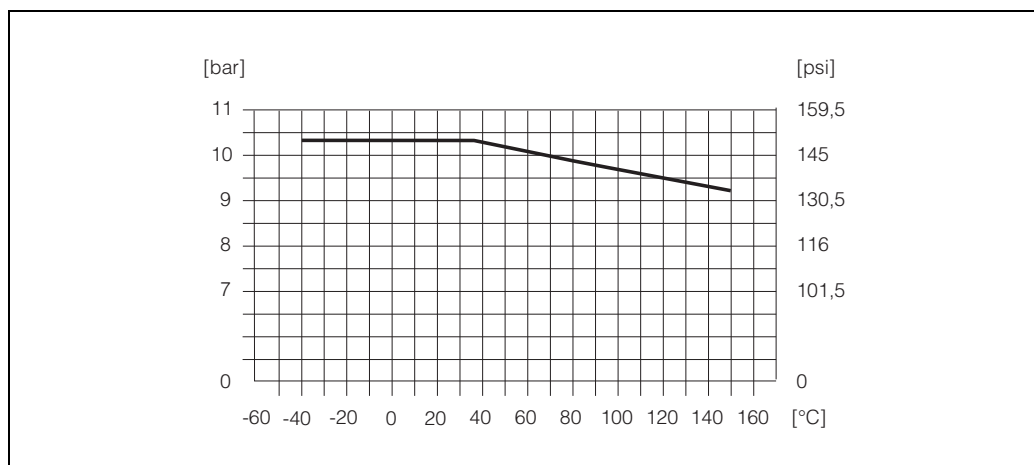
Material: F316L



F06-xxFxxxxx-05-xx-xx-xx-002

Flange connection to AWWA C 207, Class D

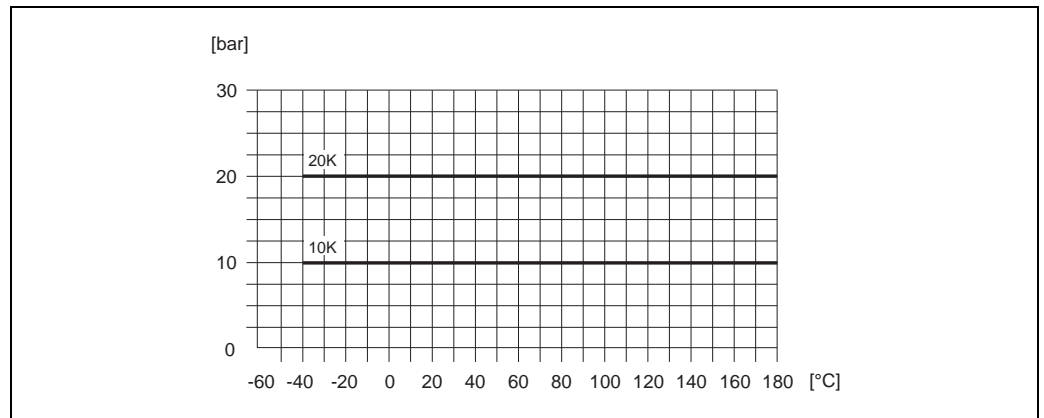
Material: 1.0425



F06-xxFxxxxx-05-xx-xx-xx-004

Flange connection to JIS B2238

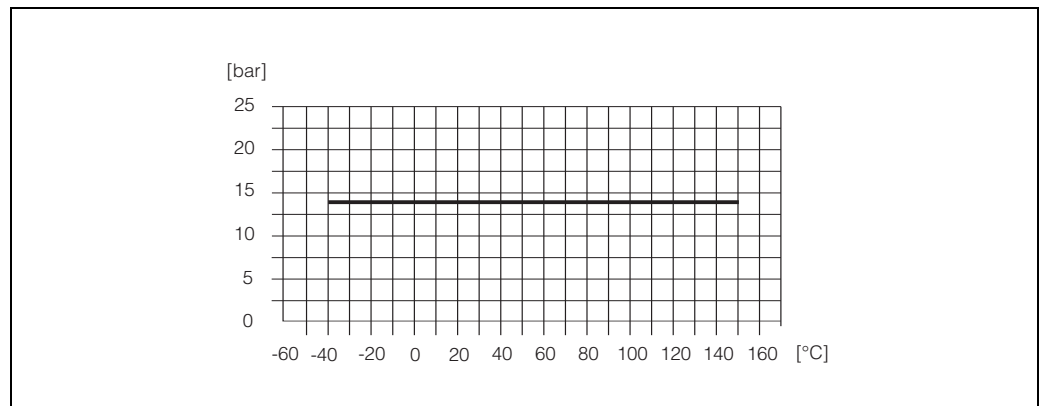
Material: RSt37-2 (S235JRG2) / H II / 1.0425



A0003228

Flange connection to AS2129 Table E or AS4087 Cl. 14

Material: A105 / RSt37-2 (S235JRG2) / St44-2 (S275JR)



F06-xxFxxxxx-05-xx-xx-xx-010

Fitted electrodes

Measuring, reference and EPD electrodes:

- Standard with: 1.4435, Alloy C-22, tantalum
- Optional: exchangeable measuring electrodes made of 1.4435 (DN 350...2000)

Process connection

Flange connection:

- EN 1092-1 (DIN 2501), < DN 350 Form A, > DN 300 Form B
(dimensions acc. to DIN 2501; DN 65 PN 16 and DN 600 PN 16 exclusively to EN 10921)
- ANSI B16.5
- AWWA C 207, Class D
- JIS B2238
- AS2129 Table E
- AS4087 Cl. 14

Surface roughness

- Electrodes:
 - 1.4435, Alloy C-22, Tantalum: 0.3...0.5 µm
- (all data relate to parts in contact with the medium)

Human interface

Display elements	<ul style="list-style-type: none"> ■ 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: <ul style="list-style-type: none"> Promag 50: 2 totalizers Promag 53: 3 totalizers
Operating elements	<p>Unified operation concept for both types of transmitter:</p> <p>Promag 50:</p> <ul style="list-style-type: none"> ■ Local operation with three push buttons (–, +, E) ■ Quick Setup menus for straightforward commissioning <p>Promag 53:</p> <ul style="list-style-type: none"> ■ Local operation with three optical keys (–, +, E) ■ Application-specific Quick Setup menus for straightforward commissioning
Language group	<p>Language groups available for operation in different countries:</p> <p>Promag 50, Promag 53:</p> <ul style="list-style-type: none"> ■ Western Europe and America (WEA): English, German, Spanish, Italian, French, Dutch and Portuguese ■ Eastern Europe and Scandinavia (EES): English, Russian, Polish, Norwegian, Finnish, Swedish and Czech ■ South and east Asia (SEA): English, Japanese, Indonesian <p>Promag 53:</p> <ul style="list-style-type: none"> ■ China (CIN): English, Chinese <p>You can change the language group via the operating program “ToF Tool – Fieldtool Package.”</p>
Remote operation	<p>Promag 50: Remote control via HART, PROFIBUS DP/PA</p> <p>Promag 53: Remote control via HART, PROFIBUS DP/PA, MODBUS RS485, FOUNDATION Fieldbus</p>

Certificates and approvals

Ex approvals	Information about currently available Ex versions (ATEX, FM, CSA) can be supplied by your Endress+Hauser Sales Centre on request. All explosion protection data are given in a separate documentation which is available upon request.
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 is in conformity with the EMC requirements of the Australian Communications Authority (ACA).
Pressure Equipment Directive	Flow meters with a nominal diameter smaller or equal DN 25 are covered by Art. 3(3) of the European directive 97/23/EG (Pressure Equipment Directive) and are designed according to sound engineer practice. For larger nominal diameter, optional approvals according to Cat. III are available when required (depends on fluid and process pressure).
PROFIBUS DP/PA certification	<p>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:</p> <ul style="list-style-type: none"> ■ 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)
FOUNDATION Fieldbus certification	<p>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:</p> <ul style="list-style-type: none"> ■ Certified to FOUNDATION Fieldbus Specification ■ The device meets all the specifications of the FOUNDATION Fieldbus H1. ■ Interoperability Test Kit (ITK), revision status 4.0 (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 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.
Other standards, guidelines	<p>EN 60529: Degrees of protection by housing (IP code)</p> <p>EN 61010: Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures.</p> <p>EN 61326/A1 (IEC 6326): Electromagnetic compatibility (EMC requirements)</p> <p>NAMUR NE 21: Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment.</p> <p>NAMUR NE 43: Standardisation of the signal level for the breakdown information of digital transmitters with analogue output signal.</p> <p>NAMUR NE 53: Software of field devices and signal-processing devices with digital electronics.</p>

Ordering information

The Endress+Hauser service organisation 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. The Endress+Hauser service organisation can provide detailed information on request.

Supplementary documentation

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

Registered trademarks

HART®

Registered trademark of HART Communication Foundation, Austin, USA

PROFIBUS®

Registered trademark of the PROFIBUS User Organisation, Karlsruhe, Germany

FOUNDATION™ Fieldbus

Registered trademark of the Fieldbus FOUNDATION, Austin, USA

MODBUS®

Registered trademark of the MODBUS Organisation

HistoROM™, S-DAT®, T-DAT™, F-CHIP®, ToF Tool - Fieldtool® Package, Fieldcheck®, Applicator®

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Endress+Hauser 
People for Process Automation

Warranties

MPA Engineering - Letter of Warranty

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

Thomas & Coffey will warrant the works until the end of the defect liability period.

Commissioning Information

FAT documents

Linked Documents

 [20142 4 lagoons kalbar Completed FAT.pdf](#)

SAT documents

Linked Documents

 [Kalbar site.pdf](#)

Kalbar Level Sensor Calibration Certificate

Linked Documents

 [Level Sensor Calibration Certificate-Kalbar.pdf](#)



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Specialists in Machine Plant Automation

QUU 4 LAGOON BOONAH STP UPGRADES – STP-ST59 KALBAR

QUEENSLAND URBAN UTILITIES

4 LAGOON UPGRADES

KALBAR

STP-ST59

FACTORY ACCEPTANCE TEST MAIN SWITCHBOARD

MPA Engineering

Job Number 20142

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1. 4 Lagoon ST59 Kalbar Switchboard FAT

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

1.1 References

AS/NZS 3000:2007 Wiring Rules
AS/NZS 3008.1.1:2009 Cable Selection
AS/NZS 3017 Electrical Installations – Verification Guidelines
AS/NZS 3049.1:2002 Low Voltage Switchgear
AS/NZS 4836:2001 Safe Working on Low Voltage Electrical Installations
QUU SSM001/002/030/090

1.2 Objectives

To conduct thorough and electrically safe tests of switchboard.

Tests include:

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

1.3 Equipment & Software Requirements

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

- 1.3.1** Fluke 1652C installation Tester
- 1.3.2** Fluke 177 multimeter
- 1.3.3** Project drawings
- 1.3.4** Safety barrier and flashing amber light
- 1.3.5** Temporary 3 phase and neutral supply



1.4 Methodology

1.4.1 De-energised Testing

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

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

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

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

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

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

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

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

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



1.4.2 Energised Testing

- 1.4.2.1** Complete safe work method statement for live commissioning. All personnel to contribute, read, understand and sign the document
- 1.4.2.2** Install barrier tape around the area to exclude unauthorised personnel.
- 1.4.2.3** Install a temporary three phase and neutral supply to the switchboard.
- 1.4.2.4** Communicate with personnel and install signage to warn personnel of live switchboard testing
- 1.4.2.5** Install a flashing light to warn of live testing
- 1.4.2.6** Turn on power to the switchboards
- 1.4.2.7** Using the Multimeter to test for correct connections and polarity, test for 415 VAC and 240VAC where appropriate around the switchboard.
- 1.4.2.8** Switch on circuit breakers for the 24 VDC power supplies. Use the multimeter to measure and if necessary adjust the output of the supplies for 24 VDC.
- 1.4.2.9** Test operation of items listed in the function test sections
- 1.4.2.10** Test the operation of all the controls
- 1.4.2.11** Test the operation of light circuits



2. Tests Summary

2.1 Inspection and Test Plan 4 Lagoon ST59 Kalbar Switchboard

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



2.2 Enclosure Inspection 4 Lagoon ST59 Kalbar Switchboard

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

Testing Officer: <u>P. I. Harrison</u>	Licence No: <u>53184</u>	Signature: <u>[Signature]</u>	Date: <u>15/4/13</u>
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2.3 Enclosure Fit-out Inspection 4 Lagoon ST59 Kalbar Switchboard

ELECTRICAL FITOUT INSPECTION		NA	Pass	Comments
6mm SDI (Minimum) fitted to line side of control fuses for high fault level takeoffs			✓	16mm ²
Check surge arrester line side cabling size			✓	16mm ²
Check cable size with cable schedule			✓	
Check cable size with rating of CB			✓	
All control wiring ferruled as required			✓	
All control wiring numbers and colours as per drawings			✓	
Wiring looms to doors incorporates suitable slack			✓	
All terminal numbers fitted			✓	
Terminals randomly checked for tightness			✓	
Check contactors, O/L's and CB's are correct for particular operation			✓	
Check fuses for continuity			✓	
Check fuses for correct current rating			✓	
All indicators correct colour and voltage		-	✓	
All pushbuttons correct colour		-	✓	
Labels correct sizes, colours and wording			✓	
All labels secured with screws			✓	
All internal equipment labelled			✓	
Ammeters and CT's correct range			✓	
Meter fuses fed from line side of main switch and CT's			✓	Should read Load Side
CT test block fitted			✓	
Voltmeters correct range		-	✓	
Bolts fitted to incoming terminations			✓	
Phase separators and shrouds provided			✓	
Fit fuse cartridges			✓	
Sample check tightness of connections			✓	
All protective covers in place			✓	
All duct lid fitted			✓	
All pole fillers fitted			✓	
Lighting operation correct			✓	
Door limit switches operational		-	✓	
All doors are earthed			✓	
All escutcheons are earthed			✓	
C.T secondary's earthed			✓	
All transformer secondaries are earthed			✓	
All power supplies 0 Volts are earthed			✓	
Check correct screen connections of analog and VSD cable		-	✓	
Adjust O/L settings to motor current or minimum		-	✓	
Adjust timers to correct values		-	✓	
Adjust CB settings		-	✓	
Adjust RCD settings		-	✓	
Point to point wiring check completed			✓	

Testing Officer: <i>P. Harrison</i>	Licence No: <i>53184</i>	Signature: <i>P. Harrison</i>	Date: <i>15/4/13</i>
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2.4 **Insulation Resistance Testing 4 Lagoon ST59 Kalbar Switchboard**

1000 VOLT APPLIED FOR 1 MINUTE

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

MAINS SUPPLY AND BUSBAR SYSTEM INSULATION RESISTANCE TESTS – PASS CRITERIA IS > 1 MΩ					
Red – White	>26Ω	White - Blue	>26Ω	Red - Blue	>26Ω
Red – Neutral	>26Ω	White - Neutral	>26Ω	Blue - Neutral	>26Ω
Red – Earth	>26Ω	White - Earth	>26Ω	Blue - Earth	>26Ω
Neutral – Earth	>26Ω				
DISTRIBUTION BOARD INSULATION RESISTANCE TESTS – PASS CRITERIA IS > 1 MΩ					
Red – White	—	White - Blue	—	Red - Blue	—
Red – Neutral	—	White - Neutral	—	Blue - Neutral	—
Red – Earth	—	White - Earth	—	Blue - Earth	—
Neutral – Earth	—				
Reconnect all equipment isolated for the insulation tests					

Testing Officer: <u>P J Harrison</u>	Licence No: <u>53184</u>	Signature: <u>[Signature]</u>	Date: <u>15/4/13</u>
--------------------------------------	--------------------------	-------------------------------	----------------------




2.5 Electrical Operational Testing 4 Lagoon ST59 Kalbar Switchboard

ELECTRICAL OPERATIONAL TESTING

Before applying power to the switchboard for testing, connect test equipment where appropriate. Install barrier tape and flashing light to limit pedestrian access.

[illegible]

Testing Officer: P.H. Harrison	Licence No: 53184	Signature: 	Date: 15/4/13
---------------------------------------	--------------------------	---	----------------------



3. Corrective Action

ITEM	DESCRIPTION	DATE COMPLETED	INITIAL
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			



4. **Witness**

ACCEPTANCE			
NAME	COMPANY	SIGNATURE	DATE
GREG KELLY	MPA ENGINEERING	<i>G Kelly</i>	15/4/13
<i>Paul Harrison</i>	<i>MPA Engineering</i>	<i>Paul Harrison</i>	15/4/13



5. Attachments

5.1 4 Lagoon ST59 Kalbar switchboard drawings 486/5/5-0107-nnn



Engineering Pty Ltd

Specialists in Machine and Plant Automation

Queensland Electrical Contractor's Licence Number 10423

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

3707

CERTIFICATE OF:

(Mark relevant check-box)

- ☒ **TESTING AND COMPLIANCE** (Electrical Installations)
Issued in accordance with section 159 of the *Electrical Safety Regulation 2002*
- ☒ **TESTING AND SAFETY** (Electrical Equipment)
Issued in accordance with section 15 of the *Electrical Safety Regulation 2002*

Worked Performed for:

Name

Thomas & Coffey

Address

Velge St Kalbar

Details of work carried out:

Visual Inspection:

Cables

Current rating ☒
Installation ☒
Terminations ☒
Identification ☒
Colours ☒

Switchboard

Location / Access ☒
Protective devices ☒
Isolating devices ☒
Labelling ☒
Connections ☒

Electrical Equipment

Isolating / switching devices ☒
Connections ☒
Compliance with Codes ☒
Interlocks / Guards ☒
Emergency Stop Check ☒

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

Electrical Testing:

Main earthing conductor resistance ☒
Equipotential bonding conductor resistance ☒
Insulation resistance ☒
Verification of polarity ☒
Circuit connections ☒
Earth fault loop impedance ☒
RCD's trip tested by test button ☒

Result

0.15 (Max 0.5 ohm) ☒
0.15 (Max 0.5 ohm) ☒
200M (Min 1.0 megohm) ☒

Comments: Installation meets & exceeds Requirements
of AS/NZS 3000

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

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

Date of Test: 10/7/13

Tested by:

T. Conway

Licence No: 127 277

Signature:

MPA Job No.

2 0 1 4 2



Kalbar STP

MPA Engineering Pty Ltd

Quality Assurance

ISO 9001 2008

UNCONTROLLED - VALID ONLY ON THE DATE OF ISSUE

Effective Date: 15/10/10

Issue: 1

WORK INSTRUCTION

INSTALLATION TEST SHEET

QWI 07.31

Pages: 1

TEST	CIRCUIT		CIRCUIT		CIRCUIT		CIRCUIT	
	Value	Pass	Value	Pass	Value	Pass	Value	Pass
MF Building			PH Building		MF & PH Lighting		Existing DBs	
Circuit breaker	100A @ 100V	✓	20A @ 100V	✓	20A @ 100V	✓	63A @ 100V	✓
Protection Size								
1 Ø or 3 Ø	3Ø	✓	1Ø	✓	1Ø	✓	3Ø	✓
Visual inspection complete		✓		✓		✓		✓
Main earth resistance < 0.5 Ohms	0.22	✓	0.23	✓	0.15	✓	0.15	✓
Bonding conductors < 0.5 ohms	0.15	✓	0.15	✓	0.15	✓	0.15	✓
Correct polarity and connections		✓		✓		✓		✓
Insulation Resistance Ø(L1) to Ø(L2 or N) > 1mΩ	200MΩ	✓	200MΩ	✓	200MΩ	✓	200MΩ	✓
Insulation Resistance Ø(L2) to Ø(L3) > 1mΩ	200MΩ	✓					200MΩ	✓
Insulation Resistance Ø(L3) to Ø(L1) > 1mΩ	200MΩ	✓					200MΩ	✓
Insulation Resistance Ø(L1) to earth > 1mΩ	200MΩ	✓	200MΩ	✓	200MΩ	✓	200MΩ	✓
Insulation Resistance Ø(L2) to earth > 1mΩ	200MΩ	✓					200MΩ	✓
Insulation Resistance Ø(L3) to earth > 1mΩ	200MΩ	✓					200MΩ	✓
Insulation Resistance neutral to earth > 1mΩ	200MΩ	✓	200MΩ	✓	200MΩ	✓	200MΩ	✓
Fault loop impedance correct for circuit		✓		✓		✓		✓
Thermal overload set (motors)								
Motor runs in correct direction (motors)								
Operates correctly (motors)								
Connection (Y/Δ) – as per nameplate (motors)								

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

Tested By

License No.

Signature

Date

T. Conway

127 277

10/7/13



LEVEL SENSOR CALIBRATION CERTIFICATE

Site: Kalbar Sewage Treatment Plant

Address: Heit Rd, Kalbar

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

Date of calibration: 20th of November 2013

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

	BWL RL	BWL (0%) sensor reading	TWL RL	TWL (100%) sensor reading	Level sensor RL
Kalbar	73.405	1.854	73.9	1.359	75.259

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

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

Calibrated by

Toby Grayson

Help & Contact

MPA Engineering

Trade or Product: Electrical

Contact & Address Details:

Elmo Allan

Branch Manager

MPA Engineering Pty Ltd | 117 Toongarra Road, Ipswich QLD 4305

P +61 (0) 7 3413 8850 F +61 (0) 7 3413 8879

D +61 (0) 7 3413 8854

W www.mpaeng.com.au E Elmo.Allan@MpaEng.com.au

As Built Drawings

Kalbar

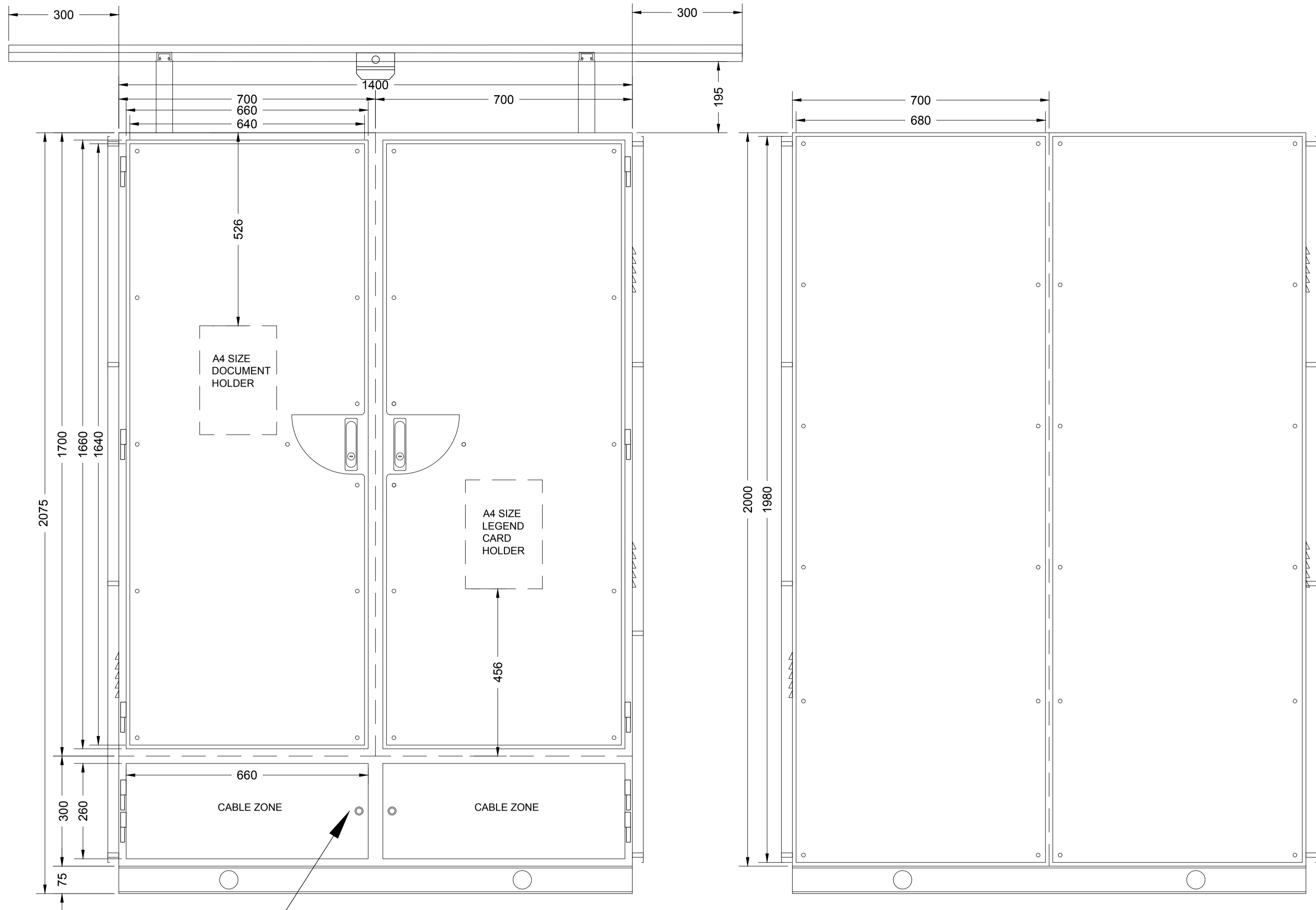
Site: (ST059) Kalbar

Process: (1100.0) GENERAL

Sub: (1150) SEWERAGE

Linked Documents

 [20142 - Kalbar As Built.pdf](#)



92268 LOCKS
FRONT VIEW SHOWING OUTER DOORS AND SUN SHIELDS

BACK VIEW SHOWING OUTER DOORS AND SUN SHIELDS,
ROOF REMOVED

AS CONSTRUCTED DETAILS

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

SIGNED: _____ DATE: 11/06/13

NAME of SIGNATORY: GREG BOTT

RPEQ No. or LICENCE: 10036

COMPANY NAME: MPA Engineering Pty. Ltd.

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

MPA ENGINEERING PTY LTD

 BRENDALDE OFFICE
UNIT 3/22 STRATHWYN ST
BRENDALDE QLD 4500
Phone:- 07 3881 0722
Fax:- 07 3881 0723
Website:- www.mpaeng.com.au
Job No:- 20142

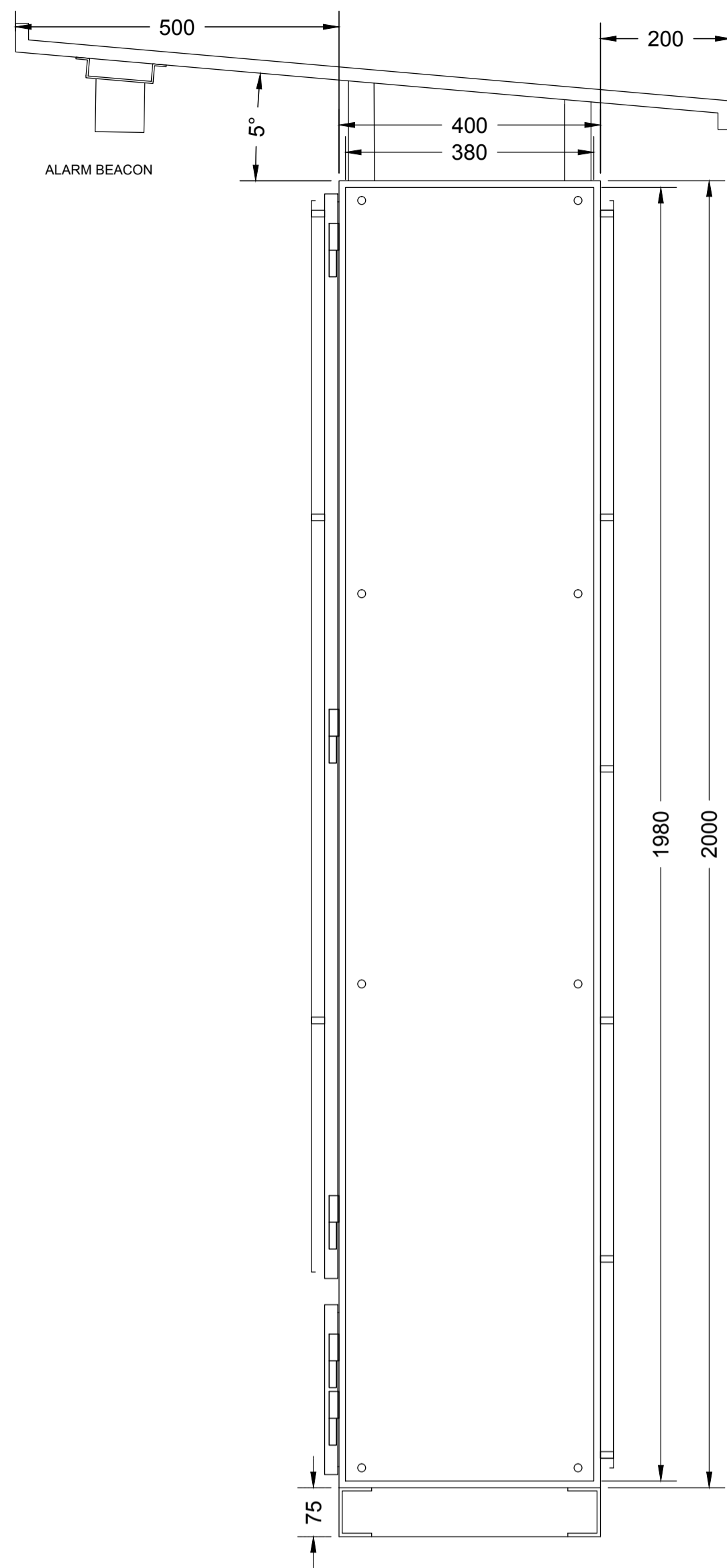
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QUEENSLAND URBAN UTILITIES DELEGATE
(AUTHORISED FOR 12 MONTHS FROM DATE SHOWN)

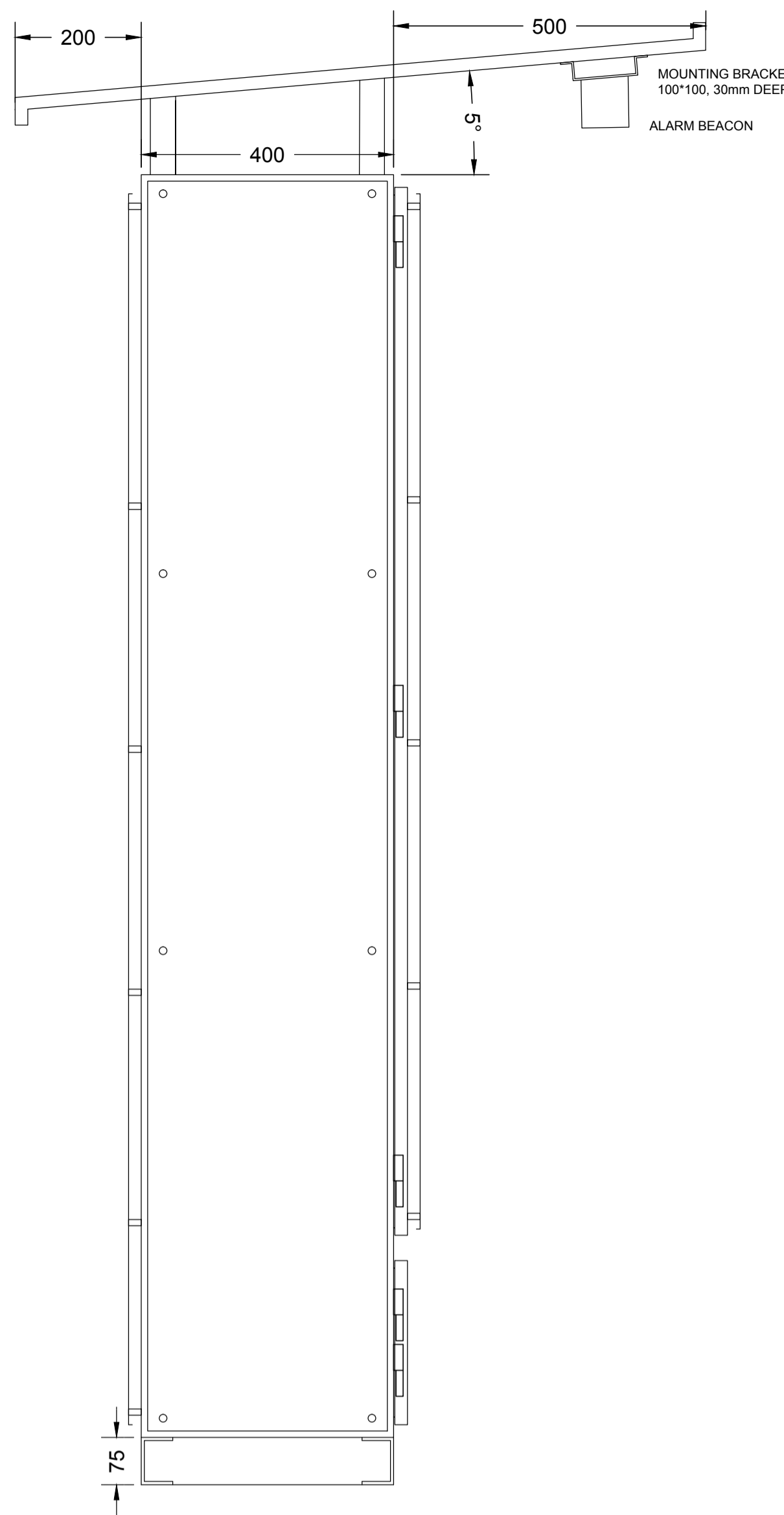


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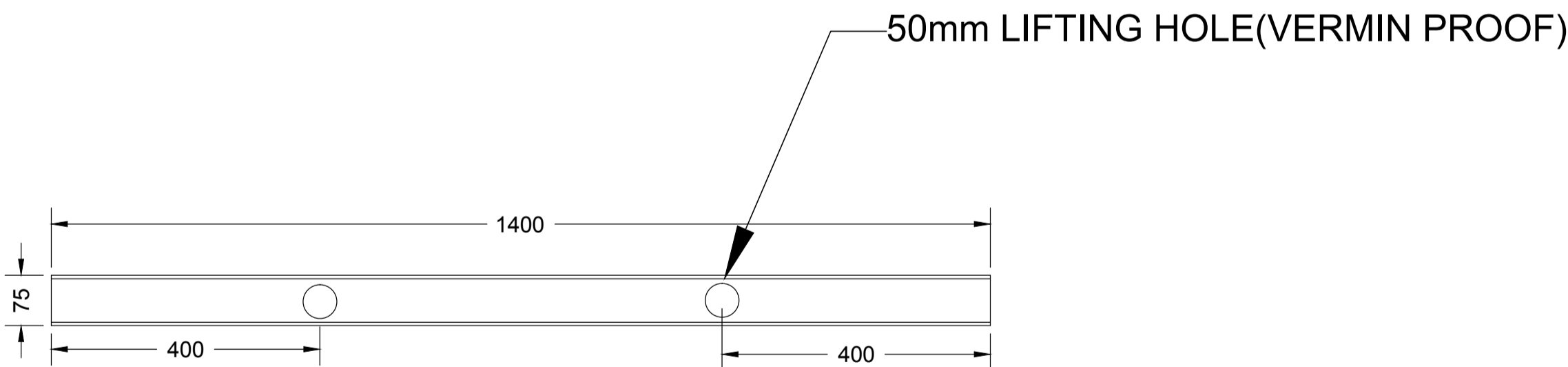
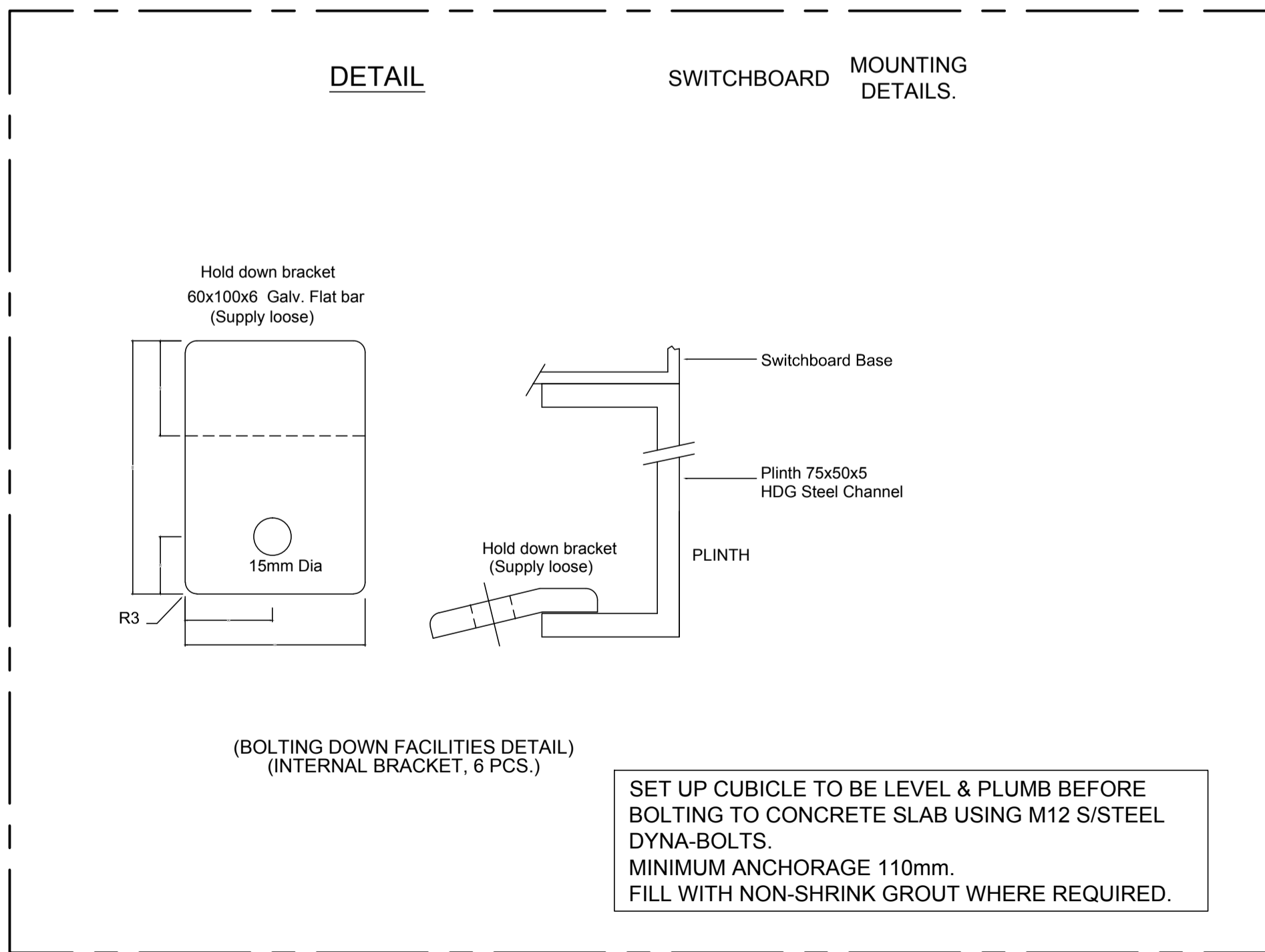
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0	22/03/13	FOR CONSTRUCTION	CX	EA	DESIGN W.O. No.		DRAFTING CHK	PAUL KAJEWSKI	DESIGN	R.P.E.Q. No.	DATE			QUEENSLAND URBAN UTILITIES DRAWING No.		AMEND.
B	22/01/13	FOR REVIEW	CX	EA	CONSTRUCT W.O. No.		CAD FILE	486-5-5-0107-150_1.dwg	GREG BOTT	10036	11/06/13			486/5/5-0107-150		1
No.	DATE	AMENDMENT	DWN	APD	FUNDED BY Q.U.U. (✓)	EXTERNAL ()	Q.U.U. FILE No.		DESIGN CHECK	R.P.E.Q. No.	DATE					
APPROVED BY (CONSULTANT) SIGNATURE DATE																



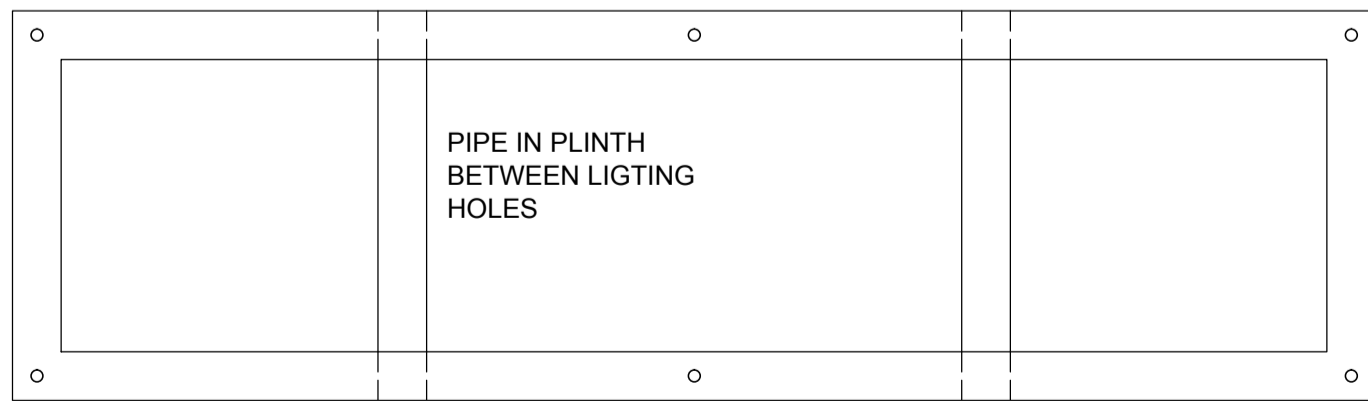
RIGHT VIEW



LEFT VIEW



PLINTH FRONT VIEW




PLINTH TOP VIEW

AS BUILT

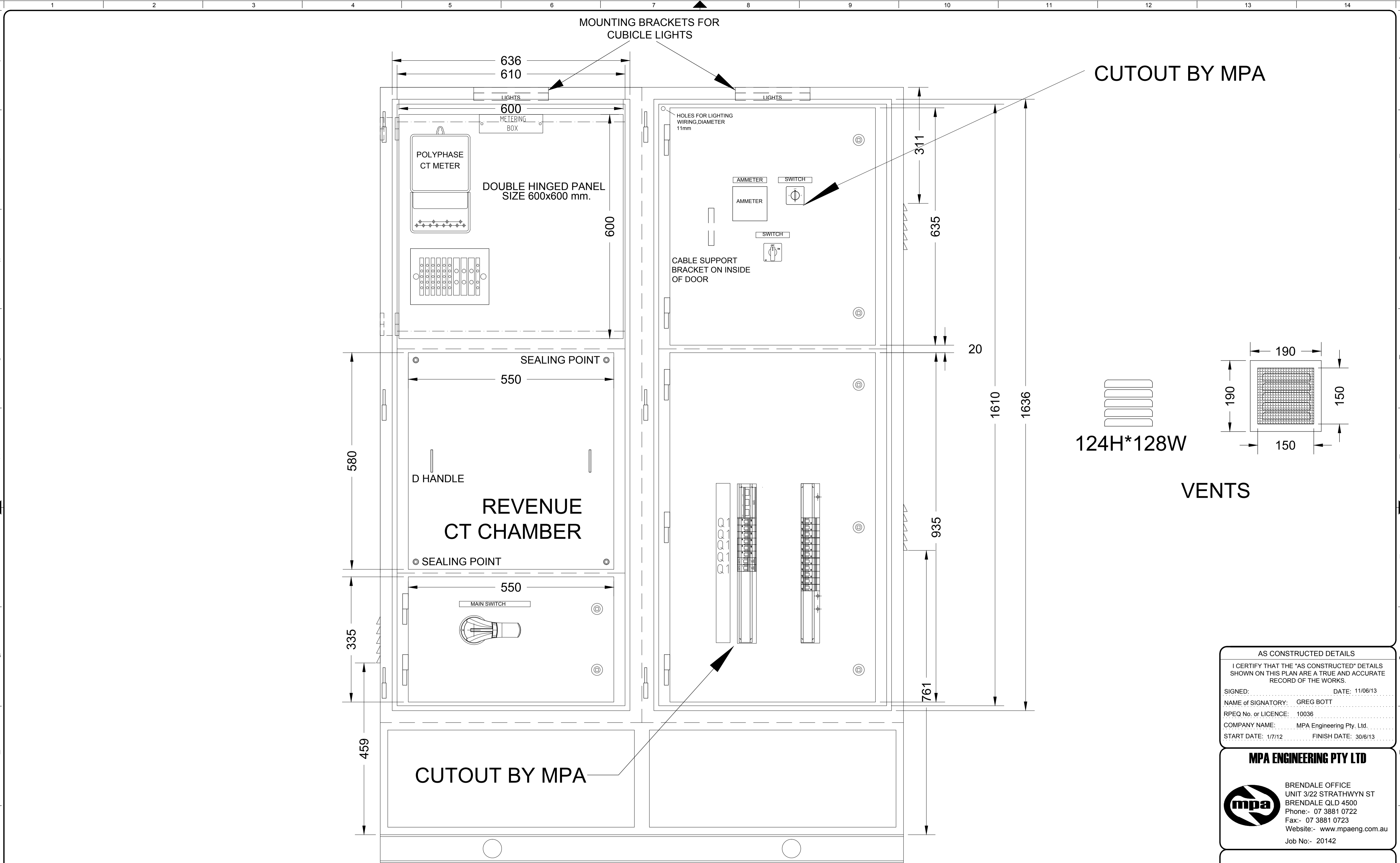
AS CONSTRUCTED DETAILS
I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.
SIGNED: _____ DATE: 11/06/13
NAME of SIGNATORY: GREG BOTT
RPEQ No. or LICENCE: 10036
COMPANY NAME: MPA Engineering Pty. Ltd.
START DATE: 1/7/12 FINISH DATE: 30/6/13

MPA ENGINEERING PTY LTD

BRENDALDE OFFICE
UNIT 3/22 STRATHWYN ST
BRENDALDE QLD 4500
Phone:- 07 3881 0722
Fax:- 07 3881 0723
Website:- www.mpaeng.com.au
Job No:- 20142

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


1	22/04/13	AS BUILT	CX	EA	FUNDING		DRAFTED	CLAIRE XU	GREG BOTT10036		ASSET/PROJECT QUU FOUR LAGOONS STP UPGRADES	DRAWING TITLE KALBAR MAIN SWITCHBOARD GENERAL ARRANGEMENT	SHEET No. 02 OF 07	
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FRONT VIEW SHOWING OUTER DOORS AND SUN SHIELDS REMOVED

AS BUILT

1	22/04/13	AS BUILT	CX	EA	FUNDING		DRAFTED	CLAIRE XU	GREG BOTT	10036	ASSET/PROJECT QUU FOUR LAGOONS STP UPGRADES	DRAWING TITLE KALBAR MAIN SWITCHBOARD GENERAL ARRANGEMENT	
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										APPROVED BY (CONSULTANT)	SIGNATURE	DATE	


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COMPANY NAME: MPA Engineering Pty. Ltd.	
START DATE: 1/7/12	FINISH DATE: 30/6/13

MPA ENGINEERING PTY LTD

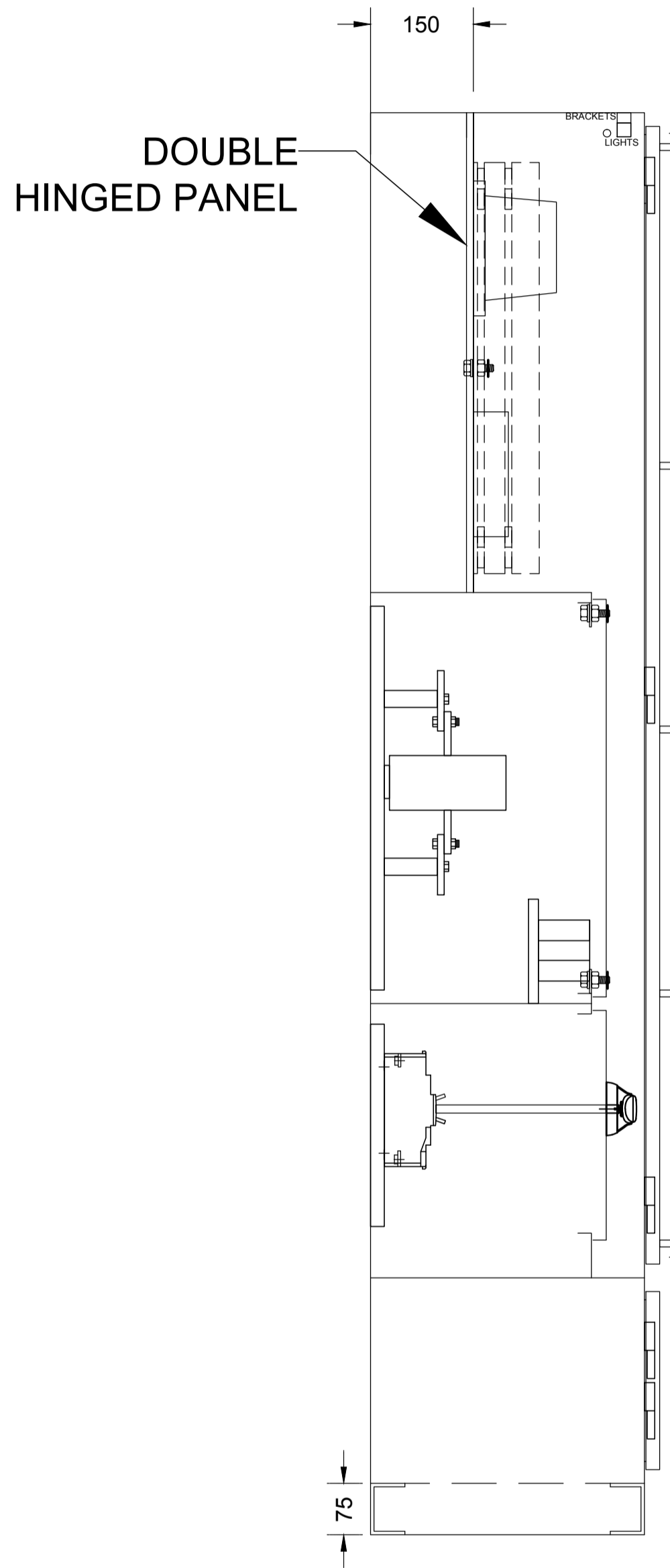
 BRENDALDE OFFICE
UNIT 3/22 STRATHWYN ST
BRENDALDE QLD 4500
Phone:- 07 3881 0722
Fax:- 07 3881 0723
Website:- www.mpaeng.com.au
Job No:- 20142

NAME SIGNATURE DATE

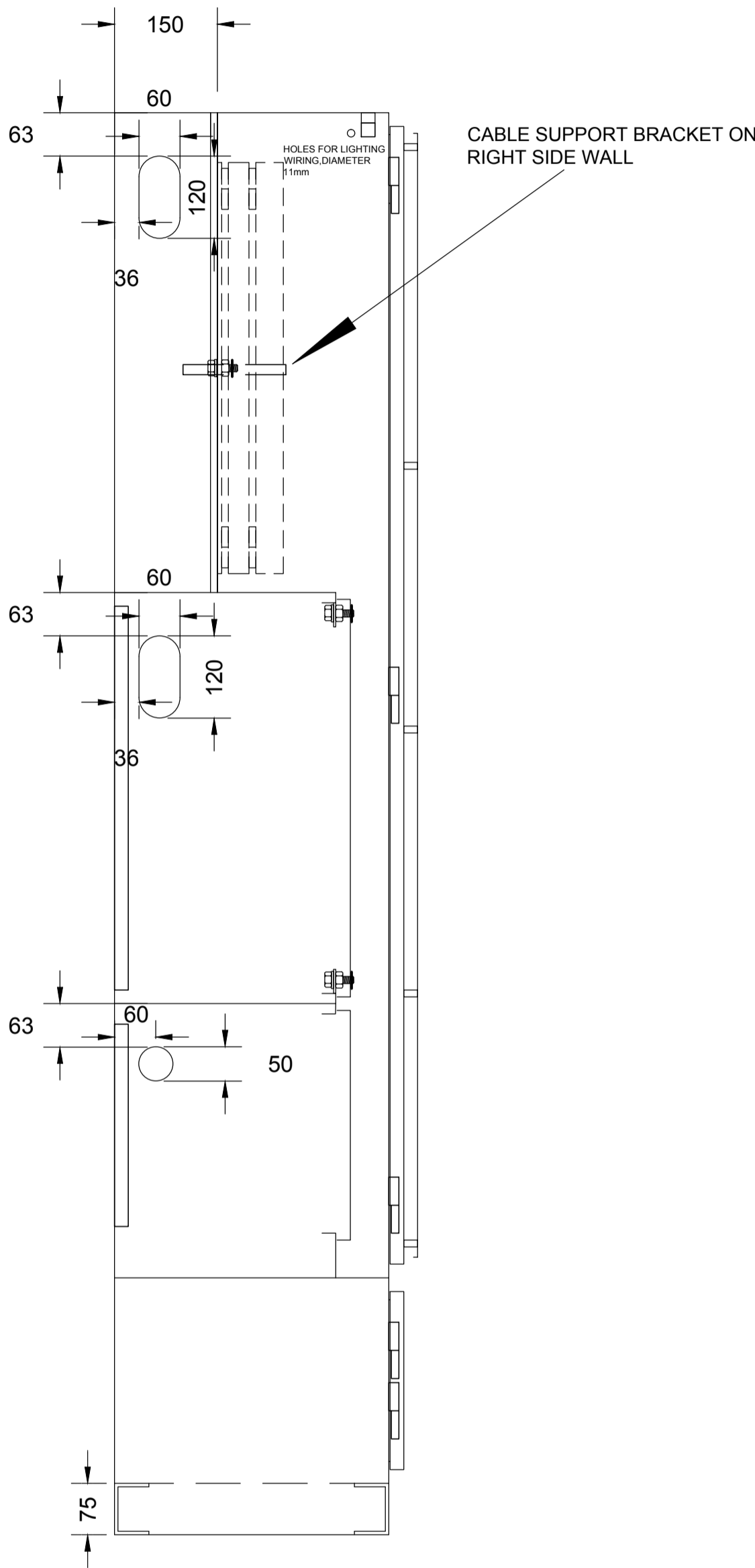
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(AUTHORISED FOR 12 MONTHS FROM DATE SHOWN)



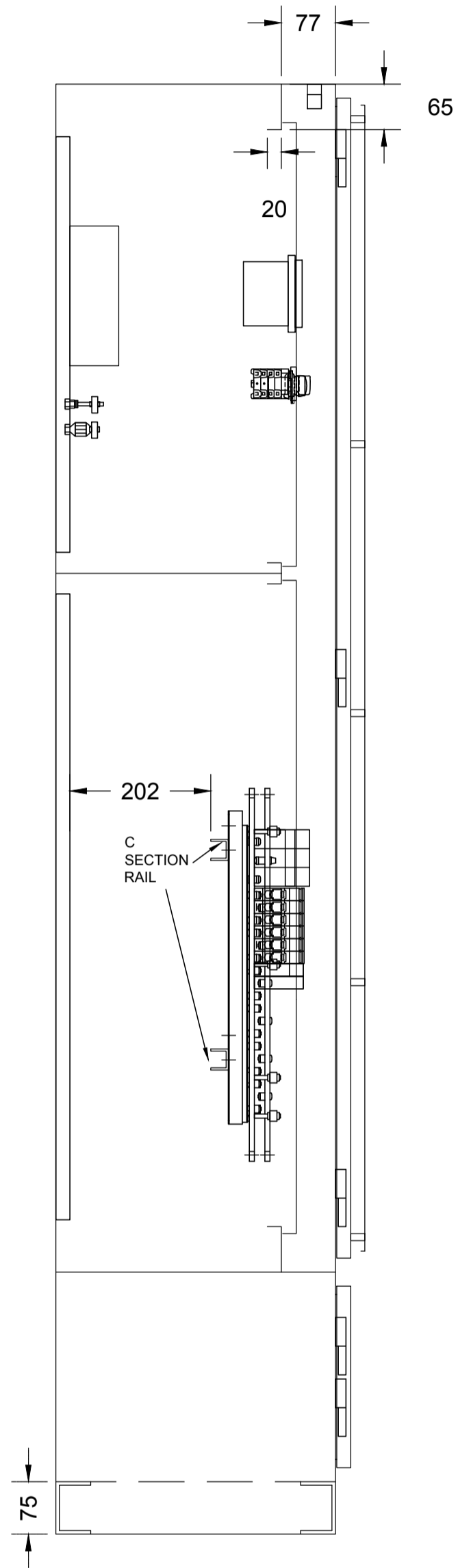
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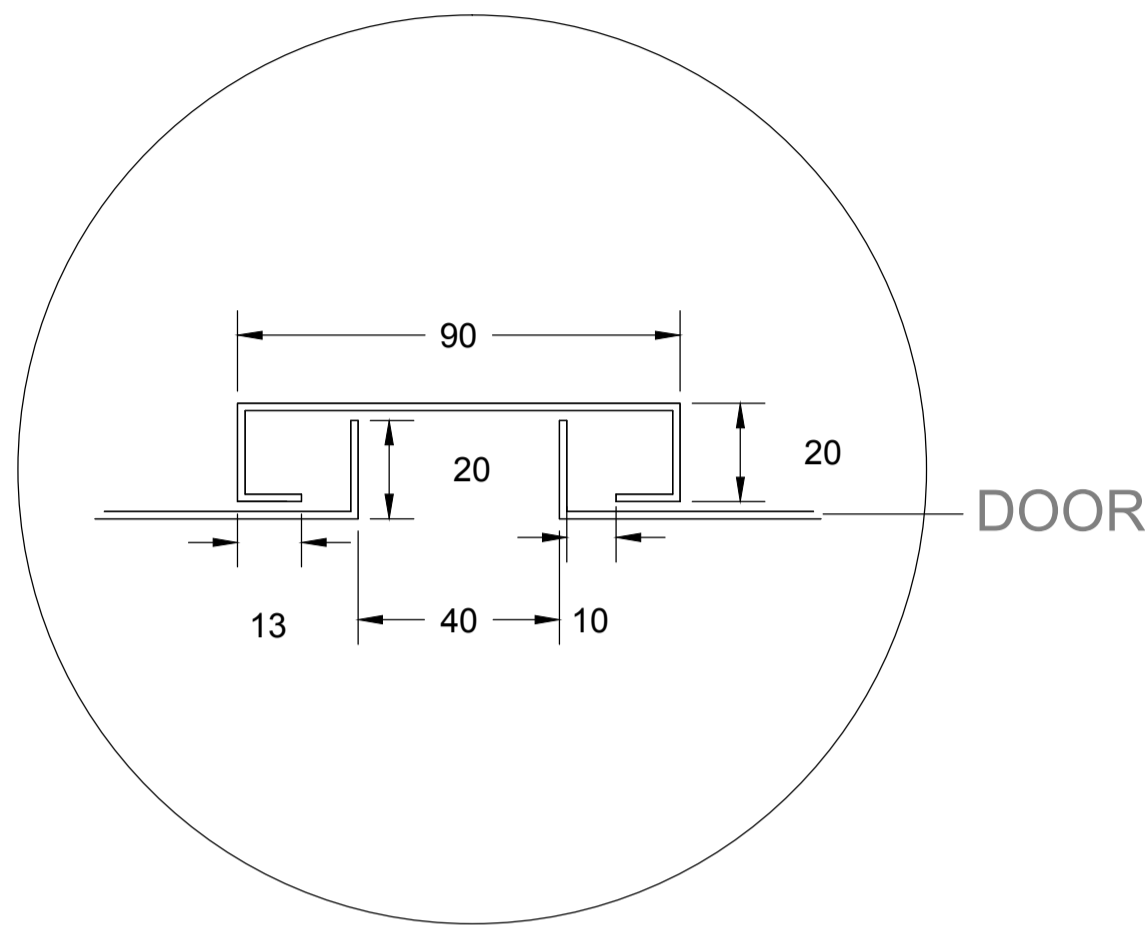
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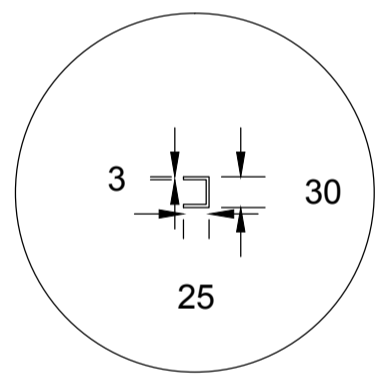
SECTION A-A CUT OUT



SECTION B-B




CENTRE DOOR MULLION DETAILS



C SECTION RAIL, SIDE VIEW


AS CONSTRUCTED DETAILS	
I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.	
SIGNED:	DATE: 11/06/13
NAME of SIGNATORY: GREG BOTT	
RPEQ No. or LICENCE: 10036	
COMPANY NAME: MPA Engineering Pty. Ltd.	
START DATE: 1/7/12	FINISH DATE: 30/6/13

MPA ENGINEERING PTY LTD



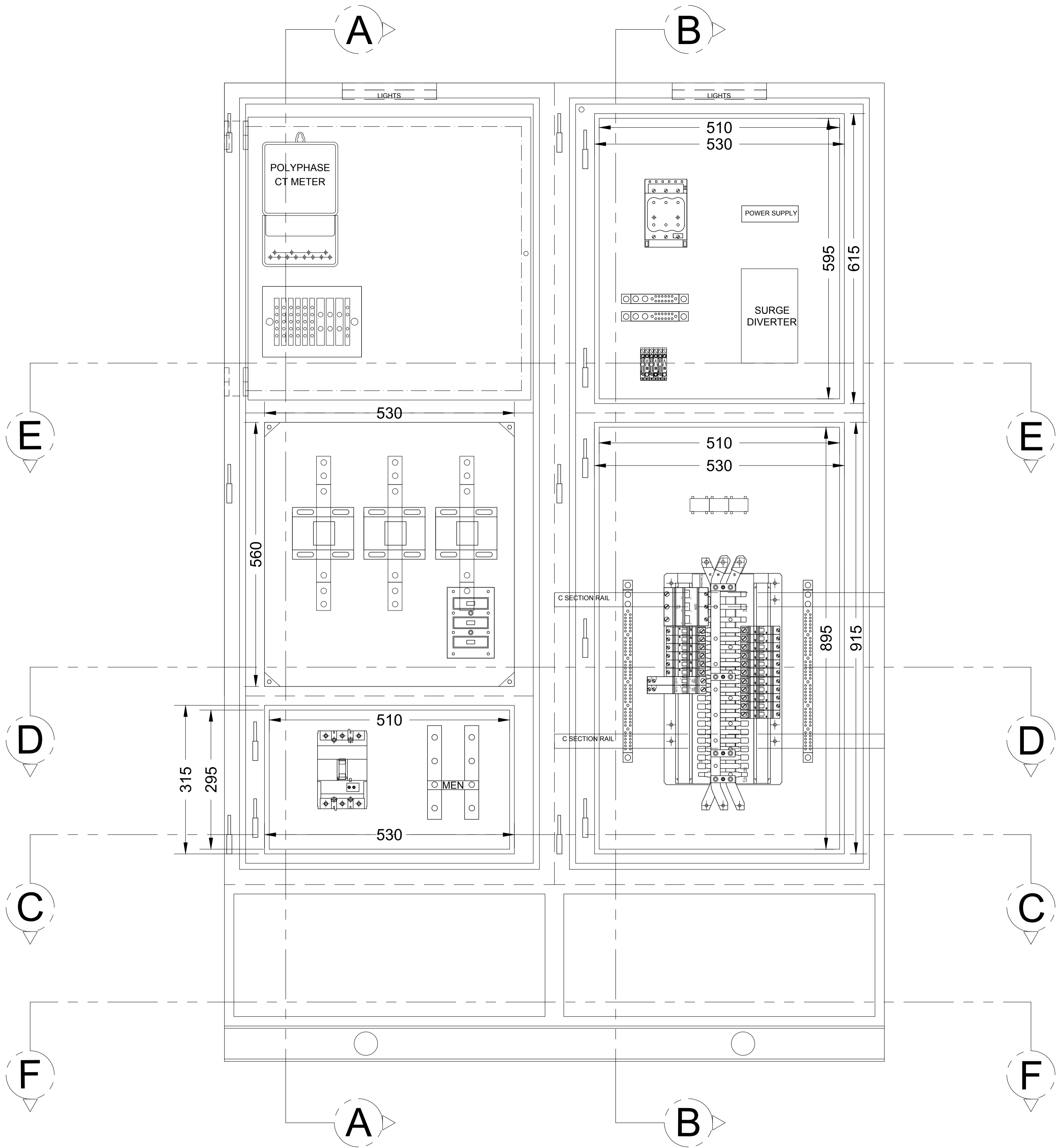
BRENDALE OFFICE
UNIT 3/22 STRATHWYN ST
BRENDALE QLD 4500
Phone:- 07 3881 0722
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Website:- www.mpaeng.com.au
Job No:- 20142

NAME	SIGNATURE	DATE
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AS BUILT

1	22/04/13	AS BUILT	CX	EA	FUNDING		DRAFTED	CLAIRE XU	GREG BOTT		10036	ASSET/PROJECT QUU FOUR LAGOONS STP UPGRADES	DRAWING TITLE KALBAR MAIN SWITCHBOARD GENERAL ARRANGEMENT	SHEET No. 04 OF 07		
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APPROVED BY (CONSULTANT) SIGNATURE DATE																



FRONT VIEW SHOWING INNER ESCUTCHEONS

AS BUILT

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

FUNDING		DRAFTED	CLAUDE XU
DESIGN W.O. No.		DRAFTING CHK	PAUL KAJEWSKI
CONSTRUCT W.O. No.		CAD FILE	486-5-5-0107-150_1.dwg
FUNDED BY Q.U.U. (✓)	EXTERNAL ()	Q.U.U. FILE No.	

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

APPROVED BY (CONSULTANT)	SIGNATURE	DATE
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ASSET/PROJECT	QUU FOUR LAGOONS STP UPGRADES
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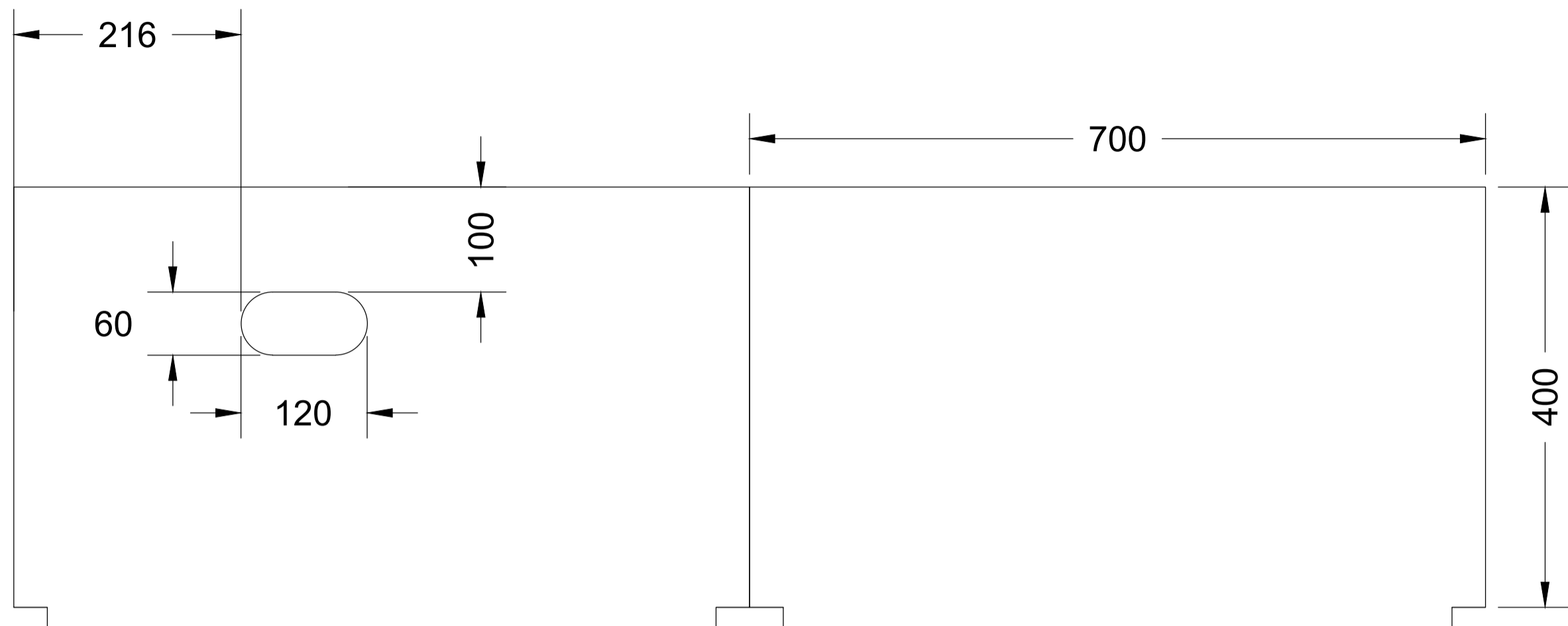
DRAWING TITLE	KALBAR MAIN SWITCHBOARD GENERAL ARRANGEMENT
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QUEENSLAND URBAN UTILITIES DRAWING No.	AMEND.		
486/5/5-0107-153			1

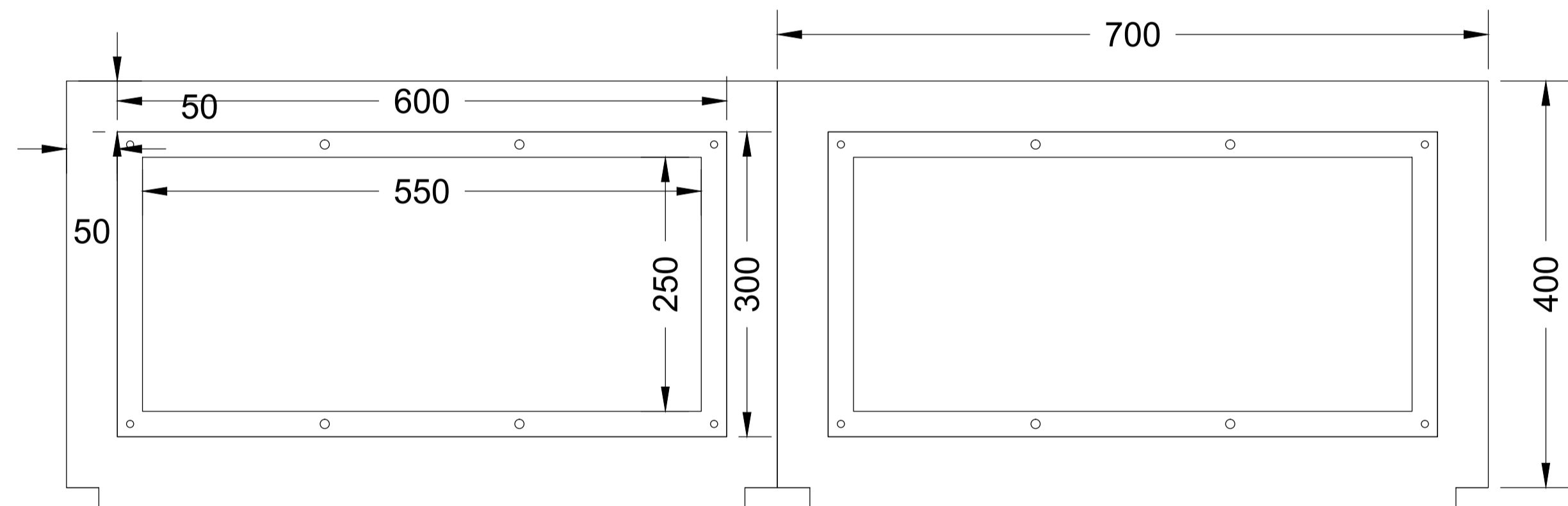
AS CONSTRUCTED DETAILS	
I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.	
SIGNED:	DATE: 11/06/13
NAME of SIGNATORY:	GREG BOTT
RPEQ No. or LICENCE:	10036
COMPANY NAME:	MPA Engineering Pty. Ltd.
START DATE: 1/7/12	FINISH DATE: 30/6/13

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

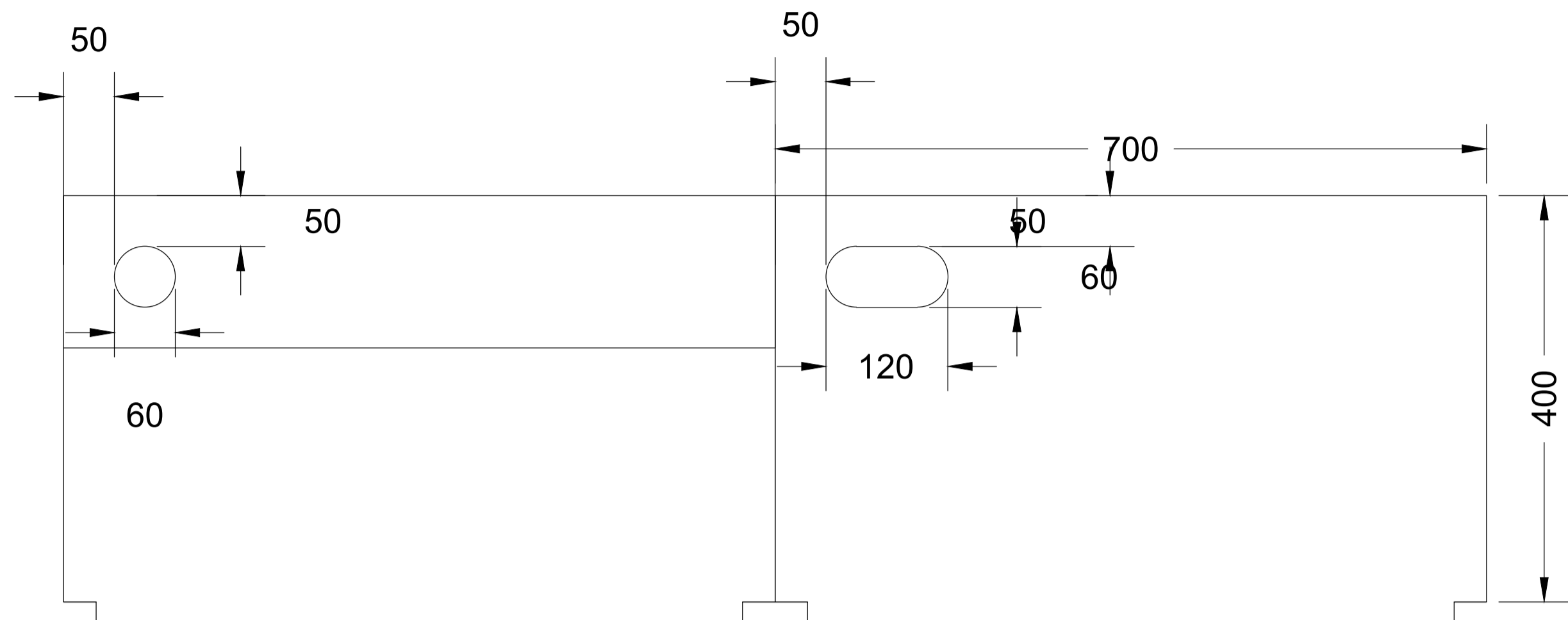
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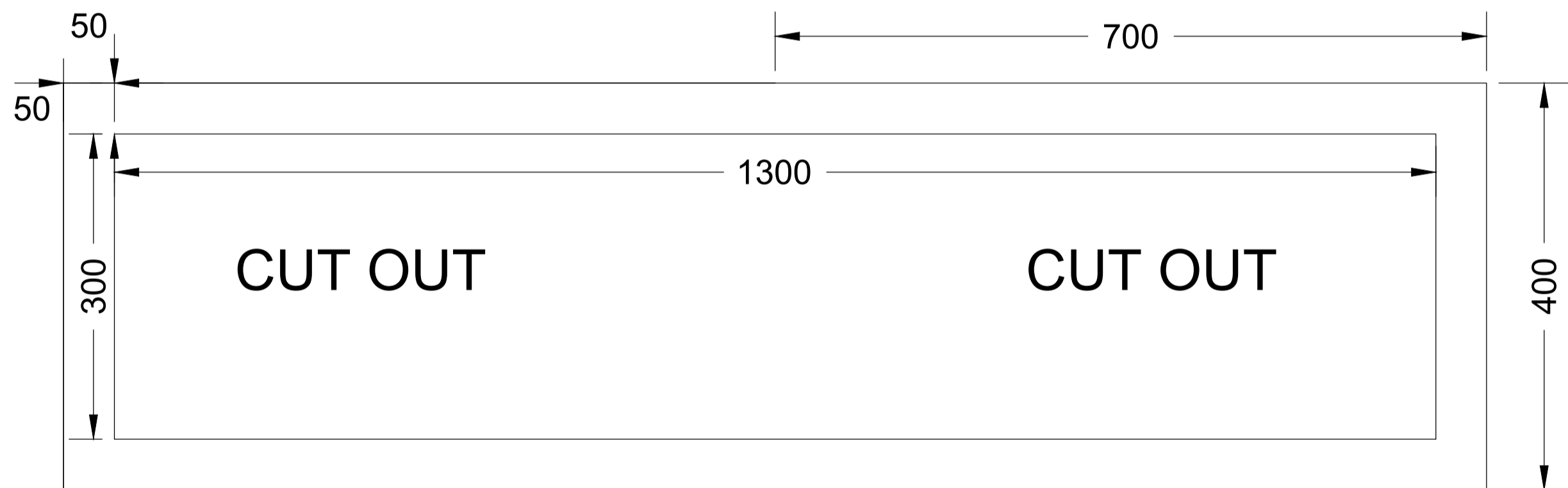
SECTION D-D CUT-OUTS



SECTION C-C GLAND PLATES



SECTION E-E CUT-OUTS



SECTION F-F CUT-OUTS

AS CONSTRUCTED DETAILS

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

SIGNED: _____ DATE: 11/06/13


NAME of SIGNATORY: GREG BOTT

RPEQ No. or LICENCE: 10036

COMPANY NAME: MPA Engineering Pty. Ltd.


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

MPA ENGINEERING PTY LTD

 BRENDALDE OFFICE
UNIT 3/22 STRATHWYN ST
BRENDALDE QLD 4500
Phone:- 07 3881 0722
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Job No:- 20142

NAME SIGNATURE DATE

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



AS BUILT

1	22/04/13	AS BUILT	CX	EA	FUNDING		DRAFTED	CLAIRE XU	GREG BOTT	10036	APPROVED BY (CONSULTANT)	SIGNATURE	DATE	ASSET/PROJECT QUU FOUR LAGOONS STP UPGRADES	DRAWING TITLE KALBAR MAIN SWITCHBOARD GENERAL ARRANGEMENT	SHEET No. 06 OF 07	
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No.	DATE	AMENDMENT	DWN	APD	FUNDED BY Q.U.U. (✓) EXTERNAL ()		Q.U.U. FILE No.		DESIGN CHECK	R.P.E.Q. No.	DATE					486/5/5-0107-155	
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PLOTTED BY DARRYN WILEY ON 17/07/13 AT 3:08 PM