

AFLQWT



**TECHNOLOGICAL MAGNETIC
FLOW METER**

AFLOWT MFT

INSTALLATION MANUAL



ISO 9001:2015

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The present manual covers procedures for on-site (at a metering point) mounting and dismounting of "AFLOWT MFT" Technological Magnetic Flowmeter. In the course of work, also refer to the "Technological Magnetic Flowmeter "AFLOWT MFT". Operation manual" document, Part I and Part II.

LIST OF ABBREVIATIONS

DN	- Nominal diameter
BE	- Electronic block
PFC	- Flow sensor (Primary flow converter)
MFT	- Magnetic flowmeter
SC	- Secondary converter

NOTE. Words in the text marked in bold, for example, **FLOW DATA**, corresponds to the items displayed on the Flowmeter's screen.

CAUTION!

1. **NEVER** touch the electrodes in the flow sensor (PFC) inner channel.
2. When the flowmeter is energized, **DO NOT** perform electric welding in the room where the flowmeter is placed in case the pipeline where the flowsensor is installed is not filled with liquid, and on the pipeline where the flow sensor is installed.
3. While welding, passing of weld current through the PFC body is **STRICTLY FORBIDDEN**.
4. When welding is performed, **DO NOT** use the flowmeter with PFC installed. Install the PFC dimension simulator provided in the delivery package.
5. MFT mounted in the pipeline **SHOULD NOT** be rotated around the pipeline axis.
6. When mounting and using MFT, **DO NOT** remove protection rings from PFC. The protection rings are installed to protect projecting fluoroplastic lining.
7. When relocating MFT, **DO NOT** hold it by the electronic block.

1. SAFETY INSTRUCTIONS

- 1.1. The flowmeter should be mounted (dismounted) by the qualified technical staff:
 - Certified for performing work of this type on the site where the flowmeter is installed and authorized by the manufacturer
 - Authorized to work with electrical installations up to 1000 V
 - Familiar with the instructions for the flowmeter and the auxiliary equipment used for mounting and dismounting.
- 1.2. When working with the flowmeter, the dangerous factors are as follows:
 - AC voltage (RMS value up to 264 V, frequency 50/60 Hz)
 - Pipeline pressure (up to 4.0 MPa depending on PFC design version)
 - Temperature of medium (up to 150 °C depending on PFC design version)
 - Other installation site-specific factors.
- 1.3. In the course of mounting (dismounting), **YOU MUST NOT:**
 - Connect to the flowmeter, switch over modes and replace electronic components, if the flowmeter is powered up
 - Remove the flowmeter from the pipeline until pressure in the pipeline section worked on is fully released
 - Use defective electronic devices and electric tools or use them without proper grounding.
- 1.4. Prior to performing work, make sure that no dangerous AC/DC voltage that may cause injury or death is applied to the pipeline section to be worked on. Use an appropriate measuring device for this purpose.

2. PREPARATION FOR MOUNTING

- 2.1. The flowmeter should be transported packed in the manufacturer's box.
- 2.2. After the flowmeter has been moved to the mounting location from a cold environment into a warm one (with ambient temperature above zero), it shall be left in the manufacturer's box for at least 3 hours to make sure that no moisture will condensate inside.
- 2.3. When unpacking the flowmeter, check that the delivery package contains all items specified in the Passport.

3. MOUNTING

3.1. General Requirements

When mounting the flowmeter on site, a free pipeline section should be provided. It is used to mount the flow sensor; straight pipe runs of appropriate length upstream and downstream the flow sensor.

Overall dimensions and weight of the flowmeter are given in the Operation Manual, Part I, Appendix A.

CAUTION! You MUST choose a mounting location with the conditions meeting the requirements specified in the user manual.

3.2. Mounting the flowmeter in the pipeline

3.2.1. Mounting considerations:

- The flowmeter may be mounted into a pipeline installed horizontally, vertically, or obliquely; special filters or dirt traps are not needed
- To prevent air collection at the mounting location, the flowmeter should not be placed at the upper point of the pipeline or in the open-ended pipeline; the best place to mount the flowmeter (if applicable) is the lower or the uprising pipeline run (see Fig.1)
- Liquid pressure in the pipeline must not be of values that may facilitate gas release
- The flowmeter should be mounted in the part of a pipeline where liquid turbulence and pulsations are minimal.

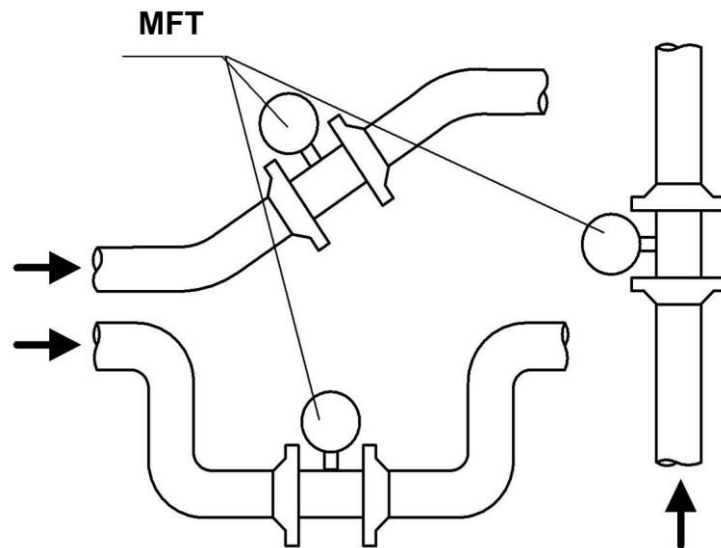


Fig.1. Recommended MFT locations

- Straight pipe runs with nominal diameter (DN) equal to nominal diameter of the flowmeter and length of no less than specified in table 1 should be provided upstream and downstream the flowmeter. These runs must not include devices or components that may disturb flow structure
- When the flowmeter is operated, PFC inner channel should be fully filled with liquid

- When mounting the flowmeter into the horizontal or oblique pipeline, position the axis of the Electronic Block (BE) in the vertical plane going through the pipeline axis. Maximum deflection is $\pm 30^\circ$
- Intensity of external magnetic field (commercial frequency) should not exceed 400 A/m.

Table 1. Lengths of straight runs for various MFT design versions

Unidirectional flow		Bidirectional flow	
upstream MFT	downstream MFT	upstream MFT	downstream MFT
5·DN	3·DN	5·DN	5·DN

3.2.2. Assembly-welded structure made of the supplied fittings of appropriate size and design must be used to mount flanged or wafer type flowmeters into the pipeline.

3.2.3. The fitting assembly for the assembly-welded structure includes:

- Flat welded flanges modified (for flanged and wafer type PFC)
- PFC dimension simulator of appropriate size and design
- Gaskets
- Fasteners (for flanged and wafer type PFCs).

The simulator overall mounting dimensions and DN correspond to the dimensions (with the highest possible tolerances) of the flowmeter's PFC to be mounted with this fitting assembly. The simulator is installed instead of the flowmeter when performing mounting or welding or dispatching MFT for regular calibration or repair.

In addition, the set may include straight pipe runs of appropriate length (DNs equal to DN of the flowmeter) and concentric adaptors to provide connection from pipeline's greater DN₁ (DN₂) to DN of the flowmeter. DN/DN₁(DN₂) ratio – at customer's option.

View of assembly-welded structures for mounting flanged flowmeters into the pipeline, and reference linear dimensions are given in Appendices A and B.

Delivery package is agreed with the customer. Design documentation package for the fittings is available at customer's option.

3.2.4. Components of the assembly-welded structure are welded together and then welded to the pipeline where the flow meter will be installed in compliance with local rules and regulations in force. It is important to provide alignment of the whole unit and flatness/parallel alignment of the flanges between which the Flow Sensor is being installed.

3.2.5. The procedure for manufacturing the assembly-welded structure for the flanged or wafer type flowmeters is as follows:

- a) Weld the flanges to the straight pipe runs (pipeline) considering that the straight pipe run (pipeline) axis should be perpendicular to the flange plain adjacent to PFC (see Fig.2).
- b) If necessary, weld the adaptors to the opposite ends of the runs (see Fig.3).

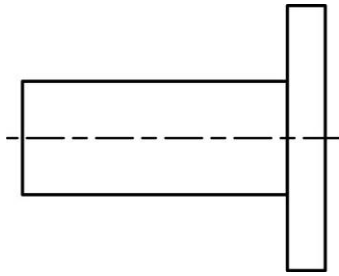


Fig.2

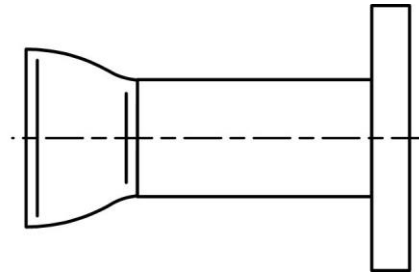


Fig.3

CAUTION! Overlaps and undercuts inside the channel are unacceptable. After completing the work, remove burrs and scales from the inside.

- c) Assemble the whole structure using bolts (studs) to fix components. Please make sure that the simulator is installed instead of PFC to provide alignment between two welded units, flatness/parallel alignment of the flanges, and to avoid damages to the flowmeter in the course of welding the structure to the pipeline. Before assembling, make sure that mounting gaskets included in the set of fittings are installed.

3.2.6. Mounting fittings into the pipeline

- 3.2.6.1. Before mounting and where the set of fittings is to be installed, fix the pipes that may tip out of their axes after cutting the pipeline to stationary supports by clamps. Drain liquid from the pipeline, cut it and mount the set of fittings considering the following conditions:

- Longer straight pipe run should be installed upstream
- M5 threaded holes on the cylindrical surface of the flanges used to connect wires to BE case should be in a position allowing easy connection of the wires.

- 3.2.6.2. After welding, the weld joints must be stress relieved by means of heat treatment.

- 3.2.6.3. After completion of work, check weld joints and mating faces for leakages according to the norms specified for pipelines of the corresponding type. To do this, loosen the clamps fastening pipes to the supports and put the pipeline into operation. Re-weld bad joints and replace gaskets, if necessary.

Wash the system before the simulator is replaced by PFC.

The set of fittings should not be subjected to stresses and strains from the pipeline (bending, compression, tension, twisting caused by disbalance, misalignment or torque nonuniformity). To prevent this, leave the supports of the inlet and outlet ducts and tighten the fastening clamps.

- 3.2.6.4. Position the flowmeter so that the BE axis stand is arranged in vertical plane with maximum deflection of $\pm 30^\circ$. The arrow on PFC shall point in the flow direction.

NOTE. For the flowmeter measuring bidirectional flow parameters, the arrow shall match the forward (positive) or prevailing direction of the flow.

- ◆ Non-flanged flowmeters with protection rings are automatically centered relative to companion flanges of the pipeline because the outer diameter of the external rings matches the diameter of flange grooves.

When mounting the flowmeter, put new gaskets provided in the delivery package into the companion flanges.

- ◆ When mounting flanged type flowmeters into the pipeline, bolt PFC/pipeline mating flanges from the side of the pipeline flanges. Length of the bolts must provide the minimal distance of 3 mm from a bolt end to the flowmeter's assembly.

To move pipeline flanges apart when installing or removing the flowmeter (Simulator), it is recommended to use special tool.

Alignment of the pipeline and PFC inner channel is provided when the PFC flanges are aligned with the companion pipeline flanges.

When mounting the flowmeter into the pipeline, it is required to install new rubberized asbestos fabric gaskets of appropriate thickness or several gaskets of greater thickness.

When mounting flowmeters of corrosion-resistant type without the protection rings into the pipeline, it is required to install new fluoroplastic gaskets of appropriate thickness or several gaskets of greater thickness.

CAUTION! Please make sure that the gaskets are aligned relative to the PFC inner channel, i.e. a gasket must not even partly cover the PFC inner channel. To provide alignment of gaskets, it is recommended to fix the gaskets by adhesive.

The flowmeter is mounted into the pipeline when all construction, welding and other works are finished.

3.2.6.5. When mounting PFC (Simulator) into the pipeline, tighten nuts in order specified in Fig.4 by a torque indicating wrench with maximum torque value that does not exceed the value specified in Table 2. **Exceeding of torque value may cause damage to PFC followed by leaking liquid into the flowmeter.**

To prevent disbalance and misalignment, it is recommended to tighten nuts in several steps increasing torque step-by-step up to the value specified in Table 2 while controlling alignment of the mating flanges.

Table 2

DN, mm	10	15	20	25	32	40	50	65	80	100	150	200	300
Torque, N·m	15	15	15	20	25	35	35	40	50	60	80	100	150

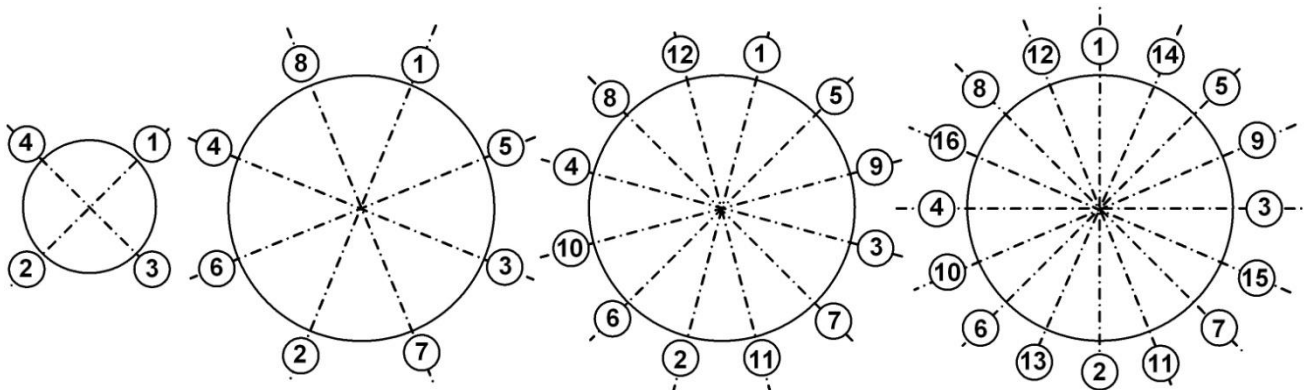


Fig.4. Order of tightening flange nuts.

The flowmeter mounted in the pipeline **SHOULD NOT** be rotated around the pipeline axis.

3.2.7. Mounting the flowmeter with threaded coupling

3.2.7.1. Select the flowmeter's pipeline mounting location observing the rules specified in Table 1. Cut the pipeline drained of liquid following the instructions given in section 3.2.6.

3.2.7.2. Unscrew grooved nuts and dismount nipple joints which are the parts of PFC.

3.2.7.3. Make sure that the simulator is installed into the assembly-welded structure instead of PFC, this is necessary to provide alignment between two welded units and to avoid damages to the flowmeter during welding the structure to the pipeline.

Weld conical nozzles to the pipeline butt-to-butt in the same way as to weld the adaptor pipes for the wafer type flowmeters, so that the nozzle axis is perpendicular to the grooved nut plane. Welding works shall be conducted in accordance with the requirements given in section 3.2.6.

CAUTION! When replacing the simulator by the flowmeter after welding, it is recommended to use a compensator to ensure that the threaded couplings are moved apart by the distance of no less than 10 mm. The compensator may be as follows:

- KRK manufactured by JSC "ArmaTroid"
- ARN/HYDRA by Danfoss
- Compensators from "WILLBRANDT" (authorized distributor is "KREOLAIN" company), or similar.

The compensator shall be mounted into the pipeline following the instructions outlined in the corresponding operational (maintenance) documentation and considering the requirements given in Table 1.

3.2.7.4. Replace the simulator with the flowmeter. The whole structure is assembled by firm tightening of grooved nuts. When assembling the structure, it is required to install gaskets made of edible material and supplied with the flowmeter, between the nozzles and grooved nuts.

3.3. Mounting the secondary converter of the flowmeter remote version

3.3.1. The place of installation is selected from the condition of convenience of work with the secondary Converter. Installation dimensions are specified in the operating manual. When selecting the SC location, the length of the flowmeter and SC communication cables must be taken into account.

3.3.2. Do not install SC:

- In places where the ambient temperature can go beyond 5 to 50°C, and the humidity can be above 80 %, at a temperature below 35°C
- Near heat sources such as hot pipes. Lighting SC is optional, its display has its own backlight.

3.3.3. Using screws with a diameter of 5 mm bracket (Fig.C.1) installed on the wall. Detachable coupling (Fig.C.3) one end is fixed to the rack of the secondary Converter. The free end of the clutch is put on the bracket

protrusion as shown in Fig.C.4, after which the top plate is secured with screws.

3.4. Wiring the Flowmeter

- 3.4.1. Power and communication cables are connected to the flowmeter after it is installed into the pipeline.

Prior to connection, cut isolation from cable ends by 5 mm and after that, connect them to the terminals on the switching module. Multicore cables must be tinned.

- 3.4.2. For the flow meter in a combined version, the power and communication cables are connected to the electronics block. Opening of back cover BE to make by means of a key for oil filters "UNIOR" № 205. Skip the power cable through one cable gland, interface cable – through the other cable gland. Cables are connected to the connectors on the switching module in accordance with the input and output diagrams given in the operation manual. To ease wiring, the sticker designating the switching module connection elements is put on the flowmeter's rear cover.

- 3.4.3. The secondary converter flowmeter in the remote version comes with mounted cables PFC-SC. Therefore, the connection of the free ends of these cables is performed only to the PFC. For this opening of back cover of the PFC communication block. Skip the cables through cable glands. Cables are connected to the connectors on the switching module (see Fig.D.1).

The maximum cable length is 10 meters. Connection of power and communication cables to the electronics block is performed in the same way as for the flow meter in a combined version (п.3.4.2).

- 3.4.4. As a 24 V power cable you must use twin core round conductor. The power cable should be up to 150 m long for the core cross section of 1.5 mm² and up to 250 m for the core cross section of 2.5 mm². For the less core cross section, cable length is reduced proportionally.

Any twin/four core round cable up to 300 m long may be used as a communication cable for the universal outputs. Twin core shielded cable up to 1200 m long is used as a serial interface communication cable.

A cable for the analogue output is selected considering load rating of the output as well as the parameters of an input connected to receive the analogue signal.

When several interfaces are used simultaneously, e.g. both universal outputs of the flowmeter, analogue output (or an external button), six core cable may be used.

Cable core cross section shall be within 0.2 mm² to 2.5 mm² range.

- 3.4.5. The power and communication cables used must comply with the operating conditions of the flow meter

CAUTION! To ensure the declared level of protection IP67, it is necessary to execute following operations:

- The sealing ring of the case of the BE should be pure and intact at its installation on the block case

- The cover BE should be reliably tightened
 - Power and communication cables external diameter shall be from 5 to 8.8 mm
 - The cable glands should be reliably tightened.
- 3.4.6. The power and communication cables are fixed on the wall wherever possible. To avoid mechanical damages, it is recommended to place them in a metal tube or sleeve. The signal (communication) and power cables may be placed in one tube (sleeve).

DO NOT fix cables to the heated pipeline.

- 3.4.7. To provide electrical connection, it is necessary to connect the pipeline sections cut in the wafer type MFT mounting location by wires (jumpers) via a terminal located on the BE; wires should be of 4 mm² cross section as a minimum (see Appendix A). If the pipeline has cathode protection, cross section of the jumpers shall correspond to the value of cathode protection current. Use the M5 threaded holes on cylindrical surface of the flanges to connect the jumpers.

When mounting flanged type flowmeters, it is necessary to connect the PFC flanges and the mating pipeline flanges by wires with cross section of no less than 4 mm to ensure appropriate electrical connection (see Appendix B).

When mounting flowmeters with the threaded coupling, connection of the wires is not required as the electrical connection of the cut pipeline parts is ensured by the flowmeter's components.

- 3.4.8. The need for protective grounding is determined by power supply and environment conditions under which the flow meter is operated.

To prevent failures of the flow meter, the grounding terminal must not be connected to the lightning protection system.

As a grounding wire, you must use a mechanically protected copper wire of 2.5 mm² cross-section as a minimum or a copper wire without mechanical protection of 4 mm² cross section as a minimum.

The grounding conductor is connected to the fixing screw on the electronic block.

CAUTION! If the pipeline is equipped with cathode protection, do not ground the flowmeter.

- 3.4.9. After completing the wiring of the flow meter, install in place the back cover of the electronics block, and for the flow meter in the remote version – the cover of the switching block.

4. DISMOUNTING

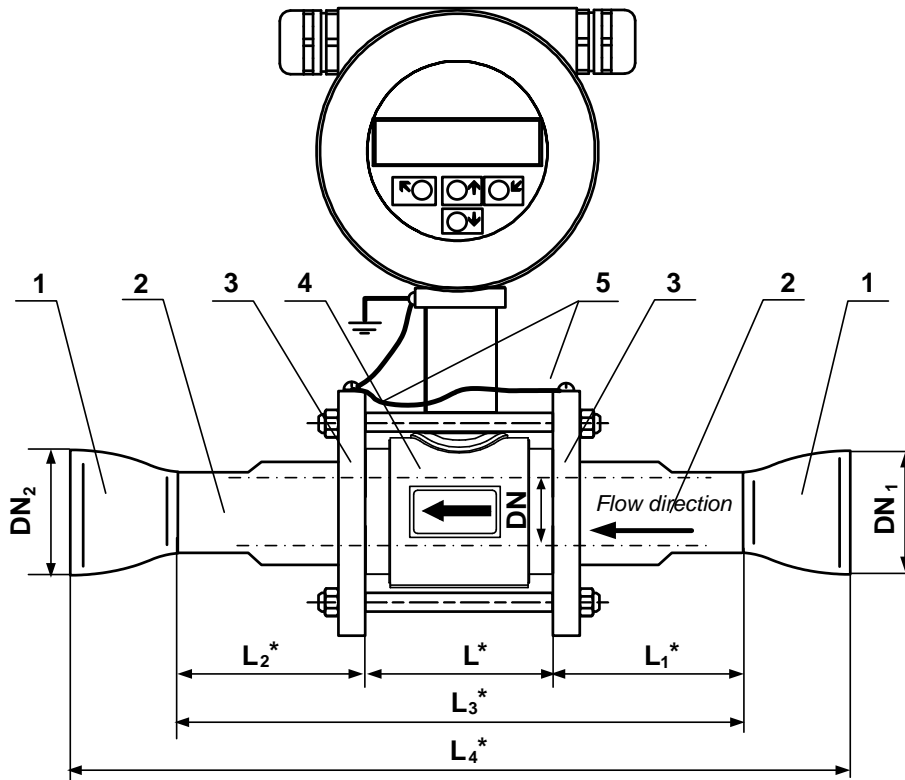
- 4.1. The order of dismantling the flowmeter before dispatching for regular calibration or repair is as follows:
- Turn off power, then disconnect network and signal cables from the flowmeter
 - Disconnect wires (connecting jumpers, if any) from the pipeline flanges
 - Cut off liquid at the PFC location, make sure that pressure is released and drain the liquid
 - Remove PFC

- Immediately after PFC is dismantled from the pipeline, install the clamping plates with the tightening stud (bolt) on PFC covered by fluoroplastic with the protection rings removed
 - Install the simulator in the pipeline instead of PFC.
- 4.2. On installing the simulator, check mating surfaces for leakage. Replace gaskets, if necessary. In case that no leakages are found, put the pipeline into operation.
- 4.3. Clear the PFC inner channel from sediment and liquid residues before packing.

5. PUTTING INTO OPERATION

- 5.1. When putting the flowmeter into operation check the following:
- The flow is in the direction of the arrow located on the flowmeter's body
 - Length of the inlet and outlet straight pipe runs corresponds to flow direction
 - The flowmeter and related equipment are connected in accordance with the selected wiring diagram
 - The outputs operate in the preset modes
 - Power supply voltage corresponds to the specifications.
- 5.2. At first power-up or after a long break in operation, the flowmeter is operational after:
- All hydraulic processes in the pipeline related to changes of flow rate (draining, filling, flow adjustment etc.) are fully terminated
 - PFC is washed by medium for 30 minutes
 - The flowmeter is kept powered for 30 minutes.
- 5.3. To protect the device from unauthorized access during operation, the cover of BE case may be sealed with hanging seals.
- If a bypass is installed, it is necessary to seal its gates in closed position.

APPENDIX A. Mounting wafer type Flowmeters into the pipeline



1 – taper adaptor; 2 – adaptor pipe; 3 – mating flange; 4 – MFT (PFC dimension simulator); 5 – wires (electrical jumpers) connecting the flowmeter's case and pipeline

Fig.A.1. Assembly-welded structure for mounting the wafer flowmeters DN10, DN15 into the pipeline

Table A.1. Dimensions of the assembly-welded structure for mounting the wafer type flowmeters (mm)

DN	DN ₁ / DN ₂	L*	L ₁ *	L ₂ *	L ₃ *	L ₄ *	Notes
10	20	83	78	78	239	299	
	25					359	**
	32					329	
	40					359	**
	50					389	**
	65					439	**
15	20	83	103	78	264	324	
	25					384	**
	32					354	
	40					384	**
	50					414	**
	65					464	**

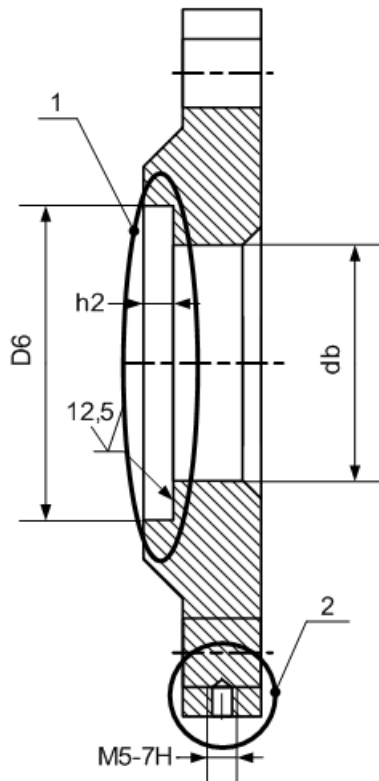
* - reference dimensions without processing tolerances

** - adaptor is made from two concentric adaptors

Flat weld flanges (for 2.5 MPa pressure) are used to mount the MFT into the pipeline:

- For DN10, DN15 – flanges of design type B (with a fixing ridge)
- For DN20-DN150 – flanges of design type F (with a notch)

Modification of flanges is needed before welding which means drilling a threaded hole M5 on the flange cylindrical surface to fix wires (Fig.A.2).



1 – revision to F;

2 – threaded hole M5

DN, mm	D6, mm	h2, mm	db, mm	Workpiece
10	35 H12	2,5±0,2	10	Flange 20-25-01-1-B St25
15	40 H12	2,5±0,2	15	Flange 20-25-01-1-B St25

Fig.A.2. Modifications made for flanges for mounting MFT's of wafer type

When welding flanges shown in Fig.A.2 to the pipeline, adaptor pipes shall be used (see Fig.A.3). The length of the adaptor pipes should be no less than the length of the straight pipeline run (see Table 1 of this manual).

After welding the flange to the adaptor pipe, process the surface adjacent to the flowmeter as shown in Fig.A.4. The adaptors and pipeline sections are welded butt-to-butt.

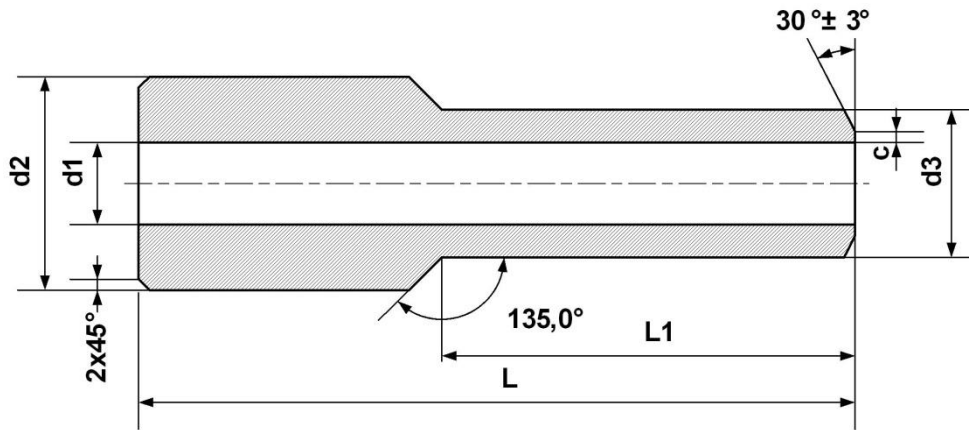


Fig.A.3. Adaptor pipes

Table A.3. Adaptor pipeline dimensions

DN, mm	d1, mm	d2, mm	d3, mm	c, mm	L, mm	L1, mm
10	11.6	26	17	0,5 ^{+0,5}	75	40
15	15	26	21		100	65

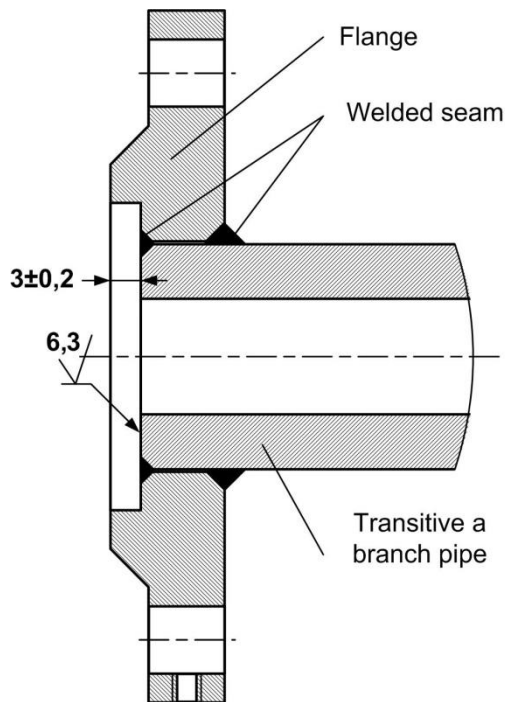
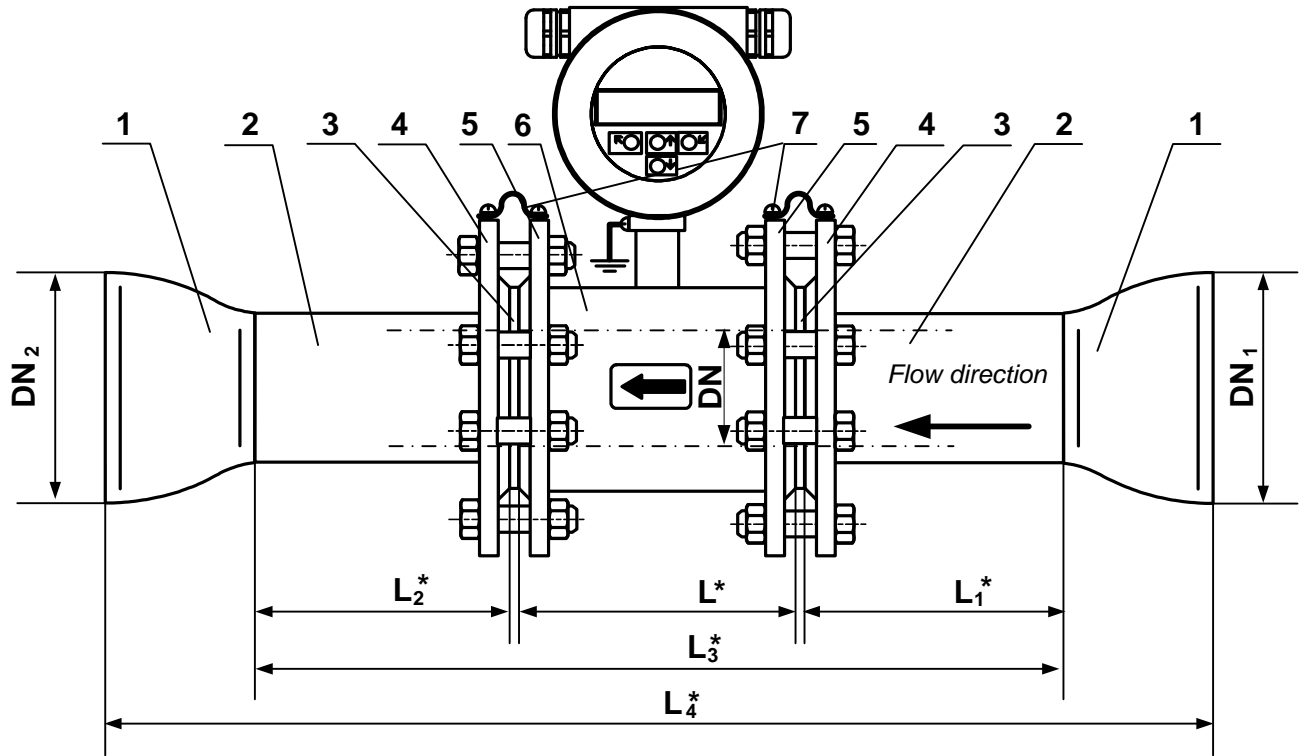


Fig.A.4. Welding flanges to adaptor pipes

APPENDIX B. Mounting Flowmeters of flanged type into the pipeline



1 – taper adaptor; 2 – straight pipe run; 3 – rubberized asbestos fabric gaskets; 4 – mating pipeline flange; 5 – PFC flange; 6 – MFT (PFC dimension simulator) 7- wires connecting flowmeter's flanges to the pipeline

Fig.B.1. Assembly-welded structure for mounting flanged flowmeters into the pipeline

Table B.1. Dimensions of assembly-welded structure for flanged MFT,s (mm)

DN	DN ₁ / DN ₂	L*		L ₁ *	L ₂ *	L ₃ *		L ₄ *		Notes
		with protect. rings	without protect. rings			with protect. rings	without protect. rings	with protect. rings	without protect. rings	
1	2	3	4	5	6	7	8	9	10	11
20	25	150	142	124	84	362	354	422	414	
	32							422	414	
	40							422	414	
	50							452	444	
	65							592	584	**
	80							602	594	**
25	32	200	192	149	99	452	444	512	504	
	40							512	504	
	50							542	534	
	65							682	674	**
	80							692	684	**
	100							702	684	**

Cont. of Table B.1

1	2	3	4	5	6	7	8	9	10	11
32	40	200	192	184	119	507	499	567	559	
	50							597	589	
	65							617	609	
	80							747	739	**
	100							757	749	**
40	50	200	192	229	149	582	574	702	694	
	65							722	714	
	80							732	724	
	100							862	854	**
	125							902	894	**
	150							846	838	**
50	65	200	192	285	185	674	666	814	806	
	80							824	816	
	100							834	826	
	125							874	866	
	150							824	816	
65	80	200	192	360	230	794	786	944	936	
	100							954	946	
	125							994	986	
	150							944	936	
	200							984	976	
80	100	200	192	435	275	916	908	1074	1066	
	125							1114	1106	
	150							1174	1166	
	200							1104	1096	
	250							1354	1346	**
	300							1324	1316	**
	350							1614	1606	**
100	125	250	242	535	335	1124	1116	1324	1316	
	150							1384	1376	
	200							1314	1306	
	250							1404	1396	
	300							1404	1396	
	350							1824	1816	**
	400							1824	1816	**
150	200	270	262	795	495	1564	1556	1844	1836	
	250							1924	1916	
	300							1844	1836	
	350							2004	1996	
	400							2004	1996	**
	500							2604	2596	**
200	250	342	324	1050	650	2042	2028	2420	2406	
	300							2420	2406	
	350							2500	2486	
	400							2500	2486	
	500							3100	3086	**
300	350	503	485	1565	965	3033	3015	3491	3473	
	400							3491	3473	
	500							4091	4073	**

* - reference dimensions without processing tolerances

** - adaptor is made from two concentric adaptors

Flat welded (slip-on) flanges supplied with the set of fittings should be modified as follows: a threaded M5 hole is drilled for fixing a wire on the cylindrical surface of a flange.

APPENDIX C. Mounting Secondary converter

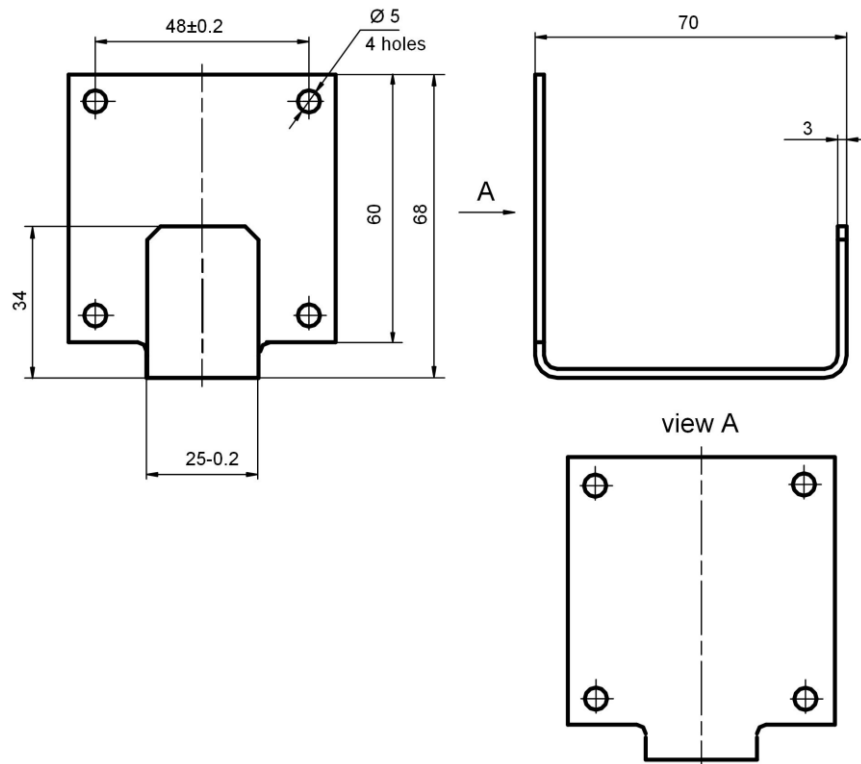


Fig.C1. Wall bracket.

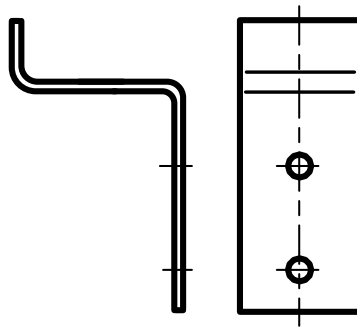


Fig.C2. Top plate

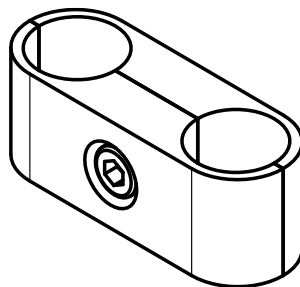


Fig.C3. Detachable coupling

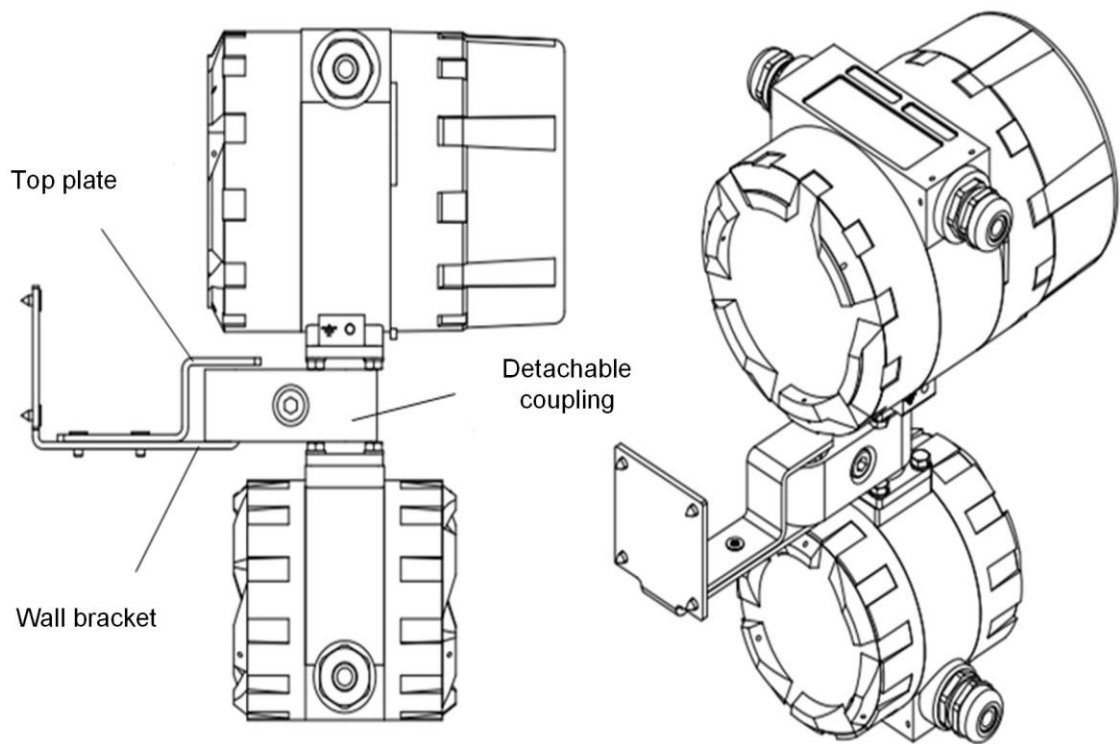


Fig.C4. The secondary converter is mounted on the bracket

APPENDIX D. Signal cables PFC-SC

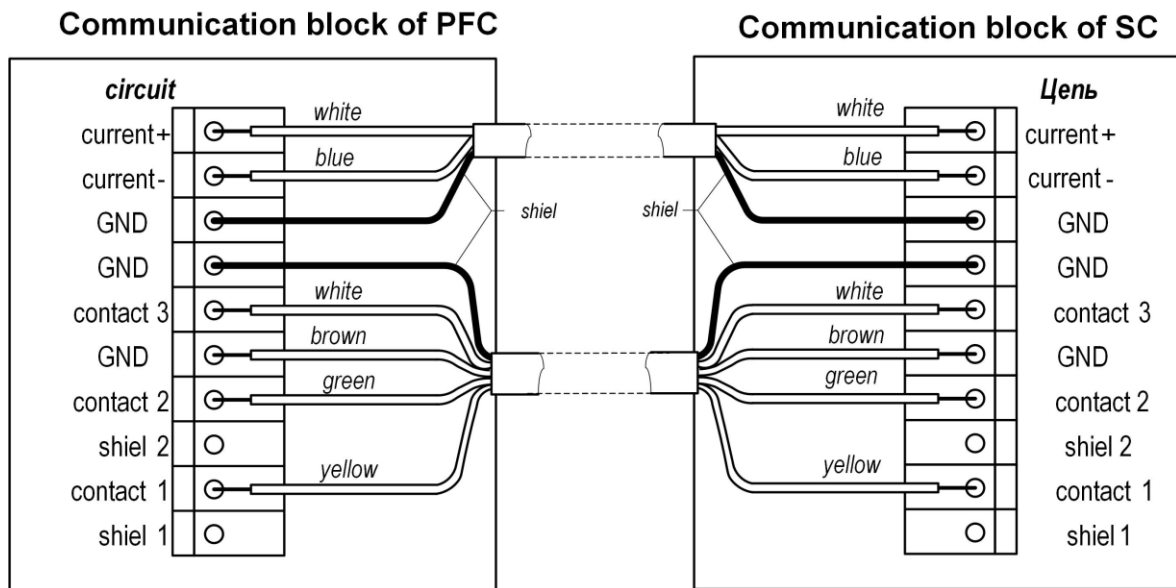


Fig.D.1 Wiring diagram of the flow meter signal cables in the remote version