User's Manual

Model FF20, FS20 and FD20
Flow, subassembly and immersion fitting

YOKOGAWA

IM12B06K01-01EN-P
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Contents

1. Preface

1.1 Introduction Model FF20/FS20

The process fittings (Model FF20) and their subassemblies (Model FS20) are used to mount sensor tips in a piping system so that the pH and/or the ORP (Redox) potential of the liquid flowing through it can be measured.

The flow fittings are for connection between two pipes of the piping system providing a “flow through” path. From a practical plant aspect (for easy maintenance and calibration) the mounting place is in a by-pass behind a sample valve. They are supplied with a ring to hold calibration dish for this cleaning and/or calibration.

The subassemblies should be cemented or welded direct in the piping system or in a T-piece of it. The subassemblies of stainless steel meet the requirements of DIN 11850 for mounting in sanitary constructions.

The model FD20 immersion fittings are used to submerge sensor tips so that the pH and/or ORP (redox) potential of liquids in open vessels, tanks, drains etc. can be measured.
The fittings are available for mounting of either:

- one electrode
- three electrodes
- four electrodes or alternatively three
- electrodes and a cleaning system.

1.2. Features

- Wide choice fo construction materials.
- High degree fo standardisation reduces spare holding requirements.
- Direct mounting of sensors with DIN dimensions.
- Liquid earth sensor for stable measurements.
- High pressure and temperature specifications.
- Chemical or brush cleaning (optional in 4-hole fittings).

1.3. Unpacking and inspection

When you receive the process fitting it is packed in a cardboard box.
Open the box and check that the model code is the same as on the packing list (see chapter 2.4, 2.5 and 3.4 for the model code). Also check that it is supplied with the options you ordered. These options are delivered in separate bags.

If you have any problems or questions, please contact the nearest Yokogawa service center or sales organisation for assistance.

1.4. Warranty and Service

Yokogawa products are guaranteed free from defects in workmanship and materials under normal use and service for a period of (typically) 12 months from the date of shipment from the manufacturer. Individual Sales organizations can deviate from the typical warranty period, and the conditions of sale relating to the original purchase order should be consulted.
Damage caused by wear and tear, inadequate maintenance, corrosion, or by the effects of chemical processes is excluded from this warranty
coverage. In the event of a warranty claim, the defective goods should be sent (freight paid) to the Service Department of the relevant Yokogawa Sales office for repair or replacement (at Yokogawa’s discretion).

The following information must be included in the letter accompanying the returned goods:

- Model Code and Serial Number.
- Original Purchase Order and Date.
- Length of time in service and description of the process.
- Description of the fault and circumstances of the failure.
- Process/environmental conditions that may be related to the failure of the sensor.
- Statement as to whether warranty or nonwarranty service is requested.

- Complete shipping and billing instructions for return of material, plus the name and phone number of a contact person that can be reached for further information.
- Clean Statement

Returned goods that have been in contact with process fluids must be decontaminated and disinfected prior to shipment. Goods should carry a certificate to this effect, for the health and safety of our employees.
Material Safety Data sheets must be included for all components of the process to which the sensor(options) have been exposed.

1.5. Serial number

The Serial number is defined by nine (9) alphanumeric characters:

X_1X_2	Production location
X_3X_4	Year/Month code
X_5X_6 X_7X_8 X_9	Tracking number

Example: N3P600028

Table 1: Production Year code

Year	Year code	Year	Year code
2014	P	2026	3
2015	R	2027	4
2016	S	2028	5
2017	T	2029	6
2018	U	2030	7
2019	V	2031	8
2020	W	2032	9
2021	X	2033	A
2022	Y	2034	B
2023	Z	2035	C
2024	1	2036	D
2025	2	2037	E

Table 2: Production Month code

Month	Month code
January	1
February	2
March	3
April	4
May	5
June	6
July	7
August	8
September	9
October	A
November	B
December	C

2. FF20/FS20 process fitting

2.1. General specifications FF20/FS20

2.1.1. Materials

Wetted parts	
a. body (refer to model code)	Polyproplylene (PP) Stainless steel AISI 316 (SS) Polyvinylchloride (PVC) Polyvinylidenefluoride (PVDF)
b. O-rings:	silicon rubber, FKM (Viton)
c. liquid earth sensor: (not in 1-hole subassembly)	titanium (in plastic designs) Stainless steel AISI 316 (SS designs)
Non-wetted parts	
a. mounting bracket:	SS AISI 316 (SS designs) PVC (plastic designs)
b. electrode mounting sets:	PPS
c. holder for calibration dish:	SS AISI 316
d. calibration dish:	Polyethilene
e. retaining nut for electrode holder:	SS AISI 304
Volume measuring vessel	
- 2-hole design:	130 ml
- 3-hole design:	130 ml
- 4-hole design:	250 ml

2.1.2. Operating range

Min./Max temp.at ambient pressure:	Depending on material and pressure*
Maximum pressure:	Depending on material and temperature*
Flow rate (fittings only):	0,1 to 10 L/min (depending on application) max. 6 m/s

* (see chapter 5, fig. 23)

2.1.3 Shipping details

Package size (LxWxH)	: Model dependant
Package weight (max)	: Model dependant
Fitting weight *Note	: see table 3

Table 3: Fitting weight

Fitting \ Material	PP	SS	PVC	PVDF
1-hole subassembly		0,2 kg	0,1 kg	
3-hole subassembly		1,2 kg	0,5 kg	
4-hole subassembly		3 kg	1,4 kg	
3-hole fitting	1,1 kg	2,2 kg		1,5 kg
4-hole fitting	1,4 kg	6,5 kg		1,8 kg

* The accessories are not included.

2.1.4. Process connection size

Process connections :	1/2” NPT or flange LAP-joint (DIN or ANSI).
- 2-, 3- and 4-hole fitting	See model code.
- 1-hole	: DN20
- 2-hole	: DN50
- 3-hole	: DN50
- 4-hole	: DN80

2.2. Installation

2.2.1. Mounting in a sample line

Part of the process liquid is tapped off to the flow fitting or subassembly (see fig. 1).

2.2.2. Mounting in a shunt line

By means of restrictor in the main line a small flow of the process liquid is lead through the flow fitting or subassembly via the shunt line (see fig. 2). The pressure in the fitting or subassembly is controlled by means of two valves.

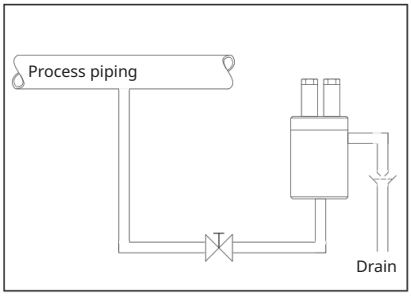

Fig. 1: Tapping point

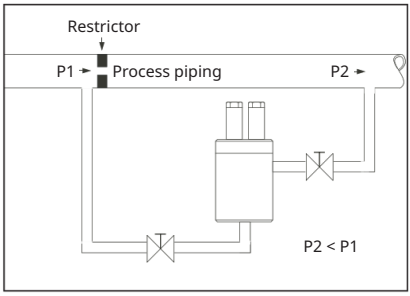

Fig. 2: Installation in shunt line

2.2.3. Mounting in a sample line with buffer liquid/cleaner connection

The sample line has an extra input for cleaning or calibration (see fig. 3).

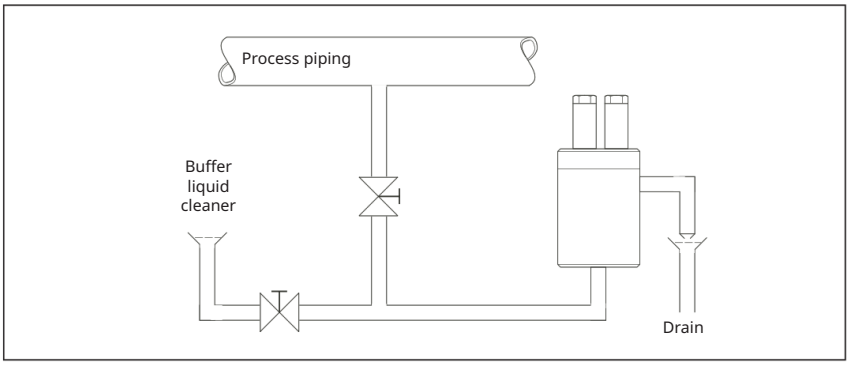

Fig. 3: Installation with buffer and cleaning input

2.2.4. Fitting installation

Install the fitting at a convenient location for maintenance and calibration. Ensure that there is some place at the top of the fitting (approx. 20 cm) for mounting or replacing the electrodes. Mounting the fitting in a piping system is shown in fig. 4. Refer to chapter 2.3 for dimensional drawings.

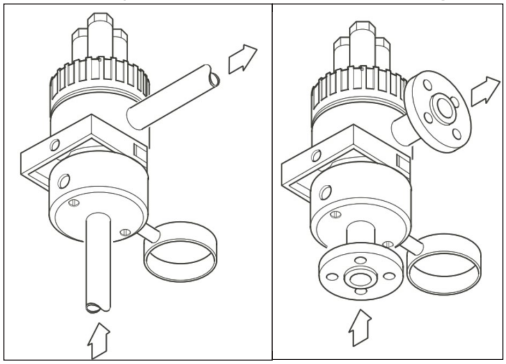

Fig. 4: Mounting in pipe system

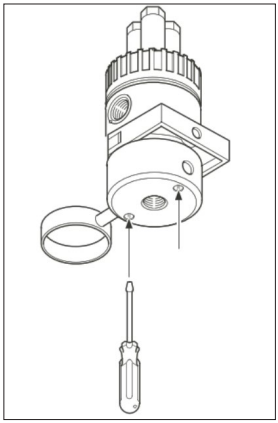

Fig. 5: Locking screws location

NOTE: The process connection (liquid outlet) can be turned from right to left.

1. The plastic fittings have locking screws for the holder of the calibration dish (see fig. 5). These screws must be loosened before turning.

2. The liquid outlet of the stainless steel fittings can be turned after loosening from the mounting bracket (see exploded view at the end of this manual).

2.2.5. Subassembly installation

The subassembly can be cemented or welded directly in a piping system or in a T-piece of it. Install the subassembly at a convenient location for maintenance and calibration.

Ensure that there is some place at the top of the fitting (approx. 20 cm) for mounting or replacing electrodes.

Fig. 6 shows some mounting examples. Select the mounting position so that the sensors are immersed in the process liquid during measurement.

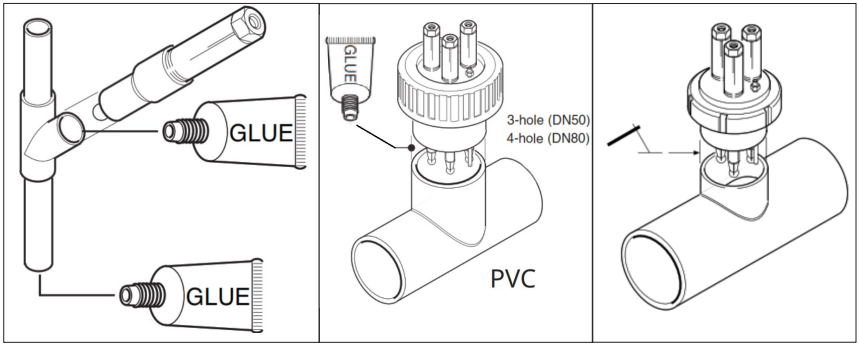

Fig. 6: Examples for glueing and welding

2.2.6. Sensor mounting

For stable measurement the glass- and the reference electrode should be mounted in the holes nearest to the earth connection. For details on analyzer, sensor and cable connection refer to the respective instruction manual.

2.2.7. Mounting in a 1-hole design

Unscrew the electrode mounting set and fix the cable and electrode as shown in fig. 7.

2.2.8. Mounting in a 3- and 4-hole design

Unscrew the nut from the top end of the fitting or subassembly. Fix the electrodes and cables as shown in fig. 8.

Note: In the holes for placing the electrodes are blanking plugs (stoppers). These plugs can be placed in unused holes after pushing the two O-rings over the bottom end.

Attention

To prevent fouling of the contact new Yokogawa electrodes are delivered with a cap. It is recommended to remove the cap just before fixing the cable.

ENSURE THAT THERE IS NO MOISTURE OR DUST IN THE PLUG

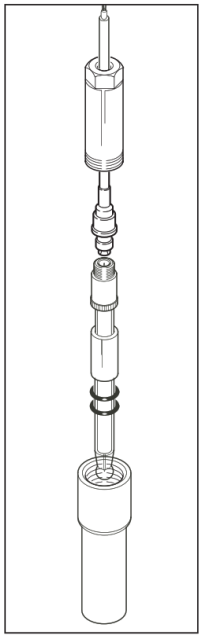

Fig. 7: 1-hole design

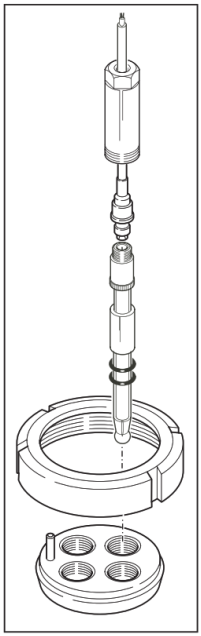

Fig. 8: 3 and 4 hole design

2.3. Dimensions

2.3.1. Flange adapters (NPT1/2" male lap joint)

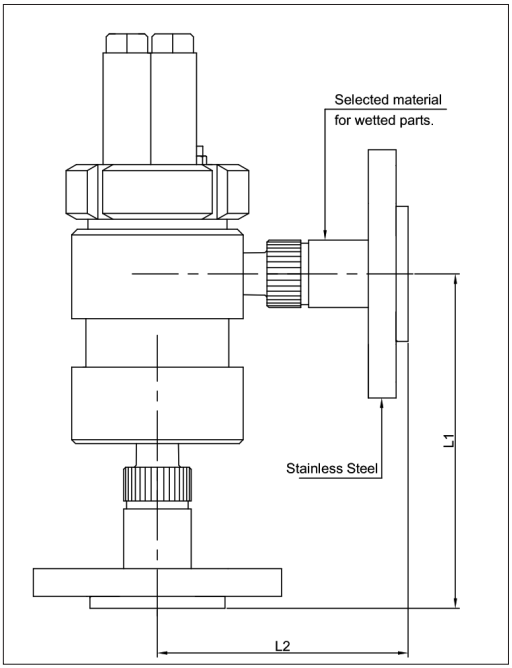

Fig. 9: Flange adapters distance

Table 4: Fitting flange installation distance

TYPE	FP1-FF1-FS1				FP2-FF2-FS2				FP3-FF3-FS3				FP4-FF4-FS4			
	L1		L2		L1		L2		L1		L2		L1		L2	
	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]
FF20-S22 / S3*	143	5.63	137	5.39	153	6.02	147	5.79	142.2	5.60	137	5.39	152.4	6.00	147.0	5.8
FF20-P22 / P3* FF20-F22 / F3	180	7.09	133	5.24	169	6.65	122	4.80	180.3	7.10	133	5.24	167.6	6.60	122.0	4.8
FF20-S43	156	6.14	133	5.24	166	6.54	143	5.63	154.9	6.10	133	5.24	165.1	6.50	143.0	5.6
FF20-P43 FF20-F43	183	7.20	153	6.02	172	6.77	142	5.59	182.9	7.20	153.0	6.02	172.7	6.80	142.0	5.6

2.3.2. Dimensions - flow fittings units mm (inch)

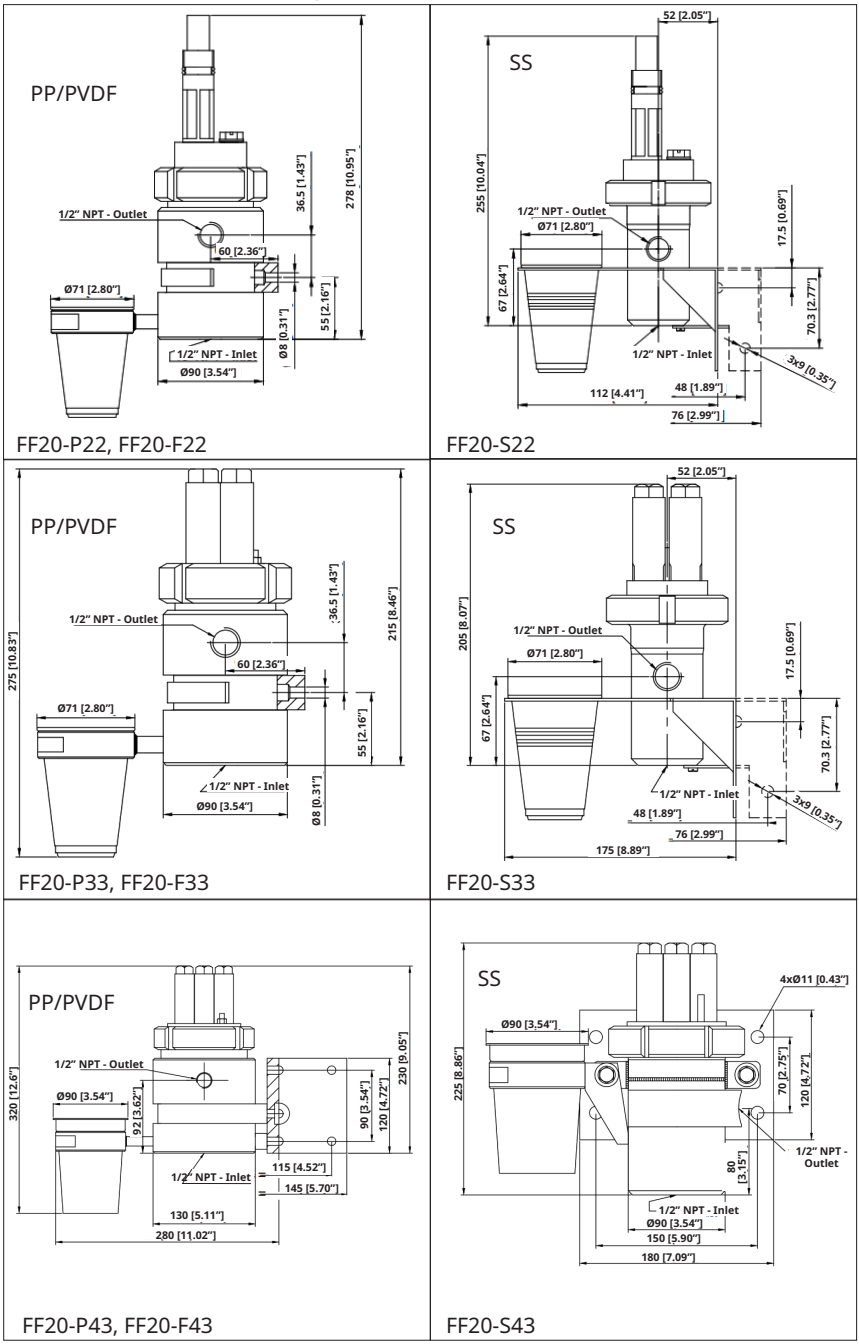

Fig. 10: Flow fitting dimensions

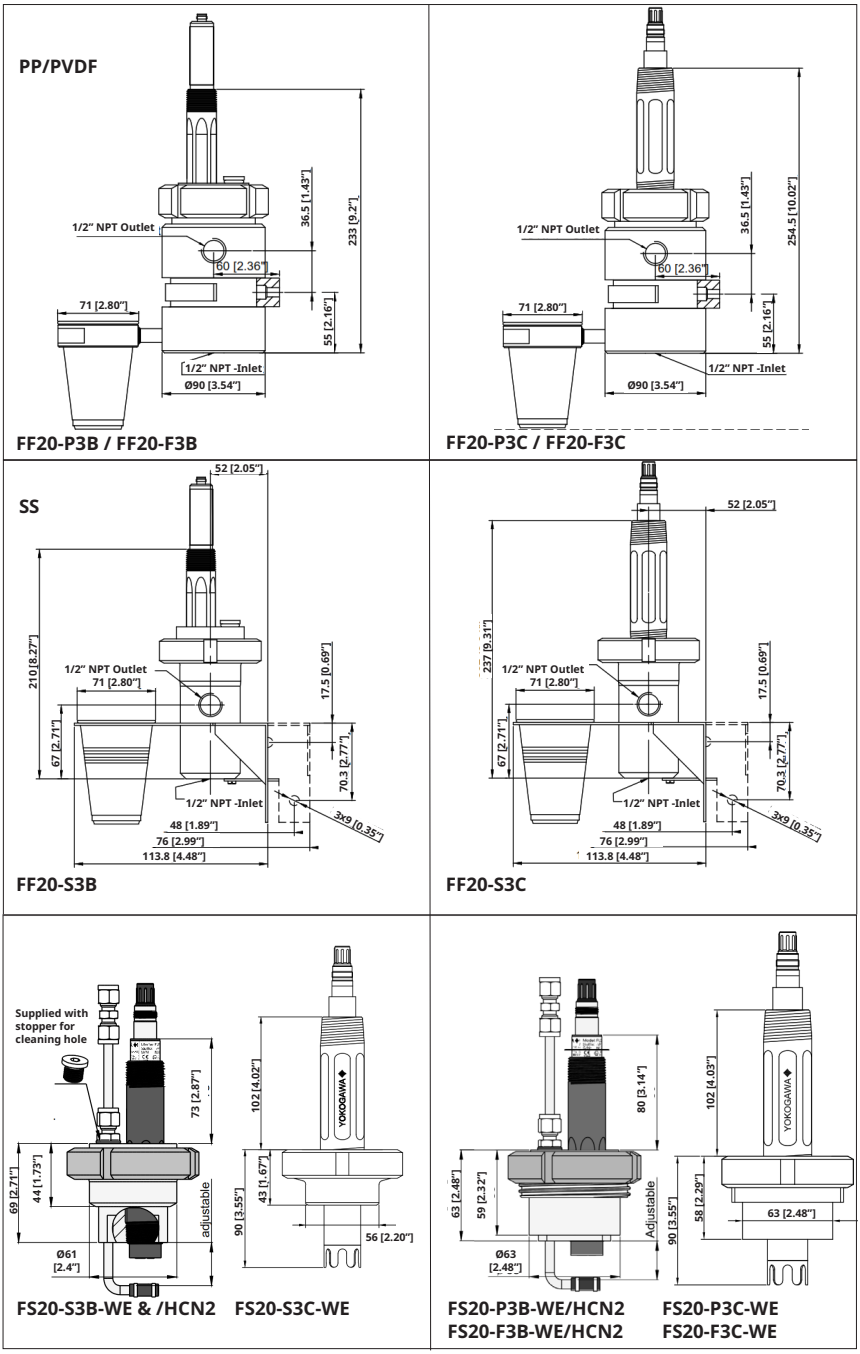

Fig. 11: Flow fitting dimensions

2.3.3. Dimensions - subassembles units mm (inch)

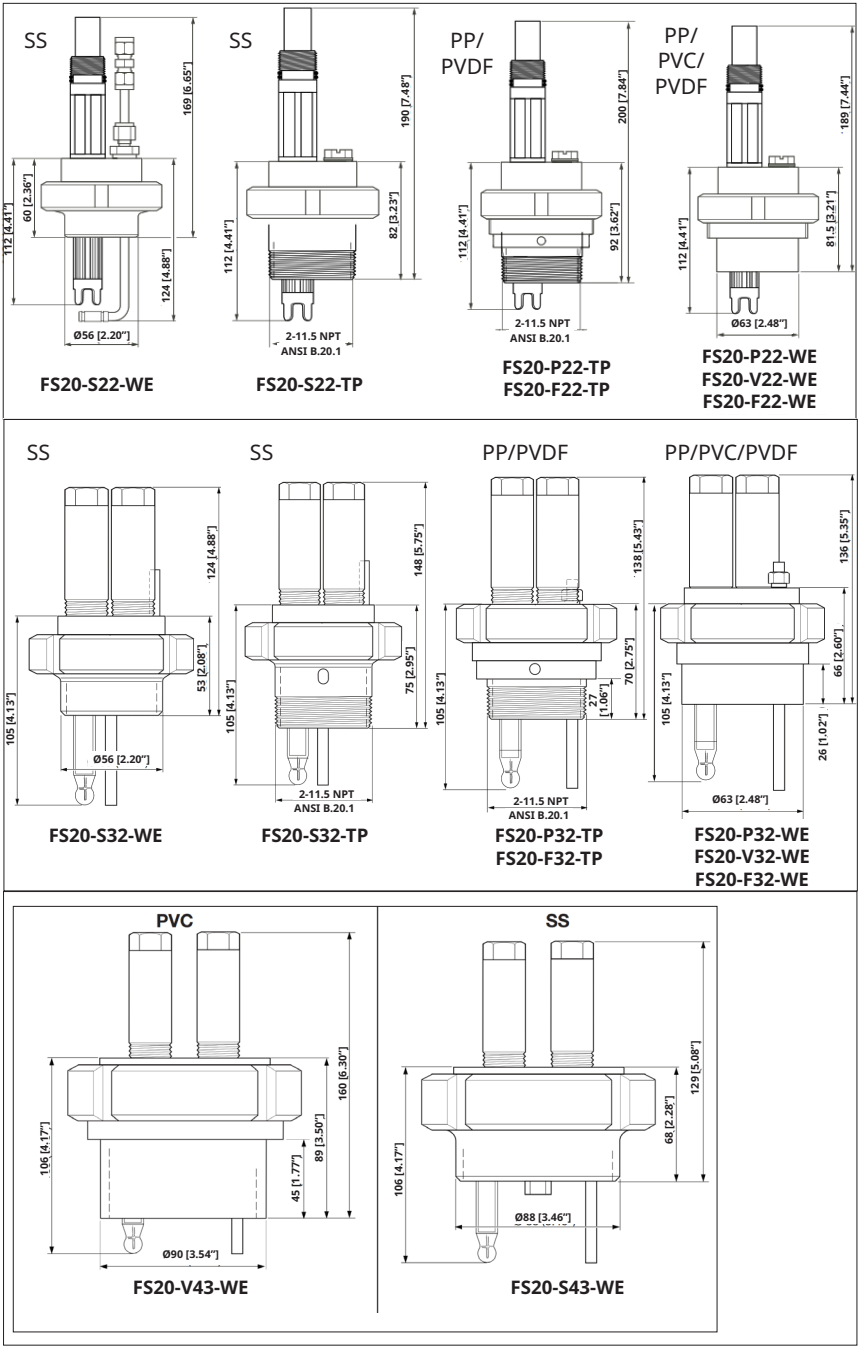

Fig. 12: Flow subassembly dimensions

2.4. Model code FF20 flow fitting

Model	Suffix Code	Option code	Description
FF20			Flow fitting
Material	-P		Polypropylene (PP)
	-S		Stainless steel AISI 316 (SS)
	-F		Polyvinylidenefluoride (PVDF)
Number of holes	22		For PH20, 2 mounting holes
	33		3 electrode mounting holes
	3B		For FU20, 2 mounting holes
	3C		For FU24, 1 mounting hole
	43		4 electrode mounting holes
	*B		Style code B
Cleaning system		/HCN2	Cleaning only for FF20-.22 / FF20-.3B / FF20-.4B
		/HCN3	Cleaning only for FF20-.33
		/HCN4	Cleaning only for FF20-.43
Mounting kit		/B	For mounting Bellomatic reference electrodes.
		/R	For mounting (top) refillable electrodes with long glass shaft.
Flange adapters (NPT ½" male lap joint).		/FP1	DN15-PN10 PP
		/FP2	DN25-PN10 PP
		/FP3	½" 150 lbs PP
		/FP4	1" 150 lbs PP
		/FF1	DN15-PN10 PVDF
		/FF2	DN25-PN10 PVDF
		/FF3	½" 150 lbs PVDF
		/FF4	1" 150 lbs PVDF
		/FS1	DN15-PN10 SS 316
		/FS2	DN25-PN10 SS 316
		/FS3	½" 150 lbs SS 316
		/FS4	1" 150 lbs SS 316
KCl-reservoir		/K	Electrolyte tubing (2.5 m) is included.
Salt bridge		/S	For liquid which cannot stand contamination with KCl.
Certificate		/M	Material certificate 3.1 according to EN-10-024 (DIN 50-049), on SS wetted parts. Not for P3B, P4B, F3B and F4B without /HCN*.

2.5. Model code FS20 Subassemblies

Model	Suffix Code	Option code	Description
FS20			Subassembly (Flow fitting)
Material	-V		Polyvinylchloride (PVC)
	-P		Polypropylene (PP)
	-S		Stainless steel AISI 316 (SS)
	-F		Polyvinylidenefluoride (PVDF)
Number of holes	12		1 electrode mounting holes (only V, S)
	22		For PH20, 2 mounting holes
	32		3 electrode mounting holes
	3B		For FU20, 2 mounting holes (only P, S, F)
	3C		For FU24, 1 mounting hole (only P, S, F)
	43		4 electrode mounting holes (only V, S)
Mounting	-WE		Welding end: type, S12, S22,S32, S3B, S3C, S43
			Glue for PVC: type V12, V22, V32, V43
			Heat welding: type F22, F32, F3B, F3C, P22, P32, P3B, P3C
	-TP		Tapered pipe thread (2”NPT acc. ANSI B.20.1). (for 2 and 3 holes version, and not in case of type V22 and V32)
Cleaning system		/HCN2	FS20- .22 / FS20- .3B
		/HCN3	FS20- .32
		/HCN4	FS20- .43
Mounting kit		/B	For mounting Bellomatic reference electrodes.
		/R	For mounting (top) refillable electrodes with long glass shaft.
KCl-reservoir		/K	Electrolyte tubing (2.5 m) is included.
Salt bridge		/S	For liquid which cannot stand contamination with KCl.
Certificate		/M	Material certificate 3.1 according to EN-10-204 (DIN 50-049) (on SS wetted parts).

2.6. Spare parts

Table 5: Spare parts FF20 and FS20

Spare part No.		Description	FF20	FS20
K1500FV	Cable accessories	LIQUID EARTH CABLE 10M	x	x
K1500DU		LIQUID EARTH CABLE 25M	x	x
K1500DW		Set of 12 cable nuts for WU20	x	x
K1500GZ		Earthpin assy for F*20 non-S	x	x
K1500BW	Tubing and accessories	Flow tube for SB20-VC	x	x
K1500DX		5 m tubing for SB20	x	x
K1500GA		5 m tube for KCl reservoir	x	x
K1530UL		Tubing for FD30/JC, 10 metre	x	x
K1547PH		10 m PVDF Tube and mounting	x	x
K1500BY	Options	Option /R for F*20.. (82850747)	x	x
K1520CD	Holders	Spare 3-hole holder PVC		x
K1521JA		Holder for FU24(F) in FF20-S3* (SS)	x	
K1521JB		Holder for FU24(F) in FF20-F3* (PVDF)	x	
K1521JD		Holder for FU20(F) in FF20-S3* (SS)	x	
K1521JE		Holder for FU20(F) in FF20-F3* (PVDF)	x	
K1521JF		Holder for FU20(F) in FF20-P3* (PP)	x	x
K1520CE		Spare 3-hole holder PP	x	x
K1520CF		Spare 3-hole holder PVDF	x	x
K1500FU		KCl reservoir PVC for F*20	x	x
K1500HA		Calibr. dish for FF20-*33 (50pcs)	x	
K1500HB		Calibr. dish for FF20-*43 (50pcs)	x	
FP20-R12	Adapters	Mounting set PPS	x	x
FP20-S12		Mounting set SS	x	x
K1500DV		Adapter M25x1.5 - PG13.5 PVDF (82890155)	x	x
K1520JN		Adapter M25x1.5 - PG13.5 PVC	x	x
K1520JP		Adapter M25x1.5 - PG13.5 SS	x	x
K1500DZ		Nut SS, FF/S20-3* + ISC40FF/S	x	x
K1521AD		Flange adapter /FS3	x	
K1521AE		Flange adapter /FF3	x	
K1521AF		Flange adapter /FP3	x	
K1521AG		Flange adapter /FS4	x	
K1521AH		Flange adapter /FF4	x	
K1521AJ		Flange adapter /FP4	x	
K1521AK		Flange adapter /FS1	x	
K1521AL		Flange adapter /FF1	x	
K1521AM		Flange adapter /FP1	x	
K1521AN		Flange adapter /FS2	x	

Table 5: Cont.- Spare parts FF20 and FS20

K1521AP	Adapters	Flange adapter /FF2	x	
K1521AQ		Flange adapter /FP2	x	
K1547PA	Cleaning units and accessories	Hast. cleaning unit HCN2/3	x	x
K1547PB		Hast. cleaning unit HCN4	x	x
K1547PF		Nozzle and mounting HCN2/3/F	x	x
K1547PG		Nozzle and mounting HCN4	x	x
K1547PP		Spare Part EPDM spraying valves	x	x
K1520FA		Ferrule set PEEK/PTFE	x	
K1500BV	O-Ring	O-rings EPDM 11x3 (6 Pcs.)	x	x
K1500BZ		O-rings Viton 11x3 (6Pcs)	x	
K1500DD		O-RING FFKM 53.34X5.33 (1PC)	x	x
K1500EK		O-rings viton 6.07x1.78 (5x2)	x	x
K1500EQ		O-ring set EPDM FF20-S22	x	
K1500ER		O-ring set Viton FF20-S22	x	x
K1500ES		O-ring set EPDM FF20-P&F33/3B	x	
K1500ET		O-ring set Viton FF20-P&F33/3B	x	x
K1500EU		O-ring set EPDM FF20-S33/S3B	x	
K1500EV		O-ring set Viton FF20-S33/S3B	x	
K1500EW		O-ring set EPDM FF20-P&F43/4B	x	
K1500EX		O-ring set Viton FF20-P&F43/4B	x	
K1500EY		O-ring set EPDM FF20-S43/S4B	x	
K1500EZ		O-ring set Viton FF20-S43/S4B	x	
K1500FK		O-ring set Viton FF20P&F22	x	
K1500FL		O-ring set standard FF20P&F22	x	
K1500FM		O-ring set FF20-S22	x	
K1500GN		O-ring set silicon FF/FS20 3-hole/3B SS	x	x
K1500GP		O-ring set std FF/FS20 3-hole/3B P/F	x	x
K1500GR		O-rings silicon 10.77x2.62 8pcs	x	x
K1500GT		O-ring set silicon. FF20-.4.	x	x
K1500HD		O-rings silicon 10.77X2.62 50pcs	x	x
K1511DP		O-rings viton 21.9x2.62 (5x2) PH20	x	x

3. FD20 process fitting

3.1. General specifications FD20

3.1.1. Material

- wetted parts

A. body (refer to model code):	polyproplylene (PP) stainless steel AISI 316 (SS) polyvinylchloride (PVC) polyvinylidenefluoride (PVDF)
B. O-rings:	silicone rubber
C. liquid earth sensor:	titanium (PP and PVDF design)
(not in 1-hole fitting)	stainless steel AISI 316 (SS design)
- electrode mounting sets:	PPS (Ryton™)
- “hoisting eye”:	stainless steel cable (twisted)
Mounting:	by means of the “hoisting eye” or flange mounting

3.1.2. Functional specifications

Temperature	
- min / max.:	see chapter 5. figure 23
Immersion length (m):	between 0,5 and 2,0 m
Pressure:	see chapter 5. figure 23

3.1.3. Shipping details

Package size (LxWxH)	: Model dependant
Package weight (max)	: Model dependant
Fitting weight *Note	: see table 6

Table 6: FD20 weight

Fitting \ Material	PVC	PP	SS	PVDF
1-hole fitting	0,4 kg			
3-hole fitting		2 kg	5,3 kg	2,5 kg
4-hole fitting		4,5 kg	6,4 kg	5,5 kg

* The accessories are not included. The noted weights are at an immersion length of 1 m.

3.2. Installation

Before installing the immersion fitting, check that all parts and accessories were supplied by Yokogawa.
Ensure that there is enough spare around to withdraw the fitting for calibration and maintenance.

3.2.1 “Hoisting eye” type mounting

On top of each fitting is a “hoisting eye” to withdraw from the process.

3.2.2 Flange mounting fitting

If ordered, the immersion fittings are supplied with a flange for fixing in a tank. The flange is connected to the fitting as shown in the dimensional drawings. These drawings also show the configuration of holes.

Table 7. Flanges being used as a standard

Fitting type	Fitting material	PP flange type	Flange material	DN	Flange thickness
1-hole	PVC	glue-flange	PVC	32	
3-hole	SS	weld-flange	SS	80	20 mm
4-hole	SS	weld-flange	SS	100	20 mm
3-hole	PP	collar-bush + lap-joint flange	PP + PP (steel inlay)	80	
4-hole	PP	collar-bush + lap-joint flange	PP + PP (steel inlay)	125	
3-hole	PVDF	collar-bush + lap-joint flange	PVDF + PP (steel inlay)	80	
4-hole	PVDF	collar-bush + lap-joint flange	PVDF + PP (steel inlay)	125	

3.2.3. Cables mounting

Before mounting a sensor and/or accessory the cables must be passed through the fitting. For the details about sensor and cables please refer to the respective analyzer, sensor and cable instruction manual.

3.2.4. 1- Hole fitting

Unscrew the protector from the lower end and the nut with glands from the top end of the fitting. Mount the cable and sensor as shown in figure 13.

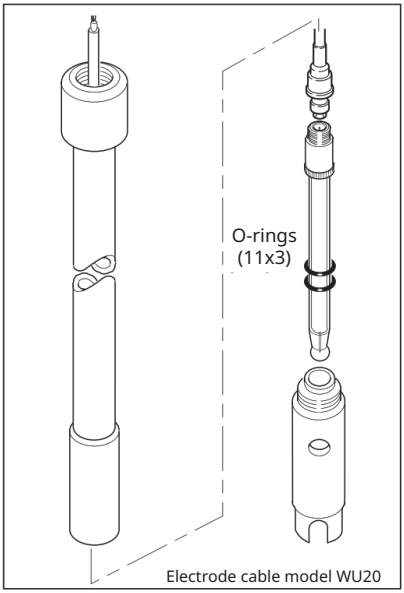

Fig. 13. Mounting a cable and sensor in a 1-hole fitting

Attention:

Ensure that the cable has slack remaining in the fitting so that sensor replacement is simplified. To prevent damage of the O-rings the nut and glands must be screwed HAND-TIGHT to the fitting. Prepare the sensor to be used in accordance with the directions for use. After that mounting can be made as shown in fig. 13.

Attention:
To prevent fouling of the contacts, it is recommended to screw the electrode cable on the electrode as soon as possible. Ensure that there is no moisture or dust in the connection sensor-cable.

Note:
This fitting has no liquid earth connection.

3.2.5. 3- Hole and 4-hole fitting

Unscrew the protector complete with electrode holder from the lower end of the fitting (see figure 13).

Unscrew the cap of an electrode mounting set. Pass the electrode cable through this cap and after that through the fitting. Mount the other electrode cables in a similar manner. Pass the electrode cables and the liquid earth cable through a hose connection, which is delivered with the fitting in a plastic pocket.

Attention:
Ensure that the cables have slack remaining in the fitting. The plug of the electrode cable must be ± 15 cm out of the lower end so that torsion will be avoided and sensor mounting is simplified.

Before screwing the hose connection into place HAND-TIGHT, some glue must be put to the screw end (see figure 14).

Prepare the sensors to be used in accordance with the directions for use and mount them in the fitting as shown in fig. 14. For stable measurements the glass and reference electrode should be mounted in the holes nearest to the earth connection.

As delivered the O-rings (2x) for water-tight sealing in the mounting holes are on the blanking plugs. These plugs are for unused holes. To prevent fouling of the contacts, it is recommended to screw the electrode cable on the electrode as soon as possible. ENSURE THAT THERE IS NO MOISTURE OR DUST IN THE ELECTRODE CABLE CONNECTION.

Attention:
To have slack remaining in the fitting the protector complete with electrode holder should be turned to the left before fixing HAND-TIGHT to the fitting.

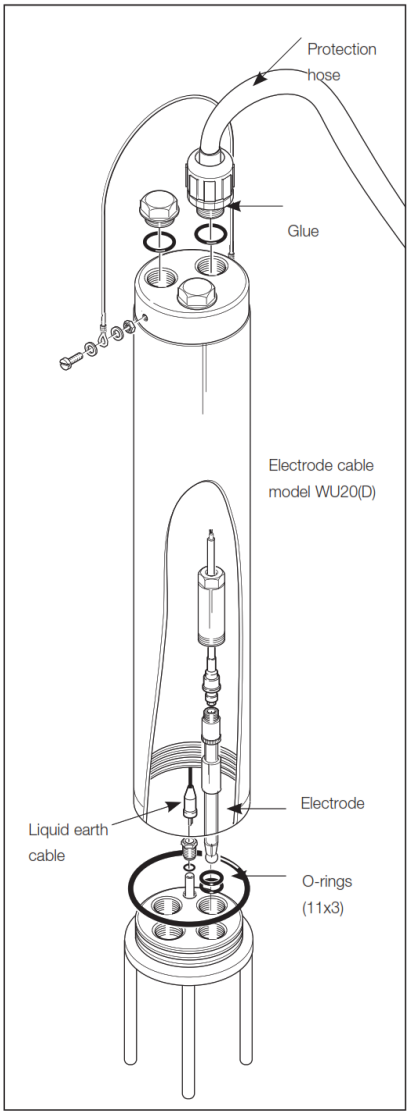

Fig. 14. Mounting cables and sensors in 3-hole and 4-hole fittings

3.2.6. Mounting kit option /B (FP20-S13)

Using this mounting kit a SR20-AC32 reference electrode of Yokogawa can be mounted in a fitting (see figure 15).

Electrodes to be used*

Order nr.	Description
SR20-AC32	Reference electrode

* For specifications of the electrodes see electrode general specification sheets.

Parts and accessories are listed in section 3.4 table 9.

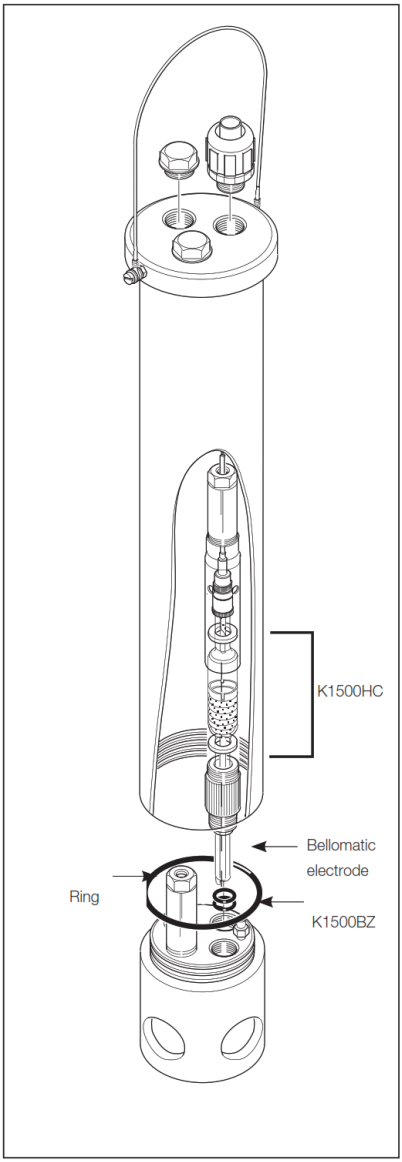

Fig. 15. Mounting of a BELLOMATIC electrode

3.2.7. Mounting kit option /R, (K1500BY)

This mounting kit replaces the standard electrode mounting set so that Yokogawa refillable electrodes with a long glass shaft can be mounted in a fitting. The mounting set may be used at process pressures up to 3 bar. Higher pressure ratings require the standard mounting set and consequently, electrodes with DIN-dimensions. Figure 16 shows the mounting.

Note:
The pressure on the KCl-solution must always exceed the liquid pressure.

The refillable electrodes can be connected to a KCl-reservoir via a silicone tubing (see figure 16). The pressure on the KCl-solution and consequently, the liquid outlet of the electrode can be increased by mounting the reservoir on top of the fitting. This prevents penetration of the process liquid into the electrode.

Electrode to be used*

* For specifications of the electrodes see electrode general specification sheets.

Parts and accessories are listed in section 3.4 table 9.

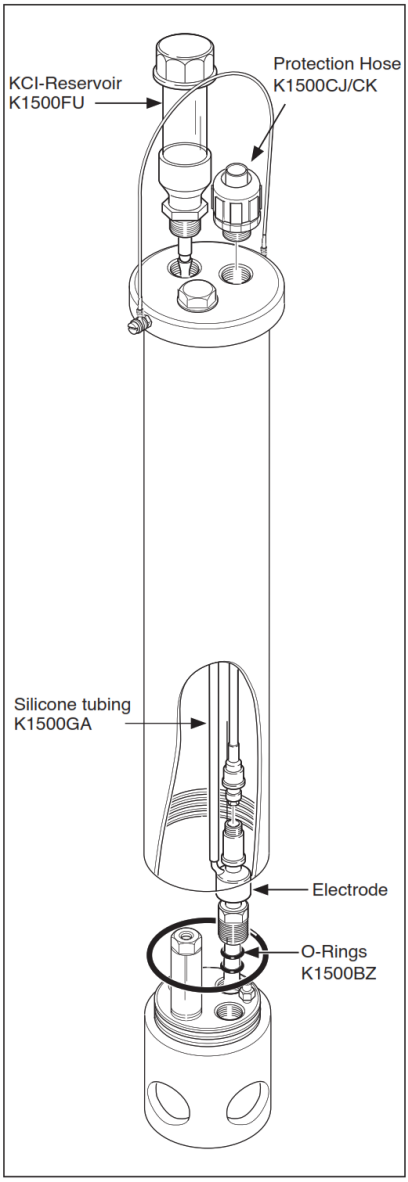

Fig. 16. Mounting of refillable electrodes with a long glass shaft

3.2.8. Chemical cleaning

The standardised design of fittings makes it possible to mount chemmical cleaning system directly. The 4-hole types are especially designed for these applications. The chemical cleaning system is based on periodically spraying of a cleanser on to the glass membrane of the electrode. The cleaner to be used, the cleaning frequency, etc. are highly dependent on the liquid to be measured. The cleaning period and frequency can be adjusted on a control unit. The mounting procedure is shown in figure 17.

Parts and accessories are listed in section 3.4 table 9.

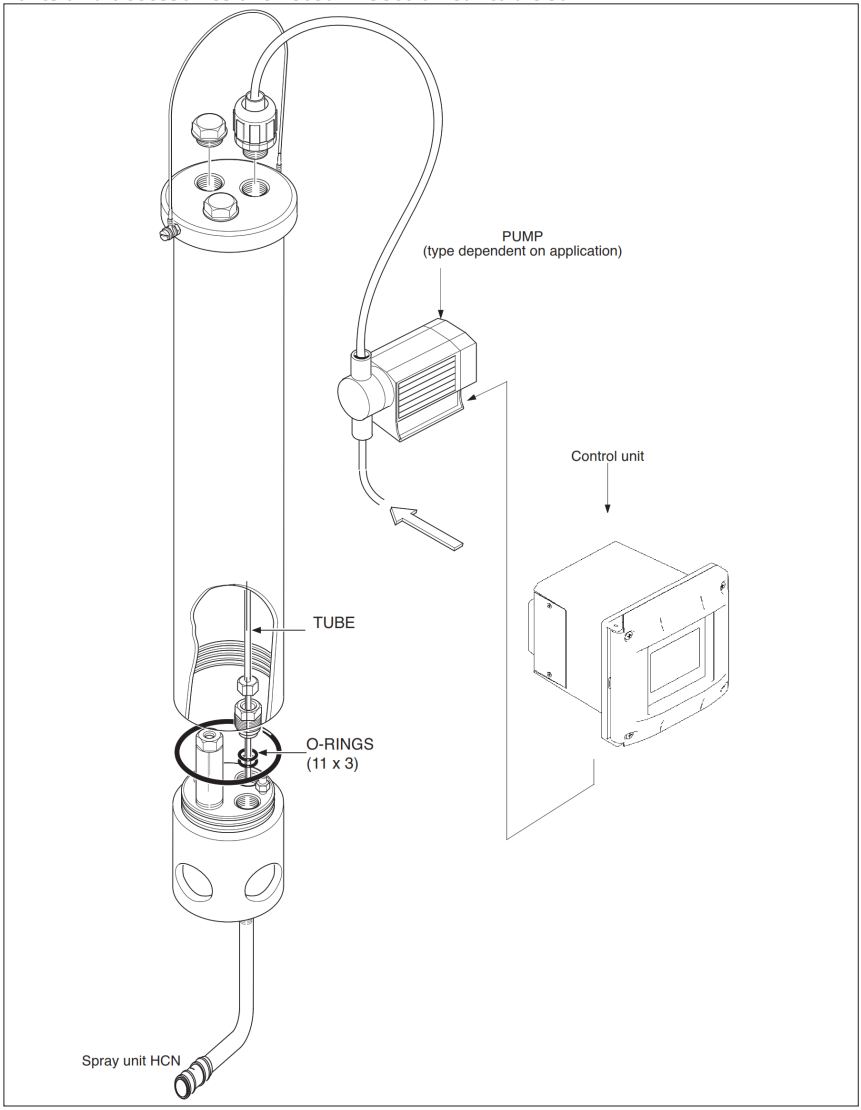

Fig. 17. Mounting a spray unit

3.2.9. Salt bridge

This reference electrode/salt bridge combination allows the measurement of pH and ORP (Redox) potentials with normal electrodes in those cases when:

A. excessive contamination of the flow diaphragm is expected. The flow of the reference liquid through the diaphragm is increased by pressurising the container. Consequently, the contamination rate will decrease.
B. the process to be measured cannot stand contamination with KCl. The salt bridge can be filled with several electrolytes, e.g. KNO_3.
C. measurement has to be performed at pressures up to 10 bar and temperatures up to 100 °C. As the container with reference liquid can be pressurised.

FLOW TUBE (A)
Material : glass
Flow diaphragm : ceramic, PTFE or sleeve
Connector : PPS (Ryton™)
TUBING (B)
Material : nylon
Diameter : 1/4" o.d.
Length : 2 mtr.
CONTAINER (C)
Container : PVC, PVC (transparent)
Mounting set : PPS (Ryton™)
O-ring : silicone
Connection : nylon
Weight : approx. 300 g.
Mounting : wall mounting (sup port with hole for screw M5)
Temp./press. ratio: max. 200 kPa (2 bar) at 100°C

Note: The reference electrode must be ordered seperately.

Parts and accessories are listed in section 3.4 table 9.

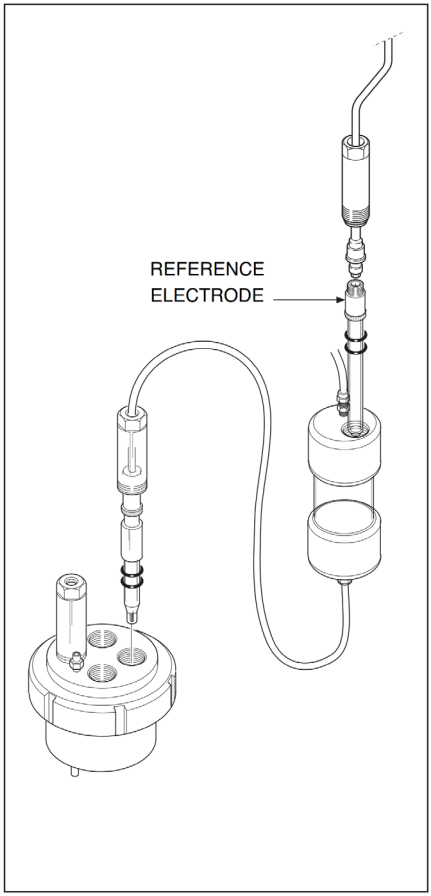

Fig. 18. Mounting the salt bridge

3.2.10. Protection hose installation kit

The protection hose installation kit is for protection of electrode cable and/or tubing between fitting and converter, connecting box, supply unit, etc. The hoses can be mounted directly to the hose connection(s) on top of each fitting. Clamps for fixing are part of the installation kit.

3.3. Dimensions

Unit (mm)

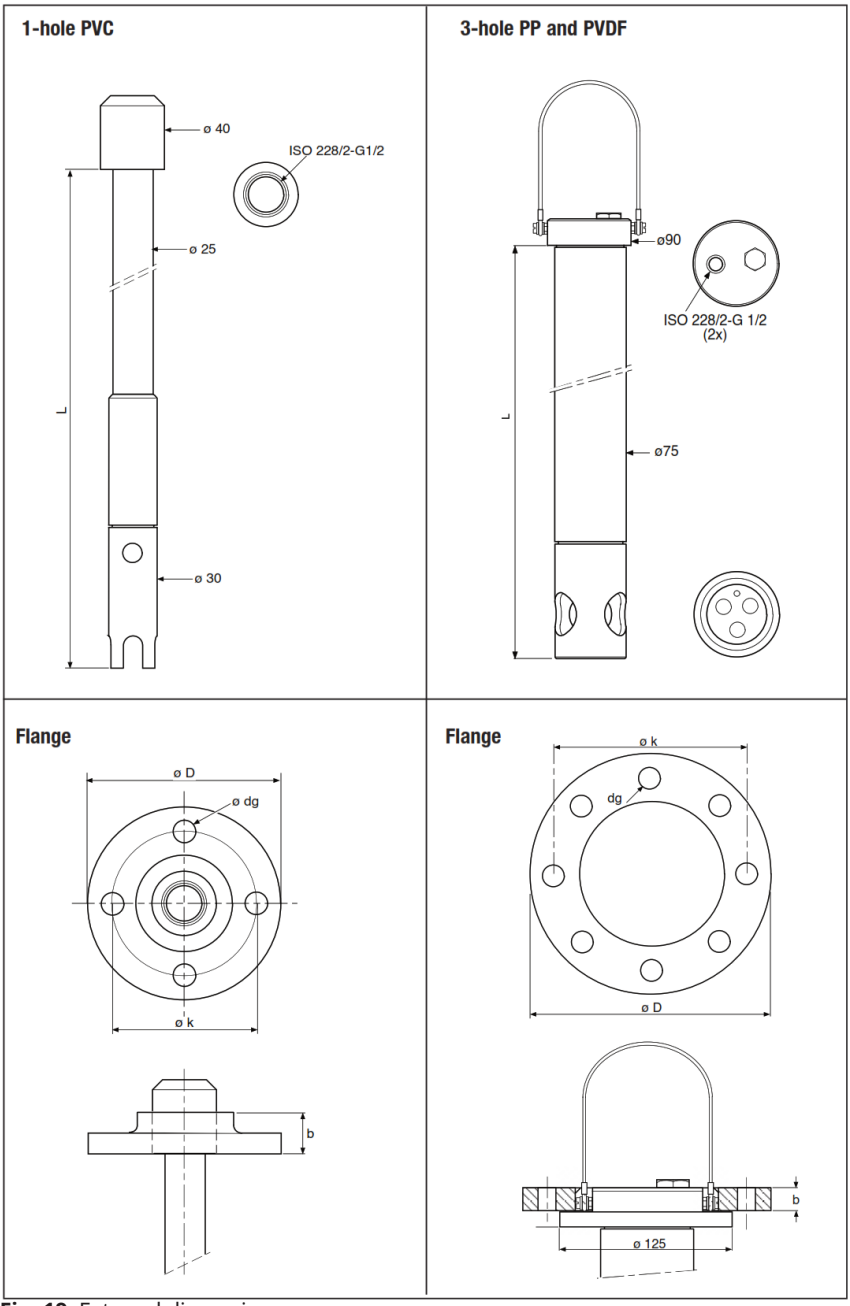

Fig. 19: External dimension

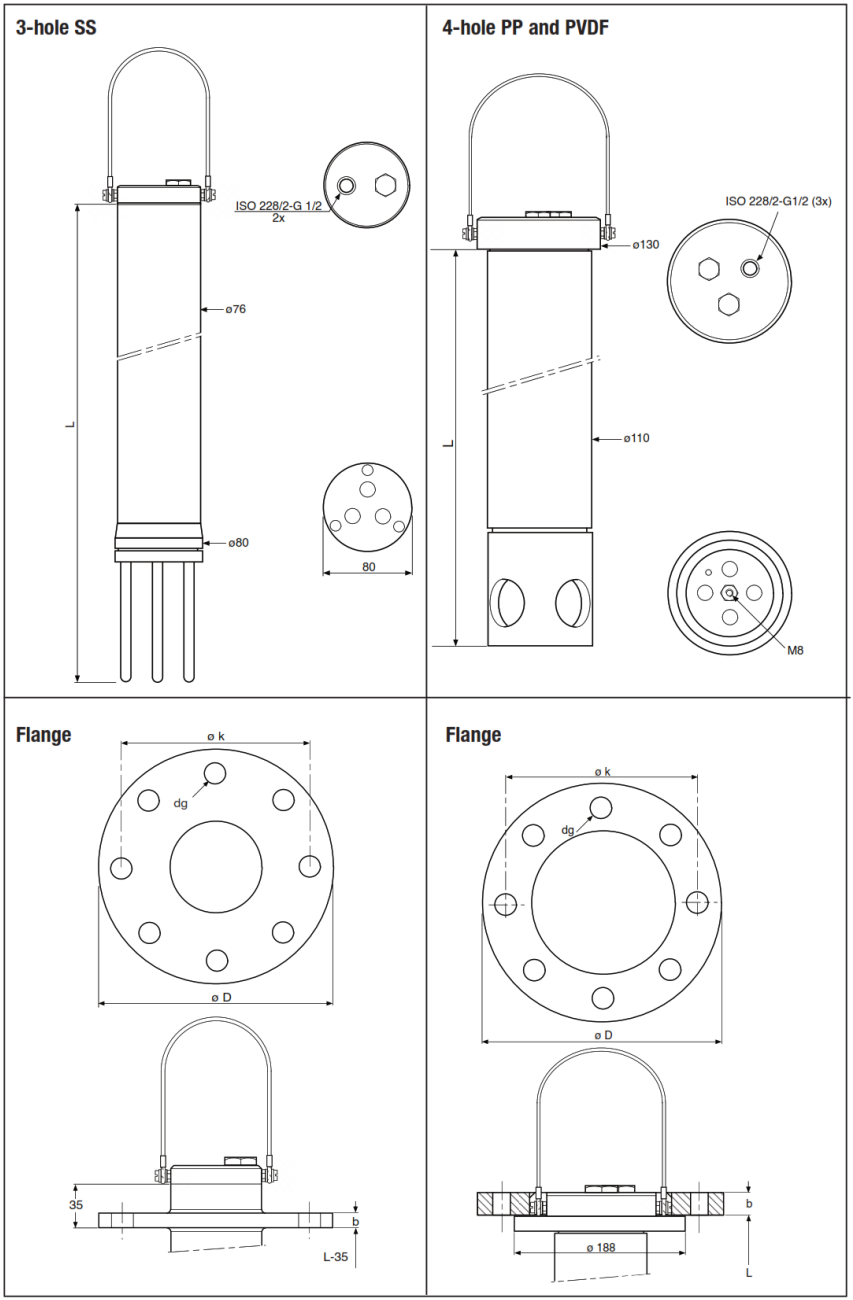

Fig. 20: External dimension

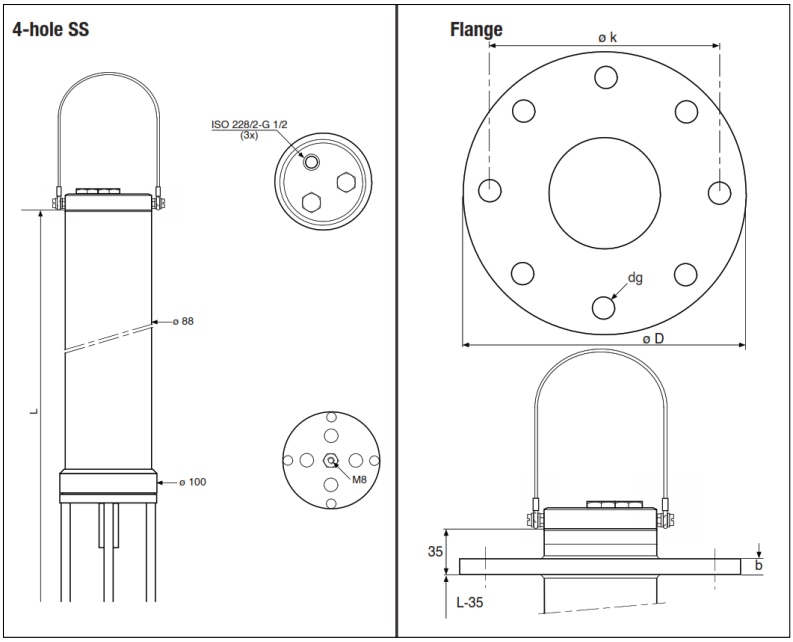

Fig. 21: External dimension

Table 8: FD20 dimensions - Unit in mm

	L	D	k	dg	b
FD20-V18-..-NF	5-20dm				
FD20-V18-..-F1	5-20dm	120	90	14	26
FD20-V18-..-S1	5-20dm	120	90	16	26
FD20-P37-..-NF	5-20dm				
FD20-F37-..-NF	5-20dm				
FD20-P37-..-F2	5-20dm	200	160	18	20
FD20-F37-..-F3	5-20dm	200	160	18	20
FD20-P37-..-S2	5-20dm	190	152,4	20	18
FD20-F37-..-S3	5-20dm	190	152,4	20	18
FD20-S37-..-NF	5-20dm				
FD20-S37-..-F4	5-20dm	200	160	18	20
FD20-S37-..-S4	5-20dm	228,6	190,5	19	23,8
FD20-P47-..-NF	5-20dm				
FD20-F47-..-NF	5-20dm				
FD20-P47-..-F5	5-20dm	250	210	18	24±2
FD20-F47-..-F6	5-20dm	250	210	18	24±2
FD20-S47-..-NF	5-20dm				
FD20-S47-..-F7	5-20dm	220	180	18	20
FD20-S47-..-S7	5-20dm	228,6	190,5	19	23,8

3.4. Model and suffix codes

Model code	Suffix code	Option code	Description
FD20F37			Immersion fitting, PVDF, 3 electrode mounting holes
FD20F47			Immersion fitting, PVDF, 4 electrode mounting holes
FD20P37			Immersion fitting, PP, 3 electrode mounting holes
FD20P47			Immersion fitting, PP, 4 electrode mounting holes
FD20S37			Immersion fitting, SS, 3 electrode mounting holes
FD20S47			Immersion fitting, SS, 4 electrode mounting holes
FD20V18[1]			Immersion fitting, PVC, 1 electrode mounting holes
Immersion length[2]	-ff		Between 5 and 20 (dm) example 06=0.6 m.
Flange[3]	-NF		No flange
	-F1		Flange DN32 for 1 hole fitting
	-F2		Flange DN80 for 3 hole fitting PP
	-F3		Flange DN80 for 3 hole fitting PVDF
	-F4		Flange DN80 for 3 hole fitting SS
	-F5		Flange DN125 for 4 hole fitting PP
(Working pressure not more than 3 bar)	-F6		Flange DN125 for 4 hole fitting PVDF
	-F7		Flange DN100 for 4 hole fitting SS
	-S1		Flange ANSI 11/4" 150Lbs for 1 hole fitting PVC
	-S2		Flange ANSI 3" 150Lbs for 3 hole fitting PP
	-S3		Flange ANSI 3" 150Lbs for 3 hole fitting PVDF
	-S4		Flange ANSI 4" 150Lbs for 3 hole fitting SS
	-S7		Flange ANSI 4" 150Lbs for 4 hole fitting SS
		*A	Style A
Cleaning system		/HCN3	Chemical cleaning for FD20- .37
		/HCN4	Chemical cleaning for FD20- .47
Protection hose installation kit		/PH5	For 5,5 m cable
		/PH10	For 10 m cable
Mounting kit		/R	For mounting (top) refillable electrodes with al long glass shaft
		/B	For mounting Bellomatic reference (SR20-AC32) and combined electrodes
KCL reservoir[4]		/K	Electrode tubing is included (2,5 m) (only in combination with /R)
Salt bridge		/S	For liquid which cannot stand contamination with KCL
Certificate		/M	3.1 according EN-10-204 (DIN 50049 3.1) for wetted metal parts

[1] PVC is available in a 1-hole design only.
[2] The immersion length of stainless steel fittings with a flange will be shortened by 35 mm (refer to dimensional drawings).
[3] Configuration of hole (see dimensional drawings 2.4). Working pressure not more than 3 bar for plastic flanges. For higher pressure ratings please contact your local Sales Department of Yokogawa.
[4] In combination with /R option only.

Notes:
a. Options are supplied with the fitting.
b. The available length of the electrode cables between fitting and converter or connection box is cable length minus immersion length (L).

Table 9: FD20 Spare parts

Spare part No.		Description	FD20F37	FD20F47	FD20P37	FD20P47	FD20S37	FD20S47	FD20V18
K1500AW	Cable accessories	Flexible conduit, 5 meter	x	x	x	x	x	x	x
K1500AX		Flexible conduit, 10 meter	x	x	x	x	x	x	x
K1500AY		Connection parts for conduit	x	x	x	x	x	x	x
K1500FV		LIQUID EARTH CABLE 10M	x	x	x	x	x	x	
K1500DU		LIQUID EARTH CABLE 25M	x	x	x	x	x	x	
K1500GZ		Earthpin assy for F*20 non-S	x	x	x	x			
K1500DW		Set of 12 cable nuts for WU20	x	x	x	x	x	x	
K1500BW	Tubing and accessories	Flow tube for SB20-VC	x	x	x	x	x	x	
K1500DX		5 m tubing for SB20	x	x	x	x	x	x	
K1530UL		Tubing for FD30/JC, 10 metre	x		x				
K1547PH		10 m PVDF Tube and mounting	x		x		x		
K1500BY	Options	Option /R for F*20.. (82850747)	x	x	x	x	x	x	
K1500CJ		Option /PH5 (82890165)	x	x	x	x	x	x	x
K1500CK		Option /PH10 (82890160)	x	x	x	x	x	x	x
K1500EM	Holders	/PH25 for immersion holders	x	x	x	x	x	x	x
K1520AV		Bottom holder for FD20F37	x						
FP20-R12	Adapters	Mounting set PPS	x	x	x	x	x	x	
FP20-S12		Mounting set SS	x	x	x	x	x	x	
FP20-S13		Mounting set SR20-AC32	x	x	x	x	x	x	
K1500DV		Adapter M25x1.5 - PG13.5 PVDF (82890155)	x	x	x	x	x	x	
K1520JN		Adapter M25x1.5 - PG13.5 PVC	x	x	x	x	x	x	
K1520JP		Adapter M25x1.5 - PG13.5 SS	x	x	x	x	x	x	
K1547PA	Cleaning units and accessories	Hast. cleaning unit HCN2/3	x		x		x		
K1547PB		Hast. cleaning unit HCN4		x		x		x	
K1547PF		Nozzle and mounting HCN2/3/F	x		x		x		
K1547PP		Spare Part EPDM spraying valves	x		x		x		
K1520FA		Ferrule set PEEK/PTFE	x	x	x	x	x	x	
K1500FA	O-Ring	O-ring set EPDM FD20P&F37	x		x				
K1500FB		O-ring set Viton FD20P&F37	x		x				
K1500GR		O-rings silicon 10.77x2.62 8pcs	x	x	x	x	x	x	x
K1500GU		O-ring set FD20P&F37	x		x				
K1500HD		O-rings silicon 10.77X2.62 50pcs	x	x	x	x	x	x	x
K1500FF		O-ring set Viton FD20P&F47		x		x			
K1500GV		O-ring set FD20P&F47		x		x			
K1500FC		O-ring set EPDM FD20-S37					x		
K1500FD		O-ring set Viton FD20-S37					x		
K1500GW		O-ring set FD20S37					x		
K1500FG		O-ring set EPDM FD20-S47						x	
K1500FH		O-ring set Viton FD20-S47						x	
K1500GT		O-ring set silicon. FF20-.4.						x	
K1500GX		O-ring set FD20S47						x	

4. General recommendation

It is important that, whatever method of mounting is used, the point of measurement is truly representative of the entire solution.

- Avoid an area where the measurement varies significantly or the flow can be interrupted (the sensors must always be immersed in the process liquid).
- The recommended type of fitting or subassembly will depend on pressure, temperature, kind of liquid, pollution, etc.
- Check whether the specifications of the fitting/subassembly and electrodes fulfil the maximum occuring process conditions.
- The fitting/suassembly has several options and optional connection possibilities. Check that you received the correct size and type.
- If the fitting is used in a tank with stirrer or agitator, or if it is placed in a fast flowing process, care must be taken that it is adequately supported to prevent any movement.
- Install the fitting in a site where it can be easily maintained.

4.1. General mounting position

The flow fitting or subassembly flow fitting is intended to be used for pH and/or ORP (Redox) measurement. The location should be in a bypass of a piping system behind a sample valve. The angle of the fitting with the horizontal should be less than 15° (see fig. 23). The pressure and temperature ratings of the electrode inside the fitting should be noticed to determine the maximum rating of the measurement point.

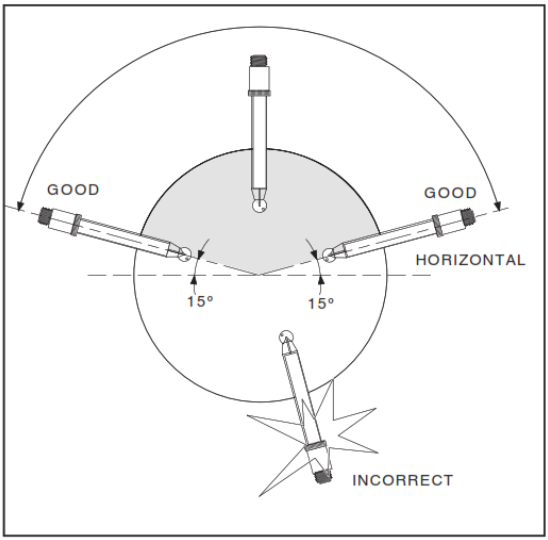

Fig. 22: General mounting position

5. Material operating performance

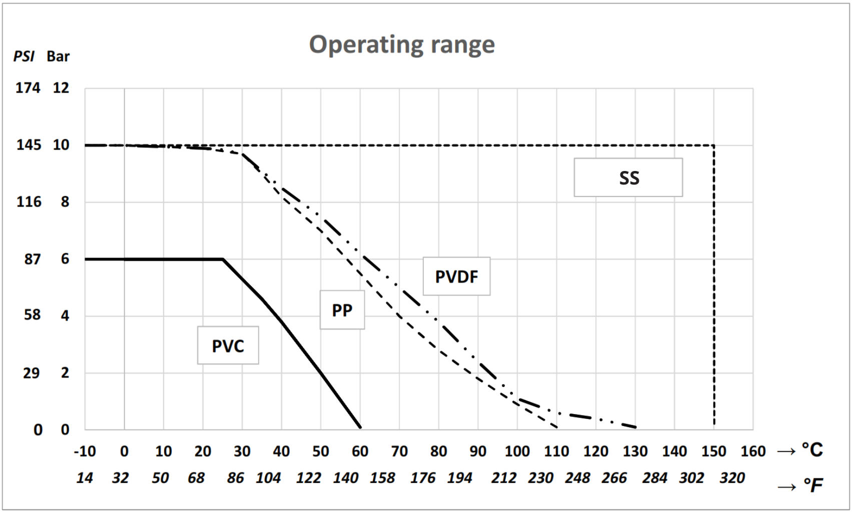

Fig. 23: Pressure / Temperature operating range

6. Chemical compatibility chart

Table 10: Material compatibility chart

			Material																					
			Silicon			Ti			SS 316(l)			PVDF (Kynar)			PP		PVC		PPS (Ryton)			Glass		
		Conc.% / Temp. °C	20	60	100	20	60	100	20	60	100	20	60	100	20	60	20	60	20	60	100	20	60	100
Inorganic acid	Sulfiric acid	10	o	o	o	-	-	-	x	x	x	o	o	o	o	o	o	x	o	o	o	o	o	o
		50	-	-	-	-	-	-	x	x	x	o	o	o	o	o	o	o	x	x	x	o	o	o
		95	-	-	-	-	-	-	x	x	x	o	x	-	x	-	x	x	x	x	-	o	o	o
		fuming	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				o	o	o
	Hydrochloric acid	10	x	-	-	-	-	-	-	-	-	o	o	o	o	o	o	x	o	o	o	o	o	o
		sat.	x	-	-	-	-	-	-	-	-	o	o	o	o	o	o	o	o	o	o	o	o	o
	Nitric acid	25	o	o	x	o	o	o	x	x	x	o	o	x	o	o	o	x	o	o	o	o	o	o
		50	x	-	-	o	o	o	x	x	x	o	o	x	x	-	o	x	x	x	x	o	o	o
		95	-	-	-	o	o	o	o	o	o	o	x	-	-	-	-	-	-	-	-	o	o	o
		fuming	-	-	-				o	o	o	-	-	-	-	-	-	-				o	o	o
	Phosphoric acid	25	o	o	x	x	x	-	-	-	-	o	o	o	o	o	o	x	o	o	o	o	o	o
		50	o	o	x	x	-	-	x	x	x	o	o	o	o	o	o	o	o	o	o	o	o	o
		95	o	x	x	x	-	-	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
	Hydrofluoric acid	40	-	-	-	-	-	-	-	-	-	o	o	o	o	o	o	x	x	x	x	x	x	x
		75	-	-	-	-	-	-	-	-	-	o	o	o	o	o	x	x	-	-	-	-	-	-

Table 10: Cont. material compatibility chart

				Material																			
				Silicon			Ti			SS 316(I)			PVDF (Kynar)			PP		PVC		PPS (Ryton)			Glass		
		Conc.%	Temp. °C	20	60	100	20	60	100	20	60	100	20	60	100	20	60	20	60	20	60	100	20	60	100
Organic acid	Acetic acid	10		o	o	o	o	o	o	o	o	x	o	o	o	o	o	o	x	o	o	o	o	o	o
		glacial		o	o	o	o	o	o	o	o	x	o	x	-	o	x	x	x	o			o	o	o
	Formic acid	80		o	o	o	x	x	-	x	x	x	o	o	o	o	o	o	-	o	o		o	o	o
	Citric acid	50		o	o	o	x	x	x	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
Alkali	Calcium hydroxide	sat.		o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
	Potassium hydroxide	50		o	o	o	o	x	-	o	o	o	o	o	x	o	o	o	o	o	o	o	o	o	x
	Sodium hydroxide	40		o	o	o	x	x	-	o	o	o	o	o	x	o	o	o	x	o	o	o	o	o	x
	Ammonia in water	30		o	o	o	x	x	-	o	o	o	o	o	o	o	o	o	x	o	o	o	o	o	x
Acid salt	Ammonium chloride	sat.		o	o	o	o	o	o	x	x	x	o	o	o	o	o	o	o	o	o	o	o	o	o
	Zinc chloride	50		o	o	o	o	o	o	x	x	x	o	o	o	o	o	o	o	o	o	o	o	o	o
	Iron(III) chloride	50		o	o	o				-	-	-	o	o	o	o	o	o	o	o			o	o	o
	Sodium sulfite	sat.		o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
Basic salt	Sodium carbonate	sat.		o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
	Potassium chloride	sat.		o	o	o	o	o	x	x	x	x	o	o	o	o	o	o	o	o	o	o	o	o	o
	Sodium sulfate	sat.		o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
	Calcium chloride	sat.		o	o	o	o	o	o	x	x	x	o	o	o	o	o	o	o	o	o	o	o	o	o
Neutral salt	Sodium chloride	sat.		o	o	o	o	o	o	x	x	x	o	o	o	o	o	o	o	o	o	o	o	o	o
	Sodium nitrate	50		o	o	o	o	o	o	x	x	x	o	o	o	o	o	o	o	o	o	o	o	o	o
	Aluminium chloride	sat.		o	o	o	o	o	x	-	-	-	o	o	o	o	o	o	o	o	o	o	o	o	o
	Hydrogen peroxide	30		x	x	x	o	o	o	o	o	o	o	o	o	o	o	o	o	x	-	-	o	o	o
Oxidizing agent	Sodium Hypochloride	50		o	o	o	x	-	-	x	x	x	o	o	o	x	x	x	x	x			o	o	o
	Potassium dichromate	sat.		o	o	o	o	o	o	o	o	o	o	x	-	o	o	o	o	x			o	o	o
	Chlorinated lime			o	o	o				x	x	x	o	o	o	-	-	o	o				o	o	o
	Ethanol	80		o	o	o	o	o	o	o	o	o	o	o	x	o	o	o	x	o	o	o	o	o	o
Organic solvent	Cyclohexane			-	-	-	o	o	o	o	o	o	o	o	x	-	-	o	o	o	o	o	o	o	o
	Toluene			-	-	-	o	o	o	o	o	o	o	o	o	x	-	-	-	o	o	o	o	o	o
	Trichloroethane			-	-	-	o	o	o	o	o	x	x	x	x	-	-	-	-	o	o		o	o	o
	Water			o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o

o = can be used x = shortens useful life - = cannot be used Blank = no data currently available

Note : Information in this list is based on our general experience and literature data and given in good faith. However Yokogawa is unable to accept responsibility for claims related to this information.

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