1. GENERAL

1.1 Dimensions

Installation dimensions and basic construction details of the conductivity cells are shown in figure 1.

1.2. Type number

The type number of the conductivity cell, shown on the type number plate, gives coded information on the cell constant, the materials of construction, etc.

Type number SC . . - . . . .

application for transmitter
- 2 electrodes + Ni100 = 41
- 2- or 4 electrodes + Pt1000 = 42
- 4 electrodes + Ni100 = 49

type of cell
- 4 = flow cell (2-el.)
- 5 = insertion cell
- 8 = flow cell (4-el)

materials
- epoxy/graphite = E
- stainless steel/PTFE = S
- PVDF/glass/platinum = F
- PTFE/glass/platinum = T

cell constant
- 0 = C = 10 cm^{-1} (1000 m^{-1})
- 1 = C = 1 cm^{-1} (100 m^{-1})
- 2 = C = 0.1 cm^{-1} (10 m^{-1})
- 3 = C = 0.01 cm^{-1} (1 m^{-1})

mounting
- P = plug in type

1.3. Type plate

In addition to the type number, information is given regarding:

– the batch number (e.g. P7.) This number should be quoted in any service or maintenance queries.

– the deviation from nominal cell constant value.
The actual cell constant measured at 1000Ω will be within ±2% of the nominal value or, if explicity indicated, of the marked value.
Individual cell calibration ensures maximum standard of compliance.

– direction of flow indication. It is important this is checked before mounting the cell.

1.4 Specifications

The specification for operating pressures and temperatures and for chemical resistance depend on the materials of construction, indicated by the type number

			DURABILITY					
Material	Max. pressure	Max. temp.	Acids (non oxid.)	Acids (oxid)	Alka-lines	Salt solution	benzine Alcohol	Acton Tri
E	10 bar	110ºC	A	C	A	A	A	B
S	10 bar	150ºC	B	B	A	B	A	A
F	10 bar	110ºC	A	B	A	A	A	A
T	5 bar	90ºC	A	A	A	A	A	A

A = resistant
B = affecting is possible
C = affecting may be expected

2. INSTALLATION

The conductivity cell connection must be made using one of the standard Yokogawa conductivity cables (type numbers WU40-LH ..) Length 2, $5^{1/2}$ or 10 mtr.
The individual cores are PVC covered and colour coded. At the instrument end the cable termination tags are numbered to correspond with their respective terminals of the transmitters, preamplifier or connection box in the program of Yokogawa (see figure 3.)

NOTE:
If the cable is used with a connection box (type BA10) then special purpose cable, type WF10 must be used between connection box and transmitter or preamplifier (see figure 4) connected to the same terminals as the cell cable.

WARNING
When special purpose cables, type WF10 are used the total ohmic resistance of this cable must be low compared with the resistance of:
– the conductivity cell (2-el. applications only)
– the temperature sensor.

The resistance of the cores of the cables WF10 is:
wires 11 and 12 : 18 Ω/km
wire 13 : 48 Ω/km
wire 15 : 90 Ω/km

2.2 Mounting

The use of a Yokogawa fitting or mounting set simplifies the mounting of a conductivity cell in a tank, piping system, etc. Figure 2 shows some examples of mounting methods.

Before mounting a cell in a process plant environment the following points should be considered:

– the cable plug should be fitted onto the cell without delay to prevent fouling of the plug connection.

– a good, representative, flow of process liquid through the cell should exist. Hence, the cell must be mounted in the process in such a way that the flow through it represents the true composition of the liquid. The flow through the cell should be uninterrupted and the cell should not be mounted at a “dead” angle (figure 5 gives examples of mounting.)
The arrow on the type number plate indicates the cell outlet.

– a flow cell must be immersed in the process liquid to a level above the outlet to ensure an uninterrupted liquid path between the electrodes.

– the cell should be mounted in such a way to allow easy removal for maintenance. It is recommended that the cell is mounted in a “by-pass’ directly behind a drain valve.

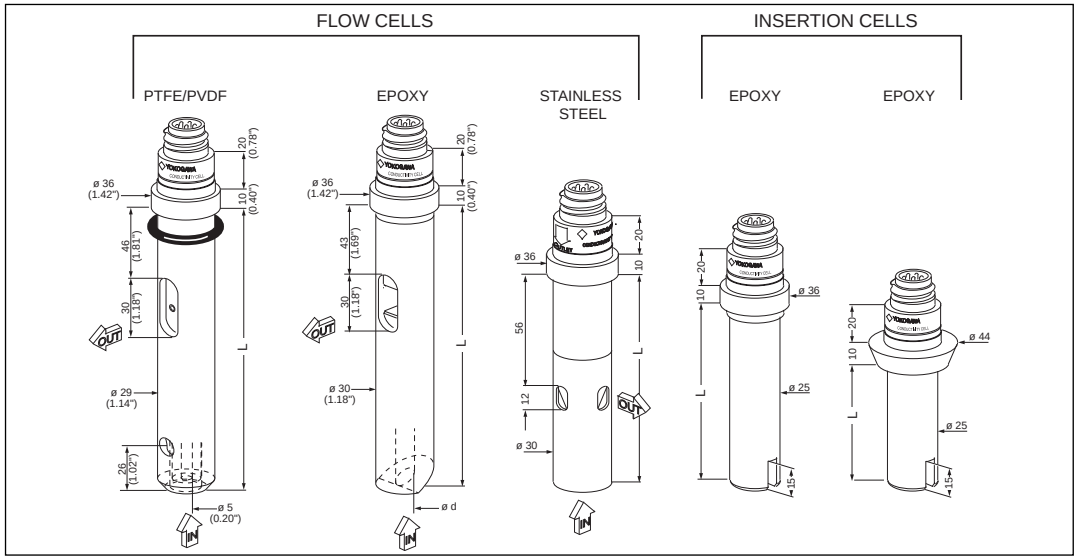

Figure 1

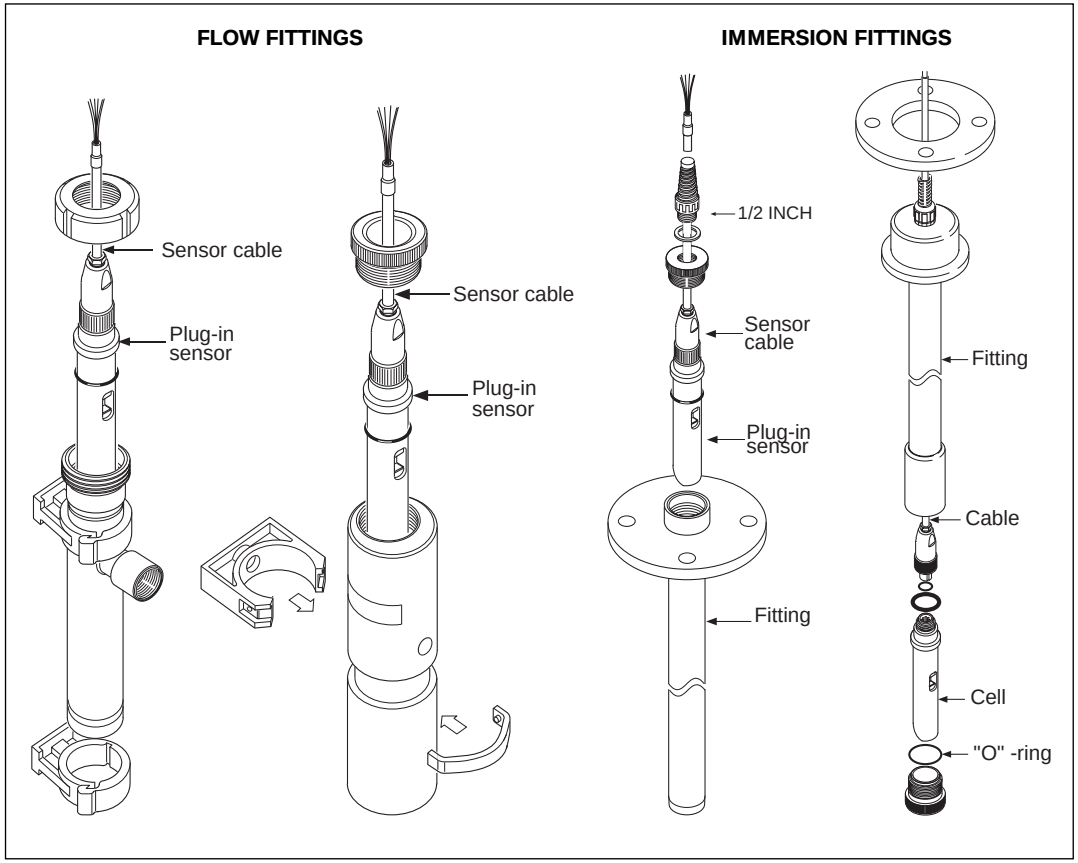

Figure 2

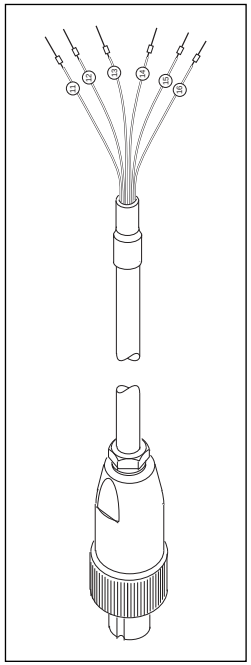

Figure 3

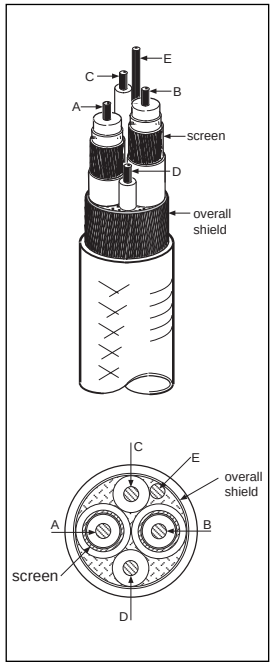

Figure 4

3. OPERATION AND MAINTENANCE

3.1. Checking the cell

If a fault occurs, first check the cell for visible damage. If damage is not apparent, check the cell resistances measuring between the cable connections:

a. 11 and 12
b. 11 and 13
c. 12 and 13
d. 14 and 15
e. 15 and 16
f. 13 and 14

cell type	a	b	c	d	e	f
SC41/ . .	NI 100 value	>10^7*	>10^7*	>10^7*	0	0
SC42/ . .4	Pt1000 value	>10^7*	>10^7*	>10^7*	0	0
SC42/ . .8	pt1000 value	>10^7*	>10^7*	>10^7*	>10^7*	>10^7*
SC49/ . .	Ni 100 value	>10^7*	>10^7*	>10^7*	>10^7*	>10^7*

* if the resistance measured is at the transmitter end of the cable, the measured value may be lower as a result of leakage in the connection box, cable or cable connector.

If the cell has become fouled resistance will be developed across the electrodes. These resistances can be measured as shown in figure 6 by making contact directly with the electrode an the relevant pin of the connector.

If the measured resistance is greater than 1Ω the cell has become fouled, and should be cleaned.
If the resistance remains higher after cleaning an internal fault may exist and replacement of the cell may be necessary.

3-2. Calibration of the cell

Yokogawa delivers a wide range of sensors, which are factory calibrated traceable to NIST standards. The cell constant values are normally indicated on the top of the sensor or on the integral cable. These values can be entered directly in service code 03 (of a Yokogawa analyser). If the cell has been subjected to abrasion (erosion or coating) calibration may be necessary.

NOTE:
During calibration the temperature compensation is still active. This means that the readings are referred to the reference temperature default 25 °C).
Calibration is normally carried out by measuring a solution with a known conductivity value at a known temperature. The measured value is adjusted in the calibration mode of the analyse. Calibration solutions can be made up in a laboratory. An amount of salt is dissolved in water to give a precise concentration with the temperature stabilized to the adjusted reference temperature of the instrument (default 25 °C). The conductivity of the solution is taken from literature tables or the table on this page.

Typical calibration solutions.
The table shows some typical conductivity values for sodium-chloride (NaCl) and Potassium cholide (KCl) solutions which can be made up in a laboratory.

Table 6-1. NaCl values at 25°C (IEC 746-3)

Weigth %	mg/kg	Conductivity
0.001	10	21.4 µS/cm
0.003	30	64.0 µS/cm
0.005	50	106 µS/cm
0.01	100	210 µS/cm
0.03	300	617 µS/cm
0.05	500	1.03 mS/cm
0.1	1000	1.99 mS/cm
0.3	3000	5.69 mS/cm
0.5	5000	9.48 mS/cm
1	10000	17.6 mS/cm
3	30000	48.6 mS/cm
5	50000	81.0 mS/cm
10	100000	40 mS/cm

Table 6-2. KCl values at 25°C (OIML)

Weigth %	molal (m)	mg of KCl / kg of solution	Conductivity
0.3	0.001	74.66	0.1469 mS/cm
0.5	0.002	149.32	0.2916 mS/cm
1	0.005	373.29	0.7182 mS/cm
3	0.01	745.263	1.4083 mS/cm
5	0.1	7419.13	12.852 mS/cm
10	1.0	71135.2	111.31 mS/cm

The table is derived from the Standards laid down in 'International Recommendation No. 56 of the Organisation Internationale de Métrologie Legale'.

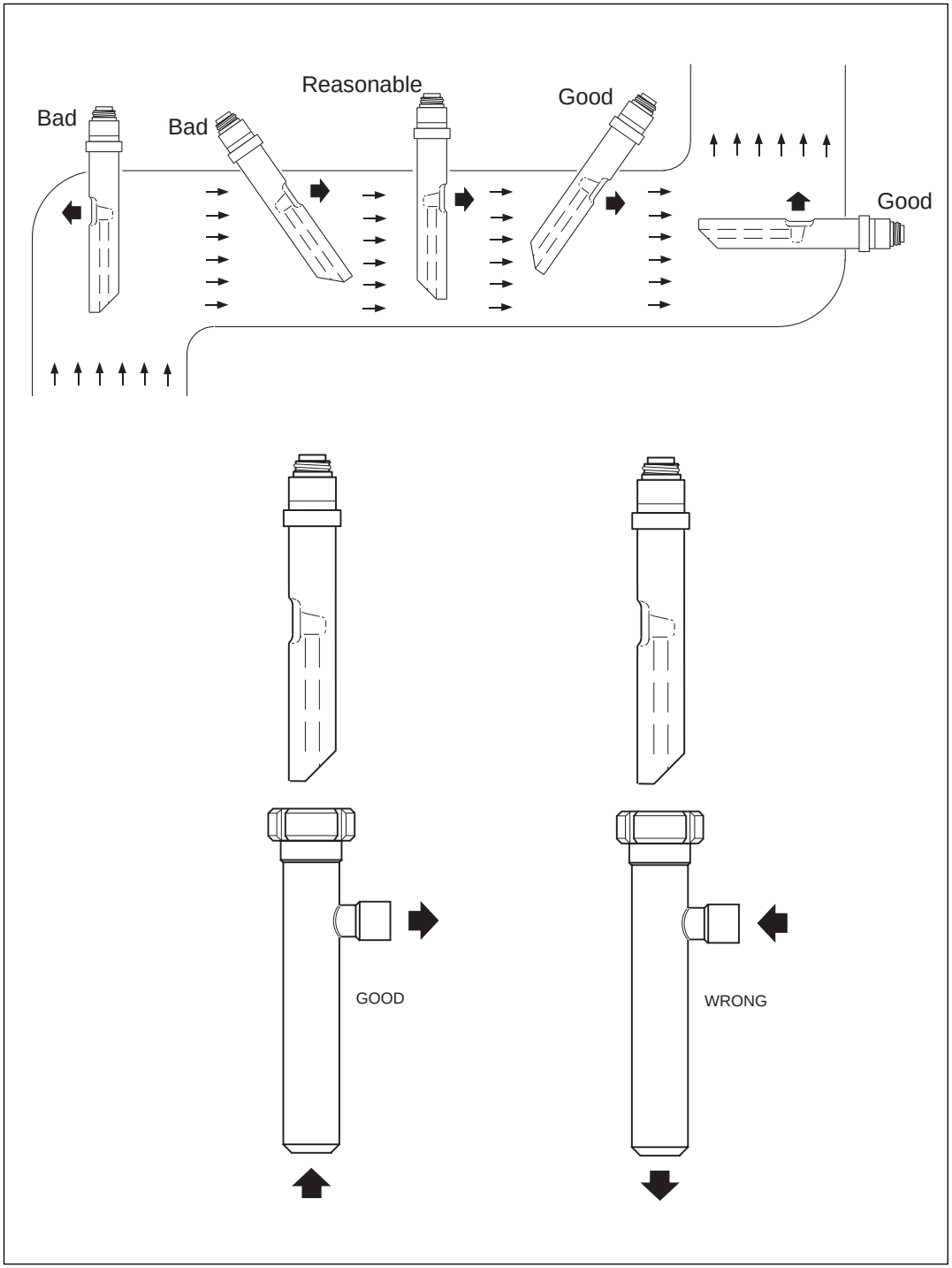

Figure 5

3-3. Periodic maintenance of the sensor

NOTE:

Maintenance advice listed here is intentionally general in nature. Sensor maintenance is highly application specific.

In general conductivity/resistivity measurements do not need much periodic maintenance. If the EXA indicates an error in the measurement or in the calibration, some action may be needed (ref. chapter 8 trouble- shooting). In case the sensor has become fouled an insulating layer may be formed on the surface of the electrodes and consequently, an apparent increase in cell constant may occur, giving a measuring error. This error is:

$$2 \times \frac{Rv}{Rcel} \times 100\ \%$$

where:
Rv = the resistance of the fouling layer
Rcel = the cell resistance

NOTE:

Resistance due to fouling or to polarization does not effect the accuracy and operation of a 4-electrode conductivity measuring system. If an apparent increase in cell constant occurs cleaning the cell will restore accurate measurement.

Cleaning methods

1. For normal applications hot water with domestic washing-up liquid added will be effective.
2. For lime, hydroxides, etc., a 5 ...10% solution of hydrochloric acid is recommended.
3. Organic foulings (oils, fats, etc.) can be easily removed with acetone.
4. For algae, bacteria or moulds, use a solution of domestic bleach (hypochlorite).

*** Never use hydrochloric acid and bleaching liquid simultaneously. The very poisonous chlorine gas will result.**

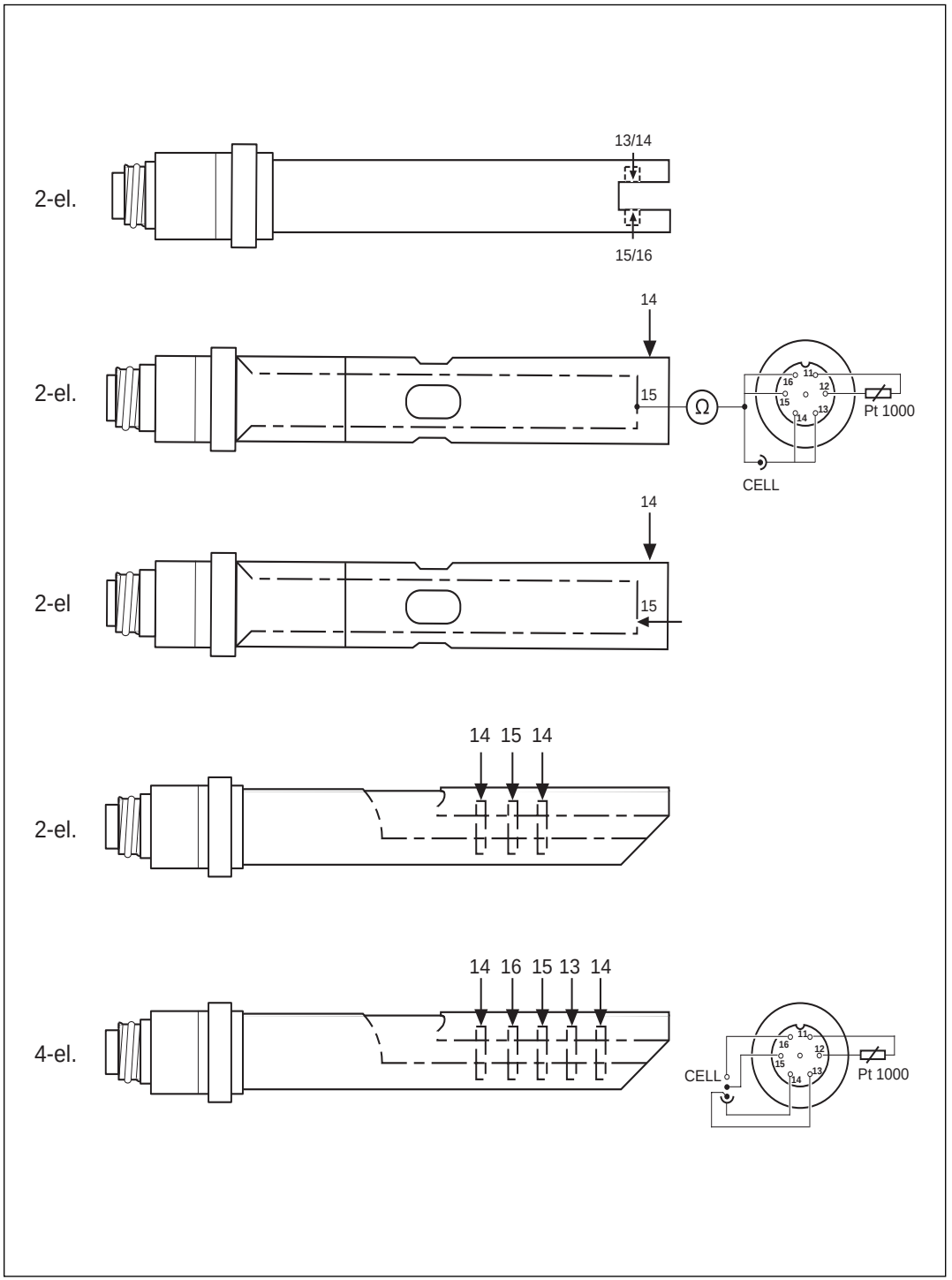

Figure 6

User Manual

Directions for use conductivity cells

YOKOGAWA ◆

IM 12D7J1-E-H
03-211 (A) Q

Printed in The Netherlands,
Subject to change without notice