instrumentation
for fluids

Electromagnetic
insertion sensor

Series

FLOMAT FX

Instructions Manual

R-MI-FlomatFX Rev.: 1 English version

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1 WORKING PRINCIPLE

The Flomat electromagnetic insertion flowmeters are based on Faraday's induction law.

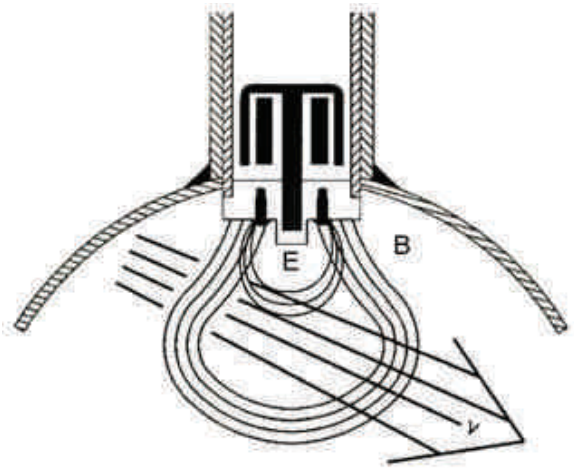
When an electrically conductive liquid flows through a magnetic field, perpendicular to the flow direction, it induces a voltage E, proportional to the liquid velocity.

Two electrodes in contact with the liquid and positioned perpendicular to the magnetic field, capture this voltage E.

$$E = B \cdot v \cdot d$$

Where:

E = Measured voltage in the electrodes
B = Magnetic flux density
v = Average liquid velocity
d = Distance between electrodes



2 RECEPTION

The Flomat electromagnetic flowmeters are supplied ready for their installation and operation.

They are also supplied packaged for their protection during storage and haulage.

All the flowmeters have been tested in our calibration rigs to obtain the Fc factor for each sensor. For more information about the Fc factor, see point 6.1, page 9 of this manual.

2.1 Unpacking

Carefully unpack the instrument, removing any packaging material that could be attached to the sensor. Do not remove any grease from the collar that fits the sensor to the electronics housing.

2.2 Storage temperature

-20ºC ..... +60ºC

2.3 Handling

This should always be done with care and without knocks.

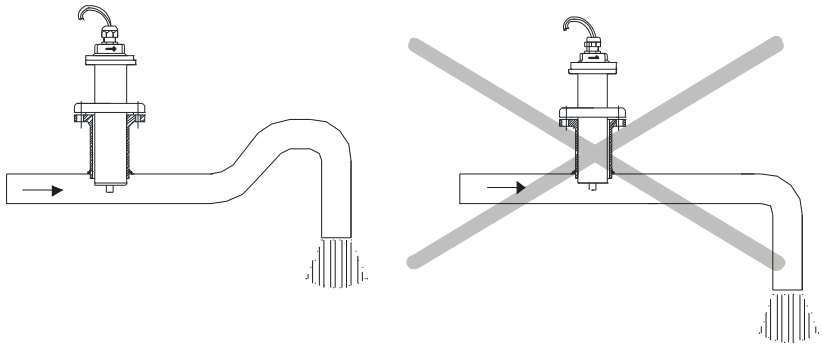
3 INSTALLATION

This should be made in a point that guarantees that the pipe is always completely full and where a turbulent flow profile is completely developed (follow recommendations in point 3.2)

Avoid high points of the pipes where air pockets usually form, or pipes with falling flow where it can form a vacuum.

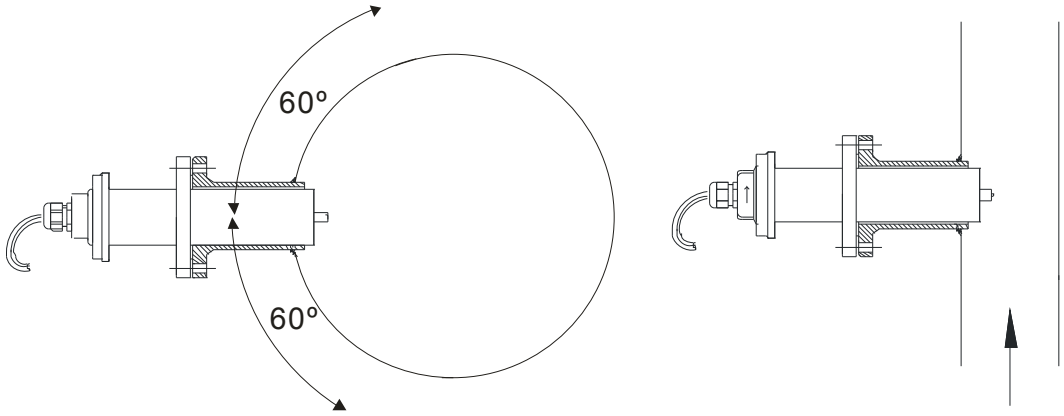
Partially full pipes can produce important reading errors.

If the point where the Flomat should be installed has a discharge point near to it, it is necessary to install a siphon in order to avoid any stagnant air in the sensor, as shown in the following figure.



3.1 Sensor position

The most adequate position is in the side of the pipe. In this way, deposits of particles on the electrodes and air pockets at the top of the pipe are avoided.



3.2 Straight pipe sections

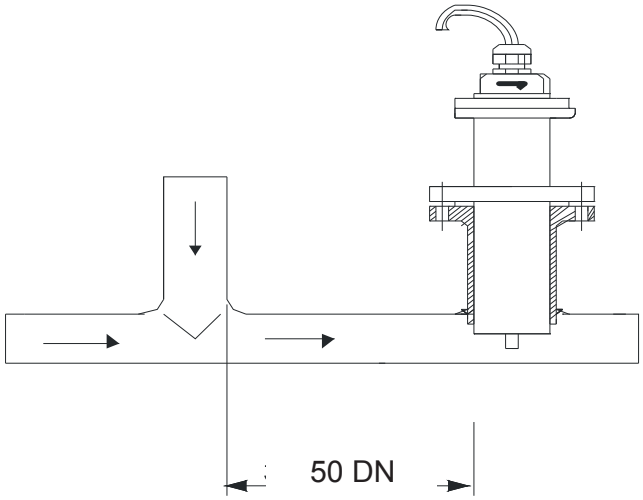
The point where the Flomat will be installed must be a straight pipe section, separated from elements that can disturb the flow profile, such as elbows, diameter changes, etc. Depending on the element the minimum necessary distances upstream from the sensor must be (**BS 1042-2.2:1983** standard**)**:

Type of disturbance upstream from the sensor	**Minimum distance between the sensor and the element**
90° elbow or T-bend	50 x DN
Several 90° coplanar bends	50 x DN
Several 90° non-coplanar bends	80 x DN
Total angle convergent 18 to 36°	30 x DN
Total angle divergent 14 to 28°	55 x DN
Fully opened Butterfly valve	45 x DN
Fully opened plug valve	30 x DN

Downstream from the sensor, the minimum recommended distance from a disturbing element is 5 x DN.

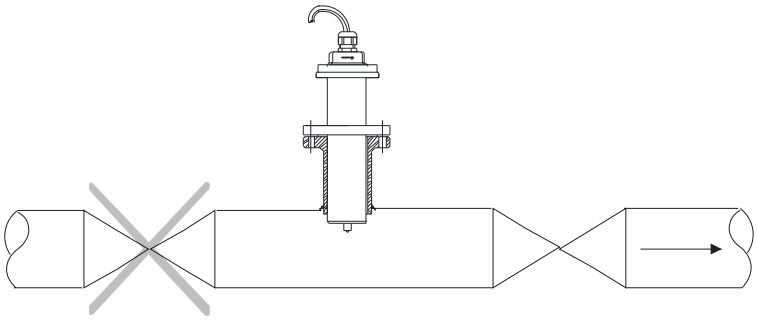
3.3 Mixtures

If liquids of different conductivities are mixed it is necessary to install the sensor a minimum of 50 x DN from the point of mixture in order to obtain a uniform conductivity of the liquid and stabilize the readings.
If this distance is less, the readings may be unstable.



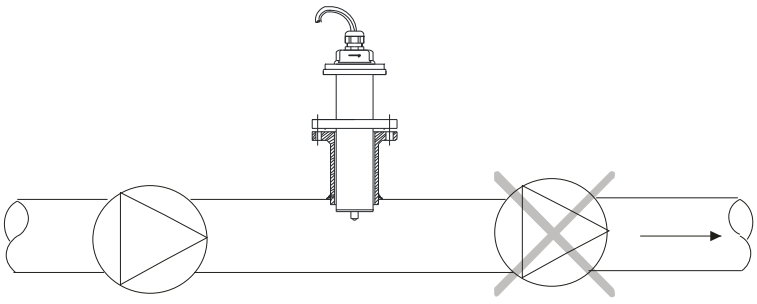
3.4 Valves

Control valves or stop cocks should always be installed downstream from the sensor to assure that the pipe is always full of liquid.



3.5 Pumps

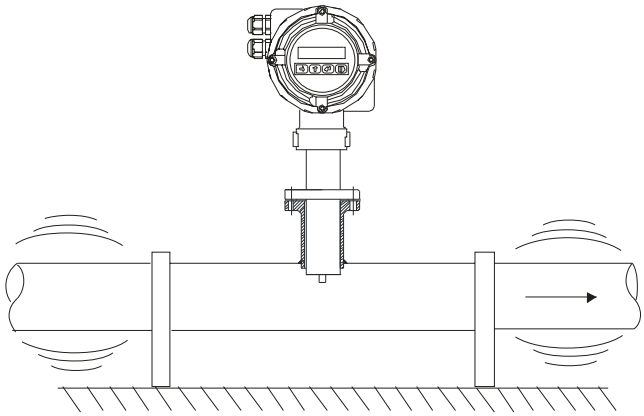
Pumps should be mounted upstream from the sensor to avoid the suction part of the pump (vacuum).



3.6 Vibrations

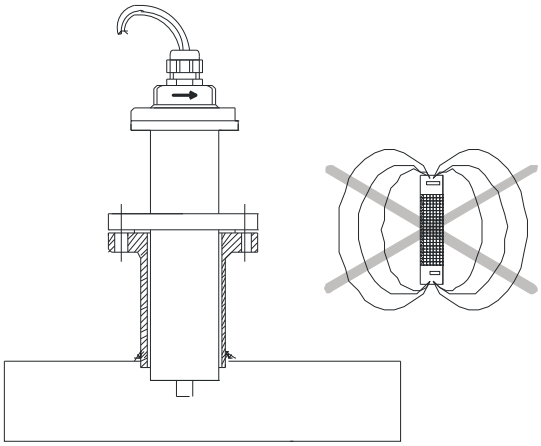
Vibrations of the pipes should be avoided by anchoring the pipe before and after the sensor.

The vibration level should be less than 2.2 G in the range of 20 -150 Hz according to IEC 068-2-34.



3.7 Magnetic fields

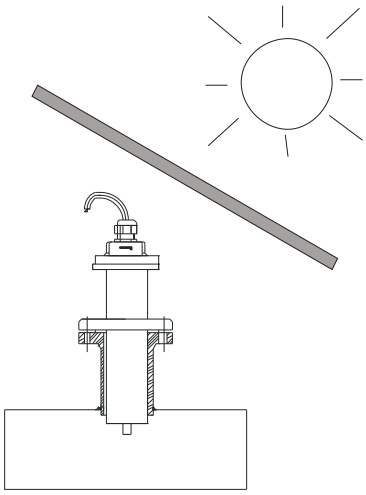
Strong magnetic fields close to the sensor should be avoided.



3.8 Temperature

In open air installations it is recommended to install a protection to avoid direct sun light on the flowmeter.

With thermally insulated pipes DO NOT insulate the sensor. High temperatures can damage it.

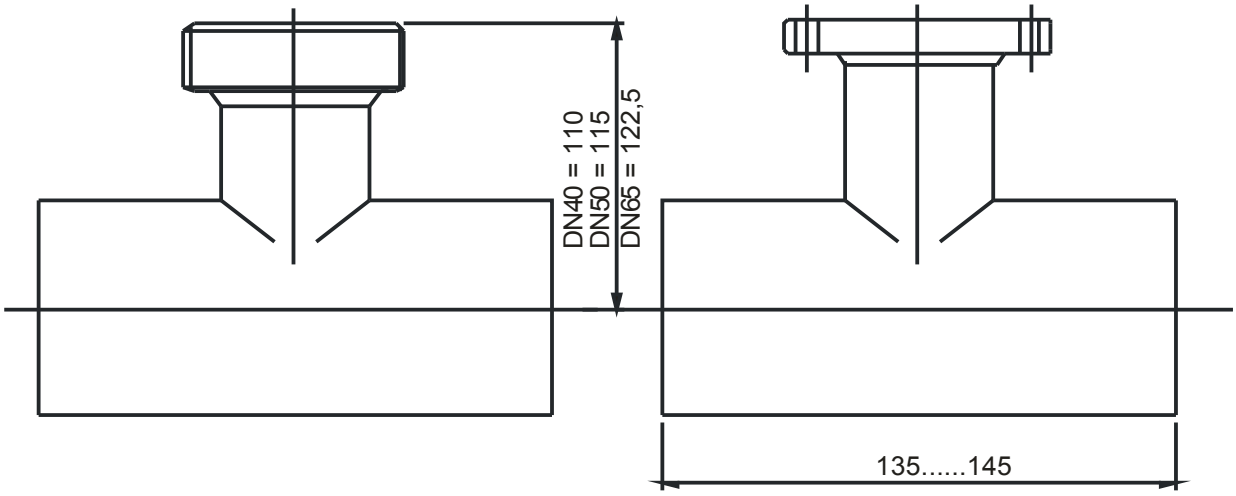


4 MOUNTING THE INSERTION FITTING

The sensor is normally supplied mounted in its insertion fitting. Before welding the fitting to the pipe , the sensor must be removed to avoid irreparable damage due to excessive temperatures.

There are two basic types of insertion fitting: threaded fitting and flange fitting.

For the smaller pipe diameters (DN40, 50 & 65) the insertion fitting is supplied fitted to a short length of pipe with a “T” form. For this type just couple it to the pipe by welding or gluing in the case of PVC .



For DN80 and greater, there are three lengths for each of the two types of fittings.

The process of putting the insert in should be done with some precision. The distance (H) (see drawings on next page) which is what the insert should protrude above the surface of the pipe is important.

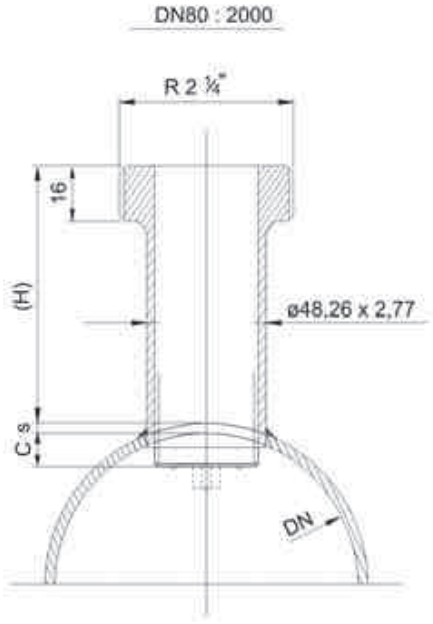
As shown in the table on the next page, to know the distance, the thickness of the pipe (s) must be known.

To help to position the insert in the pipe, on the side of the insert there is a label with markings indicating the position of the internal pipe diameter for each DN. Cut this label above the line corresponding to the DN of the pipe, at a distance equal to the pipe thickness. Peel off the bottom part of the label. Once the insert is placed into its final position, where the label was cut must coincide with the exterior of the pipe.

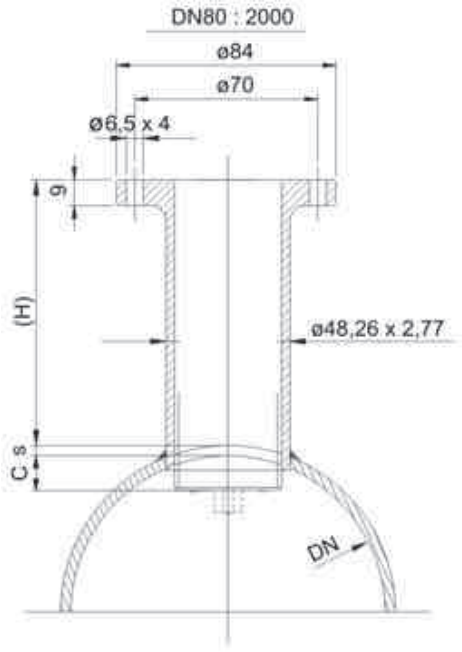
This ensures that the measuring electrodes penetrate far enough in the area of flow profile that will allow an accurate measurement.

DN	Sensor length	Fitting length	C	(H)	Qnom m^3/h
80	101	93	10	88-s	90,5
100			12,5	85,5-s	141,3
125			15,5	82,5-s	220,9
150			19	79-s	318,1
200			25	73-s	565,5
250			31	67-s	883,6
300			37,5	60,5-s	1.272.,3
350			44	54-s	1.731,8
400			50	48-s	2.261,9
500	206	145	62,5	140,5-s	3.534,3
600			75	128-s	5.089,4
700			87,5	115,5-s	6.927,2
800			100	103-s	9.047,8
900			112,5	90,5-s	11.451,1
1000			125	78-s	14.137,1
1200	356	190	150	203-s	20.357,5
1400			175	178-s	27.708,8
1600			200	153-s	36.191,1
1800			225	128-s	45.804,4
2000			250	103-s	56.548,7

Threaded fitting



Flange fitting



Example:

Suppose a pipe of 300 mm inner diameter (DN300) and 5.5 mm thick. In the table we can see that the distance that the insertion fitting must extend above the exterior wall is H = 60,5 - s = 60,5 -5,5 = 55 mm.

The values in the table are calculated with the gasket supplied with the instrument, which is 3 mm thick. If the thickness of the gasket is changed, the value of *H* will change.

The equation to calculate H' for a gasket of thickness *d* is the following:

$$H' = H + 3 - d$$

In the previous example, if the gasket was 5 mm thick, the distance that the fitting should extend above the exterior wall would be H' = 55 + 3 - 5 = 53 mm.

Drill a 48.5 mm diameter hole in the pipe to insert the fitting and weld the fitting to the pipe.

The axis of the insertion fitting should be perfectly perpendicular to the pipe axis.

If the pipe is made of concrete or other material to which the insertion fitting cannot be welded, a collar fitting or saddle fitting should be used. In this case, please contact us to inform about the suitable sensor length.

5 MOUNTING THE SENSOR

Once the insertion fitting is mounted, place the flat seal in its position and install the sensor with the arrow pointing in the flow direction. The electrodes must be perfectly perpendicular to the pipe axis.

In order to align the sensor, the two bolts or pins situated in each side of the cylinder in the top of the Flomat sensor must be aligned with the axis of the pipe and the arrow pointing in the flow direction.

5.1 Tightening torque

The tightening torque for the flange screws should not exceed 7.1 Nm.

The tightening torque for the threaded fitting should not exceed 21 Nm.

5.2 Electronic converter connection

The top of the sensor is cylindrical and it can be adapted to a connector with cable for remote electronics or to other types of electronic housings directly on the head.

In the event that during the installation of the sensor the electronics or the sensor cable were disconnected, simply replace the two connectors on the sensor, push the mesh above the head, tight the side screws, and in the case of separate electronics, tigth the cable gland in order to keep the seal.

In the cases where the electronic converter is separate, refer to the converter instructions manual for the cable connection.

6 CONFIGURATION

For the commissioning, in most of cases it is necessary to configure the equipment to put the installation into service.

6.1 Fc factor

The Flomat sensor has been calibrated in our calibration rigs to determine the “Fc” factor. This factor corresponds to the signal level with a certain liquid velocity in the pipe.

If the sensor is supplied with an electronic converter, this factor will already be programmed into the converter, but if not, the electronic converter must be programmed by entering this factor (Fc).

6.2 Pipe diameter

It is very important to verify that the converter is configured for the diameter of installation pipe.

For XT5 converter series, the inner diameter (DN) is programmed directly in mm. For the MX converter series of converters, the inner diameter is programmed by means of the nominal flow rate equivalent to a velocity of 5 m / s (Qnom.). Qnom values depend only on the inner diameter of the pipe and they are shown in the table on page 8 for most standard sizes.

7 POSSIBLE PROBLEMS WHEN COMMISSIONING

7.1 No flow rate indication

Check that the cables for remote electronic units have been correctly connected. Inverted coil cables or electrode cables will have the same effect as inverting flow direction.

Check that the electrodes are perpendicular to the flow direction. If the sensor is mounted with the electrodes aligned with the flow direction the output signal will be very poor and the flow rate reading could be zero.

Check that the electrodes are clean and free from grease. If the electrodes are dirty with grease or other insulating substance there will be no output signal. In this case the electronics units usually indicate “empty pipe”. See the point 8, to proceed to clean them.

Check that the pipe is completely full. (That the electrodes are fully covered with liquid).

7.2 The reading is not stable

Check that there are no obstacles or bends near the sensor, especially upstream from it, that can produce important turbulences (see table of page 4).

Check that there are no air bubbles or solids that interrupt the conduction path between the electrodes producing instability in the signal level

The electronic converters have a configurable filter. In most cases a stable reading can be obtained by means of the filter configuration. The filters have two characteristics that govern their operation:

7.2.1 Integration time

It is the time during which the average value is calculated. In the supposition that the instrument takes 10 readings per second, if an integration time of 5 seconds is selected the flow rate reading will be the average of the last 50 readings. If an integration time of 10 seconds is selected the flow rate reading will be the average of the last 100 readings. Logically, when there are fluctuations in the flow rate, the greater the integration time is, the more stable the readings will be.

7.2.2 Filter reset

Whilst the oscillations are within the window defined by the selected % in the filter reset configuration, the filter will average the readings over the established integration time. When there are readings outside this window the averaging of the readings will start again and the flow rate reading can give the instantaneous reading. In these cases the filter reset window must be increased to obtain a more stable reading.

The only inconvenience in leaving the window at very high levels is that the response to a sharp change in flow rate will be slower.

7.3 Empty pipe

Even when it has been checked that the pipe is full, if there is empty pipe indication, this may be caused by electrical currents that flow in the liquid inside the pipe. This problem is more common when the pipe is made of plastic or other insulating material. To eliminate this problem the metallic housings should be disconnected from the mains earth. The electronic converters have the possibility to disconnect the empty pipe detection.

8 MAINTENANCE

It is recommended to clean the electrodes in installations where appreciable incrustations or sedimentations can occur. Dirty electrodes can cause unstable readings and in extreme cases indication of empty pipe detection

Cleaning can be done using liquid detergents and medium hard brushes.

The Flomat-Tap System allows maintenance of Flomat sensors without having to stop flow of the liquid in the pipe. If you have one of these, refer to its instruction manual for operation.

9 TECHNICAL CHARACTERISTICS

9.1 Materials

Sensor housing: EN 1.4404 (AISI 316L), PVDF
Electrodes head: PVDF
Gasket: NBR

9.2 Insert fitting connection

G2 1/4 thread, DIN flange, special flange.

9.3 General characteristics

Accuracy: ± 3,5% (with respect to measured value, for velocities faster than 0.5 m/s)

Minimum electric conductivity: 20 µS/cm

Minimum recommended liquid velocity: 0.5 m/s

Process temperature (liquid):	Compact	-20 ... +70 ºC
	Remote	-20 ... +130 ºC
Ambient temperature:	-10 ... +50 ºC	
Standard pressure:	PN16	
Ingress protection:	IP68 10 m H_2O	

Conforms with the Directive 2002/96/CE

Conforms with the Directive 2004/108/CE

Conforms with the Directive 97/23/CE

This equipment is considered as being a pressure accessory and **NOT** a safety accessory as defined in the 97/23/EC directive, Article 1, paragraph 2.1.3.

WARRANTY

TECFLUID guarantees all the products for a period of 24 months from their sale, against all faulty materials, manufacturing or performance. This warranty does not cover failures which might be imputed to misuse, use in an application different to that specified in the order, the result of service or modification carried out by personnel not authorized by Tecfluid, wrong handling or accident.

This warranty is limited to cover the replacement or repair of the defective parts which have not damaged due to misuse, being excluded all responsibility due to any other damage or the effects of wear caused by the normal use of the devices.

Any consignment of devices for repair must observe a procedure which can be consulted in the website www.tecfluid.fr, "After-Sales" section.

All materials sent to our factory must be correctly packaged, clean and completely exempt of any liquid, grease or toxic substances.

The devices sent for repair must enclose the corresponding form, which can be filled in via website from the same "After-Sales" section.

Warranty for repaired or replaced components applies 6 months from repair or replacement date. Anyway, the warranty period will last at least until the initial supply warranty period is over.

TRANSPORTATION

All consignments from the Buyer to the Seller's installations for their credit, repair or replacement must always be done at freight cost paid unless previous agreement.

The Seller will not accept any responsibility for possible damages caused on the devices during transportation.

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