ISOIL IMPIANTI

USER and MAINTENANCE MANUAL

P.D. Meters
Master Meter

MA/0031/00/EN/06

rev.06/2024

FOREWORD

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GENERAL CONSIDERATION

All operating and maintenance instructions and recommendations described in this manual must be respected. The Manufacturer recommends regular cleaning and maintenance to keep the device in the best conditions and achieve optimal results. Training of the user is of particular importance, both as regards the use of the equipment, and for maintenance and compliance with the operating procedures and all the safety standards indicated in this manual. In any case, the Manufacturer is always available for any clarification or further information.

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GLOSSARY SYMBOLS

The instructions in this manual may be accompanied by the following pictograms:

SYMBOL	MEANING
	Safety instruction: failure to observe may result in a dangerous situation
	Important tips and recommendations
	Prohibition
	Remarks about maintenance

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1. INTRODUCTION

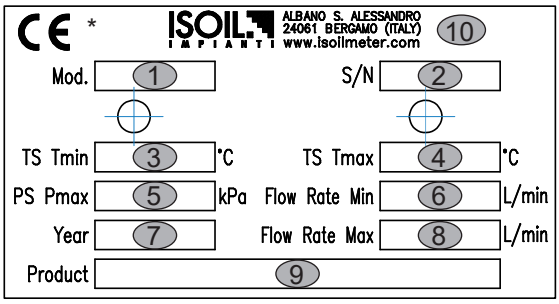
1.1. IDENTIFICATION OF THE DEVICE

DEVICE	TYPE
P.D.METER	MASTER METER

1.2. IDENTIFICATION OF THE MANUFACTURER

MANUFACTURER	
Any information or assistance request must be sent to this address:	**Isoil Impianti S.p.A.** via Madonna delle Rose,74 24061 Albano S.Alessandro (BG) Tel. +39-035 4239140 mail: albano@isoil-impianti.it

The following name plate is permanently fixed on the device.



* In case of CE marking only

1. MOD.: p.d. meter model
2. S/N: serial number
3. TS Tmin: minimum design temperature
4. TS Tmax: maximum design temperature
5. PS Pmax: maximum design pressure
6. FLOW RATE MIN: minimum flow rate of the p.d. meter
7. YEAR: production year
8. FLOW RATE MAX: maximum flow rate of the p.d. meter
9. PRODUCT: product
10. Manufacturer information

Data field layout in the name plate may change.
When ordering please specify serial number and type/model of device.

1.3. NAME PLATES AND LABELS

On the device there may be warning labels or name plates indicating the correlation between the meter and its electronic counter. When required, metric plates are fixed on the device according to PED, ATEX or MID standards.

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1.4. EU CONFORMITY DECLARATION

The EU conformity declarations are supplied separately but they are to be considered as an integral part of this service and operator's manual.

1.5. WARRANTY

1.5.1. VALIDITY

Devices are guaranteed for twelve months after the delivery date unless otherwise agreed in the purchasing order.

1.6. CONDITIONS

The warranty covers only manufacturing or manufacturing defects and does not cover damage due to wear, dirt, modifications or variations of the instrument not authorized by Isoil Impianti S.p.A.. The replacement under warranty of the defective parts is made ex works.

1.7. EXCLUSIONS AND LIMITATIONS

Warranty is valid only if original spares are used and it is null and void in case of improper use or when the technical specification of the instrument are not respected. Isoil Impianti S.p.A is the sole authority with the right to decide if the warranty can be applied. If the supply contract provides for different warranty conditions, the standard warranty conditions will be exceeded by those agreed upon in the purchasing order.

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2. GENERAL SAFETY PRINCIPLES

This operator's manual contains basic safety instructions that must be followed during system installation, operation and maintenance. Failure to comply with these instructions may result in personal injury and can lead to personal, industrial or environmental accidents.

Some examples of possible hazards caused by non-compliance with these instructions are:

- Failure of the system and/or of its components.
- Damages to people caused by exposition to electrical, mechanical or chemical hazard.
- Pollution of the environment due to the leaking of hazardous substances.

Carefully follow the safety instructions described in this manual; in case of doubt, please contact the Manufacturer.

2.1. GENERAL INSTRUCTIONS

- Carefully read the User and Maintenance Manual.
- Make sure that all the personnel assigned to the installation, operation and maintenance is properly trained.
- Make sure that the contents of the User and Maintenance Manual are completely understood by all personnel assigned to the operations on the system.
- Inspect parts under pressure in compliance with national regulations before the installation of the system.
- Make sure that a copy of the User and Maintenance Manual is available to the personnel on site.
- Make sure that the system operates in compliance with the relevant operational limits.
- The operators must also adhere to the national laws and to the safety, accident prevention and environmental protection regulations applicable to the location and field in which the devices are used.

2.2. DEVICE OPERATION

- The device must be operated exclusively by the personnel trained and authorized to its operation
- The device must not be operated in presence of foreign, unauthorized or not adequately trained personnel.
- The device must be used only for the purposes it was made for; the manufacturer is not responsible for any damage resulting from failure to comply with the conditions of use.
- The device must be operated only within the technical limits described in the User and Maintenance Manual; the manufacturer is not responsible for any damage resulting from failure to comply with the operational limits.

2.3. INSTRUCTIONS FOR THE OPERATOR

- The operator must not, on own initiative, carry out any operation that is outside his competence.
- The operator must carefully comply with all the safety instructions contained in this manual.
- Do not use petrol, solvents or other flammable substances to clean the device or its parts. Use only approved commercial solvents that are non-flammable and non-toxic.

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2.4. MAINTENANCE INSTRUCTIONS

- Carefully read the name plates on each part of the equipment.
- All maintenance operations, either ordinary or extraordinary, must be performed by authorized and trained personnel.
- The maintenance operator must wear adequate clothing according to the working environment and to the situation: loose or voluminous clothes, chains, bracelets, rings, earrings or anything that might get caught in the mechanical parts of the system must be avoided.
- The maintenance operator must wear adequate protective devices in accordance with safety and accident-prevention regulations.
- In explosive environments use only anti sparking equipment.

As an example, basic individual protections are indicated below.

PERSONAL PROTECTIVE EQUIPMENT		
	**Safety helmet**	Protects from elements or substances that may fall from above or from possible risks of collision
	**Work clothes**	Appropriate clothing e.g.: to protect from getting caught in any moving part of a device or of the plant
	**Protective goggles**	Protect eyes from any contact with hot or corrosive substances
	**Gloves**	If there is a danger of injury to the hands due to very hot substances and / or corrosive or sharp parts
	**Safety boots**	Protect from the fall of heavy elements and from hot or corrosive substances

Carefully check that the system and its parts are not under pressure before disassembling the equipment or its accessories for inspection, maintenance or replacement of components.
Also make sure that all electric or electronic part, if any, are disconnected from their power supply.

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2.5. EXPLOSION PROTECTION INSTRUCTIONS

When working in potentially explosive atmospheres, carefully follow the explosion protection instructions indicated in this chapter.

In potentially explosive atmospheres only use explosion-proof components provided with specific identification and suitable for such application.

According to EU Directive 2014/34/EU (ATEX) the Ex protection is valid only if the p.d. meter is used in compliance with the instructions at par.3.1 (intended use).

Never exceed (above or below) the limits indicated on the device name plate.

Absolutely avoid unauthorized operation modes.

2.6. TEMPERATURE CLASS

ATEX Marking: Ex II 2 G Ex h IIB T6...T4 Gb.

The temperature classes according to the maximum liquid temperature are indicated in the following table:

MAX ALLOWED TEMPERATURE OF THE LIQUID	TEMPERATURE CLASS ACCORDING TO UNI CEI EN ISO 80079-36 DIRECTIVE
100 °C	**T4**
70 °C	**T5**
50 °C	**T6**

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3. TECHNICAL DESCRIPTION

3.1. INTENDED USE

ISOIL Master Meter is a positive displacement meter for 'test-sampling' of measuring instruments used for liquids other than water. This device can tehrefore be used as an alternative to proving tanks.

It can in fact be used for initial verification at Manufacturer's premises or for installation and periodical verification of a meter at Customer's premises.

The device is designed and built to work safely but you must:

- use it within the technical limits indicated on the contract and/or in this manual,
- follow the procedures contained in this service and user manual,
- not exceed maximum pressure and flow rate indicated on the label,
- use the special tools to perform all the assembling / reassembling procedures,
- schedule ordinary maintenance (periodic check with proving tanks);
- perform extraordinary maintenance promptly if necessary;
- not disable safety devices.

3.2. MAIN COMPONENTS

The ISOIL Master Meter has the same technical and functional characteristics of the p.d. meter it is composed of (see fig.1 here below).

1	Manifold
2	Body
3	Rotor
4	Vanes

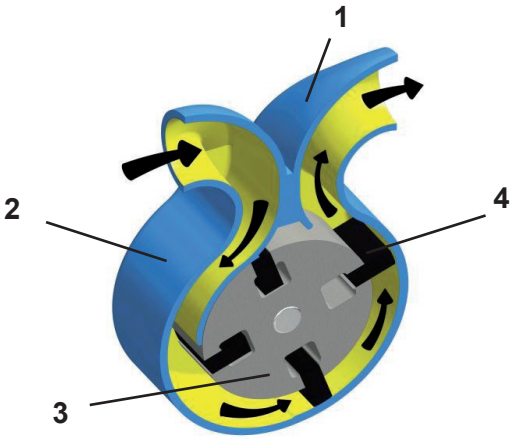

FIG.1

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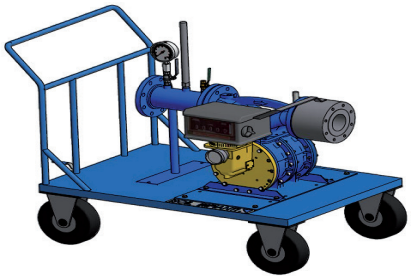
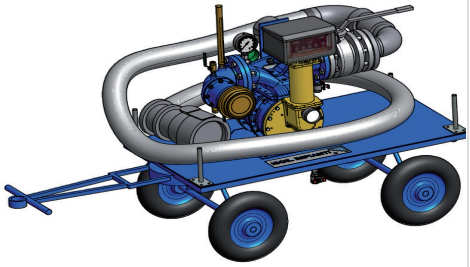
3.2.1. ACCESSORIES

The Master Meter is equipped with the following accessories:

FLOW RATE INDICATOR	Flow rate is used to calculate the error (%) of the Master Meter from the calibration curve.
UNIT DRUM	The unit drum is used to increase the precision of the counter and it should be reset whenever resetting the counter.

Futher accesories can be provided upon request:

<table>
<tr><td rowspan="2">TROLLEY</td><td colspan="2">It is used to move the Master Meter and take it as close as possible to the p.d. meter that has to be calibrated.
According to the p.d. meter two versions of the trolley are available:</td></tr>
<tr><td>4-wheels trolley
  </td><td>4-wheels trolley with hitch hook and accessories
  </td></tr>
<tr><td>KICK PLATE FOR CONNECTION WITH ANTI-OVERFILLING DEVICE</td><td colspan="2">It is used when loading operations need to be authorized by the connection between Scully or Civacon and the tank truck.</td></tr>
<tr><td rowspan="2">ACCESSORIES KIT:
- TEMPERATURE GAUGE
- PRESSURE GAUGE
- BALL VALVE</td><td colspan="2">Temperature gauge is used for the measurement of fluid temperature.</td></tr>
<tr><td colspan="2">Pressure gauge allows measurement of pressure in the Master Meter.
This has to be as close as possible to the pressure of the p.d. meter undergoing calibration and to the Master Meter calibration pressure.
Pressure is not used in calibration calculation.</td></tr>
</table>

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4. INSTALLATION AND OPERATION

4.1. REFERENCE NORMS

Ministers decree DM7702 concerning Master Meters states the need of a calibration certificate with calibration curve for the intended product. This certificate must be of an accredited laboratory.

Certification must be renewed after 100 calibrations or every 2 years of operation.

The meter must be calibrated following the instructions in the operator's manual and in the Manual of Petroleum Measurement Standards (API) with particular attention to the following chapters:

- Chapter 4: "*Proving systems*"
- Chapter 5: "*Metering*"
- Chapter 6: "*Metering assemblies*"
- Chapter 11, section 2.3: "*Water calibration of volumetric provers*"
- Chapter 12, section 2: "*Calculation of petroleum quantities*".

4.2. INSTALLATION REQUIREMENTS

The installation must be performed by qualified personnel who have read and understood the User and Maintenance manual.

- Before using the Master Meter carefully read p.d. meter user and operator's manual.
- The ISOIL Master Meter should be installed downstream all the accessories protecting the p.d. meter under test (e.g. strainers and strainer air separators).
- Between the Master Meter and the meter undergoing calibration there have to be no devices that may alter the instantaneous flow rate or the fluid characteristics.
- Valves installed between the two meters must grant perfect seal.
- The ISOIL Master Meter with trolley must be connected in series to the p.d. meter which has to be calibrated. In order to reduce volume corrections during calibration it also has to be installed as close as possible to it.
- Make sure that the flow direction through the device is the same indicated by the arrow on the device itself.

Flow through the meter must be regular and uniform: avoid pulsating and irregular flow.

Testing circuit must be completely full of product.

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4.3. USAGE

Before calibration run both the p.d. meter and the Master Meter at the desired flow rate long enough to eliminate air in the fluid and to have uniform pressure and temperature in the test circuit.

Calibration should include at least a couple of verifications at maximum flow rate (the one indicated on the meter's label or the plant maximum flow rate) and one at minimum flow rate.

The hose on the Master Meter's outlet should be connected to a product recovery line or to a tank truck/trailer coupling allowing for product collection during testing. (See par. 4.3.1)

Proceed as follows:

STEP	ACTION
1.	Reset the counters of both meters. Carefully check that also the vernier scale of the Master Meter has been reset.
2.	Set the product volume to be delivered during test. This value is obtained by multiplying test flow rate for two-minutes.
3.	Start product delivery and complete it.
4.	Record product volume as shown on the meter counter. Also take note of temperature and volume compensation, if the electronic counter has this function.
5.	Record total volume and temperature of the Master Meter.
6.	Calculate correction of the values indicated by the Master Meter according to the calibration curve of the measured product.
7.	Calculate temperature compensation at 15 °C of both volumes of tested meter and Master Meter.

For further details regarding how to perform calculation see example at par. 4.3.3

When calibrating meters measuring different products, remember to empty the Master Meter after each test. Use drain valves and vent valves to avoid the formation of blended/ mixed products.

4.3.1. MASTER METER APPLICATIONS

The Master Meter can be used for meter calibration by using different 'configurations' according to the plant where the meter to be tested is installed.

Please find some examples in the following pages.

Always check that the capacity of the product recovery tank can contain the measured product and that the recovery line allows to reach the maximum flow rate of the meter being calibrated.

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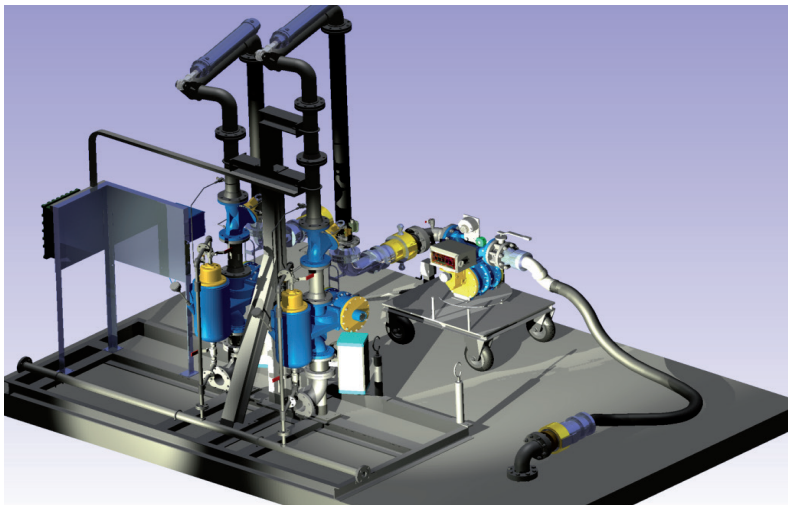
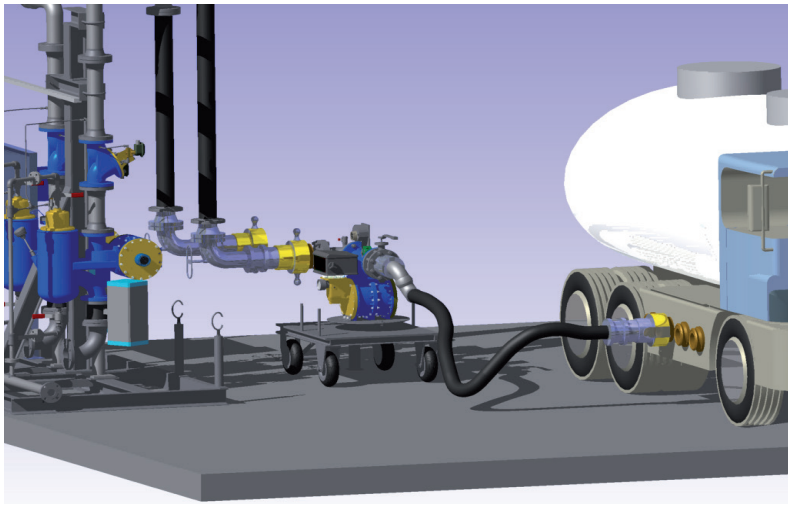
1. When there is a product recovery line.



2. With a tank truck to store measured product.



3. With a proving tank.

Should the tank be equipped with a pump, measured product can be piped to a product recovery line.

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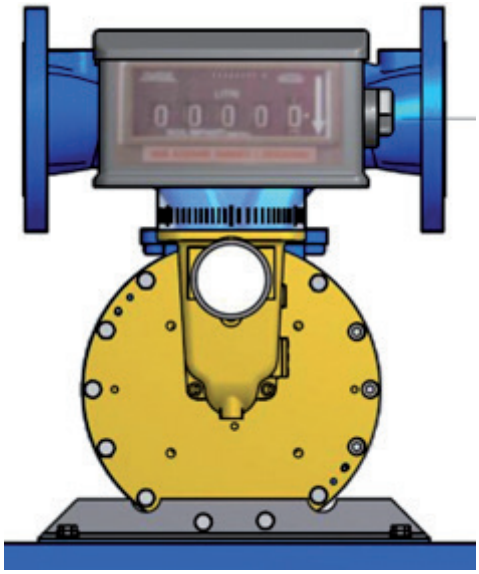
4.4. UNIT DRUM

The unit drum is placed between the counter and the mechanical counter, and its function is to simplify the reading of the decimal value of a delivery.

Below is the procedure for system calibration and use.

The pictures refer to the case of a mechanical counter with a measurement reading in liters, but the same principle is applicable for other measurement units as well.

- Reset the mechanical pd meter.
- Reset the unit drum by rotating the calibrated ring (0-1 liter scale) so that the red zero mark is aligned with one of the black marks on the metal disc (pos.1);
- Make a delivery operation: the disc of the unit drum rotates;
- Once the operation is finished, stand in front of the unit drum ring. The first black engraving inside the red graduated scale corresponds to the decimal value indicated on the mechanical counter (pos.2). In the picture, the value read is 100.8.



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4.5. METER TESTING

The values to take into account for meter testing and calibration are the following:

1.	Correction factor of the Master Meter according to flow rate and product
2.	Quantity of product erogated by the Master Meter and by the meter undergoing calibration, temperature compensation at 15°C
3.	Calculation of the error (%).

Here below is a calibration example illustrating how to calculate meter error.

Master Meter Mod: BM/M 400
Flow rate of test: 1 200 l/min
Product: Diesel
Density at (15°C) 850 Kg/m3

Calibration certificate shows the error (%) according to flow rate (e.g. 1200 l/min) and product.

Example:

Error % of the Master Meter: 0,06%

Since the error of the meter undergoing calibration is the result of its error (%) added to the error (%) of the Master Meter, calculation of meter error is required.

It is therefore necessary to read measurement of the meter and compensate it at 15°C (Vp15). Then proceed in the same way with the Master Meter (Vo15) and use the following formula:

$$E\ \% = \frac{(V_p15 - V_o15)}{V_o15} \times 100$$

DATA	P.D METER	MASTER METER
Measurement	Vp = 10 000 lt.	Vo = 9 998 lt.
Temperature	18 °C	18 °C
Comp. coeff.*	0,9975	0,9975
Compensated measurement at 15°C	Vp * comp. coeff. = = 10 000 * 0,9975= = 9 975 lt.	Vo * comp. coeff. = =9 998 * 0,9975= = 9 973 lt.

* Compensation coefficient can be found in the ASTM tables knowing fluid density at 15°C and temperature.

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$$E\ \% = \frac{(9975 - 9973)}{9973} \times 100 = 0{,}02\ \%$$

Total error of the meter= E % + E% of the Master Meter

Example is therefore:

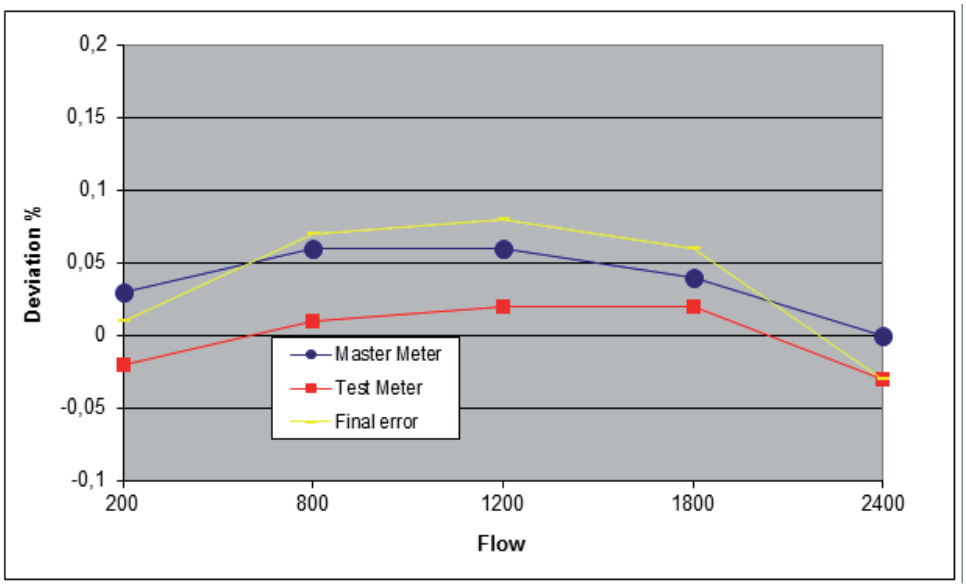
E tot = (0,02 + 0,06)% = 0,08 %

4.6. CALIBRATION CURVE

If we consider the calibration curve of a meter (test meter) measuring DIESEL OIL and a ISOIL Master Meter we have:

FLOW RATE	E% MASTER METER	E% TEST METER	FINAL ERROR
2 400	0,00	-0,03	-0,03
1 800	0,04	0,02	0,06
1 200	0,06	0,02	0,08
800	0,06	0,01	0,07
200	0,03	-0,02	0,01

The data of the table above allow tracing of the test meter calibration curve.



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5. MAINTENANCE

5.1. STORAGE

If the meter and its accessories are not going to be installed and used after receipt, follow the instructions below:

- Close the inlets and outlets of the meter and of its accessories with blind flanges and fill all the devices with clean kerosene or lubricating oil.
- Fill the carter of the calibrating mechanism with oil till the sight glass level is reached.
- Protect counters with waterproof bags.

5.2. SPARE PARTS

Provide serial number and type/model of the device.
Specify exact code number shown on drawings.

In case of gaskets storage, remember that they need to be preserved from damages caused by humidity and/or sunlight.

Spare parts must be stored carefully. Pay attention that:

- **Parts protected with oil are properly lubricated;**
- **Packaging is not damaged/broken;**
- **Spare parts are kept in a dry place.**

For correct maintenance use only spare parts recommended by Isoil impianti S.P.A.

Isoil Impianti S.p.A. is not liable for any problem resulting from the use of non original spare parts.

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