INSTALLATION AND OPERATION INSTRUCTIONS

TruckMaster®

FOR PORTABLE DIESEL OIL TANKS AND DISPENSERS
OF CAPACITY 200, 420 AND 900 L

EN

OPERATION MANUAL

TruckMaster®

FOR PORTABLE DIESEL OIL TANKS AND DISPENSERS OF CAPACITY 200, 420 AND 900 L

By Kingspan Environmental Sp. z o.o.

(version 4/2012)

This operation and maintenance manual contains important recommendations and warnings. Carefully read the instructions before using the machine and comply with all recommendations contained therein. The manual is ancillary and does not constitute a source of law. You should make sure that the instructions are sufficient to ensure safety. Compliance with instructions does not exempt from the application of local laws.

The manual was prepared according to the standard contained in European Agreement ADR 2009 - The European Agrement concerning the International Carriage of Dangerous Goods by Road.

The manufacturer is not liable for damages and losses resulting from incorrect operation of the machine.

Keep this document in a safe place for further use. In case of the resale of the machine, the manual must be provided to the new owner.

CONTENTS:

I. APPLICATION

TruckMaster® is a mobile machine intended in its standard specification for transportation and distribution of oil or biodiesel oil of methyl or ethyl esters content up to 5% (B5) for private, non-commercial purposes. Machine operation temperature range from 20°C to +60°C, permitted oil viscosity from 2 to 5.35 cSt (at temperature 37.8°C).

Only diesel oil can be used with the tank. No other liquids such as petrol can be stored in it.

Optionally, after arrangement with the producer it is possible to equip the machine in such manner as it can be applied for other liquids e.g. biodiesel of ester content of more than 5%, aviation kerosene, various types of hydraulic oils and lubricating oils.

TruckMaster® machines - **OTM00420DG** and **OTM00900DG** - meet the requirements under the European Agreement (ADR) concerning the International Carriage of Dangerous Goods by Road.
OTM00200DG machines due to their small capacity are excluded from necessity to meet such requirements.

IMPORTANT!

For transporting an amount of oil not exceeding 1,000 litres using TruckMaster® in accordance with the hereby Manual, no further ADR requirements need to be met. On each occasion, precautions need to be taken against releasing the transported liquid from the tank.

Legal basis: ADR 1.1.3. Agreement

II. TECHNICAL PARAMETERS AND EQUIPMENT

1. DIMENSIONS:

SYMBOL	OTM00200DG	OTM00420DG	OTM00900DG
Maximum capacity [l]	200	420	900
Length [m]	1.18	1.18	1.4
Width [m]	0.86	0.86	1
Height [m]	0.5	0.86	1.21
Net weight [kg]	52	64	97

2. STANDARD EQUIPMENT:

a) Single-jacket 200, 420 and 900 litre tanks:
   - material: UV-stabilised medium-density polyethylene,
   - usable capacity amounts to 95% of maximum capacity,
   - the tank is fitted with a baffle to limit liquid sloshing within it,
   - the top of the tank has four holes for fitting lifting sling shackles for machine loading or transportation (capacity 420 and 900 litres).

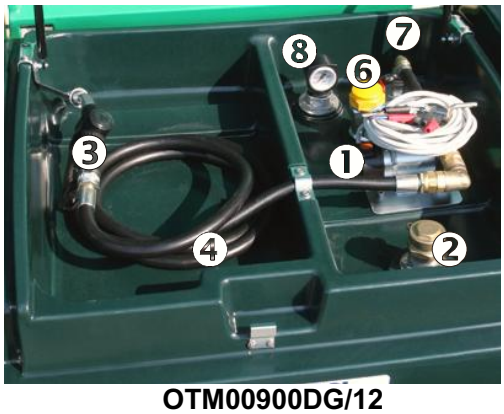
b) Standard version of distribution system is fitted with:
   - 12V DC pump with a maximum capacity of 40 l/min,
   - flexible suction hose finished with a mesh filter,
   - shut-off ball valve on the suction side of the pump, (capacity 420 and 900 l),
   - 0,75 inch, 4-metre-long flexible hose,
   - automated delivery nozzle stopping oil flow on reaching the maximal oil level in the tanked machine,
   - nozzle holder,
   - 6 m power cable to connect to the battery,
   - cable grip.

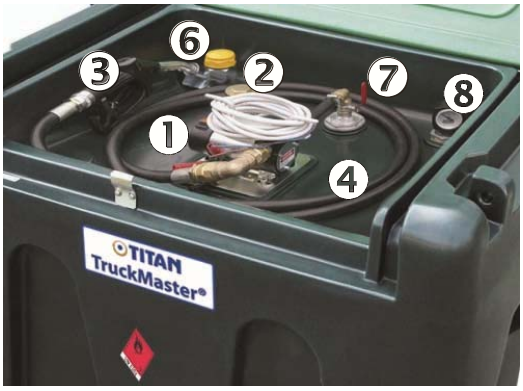
c) Float clock sensor for measuring the liquid level in the machine. (capacity 420 and 900 l).

d) Vent for regulating pressure during refuelling and discharging. Its construction does not allow oil out of the tank during transportation.

e) Oil inlet in form of male thread ferrule with a nut.

f) Lockable lid, with a key.





OTM00900DG/12
OTM00420DG/12

Equipment of machines 420 and 900 litres:

1. 12 V DC pump.
2. Oil inlet (2" ferrule).
3. Automated delivery nozzle with a handle.
4. 4m x 0,75 inch distribution hose.
5. Suction hose with a mesh filter.
6. Vent.
7. Shut-off valve.
8. Liquid level sensor.
9. Baffle preventing sloshing.

Tank cross-section 420 and 900 l

OTM00200DG/12

Equipment of machines 200 litres:

1. 12 V DC pump.
2. Oil inlet (2” ferrule).
3. Automated filler delivery with a handle.
4. 4m x 0,75 inch distribution hose.
5. Suction hose with a mesh filter.
6. Vent.

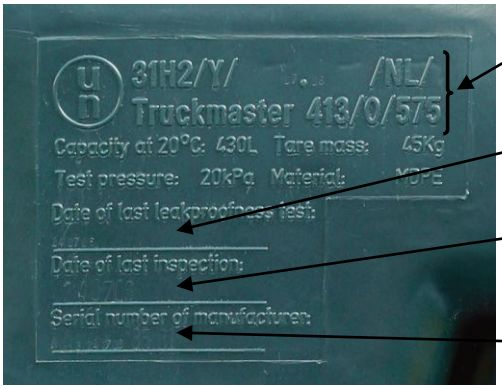
Equipment can vary depending on the purchased version of the machine.

The manufacturer reserves the right to change machine equipment without any previous notice.

3. MACHINE LABELLING

Tanks with capacity 420 and 900 litres must have fixe and legible marking in accordance with ADR. The owner is responsible for legibility of such marking.

a) rating plate:



UN certificate number

last leakproofness test data

last tank inspection tank

device serial number

OTM00420DG

OTM00900DG

UN certificate number

last leakproofness test data

last tank inspection tank

device serial number

Full certificate numbers of individual machines:

UN **(OTM00420DG)** **31 31H2/Y/**--/NL/Truckmaster 413/0/575**

UN **(OTM00900DG)** **31 31H2/Y/**--/NL/Truckmaster 448/0/1237**

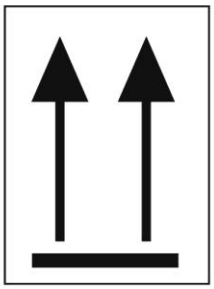
**-- means month and year of the machine production.

b) Marking denoting stacking is not permitted (layering)

DPPL not intended for stacking

The symbol should not be smaller than 100mm x 100 mm, fixe and easily visible.

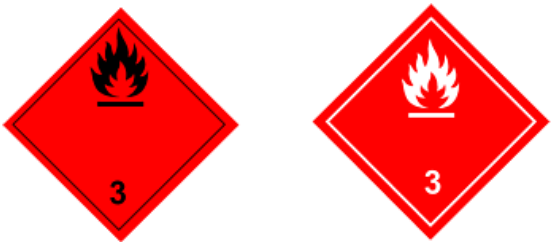
c) Marking for vertical transport



d) Marking for lifting with forks or slings

e) Marking for transported material:

Tanks should be marked for liquid, flammable materials In the form of:



The symbol (flame) of black or white colour on red background.
Digit „3" in the lower corner.
Marking should not be less than 100mm x 100mm.

Additionally, the tank should be labelled with type of transported liquid in form of:

"UN 1202" – for diesel oil,

"UN 1223" – for aviation kerosene.

Letter size minimum 12mm.

New ADR marking for the carriage of hazardous materials.

Sample visualization of the markings on the TruckMaster® tanks.

4. OPTIONAL EQUIPMENT

Options available for **OTM00200DG**, **OTM00420DG** and **OTM00900DG**:
- diesel oil pump BY PASS 24V DC of capacity max. 40 l/min.,
- diesel oil pump PANTHER 12V or 24V DC of capacity max. 70/35 l/min.,
- diesel oil pumps BIPUMP 12V or 24V DC of capacity max. 85 l/min.
(in case the pump is used, suction hose 1 1/4", distribution hose 1" and delivery nozzle of inlet diameter 29mm),
- biodiesel oil pump VISCOMAT for 12V or 24V DC of capacity max. 10 l/min.,
- diesel oil pump PANTHER 230V AC of capacity max. 56 l/min.,
- digital flowmeter K24 of maximum accuracy +/- 1%, installed at delivery nozzle,
- digital flowmeter K600 of maximum accuracy +/- 1%, installed at pump outlet.

Options available for machine: **OTM00200DG**:
- four shackles for lifting,
- portable lamp battery charged; charger.

III. GUIDELINES FOR USE

TruckMaster® in its standard specification is intended for transportation of diesel oil or biodiesel oil of ester content up to 5%. The machine can also be used for other materials after arrangements with the manufacturer. It is necessary to specify classification of the transported material and to select correct TruckMaster® equipment.

The ultimate classification for transported liquid results from its Material Safety Data Sheet.

Main hazards posed by diesel oil

Diesel oil is inflammable and toxic, thus dangerous for both human and the environment. If inhaled or swallowed, it can be irreversibly detrimental to health, for instance it can cause damage to the lungs or the digestive system. Repeated exposure may cause skin dryness or cracking.

Toxic to both land and water wildlife, diesel oil can cause lasting damage to the environment. The substance also increases fire hazard, as its vapours mixed with air are highly explosive and, being heavier than air, accumulate near the ground and floors in buildings.

Main hazards posed by aviation kerosene

Toxic, irritating, allergic substance of depressive influence on central nervous system.
Content of n-hexane in kerosene is responsible for circular nervous system, benzene content – for blood system.
In form of aerosol mist it causes eye lacrimation, conjunctiva redness, cough.
In big concentrations it can cause headaches, dizziness, psychomotor agitation, balance distortions, torsions, nausea, drowsiness, convulsions. Irritation of skin with liquid kerosene can cause redness, pain and prolonged contact – chemical burns. Irritation of eyes with liquid kerosene causes pain, lacrimation, conjunctiva redness. Intoxication via digestive system causes throat burning, torsions – with a risk of pneumonia, diarrhea.
Results of severe intoxication : disturbances of nervous system; lack of appetite.

Transport classification:

Name	Diesel fuel, gas oil light fuel oil	Aviation Kerosene
UN number:	1202	1223
Packaging group:	III	III

Class:	3 (liquid materials, flammable)	3 (liquid materials, flammable)
Exempted volumes:	1000 litres	1000 litres

IV. OPERATION GUIDELINES

The TruckMaster® portable oil dispensing tank was designed for lasting, failsafe and maintenancefree operation, as far as possible.

For safe use, before first filling the tank, examine it for any missing elements and any possibile damage having arisen during transport.

If the tank is complete, it can be safely used after filling it with oil and connecting the pump to power supply.

To avoid the environmental hazards caused by the stored liquid, the following guidelines should be followed:

1. REFUELLING OF TANKS

a) Do not store contaminated fuel oil, as it may lead to contamination of the machine and damage to pumping system. Operator is to be able to document origin and ignition temperature of stored fuel oil.

b) The machine can be refilled only to its rated volume, which is 95% of maximum volume. Never allow overfilling!

c) The machine can be refuelled only by trained person . If the tank is situated far from the mobile tank, tank refuelling should always be supervised by an additional person.

d) In justified cases it is also required that person supervising refuelling of the machine wears bright-coloured clothing and hardhats. In addition, depending on situation, mobile tank driver is to wear personal protective equipment, such as boots, goggles, gloves, ear protection, raincoats, etc. as provided for this type of activities.

e) Diesel oil delivery location should be protected for refuelling time with safety signs; warning lights etc. Safety measures should be applied in particular when refuelling causes obstructions to traffic e.g. occupies part of a street or pavement.

f) Prior to refuelling check the condition of tank shell, inlet ferrule and ventilation, oil level in the machine, and cleanness of machine interior. Check if the machine is stable and if it is not damaged. Damages and other irregularities make the machine unfit for refuelling.

g) Tank is to be refuelled only via inlet ferrule. Max permitted refuelling speed 150 l/min. Do not allow for excessive oil foaming.

h) During refuelling observe other not aforementioned regulations in force in a given location.

i) All possible measures against the escape of small quantities of liquid (dripping) should be taken. Use sorbents.

2. REFUELLING OF VEHICLE

a) Refuelling from TruckMaster® can only be performed by adult and trained persons. Prior to refuelling, read and observe machine manual; in particular in the scope of pump and flowmeter operation (equipment option).

The machine should be protected against access of unauthorized persons.

b) The machine cannot be operated at temperatures below -20°C and over +60°C or during severe atmospheric conditions e.g. rain, strong wind etc. Keep work area in order and provide proper lighting.

Locate vehicle to be refuelled as close to the machine as possible, so that it does not obstruct possible evacuation from fire zone. It is forbidden to stay in refuelled vehicle; the vehicle should be left.

c) Prior to operation perform visual inspection of the machine condition. If the machine or its part has been damaged, they should be taken out of order until the damage is repaired. If tank leakage is observed, immediately pump the oil to other machine or a tank and inform the closest department of Kingspan Environmental.

d) !!! **Prior to use make sure the machine is filled with fuel** !!!
Dry operation results in pump damage.

e) Check if the pump switch is in OFF position. Unwind pump supply cable and connect it to power source e.g. to a battery; open shut-off valve on pump suction side. Zero the flowmeter counter if available. Start the pump, insert delivery nozzle to vehicle inlet and keep it open in order to allow for air escape. Time until the fuel is present can be max. up to 2 minutes.

f) The vehicle motor should not operate during refuelling, except when its starting is necessary for pump operation or for operation of other devices for refuelling and if local regulations of the vehicle location permit.

g) Do not overheat the pump. After 30 minutes of continuous operation, switch the pump off for ca. 30 min., until it cools down.

h) The pump supply voltage cannot exceed +/- 5% of its nominal value. The excess can result in incorrect pump operation or its damage.

i) It is forbidden to locate more than one vehicle at the machine. The driver of the next vehicle is obliged to keep safety distance (min. 5 meters).

j) Do not exceed max. pump lifting height the machine is equipped with. For standard pump 12V DC it is 2m.

k) In case fuel is spilled onto machine or in its vicinity, immediately remove contamination prior to restarting of the machine.

l) In case several vehicles are refuelled, after the next one is refuelled, switch off the pump. Pump operation with closed delivery nozzle results in adverse effects; after 2-3 minutes it can be damaged. After refuelling, immediately drive away. It is forbidden to park vehicles in the machine vicinity.

m) After refuelling is completed and pump is switched off, if the machine is not to be operated for longer period; press one time delivery nozzle coupling when it is still in the vehicle inlet. Such operation provides that no pressure oil remains in distribution hose.

n) After refuelling is completed, if the machine is not to be operated for longer period disconnect power supply, wind supply cable on its rack, wind distribution hose, place delivery nozzle on its handle, close shut-off valve and lock cover with a key.

3. TRANSPORTATION AND STORAGE

The machine must be transported and stored in such manner as to avoid mechanical damages of the tank jacket and its equipment. Apart from traffic regulations requirements, observe the following recommendations:

1. Loading and unloading of filled machine can be done only with fork lift or crane, slings and shackles fitted at designated four holes in the machine upper part.

IMPORTANT!
Each of the four shackles must be fitted with separate sling. The shackles must be loaded evenly.
Always use all four shackles for lifting.

Lifting the tank with slings should be performed slowly, minimizing dynamic loads.

It is forbidden to move or roll the tank on the ground.

For handling, use handles located on both sides.

2. Tank transportation can be performed on special vehicles, equipped with:

a) Machine fixing means, appropriate for transported tank allowing for its fixing and securing against movement during transportation. Fixing can be done by locating the machine in fixed position, e.g. by limiting movement possibility with beams or stretcher-bars or with belts. Shackles, the machine is equipped with, can be used for this purpose. One belt should be attached to one shackle; then the

belt is fixed to fixing points on the vehicle. Upon selection of belts, consider LC parameter – which denotes maximum strength which can be generated with single belt. Belts must be in good technical condition and with undamaged labelling.

Depending on its type, the machine can generate during transportation strength equal to:

OTM00200DG – ca. 150 daN (direction forward);

OTM00420DG – ca. 350 daN (direction forward);

OTM00900DG – ca. 760 daN (direction forward).

The strength must be balanced by generating counter strengths of at least the above values.

Cargo space must be clean, smooth and without any sharp edges. In order to improve fixing conditions, place anti-slippery layer under the tank.

Caution!

Vehicle reconstructions, incl. assembly of elements for mounting fittings in vehicle frame, require note in vehicle license.

b) At least one portable fire extinguisher for putting out fires of group A/B/C of capacity at least 2 kg of fire extinguishing powder with a seal, official standard compliance mark and expiry date (month/year).

c) Wedge to be located under wheels, at least one per single vehicle, with dimensions appropriate for the vehicle mass and diameter of wheels.

d) Warning signs, e.g. bollards or reflective triangles or flashing lamps with orange colour, with power supply independent from the vehicle electric system, according to national regulations.

e) Appropriate warning vest or warning clothing (in accordance with European standard EN 471) for each vehicle crew member. The driver should be equipped with personal protection means such as glasses and gloves in order to perform safe operations with fuel.

f) The means for possible machine unsealing during transportation, for possible prevention of acess of fuel to sewers or ground water such as film, sleeves, sorbents, brush and spade made of non-sparking materials (e.g. plastic).

3. During transportation:
- cover and inlet ferrule must be completely closed and protected,
- delivery nozzle located in holder,
- pump power supply disconnected, supply cable wound on rack,
- distribution hose wound and routed in such manner as to avoid its damage,
- ball shut-off valve on pump suction line must be closed during transportation and storage of the tank. It can only be open during vehicle refuelling.

4. On transport means handling dangerous goods, no passengers are allowed apart from trained crew. The machine must be protected against access of unauthorized persons.

5. Single vehicle cannot transport more than 1000 litres of diesel oil, i.e. single OTM00900DG machine or max. two OTM00420DG machines. Transportation of more oil requires application of all ADR regulations. In such case it is necessary to appoint road transportation safety specialist in the company who shall issue binding regulations in the scope of transportation. OTM00200DG, due to its small capacity and construction, is not covered by ADR requirements, provided single vehicle transports not more than two pieces.

6. It is forbidden to enter vehicles with flame lighting devices. Moreover, used lighting devices cannot have sparking metal surfaces. During cargo handling it is forbidden to smoke cigarettes in the vicinity and inside the vehicles.
7. Means of transport with dangerous goods cannot be left parked if it they not been secured with hand brake.
8. Vehicle transporting dangerous goods can have maximum one trailer.
9. The machine can be used for periodic storage of transported media. In such case it should be located in a warehouse in accordance with abiding fire protection and labour safety and hygiene regulations.

4. REQUIRED DOCUMENTATION

Apart from documents required under separate regulations, a vehicle transporting OTM00900DGP or OTM00420DG should be provided with a packing slip as required under ADR regulations, containing the following information on a dangerous substance, material or other good to be transported:

a) "UN" letters,

b) UN number,

c) Material packing group number,

d) Correct transport name of the material,

e) Warning label numbers,

f) Number of pieces of transported goods or packaging of material,

g) Total amount of transported dangerous material (capacity, gross weight or net weight),

h) Information that the shipped material may pose a potential threat to the environment.

Note:

In most cases, oil dealers, professionally engaged in road transport, will provide their assistance in dealing with the required documentation.

5. VEHICLE CREW TRAINING

The driver and other crew members should be acquainted with regulations concerning transportation dangerous goods.

Furthermore, they should be provided with detailed training on such dangerous material transport regulations which are directly related to their duties and responsibilities. The training should be arranged and registered by the owner of the TruckMaster®, as required by local regulations.

In particular, the training should cover, among other things, guidelines for proceedings in the event of an accident such as fire or leakage.

From 1 January 2011 each of the persons involved in the transport MUST be trained prior to transportation according to their tasks and responsibilities (on-the-job training of ADR).

6. GENERAL SAFETY MEASURES

1. Notes on stored material

   The basic source of information on dangerous material and its handling is located in characteristics table of diesel oil manufacturer. It should be requested from the fuel seller. Upon handling diesel oil proceed with particular caution. In order to minimize risk, one should:

   a) avoid repeated or long term oil contact with the skin,

   b) wear protective gloves when refuelling the machine,

   c) observe basic rules of hygiene, immediately wash contaminated body parts with water and soap,

   d) do not eat or drink during operation of the machine,

   e) during operation of the machine it is forbidden to smoke and use open fire,

   f) avoid inhalation of fumes; oil fumes are toxic to respiratory system; there is a risk of irrevocable changes to human health,

   g) avoid contact with eyes, if there is such risk, wear protective glasses with side protections,

   h) prevent oil from leaking into environment as its toxic influence on water and earth organisms can result in long term negative changes,

   i) minimize fire risk; oil vapours generate explosive mixtures with air and as they are heavier than air, they collect close to ground surface and in lower areas of rooms,

2. Persons involved in transportation of dangerous goods should observe necessary safety measures, according to nature and scope of risks to be foreseen, in order to prevent any damages and injuries and, if necessary, in order to minimize their effects. In case of direct risk to public security transportation participants should immediately inform rescue teams and provide them with information to undertake appropriate actions. Obligations of main participants of transportation are specified in ADR regulations and in national regulations.

   In case of the machine failure (leak, spillage, fire, electric shock etc.) the person who observes such an event is obliged to:

   a) Stop work realization in danger zone; disconnect the machine power supply and the motor of refuelled vehicle.

   b) The immediately help the injured persons – after making sure it is safe to enter the danger zone.

   c) Remove all persons not involved in failure remedy outside the danger zone, if necessary, arrange evacuation; inform the superior.

   d) Person in charge and responsible for warehouse or area where the risk has occurred or a person appointed by him/her is in charge of rescue operation, and if necessary calls for fire brigade, ambulance or other appropriate rescue teams and provides them with necessary information.

   e) Prevent oil from entering sewers, water or ground. In case the machine is leaking, its content must be pumped into another tank.

   f) In case large quantities of product are released, inform appropriate authorities. Small quantities of spilled liquid pour with inflammable, absorptive material, collect to closed waste disposal container. Utilize in accordance with current regulations or use services of companies authorized for waste transportation and utilization.

   g) Tanks exposed to operation of fire or high temperature must be cooled with water, possibly from safe distance – risk of explosion. If it is possible and safe, remove them from danger zone.

   h) Call authorized service team of the manufacturer..

3. Waste oil should not be disposed to sewage system. Prevent surface water and ground water from contamination. Recycling or utilization must be conducted in accordance with waste disposal

principles, environment protection regulations and waste disposal plans only at designated location in accordance with regulations and in installations and devices which meet the specific requirements.

Recommended utilization – thermal treatment.

CAUTION!

Empty, not cleaned machine can contain residual oil which may cause fire and explosion risk.

4. Maintain order at the machine operating location. Provide good lighting. Keep the machine In working order; perform periodic inspections and maintenance, in accordance with the producer's recommendations.
5. Tank supervision is performed by its owner or lessee in case the machine is leased. Tank owner must prepare and locate in visible place the machine operation procedure, compliant with fire protection and labour safety and hygiene regulations in force. The machine can be operated by a person over 18, who is familiar with such procedure and with the machine operation manual. Children and unauthorized persons should keep away from work area.

7. OWNER'S RESPONSIBILITIES

The owner's responsibilities include:

a) Supervising the machine by periodic inspections and overhauls. This can be conducted by another authorised company. Maintaining good working condition of the machine.

b) Conducting inspection checks at least on annual basis and drafting reports on the results. The reports are to be kept as long as the machine is used for dangerous substance transportation. Draft reports are available in chapter X.

c) Commissioning any justified inspections and conducting periodic inspections at least every 2.5 and 5 years, respectively.

d) Observing labour hygiene and safety and fire protection regulations, ADR, manufacturer's guidelines and other, local regulations during machine operation and providing machine operating personnel training in this scope.

e) Informing a possible new owner of the machine about periodic checks and inspections conducted so far and providing them with the documentation for the machine.

8. PERIODIC INSPECTIONS

Machines OTM00900DG and OTM00420DG must be periodically checked an authorised inspection authority. Each machine should be inspected in accordance with ADR regulations, as described below:

Checks by an inspection authority

(at least every 5 years):
a) construction (for any unauthorised changes) and proper labelling,
b) general condition of both the outside and inside of the machine,
c) proper functioning of control and operation equipment.

(at least every 2,5 years):
d) leakproofness at pressure of 0,2 bar,
e) general condition of the outside of the machine,
f) proper functioning of control and operation equipment.

Checks by the owner

(at least once a year) for:
a) proper labelling,
b) general condition of both the outside and inside of the machine,

c) proper functioning of control and operation equipment.

Date of last inspection of supervising body and leakproofness check (month/year e.g. 09/10) must be permanently marked on the machine rating plate. Check report must be kept by the machine owner. In case the machine is sold the reports must be attached to the machine for its new owner. In case the check result is negative, send the machine for repair.

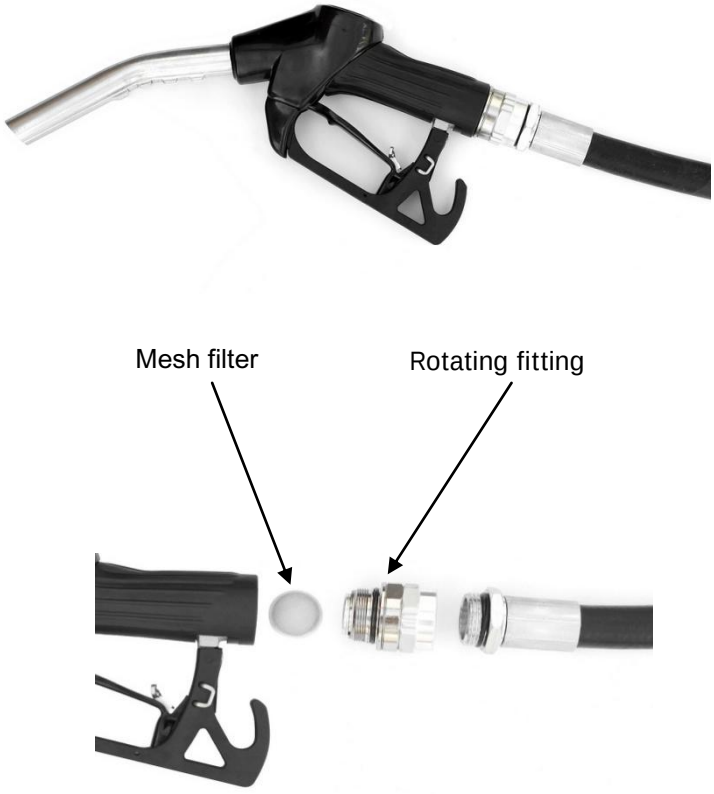
V. MAINTENANCE

The following table presents a list of maintenance operations and their frequency:

No	Operation	Frequency of operation
1	Check if the machine equipment is complete. All damaged or incomplete sub-assemblies should be replaced or repaired.	prior to operation
2	Check condition of the electric system and correctness of its connection.	prior to operation
3	Check condition of the tank surface, e.g. for any cracks, deformation of walls.	●
4	Check functionality of level sensor. Check accuracy and if necessary recalibrate the flowmeter (option).	●
5	Check and clean mesh filter at the end of suction hose and at the delivery nozzle, if necessary also at the pump and flowmeter (see pictures below).	●
6	Check and if necessary clean inside of the machine. At the tank bottom layers of contaminations can collect, e.g. water, glycerine, sediments. In case of contamination, e..g. with liquid forbidden for use with the machine; additionally disassemble whole distribution system and clean its elements.	●
7	Check and if necessary replace brushes and fuse in pump motor.	●
8	Check and if necessary replace collecting plates of the pump rotor.	●
9	Unscrew and check functionality of venting ferrule.	●
10	Check functionality of distribution system.	●
11	Clean accessories and wash the machine on the outside.	●
12	Check and if necessary tighten all fitting elements, e.g. bolts, clamps, nuts etc. Check fittings for any leakage.	●
13	Protect metal elements against corrosion. Rubber elements (distribution hose, delivery nozzle shield) protect with rubber maintenance agents.	●
14	Check the machine labelling.	●

„●” means frequency every 6 months or every 50 000 liters of refuelled fuel depending on which occurs as the first.

End of suction hose with mesh filter



Mesh filter in delivery nozzle

BP3000 pump rotor

VI. TROUBLESHOOTING

Item	DEFECT	CAUSE	ADVICE
1	Distribution system leak	Damaged conection.	Dismantle connection, install new sealing.
2	Insufficient flowmeter accuracy	Flowmeter miscalibration.	Perform recalibration.
		Contaminated flowmeter chamber.	Dismantle and clean flowmeter chamber.
		Air content in oil.	Find and remedy leak in pump/suction line.
3	Reduced flow rate.	Blocked or contaminated filter on one of the hoses or at delivery nozzle.	Locate and remove contamination.
		Air in pump, air in oil.	Vent pumping system, check tightness of suction line.
		Incorrect pump power supply.	Check voltage of power.
		Blocked flowmeter measuring chamber.	Dismantle the flowmeter and remove blocking cause.
		Worn or damaged plates in pump rotor.	Replace pump plates.
4	Noise increase during pump operation.	Air in oil.	Find and remedy leak.
5	Motor is not rotating.	No power supply.	Ensure correct power supply.
		Rotor jammed.	Check rotating parts of pump and motor.
		Pump thermal protection tripped.	Wait until motor cools down.
6	Lack of flowmeter LCD display indications.	Worn batteries of lack of connection.	Check the batteries.
		Damages electronic system.	Contact the distributor.
7	Digital flowmeter counter despite displaying does not count units correct flow rate value.	Gears have been incorrectly installed after cleaning.	Instal gears correctly.
		Possible problem with electronic system.	Contact the distributor.
8	Digital flowmeter counter does not count units.	Incorrect installation of gears.	Instal gears correctly.
		Reed switch damaged.	Replace reed switch.
9	Tank deformation during refuelling.	Ventilation blocked.	Check ventilation.
		Too fast speed of refuelling.	Reduce refuelling speed.
10	Faulty operation of level indicator.	Indicator floater blocked in guiding pipe.	Disassemble indicator and clean floater guiding pipe.
		Oil visible in indicator disc.	Replace level indicator.
		Clock mechanism does not work.	Replace level indicator.

VII. UTILIZATION OF TANKS

In order to protect the environment the tanks excluded from the operation must not be disposed of together with unsorted household waste.

After a lifetime the tanks must be disposed of in accordance with European Directive 2002/96/EC.

Recycling should be carried out by a specialist company. Tanks must be cleaned of residual oil, cutup, divided into different components - made of plastic, rubber, metal, electronic components.

Each material and should be recycled or disposed of in accordance with current regulations. The resulting waste cannot be mixed with other waste, if it endangers the environment.

VIII. TERMS OF WARRANTY

1. The manufacturer issues warranty for:
   - 5 years for tank leakproofness,
   - 2 years for distribution system and other equipment of the machine.
2. When reporting failure the first step is to send Service Order (Defect Report Sheet) in writing (e.g. by fax), to Kinsgpan Environmental Sp. z o.o.
3. Defects revealed within guarantee period shall be remedied within two weeks following the date of report in writing.
   Guaranteed response time to notification is 48 hours on business days.
   Defect reports are received 24/7. Report acceptance time for reports sent from 4 p.m. to 8 a.m., and on holidays and weekends, is 8 a.m. the following business day.
4. Upon service ordering, Purchaser agrees to be charged for services outside the scope of guarantee offered by Service Centre authorized by manufacturer. Kingspan Environmental Sp. z o.o. verifies reports, supports purchaser of service, and authorized service centre, to ensure the most effective performance of order. However, the company is not the party in settlements between Purchaser and service Contractor.
5. The warranty does not include damages or premature wear of subassemblies resulting from lack of standard maintenance service such as cleaning of filters, replacement of batteries, calibration of flowmeter etc. The warranty repairs do not cover defects resulting from incorrect operation of the machine, not compliant with the manufacturers' manual and with additional manuals of accessories, pump, flowmeter or delivery nozzle. In all aforementioned cases, the reporting party shall be charged with service costs.
6. Purchaser forfeits guarantee rights in the following cases:
   - damages due to improper transportation, storage or random events,
   - failure to ensure maintenance, mechanic damages, acts of vandalism,
   - defects due to unauthorized repairs or modifications by service not authorized by the manufacturer,
   - using not original parts or subassemblies for service works,
   - changing product purpose,
   - if damages or premature wear result from incorrect operation of the machine.
7. **Company Kingspan Environmental Sp. z o.o. is not responsible for damages and losses resulting from incorrect operation and operation contrary to the product operation manual and to legal regulations.**

IX. BASIS FOR THE INSTRUCTION MANUAL

1. ADR 2011 - The European Agreement concerning the International Carriage of Dangerous Goods by Road, issue 01/01/2011.
2. Certificate issued by TNO Certification B.V.Packaging Research for OTM00420DG no **413.**
3. Certificate issued by TNO Certification B.V.Packaging Research for OTM00900DG no **448.**
4. Manuals for sub-assemblies produced by PIUSI.

X. INSPECTION AND CHECK REPORT (FOR INSPECTIONS AND CHECKS PERFORMED BY OWNER/USER)

Tank inspection report form

Manufacturer: Kingspan Environmental Sp. z o.o.
Address: Topolowa 5
Postal code, city 62-090 Rokietnica

☐ OTM00420DG (400 L) UN **31 31H2/Y/**--/NL/Truckmaster 413/0/575**

☐ OTM00900DG (900L) UN **31 31H2/Y/**--/NL/Truckmaster 448/0/1237**

„☐" – *tick appropriate tank* „****--** *" - fill in according to tank rating plate*

Tank serial number: ……

Owner (name, address, telephone) **User (name, address, telephone)**

…… ……

…… ……

…… ……

Commissioning inspection / Periodic check performed by user/owner on annual basis

Full name of inspecting person	Inspection date	Internal condition	External condition	Operation equipment	Labelling legibility

*Report coding: **O** = pursuant to specifications and instructions **X** = specifications and instructions*
In case of irregularities, fill in the fault and repair report.

Fault and Repair Report

Full name and date	Description of faults and measures taken to repair them

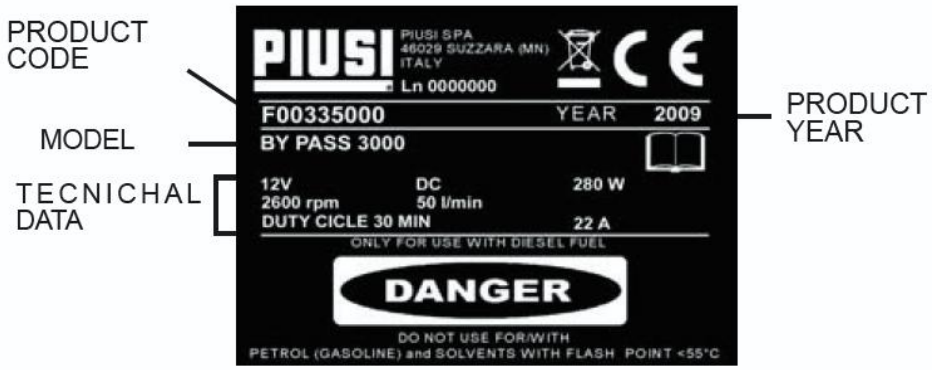
XI. USE AND MAINTENANCE MANUAL BY PASS 3000 12V / 24V DC

A. INDEX

B. MACHINE AND MANUFACTURER IDENTIFICATION

Available Models:

- By-pass 3000 12–24 V DC
- Carry 3000
- Battery kit 3000



C. DECLARATION OF CONFORMITY

The undersigned

PIUSI S.p.A
Via Pacinotti, c.m.-z.i.Rangavino
46029 Suzzara-Mantova-Italy

HEREBY STATES, under its own responsibility, that the partly-completed machinery:

Description: **Machine for diesel oil transfer**

Model: **By-pass 3000 12–24 V DC / Carry 3000 / Battery kit 3000**

Serial number: refer to Lot Number shown on CE plate affixed to product

Year of manufacture: refer to the year of production shown on the CE plate affixed to the product.

Is intended to be incorporated in a machine (or to be with other machines) so as to create a machine to which applies Machine Directive 2006/42/EC, may not be brought into service before the machine into which it is to be incorporated has been declared in conformity with the provisions of the directive 2006/42/EC.

Is in conformity with the legal provisions indicated in the directives:

- Machine Directive 2006/42/EC,

- Electromagnetic Compatibility Directive 2004/108/EC.

To which the essential safety requirements have been applied and complied with what indicated on annex I of the machine directive applicable to the product and shown below:

1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 2.2, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 6.5.

The documentation is at the disposal of the competent authority following motivated request at Piusi S.p.A. or following request sent to the email address: doc_tec@piusi.com

The person authorised to compile the technical file and draw up the declaration is Otto Varini as legal representative.

Suzzara, 29/12/2009 Podpis

D. MACHINE DESCRIPTION

PUMP: Self-Priming, volumetric, rotating vane pump, equipped with by-pass.

MOTOR: Brush motor, DC, low tension with intermittent cycle, closed type in protection class IP55 according to CEI-EN 60034-5, directly flanged to the pump body.

D1 MOVING AND TRANSPORT

Due to the limited weight and dimensions of the pumps, special lifting equipment is not required to move them. The pumps are carefully packed before dispatch. Check the packing when receiving the material and store in a dry place.

E. GENERAL NOTES

E1 GENERAL INFORMATIONS

- Before connecting and operating the unit, you must wear your personal protective equipment (PPE).
- Make sure that the tubing and line accessories are in good condition. Gasoline leaks can damageobjects and injure persons.
- During operation a few parts may reach high temperatures and result in burns if touched.

Extreme operating conditions can cause the temperature of the motor to rise and even to stop following the intervention of the electronic controls. Switch off the pump and wait for it to cool down before using again

ATTENTION
Before starting up the system, make sure that pump has been assembled correctly,with all lids correctly closed.

E2 FIRST AID RULES

EYES: If the gasoline comes into contact with the eyes, rinse immediately with a lot of water. Emergency measures are not necessary. However, should the eyes show suspicious symptoms, seek medical assistance.

SKIN: Rinse the contaminated part immediately with water and soap. Emergency measures are not necessary, but if the skin shows suspicious symptoms, seek medical assistance.

INHALATION: Take the affected person out into the open air: If s/he does not recover rapidly, seek medical assistance.

SWALLOWING: DO NOT INDUCE VOMITING. Emergency measures are not necessary, but should there be signs of illness,seek medical assistance.

PERSONS WHO HAVE SUFFERED ELECTRIC SHOCK: disconnect the power source, or use a dry insulator to protect yourself while you move the injured person away from any electrical conductor. Immediately call for help from qualified and trained personnel. Do not operate switches with wet hands.

E3 USING AND LOOKING AFTER MANUALS

This manual illustrates the main features of pump, providing information regarding:- Electrical and mechanical installation- First start-up operations- Daily use- General safety rules. This manual represents an integral and essential part of the product and, according to the provisions of directive 2006/42/CE, must be given to operators and maintenance staff in order to comply with the obligations relating to training/information referred to in directive 2006/42/CE. Carefully read the instructions contained in this manual, as they contain important information regarding installation safety, operation and maintenance. The manufacturer disclaims all liability for injury to persons or damage to things, or the machine, in the event of this being used in a way different to that indicated in the instructions.

E4 DISPOSING OF CONTAMINATED MATERIALS

In case of maintenance or demolition by the product, the parts that make it up must be sent to companies that specialize in the disposal and recycling of industrial refuse and, in particular:

DISPOSAL OF PACKING MATERIAL: The packaging consists of biodegradable cardboard which can be delivered to companies for normal recycling of cellulose.

DISPOSAL OF METAL COMPONENTS: Metal parts, whether paint-finished or in stainless steel, aluminium, brass can be consigned to scrap metal collectors.

DISPOSAL OF ELECTRIC AND ELECTRONIC COMPONENTS: These have to be disposed by companies that are specialised in the disposal of electronic components, in accordance with the instructions of 2002/96/EC (see text of Directive below).

INFORMATION REGARDING THE ENVIRONMENT FOR CLIENTS RESIDING WITHIN THE EUROPEAN UNION: European Directive 2002/96/EC requires that all equipment marked with this symbol on the product and/or packaging not be disposed of together with non-differentiated urban waste. The symbol indicates that this product should be disposed of separately from regular household waste streams. It is the responsibility of the owner to dispose of these products as well as other electric or electronic equipment by means of the specific refuse collection structures indicated by the government or the local governing authorities.

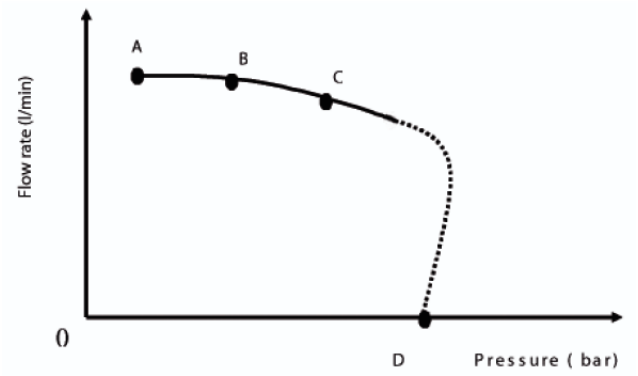
DISPOSAL OF OTHER PARTS: Other components, such as pipes, rubber gaskets, plastic parts and wires, must be disposed of by companies specialising in the disposal of industrial waste.

F. TECHNICAL DATA

F1 PERFORMANCE SPECIFICATIONS

The performance diagram shows flow rate as a function of back pressure.

Functioning Point	Flow Rate	Voltage (V)	Absorption (A)	Typical Delivery Confi guration			
				4 meters of 3/4" tube	K33 Meter	Manual dispensing nozzle	Automatic dispensing nozzle
A (Maximum Flow Rate)	50	12	15	*		*	
		24	8				
B (High Flow Rate)	48	12	16	*	*	*	
		24	8,5				
C (Rated Conditions)	46	12	17	*	*		*
		24	9				
D (By pass)	0	12	21	Delivery Closed			
		24	12				



ATTENTION
The curve refers to the following operating conditions:
Fluid Diesel Fuel
Temperature 20°C
Suction Conditions Suction Conditions The tube and the pump position relative to the fluid level is such that a pressure of 0.3 bar is generated at the nominal flow rate.
Under different suction conditions higher pressure values can be created that reduce the flow rate compared to the same back pressure values.
To obtain the best performance, it is very important to reduce loss of suction pressure as much as possible by following these instructions:

- **Shorten the suction tube as much as possible**
- **Avoid useless elbows or throttling in the tubes**
- **Keep the suction filter clean**
- **Use a tube with a diameter equal to, or greater than, indicated (see Installation)**

G. ELECTRICAL SPECIFICATIONS

PUMP MODEL	FUSES	ELECTRICAL POWER		CURRENT
		Current	Voltage (V)	Maximum(*) (A)
VERSION 12V	25	DC	12	22
VERSION 24V	15	DC	24	12

(*) referred to operations in by-pass mode

H. OPERATING CONDITIONS

H1 ENVIRONMENTAL CONDITIONS

TEMPERATURE: min. -20°C / max. +60°C
RELATIVE HUMIDITY : max. 90%

ATTENTION
The temperature limits shown apply to the pump components and must be respected to avoid possible damage or malfunction.

H2 ELECTRICAL POWER SUPPLY

N.B.: THE PUMP SHOULD BE POWERED BY A SAFE SOURCE: BATTERY OR POWER SUPPLY 12/24V WITH SAFETY TRANSFORMER.
OR POWER SUPPLY 12/24V WITH SAFETY TRANSFORMER. In accordance with the model, the pump must be powered by a direct current line, the nominal values of which are indicated on the table in the paragraph “G – ELECTRICAL SPECIFICATIONS”.

The maximum acceptable variations from the electrical parameters are: Voltage: +/- 10% of the nominal value

ATTENTION
Power supply from lines with values that do not fall within the indicate limits could cause damage to the electrical components and reduction of working performance.

H3 WORKING CYCLE

The pumps are designed for intermittent use with a working cycle of 30 minutes under maximum back pressure conditions.

ATTENTION
Functioning under by-pass conditions is only allowed for brief periods of time (2-3 minutes maximum).

H4 FLUIDS PERMITTED / FLUIDS NOT PERMITTED

PERMITTED:
DIESEL FUEL at a VISCOSITY from 2 to 5.35 cSt (at a temperature of 37.8° C)
Minimum Flash Point (PM): 55°C

NOT PERMITTED:	RELATED DANGERS:
- GASOLINE	- FIRE EXPLOSION
- INFLAMMABLE LIQUIDS with PM < 55° C	- FIRE EXPLOSION
- WATER	- PUMP OXIDATION
- FOOD LIQUIDS	- CONTAMINATION OF THE SAME
- CORROSIVE CHEMICAL PRODUCTS	- PUMP CORROSION INJURY TO PERSONS
- SOLVENTS	- FIRE – EXPLOSION DAMAGE TO GASKET SEALS
- LIQUIDS WITH VISCOSITY>20CsT	- MOTOR OVERLOAD

I. INSTALLATION

I1 PRELIMINARY INSPECTION

Verify that all components are present. Request any missing parts from the manufacturer.

- Check that the machine has not suffered any damage during transport or storage.
- Carefully clean the suction and delivery inlets and outlets, removing any dust or other packaging material that may be present.
- Make sure that the motor shaft turns freely.
- Check that the electrical data corresponds to those indicated on the data plate.
- Always install in an illuminated area.
- Install the pump in ventilated place to avoid any vapours accumulation.
- We recommend that a suction filter be used.

I2 POSITIONING THE PUMP

The pumps can be installed in any position (with pump axis in vertical or horizontal position). The pump must be securely attached by means of the provided fixing bracket and fixing screws.

ATTENTION
THE MOTORS ARE NOT OF THE ANTI-EXPLOSIVE-TYPE.
DO NOT install them where inflammable vapours could be present.

I3 NOTES ON SUCTION AND DELIVERY LINES

I3.1 DELIVERY

The selection of the pump model must be made taking into account the characteristics of the system. The combination of the length of the pipe, the diameter of the pipe, the flow rate of the diesel or other liquid, as well as the accessories installed on the line, could create back pressure that are greater than the maximum predicted pressure, thereby causing the pump's electronic controls to intervene and reducing the dispensed flow considerably. In these cases, to guarantee correct operation of the pump, it is necessary to reduce the resistance of the system using pipes that are shorter or that have a greater diameter, as well as line accessories with smaller resistances (e.g. an automatic dispensing nozzle with greater flow rate capacity).

I3.2 SUCTION

The self-priming pumps have a good suction capability. During the start-up phase, when the suction pipe is empty and the pump is wet with the fluid, the electric pump unit is able to suck liquid from a maximum vertical distance of 2m. It is important to note that it could take up to 1 minute for the pump to prime and that the presence of an automatic dispensing nozzle on the delivery side will prevent the air trapped during the installation from being released and, therefore, the correct priming of the pump. For this reason, it is always advisable to prime the pump without an automatic delivery nozzle, verifying the proper wetting of the pump. Always install a foot valve to prevent the suction pipe from being emptied and to keep the pump wet at all times. In this way, the pump will always start up immediately the next times it is used.
When the system is in operation, the pump can operate with back pressures of up to 0.5 bars on the suction inlet; beyond this point, the pump may begin to cavitate resulting in a drop of the flow rate and an increase in the noise levels of the system. In light of this, it is important to guarantee small back pressures on the suction side, by using short pipes with diameters that are equal to or larger than those recommended, reducing bends to a minimum, and using filters with a large cross-section and foot valves with minimum possible resistance on the suction side. It is very important to keep the suction filters clean because, when they become clogged, they increase the resistance of the system. The vertical distance between the pump and the fluid must be kept as short as possible, and it must fall within the 2m maximum required for priming. If the distance is greater, a foot valve must be installed to allow the suction pipes to fill up and the diameter pipes must be larger. It is however recommended that pump not be installed if the vertical distance is greater than 3m.

ATTENTION
If the suction tank is higher than the pump, an anti-siphon valve should be installed to prevent accidental diesel fuel leaks. Size the installation to contain the back pressures caused by water hammering.

ATTENTION
It is a good system practice to install vacuum and air pressure gauges right at the inlets and outlets of the pump, which allow verifi cation that operating conditions are within anticipated limits. To prevent the suction pipes from being emptied when the pump stops, a foot valve should be installed.

THE INSTALLER IS RECOMMENDED TO INSTALL A SUCTION FILTER.

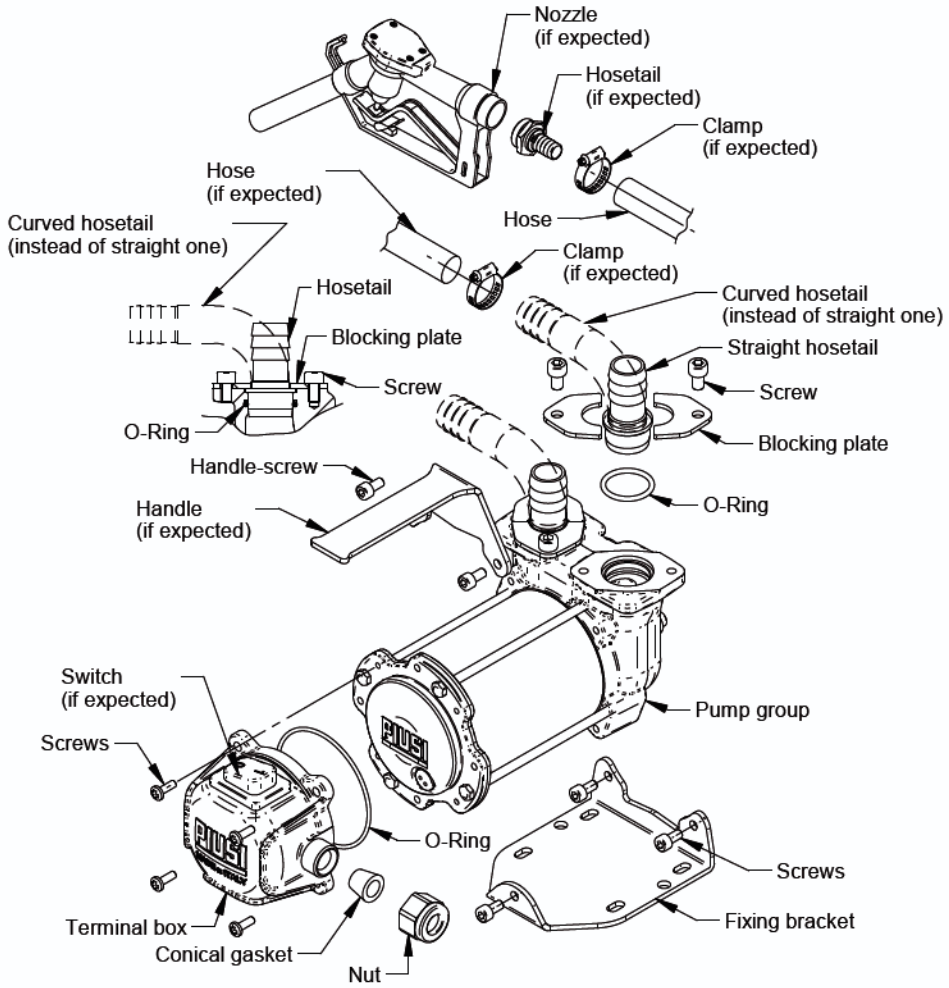
I4 CONFIGURATION AND ACCESSORIES

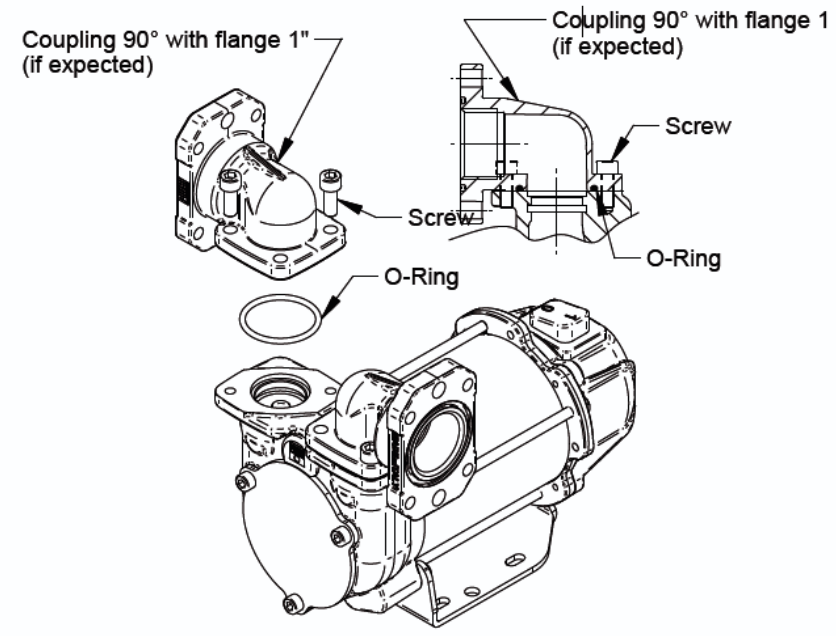
The wide range of accessories and the possibility to fit the base in different posititions allow the pump to be used for different installations.

The installation is stationary if the provided fixing bracket is used while it is mobile if the handle is used (if required).

LIST OF ACCESSORIES::

- fixing bracket,
- straight hosetails,
- 90° Curved hosetails,
- Coupling 90° with flange 1”
- Handle
- Kit terminal box (with or w/out switch). If the terminal board kit is present and the switch is in position “0”, the pump is switched OFF while if the switch in in position “I” , the pump is working.


Nozzle
(if expected)
Hosetail
(if expected)
Clamp
(if expected)
Hose
(if expected)
Curved hosetail
(instead of straight one)
Hose
Clamp
(if expected)
Hosetail
Blocking plate
Screw
O-Ring
Curved hosetail
(instead of straight one)
Straight hosetail
Screw
Blocking plate
Handle-screw
Handle
(if expected)
O-Ring
Switch
(if expected)
Screws
Pump group
O-Ring
Screws
Fixing bracket
Terminal box
Conical gasket
Nut


Coupling 90° with flange 1"
(if expected)
Coupling 90° with flange 1
(if expected)
Screw
Screw
O-Ring
O-Ring

I5 LINE ACCESSORIES

ATTENTION
It is the responsibility of the installer to provide the necessary line accessories to ensure the correct and safe operation of the pump. The accessories that are not suitable to be used with the indicated material could damage the pump or cause injury to persons, as well as causing pollution.

IT IS THE INSTALLER'S RESPONSIBILITY TO APPLY THE FOLLOWING SIGNALS ON THE MACHINE ANYWHERE PUMP WILL BE USED.

L. CONNECTIONS

L1 ELECTRICAL CONNECTIONS

GENERAL WARNINGS :
IT IS THE RESPONSIBILITY OF THE INSTALLER TO CARRY OUT THE ELECTRICAL CONNECTIONS IN COMPLIANCE WITH THE APPLICABLE REGULATIONS.

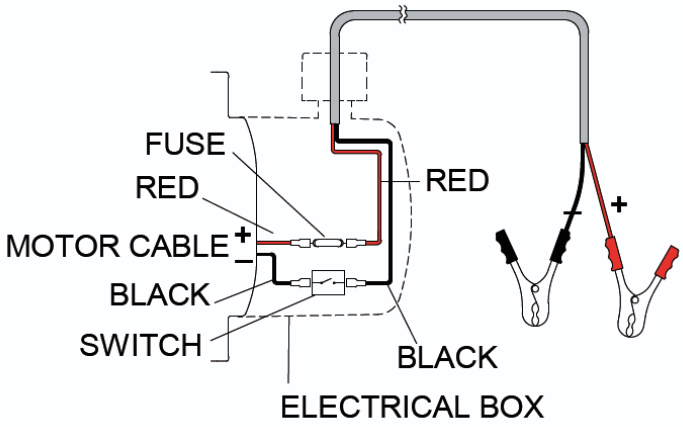
Comply with the following (not exhaustive) instructions to ensure a proper electrical connection:

- Before installation and maintenance make sure that power supply to the electric lines has been turned off;
- Use cables with minimum cross-sections, rated voltages and installation type that are suitable for the characteristics indicated in paragraph G ELECTRICAL SPECIFICATIONS.
- Always close the cover of the terminal strip box before switching on the power supply, after having checked the integrity of the seal gaskets that ensure the IP55 protection grade.
- Cables with faston connector coupling for connection to the power supply line;
- RED cable: positive pole (+)
- BLACK cable: negative pole (-)
- Terminal strip box (protection class IP55 in conformance with the directive EN 60034-5-97) complete of:

- ON/OFF switch;

- Safety fuse against short circuits and overcurrent, featuring the following characteristics:
  25A for 12V models
  15A for 24V models

- power cable complete of pincers for connection to the battery
- RED cable: positive pole (+)
  BLACK cable: negative pole (-)



ATTENTION
It is the installer's responsibility to perform the electrical connections with respect for the applicable regulations.

L2 CONNECTING THE PIPING

- Before any connections, please refer to the indications (sticker on the pump) to detect suction and delivery univocally.
- Before connecting, make sure that the pipes and the suction tank are free of dirt and thread residue, which could damage the pump and accessories.
- Before connecting the delivery pipes, partially fill the pump body with the liquid that needs to be pumped (available only for versions with threaded inlet/outlet).
- Do not use conical threaded fittings, which could damage the threaded inlet or outlet openings of the pumps if excessively tightened.

The MINIMUM recommended characteristics for hoses are as follows:

SUCTION PIPES:
- recommended minimum nominal diameter:
- nominal recommended pressure: 10 bar
- use pipes that are suitable for operation with back pressure.

DELIVERY PIPES:
- recommended minimum nominal diameter:
- nominal recommended pressure: 10 bar

ATTENTION
The provided tubes have a resistivity of <1 MOhm, as specifi ed by the EN 13617-1 standard. All the installed tubes that are different from those supplied, must have the above mentioned characteristics. When the connections are completed, the installer should check that the resistivity of the assembly complies with the EN 13617 and EN 13612 standards.

The use of tubes that are not suitable could cause damage to the pump or to persons, as well as pollution. Loosening of the connections (threaded connections, flanges, gasket seals) could cause serious ecological and safety problems. Check all the connections after the first installation on a daily basis. If necessary, tighten all the connections.

M. INITIAL START-UP

- Check that the quantity of diesel fuel in the suction tank is greater than the amount you wish to transfer.
- Make sure that the residual capacity of the delivery tank is greater than the quantity you wish to transfer.
- Do not run the pump dry. This can cause serious damage to its components.
- Make sure that the tubing and line accessories are in good condition. Diesel fuel leaks can damage objects and injure persons.
- Never start or stop the pump by connecting or cutting out the power supply.
- Do not operate switches with wet hands.
- Prolonged contact with diesel fuel can damage the skin. The use of glasses and gloves is recommended.

ATTENTION
Extreme operating conditions with working cycles longer than 30 minutes can cause the motor temperature to rise, thus damaging the motor itself. Each 30-minute working cycle should always be followed by a 30-minute power-off cooling phase.
In the priming phase the pump must blow the air initially present in the entire installation out of the delivery line. Therefore it is necessary to keep the outlet open to permit the evacuation of the air.

ATTENTION
If an automatic type dispensing nozzle is installed at the end of the delivery line, the evacuation of the air will be difficult because of the automatic stopping device that keeps the valve closed when the line pressure is too low. It is recommended that the automatic dispensing nozzle be temporarily disconnected during the initial start-up phase.

The priming phase can last from several seconds to a few minutes, as a function of the characteristics of the system. If this phase is prolonged, stop the pump and verify:

- That the pump is not running completely dry;
- That the suction tubing is not allowing air to seep in;
- That the suction filter is not clogged;
- That the suction height does not exceed 2 m. (if the height exceeds 2 m, fill the suction hose with fluid);
- That the delivery tube is allowing the evacuation of the air.

When priming has occurred, verify that the pump is operating within the anticipated range, in particular:

- That under conditions of maximum back pressure, the power absorption of the motor stays within the values shown on the identification plate;
- That the suction pressure is not greater than 0.5 bar;
- That the back pressure in the delivery line is not greater than the maximum back pressure foreseen for the pump.

N. DAILY USE

a) If using flexible tubing, attach the ends of the tubing to the tanks. In the absence of an appropriate slot, solidly grasp the delivery tube before beginning dispensing.
b) Before starting the pump make sure that the delivery valve is closed (dispensing nozzle or line valve).
c) Turn the ON/OFF switch on. The by-pass valve allows functioning with delivery closed only for brief periods.
d) Open the delivery valve, solidly grasping the end of the tubing.
e) While dispensing, do not inhale the pumped product.
f) Should you spill any fluid while dispensing, bank it with earth or sand to absorb it and limit its spreading.
g) Close the delivery valve to stop dispensing.
h) When dispensing is finished, turn off the pump.

ATTENTION
Functioning with the delivery closed is only allowed for brief periods (2 / 3 minutes maximum). After use, make sure the pump is turned off.

O. MAINTENANCE

Thanks to the design, the pump requires simple maintenance. Before carrying out any maintenance work, disconnect the pump from any electrical and hydraulic power source. During maintenance, the use of personal protective equipment (PPE) is compulsory.
In any case always bear in mind the following basic recommendations for a good functioning of the pump:
ONCE A WEEK:

- Check that the pipe connections are not loose to prevent any leaks;
- Check and keep the filter installed on the suction line clean.

ONCE A MONTH:

- Check the pump body and keep it clean and free of any impurities;
- Check that the electrical supply cables are in good condition.

ATTENTION
Do not put your fingers into the pump openings while the pump is working.

P. NOISE LEVEL

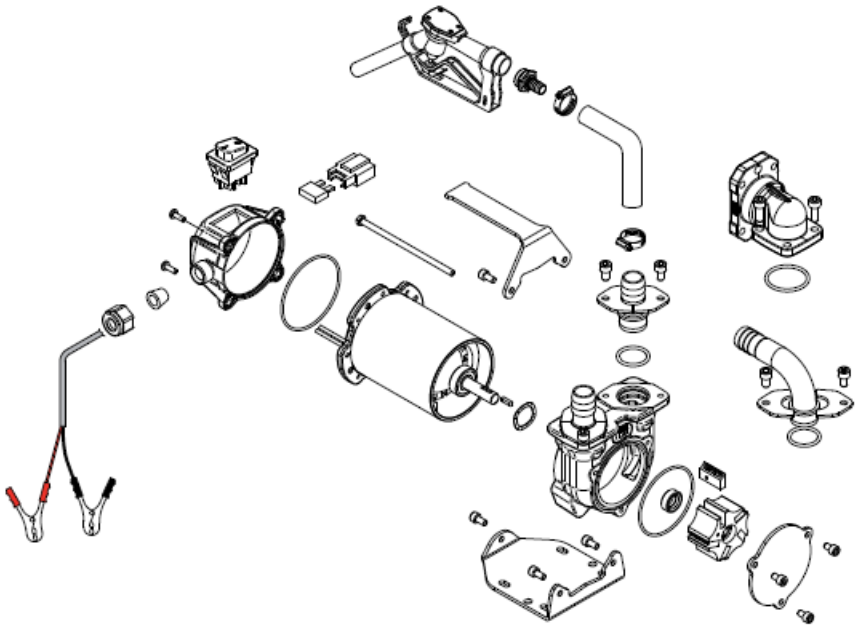
Under normal working conditions the noise emission from all models does not exceed the value of 70 db at a distance of 1 meter from the electric pump.

Q. PROBLEMS AND SOLUTIONS

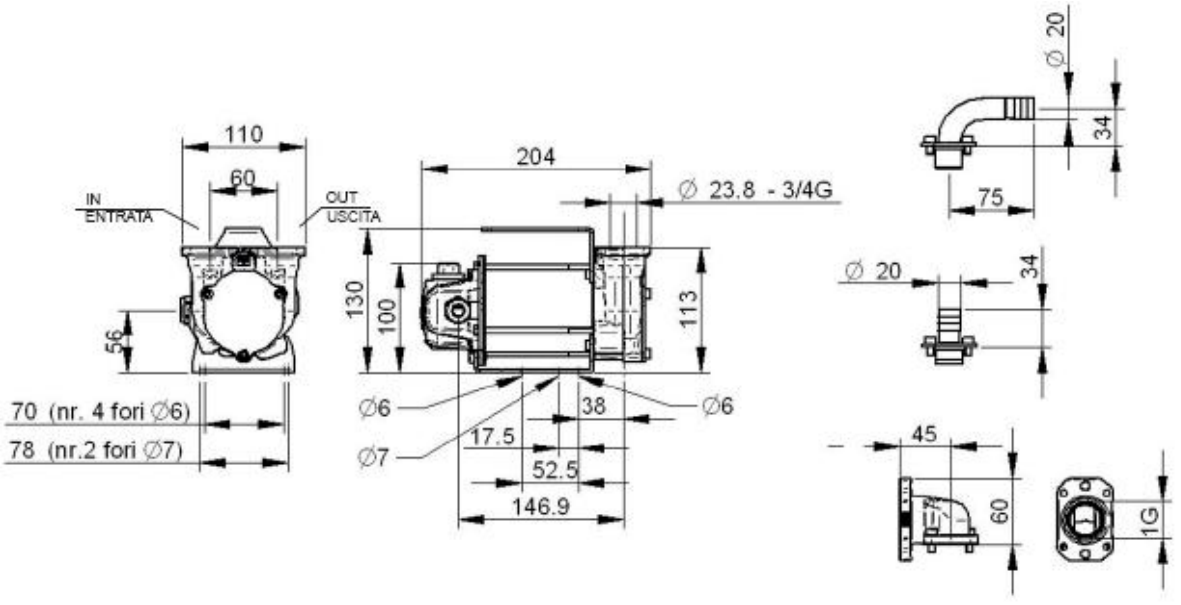
For any problems contact the authorised dealer nearest to you.

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
THE MOTOR IS NOT TURNING	Lack of electric power	Check the electrical connections and the safety systems.
	Rotor jammed	Check for possible damage or obstruction of the rotating components.
	Motor problems	Contact the Service Department
THE MOTOR TURNS SLOWLY WHEN STARTING	Low level in the suction tank	Refill the tank
LOW OR NO FLOW RATE	Low level in the suction tank	Refill the tank
	Foot valve blocked	Clean and/or replace the valve
	Filter clogged	Clean the filter
	Excessive suction pressure	Lower the pump with respect to the level of the tank or increase the crosssection of the tubing
	High loss of head in the delivery circuit (working with the by-pass open)	Use shorter tubing or of greater diameter
	By-pass valve blocked	Dismantle the valve, clean and/or replace it
	Air entering the pump or the suction tubing	Check the seals of the connections
	A narrowing in the suction tubing	Use tubing suitable for working under suction pressure
	Low rotation speed	Check the voltage at the pump Adjust the voltage and/or use cables of greater cross-section
	The suction tubing is resting on the bottom of the tank	Raise the tubing
INCREASED PUMP NOISE	Cavitation occurring	Reduce suction pressure
	Irregular functioning of the by-pass	Dispense fuel until the air is purged from the by-pass system
	Air present in the diesel fuel	Verify the suction connections
LEAKAGE FROM THE PUMP BODY	Seal damaged	Check and replace the seal

R. EXPLODED VIEWS



S. OVERALL DIMENSIONS



Pump weight: 3.5 Kg
Pump weight+Packaging: 4.3 Kg (Can be different according to the configuration)

XII. USE AND MAINTENANCE MANUAL PANTHER 12/24V DC

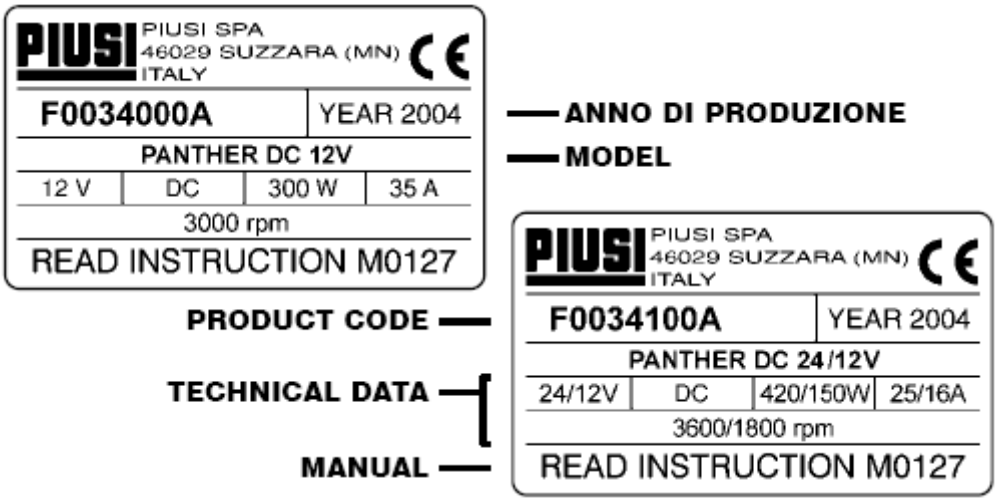
A. INDEX

B. MACHINE AND MANUFACTURER IDENTIFICATION

Available Models:

- **PANTHER DC 12V**
- **PANTHER DC 24/12V**

MANUFACTURER: **PIUSI SPA VIA PACINOTTI - Z.I. RANGAVINO 46029 SUZZARA (MN)**
IDENTIFICATION PLATE (EXAMPLE WITH THE FIELDS IDENTIFIED):



ATTENTION
Always check that the revision level of this manual coincides with what is shown on the identification plate.

C. DECLARATION OF CONFORMITY

DECLARATION OF INCORPORATION

The undersigned, representing the following manufacturer

PIUSI S.p.A.
46029 SUZZARA (MANTOVA) ITALY

hereby CERTIFIES that the equipment described below:

- **PANTHER DC 12V**
- **PANTHER DC 24/12V**

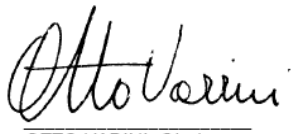
Complies with the following regulations and directives directives:

EN 292-1 - Safety of Machinery - Basic Concepts, General Principles for Design - Basic terminology, methodology.
EN 292-2 - Safety of Machinery - Basic Concepts, General Principles for Design - Technical principles and specifications.
EN 294 - Safety of Machinery - Safety distances to prevent danger zones being reached by the upper limbs.
EN 61000-6-1 - Electromagnetic compatibility - Generic standards - Immunity for residential, commercial and light-industrial environments.

EN 61000-6-3 - Electromagnetic compatibility - Generic standards - Emission standard for residential, commercial and light-industrial environments.
EN 60204-1 - Safety of Machinery - Electrical equipment of machines - General requriments.
EN 60335-1 - Household and similar appliances - Safety - General requirements.
EN 60335-2-41/A1 - Household and similar appliances - Safety - Particular requirements for pumps.
EN 60335-2-75 - Household and similar appliances - Safety - Particular requirements for commercial dispensing appliances and vending machines (electrical or gas powered).

And is in conformity with the following Italian National Decrees:
MD 31.07.1934 -Heading 1 No. XVII
Approval of the Applicable Safety Rules for the Storing, Use and Transport of Mineral Oils.
Last two figures of the year of CE marking: **04**

Suzzara 01.01.2004



OTTO VARINI, Chairman

D. MACHINE DESCRIPTION

PUMP: Self-Priming, volumetric, rotating vane pump, equipped with by-pass valve.

MOTOR: Brush motor, DC, low tension with intermittent cycle, closed type in protection class IP55 according to CEI-EN 60034-5, directly flanged to the pump body.

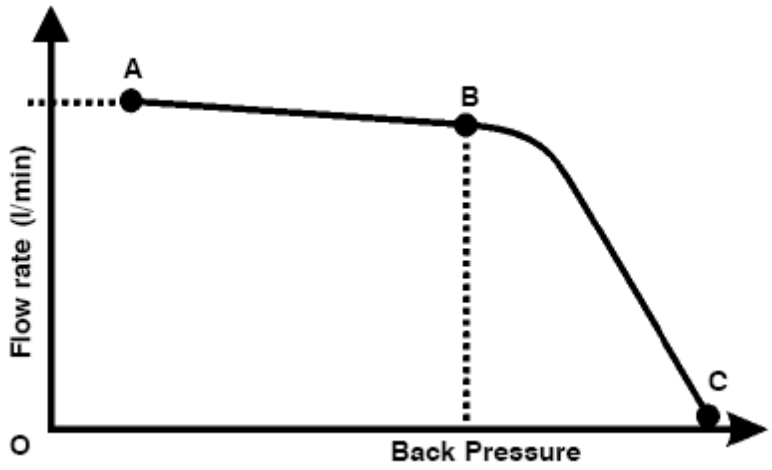
FILTER: Checkable suction filter.

E. TECHNICAL SPECIFICATIONS

E1 PERFORMANCE SPECIFICATIONS

The performance diagram shows flow rate as a function of back pressure.

	Model		Flow Rate (l/min)	Voltage (Volt)	Absorption (A)	Pressure (Bar)	Tipica configurazione in mandata			
							4 meters of 3/4" tube	K33	Manual dispensing nozzle Self 2000	Automatic dispensing nozzle PA60
A (Maximum Flow Rate)	24V / 12 V	12	35	12	8	0.5	▪		▪	
		24	72	24	15	0.5				
	12V	12	60	12	16	0.6	▪		▪	
B (Rated Conditions)	24V / 12V	12	33	12	11	1	▪	▪		▪
		24	66	24	19	1.2				
	12V	12	56	12	23	1.1	▪	▪		▪
C (By Pass)	24V / 12V	12	0	12	16	2	Delivery Closed			
		24	0	24	25	2.6				
	12V	12	0	12	35	2.5				



ATTENTION
The curve refers to the following operating conditions:

Fluid	Diesel Fuel
Temperature	20°C
Suction Conditions	The tube and the pump position relative to the fluid level is such that a pressure of 0.3 bar is generated at the nominal flow rate.

Under different suction conditions higher pressure values can be created that reduce the flow rate compared to the same back pressure values.

To obtain the best performance, it is very important to reduce loss of suction pressure as much as possible by following these instructions:

- Shorten the suction tube as much as possible.
- Avoid useless elbows or throttling in the tubes.
- Keep the suction filter clean.
- Use a tube with a diameter equal to, or greater than, indicated (see Installation).

The burst pressure of the pump is of 20bar.

E2 ELECTRICAL SPECIFICATIONS

PUMP MODEL	FUSES	ELECTRICAL POWER		CURRENT
		Current	Voltage (V)	Maximum (*) (Amp)
PANTHER DC 12V	40 A	DC	12	35
PANTHER DC 24/12V	30 A	DC	24 / 12	25 / 16

(*) referred to operations in by-pass mode.

F. OPERATING CONDITIONS

F1 ENVIRONMENTAL CONDITIONS

TEMPERATURE: min. -20° C / max +60° C

RELATIVE HUMIDITY: max. 90%

ATTENTION
The temperature limits shown apply to the pump components and must be respected to avoid possible damage or malfunction.

F2 ELECTRICAL POWER SUPPLY

Depending on the model, the pump must be supplied by a single-phase alternating current line whose nominal values are shown in the table in Paragraph E2 - ELECTRICAL SPECIFICATIONS.

The maximum acceptable variations from the electrical parameters are:

Voltage: +/-5% of the nominal value

ATTENTION
Power from lines with values outside the indicated limits can damage the electrical components.

F3 WORKING CYCLE

The pumps are designed for intermittent use with a working cycle of 30 minutes under maximum back pressure conditions.

ATTENTION
Functioning under by-pass conditions is only allowed for brief periods of time (2-3 minutes maximum).

F4 FLUIDS PERMITTED / FLUIDS NOT PERMITTED

PERMITTED:

- DIESEL FUEL at a VISCOSITY from 2 to 5.35 cSt (at a temperature of 37.8° C)
  Minimum Flash Point (PM): 55°C

NOT PERMITTED:

- GASOLINE
- INFLAMMABLE LIQUIDS with PM < 55° C
- LIQUIDS WITH VISCOSITY>20CsT
- WATER
- FOOD LIQUIDS
- CORROSIVE CHEMICAL PRODUCTS
- SOLVENTS

RELATED DANGERS:

- FIRE – EXPLOSION
- FIRE – EXPLOSION
- MOTOR OVERLOAD
- PUMP OXIDATION
- CONTAMINATION OF THE SAME
- PUMP CORROSION
  INJURY TO PERSONS
- FIRE – EXPLOSION
  DAMAGE TO GASKET SEALS

G. MOVING AND TRANSPORT

Given the limited weight and size of the pumps (see overall dimensions), **moving the pumps does not require the use of lifting devices.**

The pumps were carefully packed before shipment.

Check the packing material on delivery and store in a dry place.

H. INSTALLATION

H1 DISPOSING OF THE PACKING MATERIAL

The packing material does not require special precautions for its disposal, not being in any way dangerous or polluting.

Refer to local regulations for its disposal.

H2 PRELIMINARY INSPECTION

- Check that the machine has not suffered any damage during transport or storage.
- Clean the inlet and outlet openings, removing any dust or residual packing material.
- Should the pump be without power cables, set the reeds in the terminal strip box to the desired voltage.
- Check that the electrical specifications correspond to those shown on the identification plate.

H3 POSITIONING THE PUMP

- The pump can be installed in any position (pump axis vertical or horizontal).
- Attach the pump using screws of adequate diameter for the attachment holes provided in the base of the pump (see the section "OVERALL DIMENSIONS" for their position and dimension).

ATTENTION
THE MOTORS ARE NOT OF AN ANTI-EXPLOSIVE TYPE.
Do not install them where inflammable vapours can be present.

H4 CONNECTING THE TUBING

- Before connection, make sure that the tubing and the suction tank are free of dirt and thread residue that could damage the pump and its accessories.
- Before connecting the delivery tube, partially fill the pump body with diesel fuel to facilitate priming.
- Do not use conical threaded joints that could damage the threaded pump openings if excessively tightened.

SUCTION TUBING:
- Minimum recommended nominal diameter: 1"
- Nominal recommended pressure: 10 bar
- Use tubing suitable for functioning under suction pressure

DELIVERY TUBING:
- Minimum recommended nominal diameter: 3/4"
- Nominal recommended pressure: 10 bar

ATTENTION
It is the installer's responsibility to use tubing with adequate characteristics.

The use of tubing unsuitable for use with diesel fuel can damage the pump, injure persons and cause pollution.
Loosening of the connections (threaded connections, flanging, gasket seals) can cause serious ecological and safety problems.
Check all the connections after the initial installation and on a daily basis after that.
Tighten the connections, if necessary.

H5 CONSIDERATIONS REGARDING DELIVERY AND SUCTION LINES

DELIVERY

The choice of pump model must be made keeping the **characteristics of the system** in mind.

The combination of the length of the tubing, the diameter of the tubing, the flow rate of the diesel fuel and the line accessories installed
can create back pressure **greater than the maximums anticipated** such as to cause the (partial) opening of the pump by-pass with the consequent noticeable reduction of the flow rate supplied.

In such cases, to allow correct functioning of the pump, **it is necessary to reduce system resistance, using shorter tubing and/or of wider diameter** and line accessories with less resistance (e.g. an automatic dispensing nozzle for greater flow rates).

SUCTION

PANTHER DC models are equipped with a self-priming pump with a good suction capacity.

During the start-up phase, with an empty suction tube and the pump wetted with fluid, the electric pump unit is capable of suctioning the liquid with a maximum difference in height of 2 meters. It is important to point out that the priming time can be as long as one minute and the
presence of an automatic dispensing nozzle on the delivery line prevents the evacuation of air from the installation, and, therefore, prevents proper priming.

For this reason, it is always advisable to prime the pump without an automatic delivery nozzle, verifying the proper wetting of the pump. The installation of a foot valve is recommended to prevent the emptying of the suction tube and to keep the pump wet. In this way, the pump will subsequently always start up immediately.

When the system is functioning, the pump can work with pressure at the inlet as high as 0.5 bar, beyond which cavitation phenomena can begin, with a consequent loss of flow rate and increase of system noise.

As we have said up to this point, it is important to guarantee low suction pressure by using short tubing of a diameter equal to or larger than recommended, reducing curves to a minimum and using suction filters
of wide cross-section and foot valves with the lowest possible resistance.

It is very important to keep the suction filters clean because, once clogged, they increase system resistance.

The difference in height between the pump and the fluid level must be kept as small as possible and, at any rate, within the 2 meters
anticipated for the priming phase.

If this height is exceeded, it will always be necessary to install a foot valve to allow for the filling of the suction tube and provide
tubing of wider diameter. It is recommended that the pump not be installed at a difference in height greater than 3 meters.

ATTENTION
In the case that the suction tank is higher than the pump, it is advisable to install an antisiphon valve to prevent accidental diesel fuel leaks.
Dimension the installation in order to control the back pressures due to water hammering.

H6 LINE ACCESSORIES

The pumps are furnished without line accessories. Following is a list of the most common line accessories whose use is compatible with the proper functioning of the pumps.

DELIVERY

- Automatic dispensing nozzle
- Manual dispensing nozzle
- Meter
- Flexible tubing

SUCTION

- Foot valve with filter
- Rigid and flexible tubing

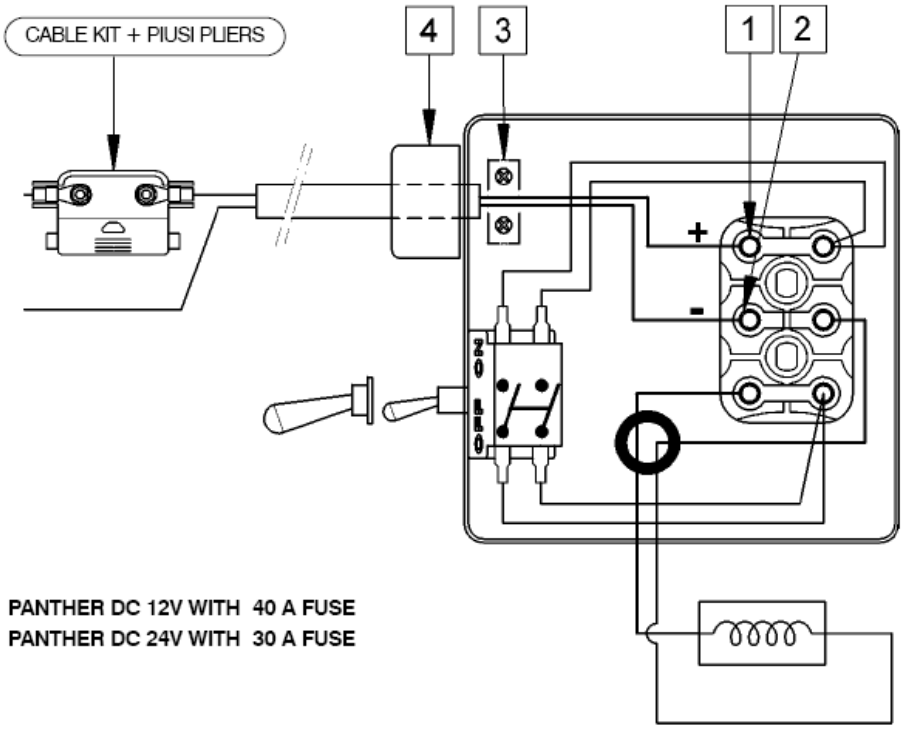
ATTENTION
It is the installer's responsibility to provide the line accessories necessary for the safe and proper functioning of the pump.
The use of accessories unsuitable for use with diesel fuel can damage the pump, injure persons and cause pollution.

H7 ELECTRICAL CONNECTIONS

The electrical box of Panther DC comes with a terminal board for the power cord connection (optional).

In case of connection of the cable kit with pliers (Piusi optional), proceed as follows:

- loosen the cable ring nut with rubber (4) and insert the cable.
- open the cable U-bolt (3) which is located inside the electrical box.
- fix the eyelet (for screw M4) of the positive cable (blue) to the terminal, in position 1 (see reference in the diagram).
- fix the eyelet (for screw M4) of the negative cable (brown) to the terminal, in position 2 (see reference in the diagram).
- tighten the U-bolt (3).
- screw the ring nut (4).



In the event of power connection with cable not supplied by Piusi, it is necessary to observe the following characteristics:

- for Panther DC 12 V - use a bipolar cable with minimum section of 6 mm^2.
- for Panther DC 24 V - use a bipolar cable with minimum section of 4 mm^2.

It is important to use a 40A fuse for the 12V version and a 30A fuse for the 24V version, to prevent the pump motor from being damaged in the event of a short circuit.

ATTENTION
IT IS THE INSTALLER'S RESPONSIBILITY TO PERFORM THE ELECTRICAL CONNECTIONS WITH RESPECT FOR THE APPLICABLE REGULATIONS.

Respect the following (not exhaustive) instructions to ensure a proper electrical installation:

- During installation and maintenance, make sure that the electric supply lines are not live.
- Use cables characterized by the minimum cross-sections, nominal voltages and wiring-type adequate to the electrical characteristics shown in Paragraph E2 - ELECTRICAL SPECIFICATIONS and the installation environment.
- Always close the cover of the strip box before supplying electrical power.

I. INITIAL START-UP

- Check that the quantity of diesel fuel in the suction tank is greater than the amount you wish to transfer.
- Make sure that the residual capacity of the delivery tank is greater than the quantity you wish to transfer.
- Do not run the pump dry. This can cause serious damage to its components.
- Make sure that the tubing and line accessories are in good condition. Diesel fuel leaks can damage objects and injure persons.
- Never start or stop the pump by connecting or cutting out the power supply.
- Do not operate switches with wet hands.
- Prolonged contact with diesel fuel can damage the skin. The use of glasses and gloves is recommended.

ATTENTION
Extreme operating conditions with working cycles longer than 30 minutes can cause the motor temperature to rise, thus damaging the motor itself.
Each 30-minute working cycle should always be followed by a 30-minute power-off cooling phase.

In the priming phase the pump must blow the air initially present in the entire installation out of the delivery line. Therefore it is necessary to keep the outlet open to permit the evacuation of the air.

ATTENTION
If an automatic type dispensing nozzle is installed at the end of the delivery line, the evacuation of the air will be difficult because of the automatic stopping device that keeps the valve closed when the line pressure is too low. It is recommended that the automatic dispensing nozzle be temporarily disconnected during the initial start-up phase.

The priming phase can last from several seconds to a few minutes, as a function of the characteristics of the system. If this phase is prolonged, stop the pump and verify:

- That the pump is not running completely dry;
- That the suction tubing is not allowing air to seep in;
- That the suction filter is not clogged;
- That the suction height does not exceed 2 m. (if the height exceeds 2 m, fill the suction hose with fluid);
- That the delivery tube is allowing the evacuation of the air;
- Check the exact rotation direction of the motor: it must be in a counter-clockwise mode considering the motor from pos. 1 of the exploded diagram.

When priming has occurred, verify that the pump is operating within the anticipated range, in particular:

- That under conditions of maximum back pressure, the power absorption of the motor stays within the values shown on the identification plate;
- That the suction pressure is not greater than 0.5 bar;
- That the back pressure in the delivery line is not greater than the maximum back pressure foreseen for the pump.

L. DAILY USE

a) If using flexible tubing, attach the ends of the tubing to the tanks. In the absence of an appropriate slot, solidly grasp the delivery tube before beginning dispensing.
b) Before starting the pump make sure that the delivery valve is closed (dispensing nozzle or line valve).
c) Turn the ON/OFF switch on. The by-pass valve allows functioning with delivery closed only for brief periods.
d) Open the delivery valve, solidly grasping the end of the tubing.
e) Close the delivery valve to stop dispensing.
f) When dispensing is finished, turn off the pump.

ATTENTION
Functioning with the delivery closed is only allowed for brief periods (2 / 3 minutes maximum). After use, make sure the pump is turned off.

M. PROBLEMS AND SOLUTIONS

Problem	Possible Cause	Correttive Action
THE MOTOR IS NOT TURNING	Lack of electric power	Check the electrical connections
	Rotor jammed	Check for possible damage or obstruction of the rotating components.
	Motor problems	Contact the Service Department
	Burnt out fuse	Replace the fuse
THE MOTOR TURNS SLOWLY WHEN STARTING	Low voltage in the electric power line	Bring the voltage back within the anticipated limits
LOW OR NO FLOW RATE	Low level in the suction tank	Refill the tank
	Foot valve blocked	Clean and/or replace the valve
	Filter clogged	Clean the filter
	Excessive suction pressure	Lower the pump with respect to the level of the tank or increase the cross-section of the tubing
	High loss of head in the delivery circuit (working with the by-pass open)	Use shorter tubing or of greater diameter
	By-pass valve blocked	Dismantle the valve, clean and/or replace it
	Air entering the pump or the suction tubing	Check the seals of the connections
	A narrowing in the suction tubing	Use tubing suitable for working under suction pressure
	Low rotation speed	Check the voltage at the pump. Adjust the voltage and/or use cables of greater cross-section
	The suction tubing is resting on the bottom of the tank	Raise the tubing
INCREASED PUMP NOISE	Cavitation occurring	Reduce suction pressure
	Irregular functioning of the by-pass	Dispense fuel until the air is purged from the by-pass system
	Air present in the diesel fuel	Verify the suction connections
LEAKAGE FROM THE PUMP BODY	Seal damaged	Check and replace the seal

N. MAINTENANCE

PANTHER DC are designed and constructed to require a minimum of maintenance.
In any case always bear in mind the following basic recommendations for a good functioning of the pump:

- On a weekly basis, check that the tubing joints have not loosened, to avoid any leakage.
- On a monthly basis, check the pump body and keep it clean of any impurities.
- On a weekly basis, check and keep clean the line suction filter.
- On a monthly basis, check that the electric power supply cables are in good condition.
- Check on a monthly basis and keep clean the dispensing nozzle provided with the BATTERY KIT model. Anyway keep clean any other final check valve installed.
- Check on a monthly basis and keep the suction filters clean.

O. NOISE LEVEL

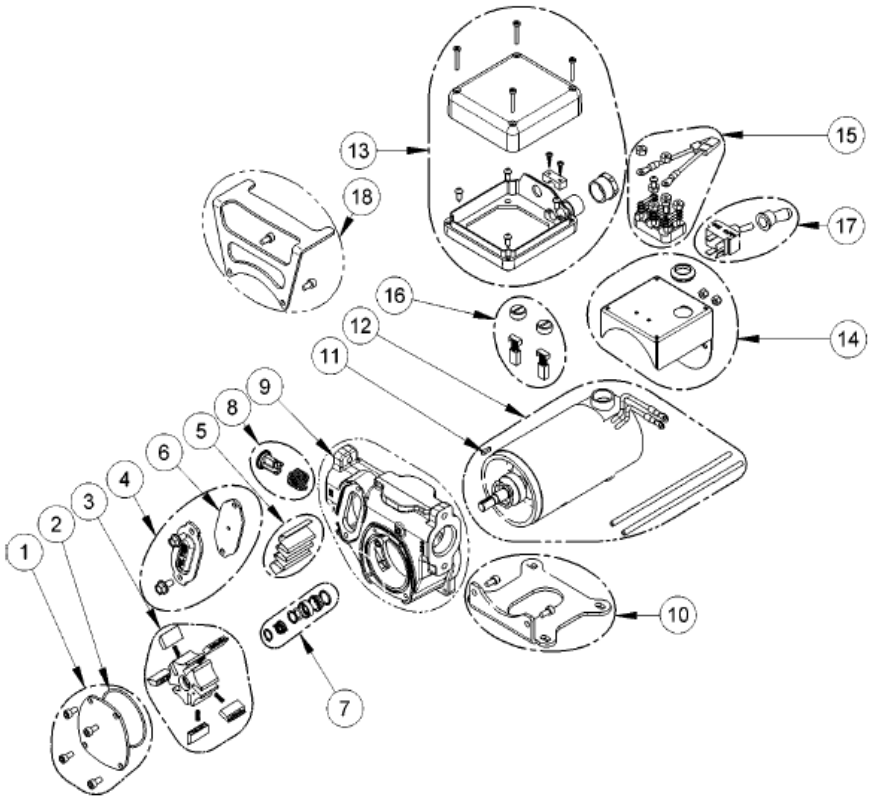
Under normal working conditions the noise emission from all models does not exceed the value of **70 db at a distance of 1 meter** from the electric pump.

P. DISPOSING OF CONTAMINATED MATERIALS

In the event of maintenance or demolition of the machine, do not disperse contaminated parts into the environment.

Refer to local regulations for their proper disposal.

Q. EXPLODED DIAGRAM AND SPARE PARTS

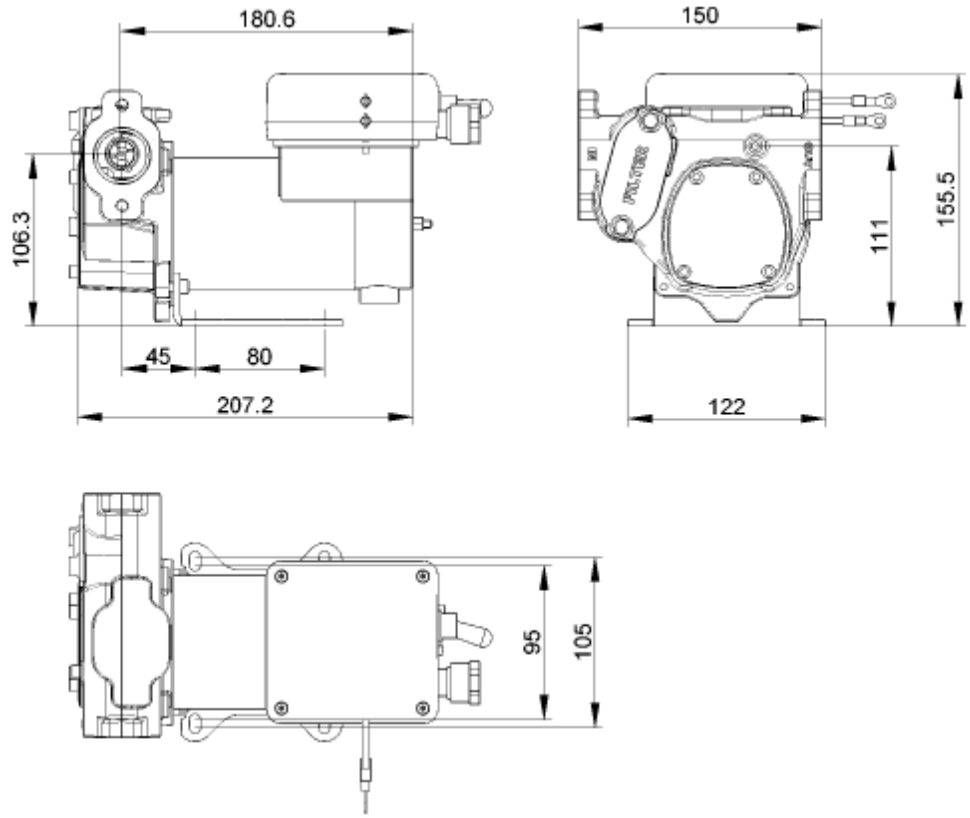


ATTENTION
Always specify the spare part position number with the product code and serial number.

Position	Component Description	Quantity
1	KIT CHAMBER COVER PANTHER DC	1
2	O-RING CHAMBER COVER	1
3	KIT ROTOR+SPRING+BLADE	1
4	KIT FILTER COVER	1
5	KIT FILTER PANTHER	1
6	O-RING FILTER COVER	1
7	KIT SEALING MOTOR SHAFT	1
8	KIT BY-PASS	1
9	KIT PUMP BODY PANTHER DC	1
10	KIT FOOT PANTHER DC	1
11	KIT KEY PANTHER DC	1
12-A	MOTOR DC 12V+KEY+COMPENSATING RING	1
12-B	MOTOR DC 24V+KEY+COMPENSATING RING	1
13	KIT ELECTRICAL BOX	1
14	KIT ELECTRICAL BOX SUPPORT PANTHER DC	1
15	KIT TERMINAL BOARD PANTHER DC	1
16	KIT BRUSHES MOTOR PANTHER DC	1
17	KIT SWITCH PANTHER DC	1
18	KIT HANDLE PANTHER DC	1

R. DIMENSIONS AND WEIGHTS

Unit of measurement: mm



XIII. USE AND MAINTENANCE MANUAL PANTHER 230V AC

A. INDEX

B. MACHINE AND MANUFACTURER IDENTIFCATION

Available Models:

- **PANTHER 56** 230V/50HZ
- **PANTHER 56** 230V/60HZ
- **PANTHER 72** 230V/50HZ

MANUFACTURER: **PIUSI SPA**
VIA PACINOTTI – Z.I. RANGAVINO
46029 SUZZARA (MN)

IDENTIFICATION PLATE (EXAMPLE WITH THE FIELDS IDENTIFIED):

C. DECLARATION OF CONFORMITY

COMPLIANCE WITH DIRECTIVES:
73/23/CEE – 89/392/CEEE – 91/368/CEE – 93/44/CEE – 89/336/CEE – 92/31/CEE – 93/68/CEE

The Manufacturer **PIUSI SPA**
46029 SUZZARA (MANTOVIA) ITALY

Declares that the following pump models: **PANTHER 56 – PANTHER 72**

conform to the following applicable regulations:

EN 292-1	Safety of machinery - General concepts - Basic methodology.
EN 50082-1	Electromagnetic compatibility - Generic emission standard - Industrial environment.
EN 292-2	Safety of machinery. Basic concepts, general principles for design. Technical principles and specification.
EN 55014	Radio interference - Limits and methods of measurement of radio interference characteristics of household electrical appliances, portable tools and similar electrical apparatus
EN 294	Safety of machinery. Safety distances to prevent danger zones being reached by the upper limbs.
CEI EN 60034-1	Rotating electrical machines - Rating and performance.
EN 50081-1	Electromagnetic compatibility. Generic emission standard. Residential, commercial and light industry.
CEI EN 60034-5	Classification of the degrees of protection of the wraps for electric equipment.

National regulations:

DPR 547-55	Regulations concerning the prevention of occupational accidents

Suzzara, 31. 01.2000
VARINI OTTO, Chairman

D. MACHINE DESCRIPTION

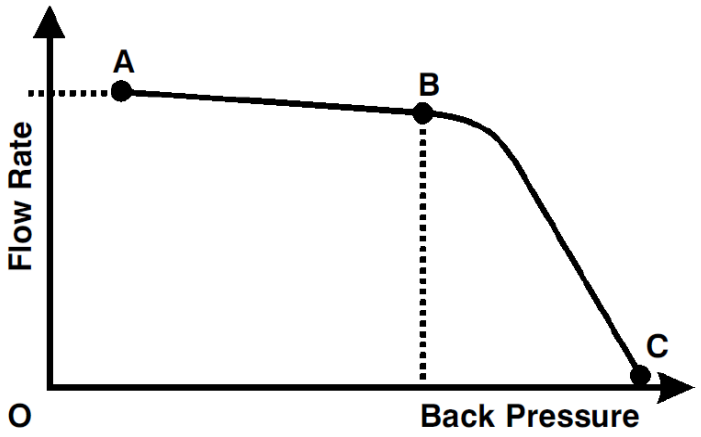
PUMP: Self-Priming, volumetric, rotating electric vane pump, equipped with by-pass valve.
MOTOR: Asynchronous motor, single-phase and three-phase, 2 pole, closed type (protection class IP55 in conformance with EN 60034-5-86 regulations) self-ventilated, directly flanged to the pump body.
FILTER: Inspectable suction filter.

E. TECHNICAL SPECIFICATIONS

E1 PERFORMANCE SPECIFICATIONS

The performance diagram shows flow rate as a function of back pressure.

Functioning Point	Model	Flow Rate	Back Pressure	Typical Delivery Configuration					
				4 meters of 3/4" tube	4 meters of 1" tube	K33/K44 Meter	Self2000 Manual Dispensing Nozzle	PA60 Automatic Dispensing Nozzle	PA80 Automatic Dispensing Nozzle
A (Maximum Flow Rate)	PANTHER 56	60	0.6	•			•		
	PANTHER 72	80	0.5		•		•		
	PANTHER 56 60Hz	75	0.5		•		•		
B (Maximum Back Pressure)	PANTHER 56	56	1.5	•		•		•	
	PANTHER 72	72	1.3		•	•			•
	PANTHER 56 60 Hz	68	1.4		•	•			•
C (Bypass)	PANTHER 56	0	2.7	Delivery Closed					
	PANTHER 72	0	2.8						
	PANTHER 56 60HZ	0	2.8						



ATTENTION
The curve refers to the following operating conditions:
Fluid Diesel Fuel
Temperature 20^0C
Suction Conditions The tube and the pump position relative to the fluid level is such that a pressure of 0.3 bar is generated at the nominal flow rate.

Under different suction conditions higher pressure values can be created that reduce the flow rate compared to the same back pressure values.
To obtain the best performance, it is very important to reduce loss of suction pressure as much as possible by following these instructions:

- Shorten the suction tube as much as possible
- Avoid useless elbows or throttling in the tubes
- Keep the suction filter clean
- Use a tube with a diameter equal to, or greater than, indicated (see Installation)

The burst pressure of the pump is of 20bar.

E2 ELECTRICAL SPECIFICATIONS

PUMP MODEL	ELECTRICAL POWER			POWER Nominal (*) [Wat]	CURRENT Maximum (*) [Amp]
	Current	Voltage [V]	Frequency [V]		
PANTHER 56 230V/50HZ	AC	230	50	370	2.2
PANTHER 56 230V/60HZ	AC	230	60	370	2.2
PANTHER 72 230V/50HZ	AC	230	50	550	3.3

F. OPERATING CONDITIONS

F1 ENVIRONMENTAL CONDITIONS

TEMPERATURE:
Min. -20^0C / max. $+60^0$C

RELATIVE HUMIDITY:
max. 90%

ATTENTION
The temperature limits shown apply to the pump components and must be respected to avoid possible damage or malfunction.

F2 ELECTRICAL POWER SUPPLY

Depending on the model, the pump must be supplied by a single-phase alternating current line whose nominal values are shown in the table in Paragraph E2 - ELETRICAL SPECIFICATIONS.
The maximum acceptable variations from the electrical parameters are:
voltage: +/- 5% of the nominal value,
frequency: ± 2% wartości nominalnej.

ATTENTION
Power from lines with values outside the indicated limits can damage the electrical components.

F3 WORKING CYCLE

The pumps are designed for continuous use under conditions of maximum back pressure.

ATTENTION
Functioning under by-pass conditions is only allowed for brief periods of time (2-3 minutes maximum).

F4 FLUIDS PERMITTED / FLUIDS NOT PERMITTED

PERMITTED:

- Diesel fuel at a viscosity of from 2 to 5.35 cSt (at a temperature of 37.8°C) Minimum Flash Point (PM): 55°C

NOT PERMITTED:

- GASOLINE
- INFLAMMABLE LIQUIDS WITH PM < 55°C
- LIQUIDS WITH VISCOSITY > 20 cSt
- WATER
- FOOD LIQUIDS
- CORROSIVE CHEMICAL PRODUCTS
- SOLVENTS

RELATED DANGERS:

- FIRE - EXPLOSION
- FIRE - EXPLOSION
- MOTOR OVERLOAD
- PUMP OXIDATION
- CONTAMINATION OF THE SAME
- PUMP CORROSION
  INJURY TO PERSONS
- FIRE – EXPLOSION
  DAMAGE TO GASKET SEALS

G. MOVING AND TRANSPORT

Given the limited weight and size of the pumps (see overall dimensions), ***moving the pumps does not require the use of lifting devices.***
The pumps were carefully packed before shipment. Check the packing material on delivery and store in a dry place.

H. INSTALLATION

H1 DISPOSING OF THE PACKING MATERIAL

The packing material does not require special precautions for its disposal, not being in any way dangerous or polluting.
Refer to local regulations for its disposal.

H2 PRELIMINARY INSPECTION

- Check that the machine has not suffered any damage during transport or storage.
- Clean the inlet and outlet openings, removing any dust or residual packing material.
- Make sure that the motor shaft turns freely.
- Check that the electrical specifications correspond to those shown on the identification plate.

H3 POSITIONING THE PUMP

- The pump can be installed in any position (pump axis vertical or horizontal)
- Attach the pump using screws of adequate diameter for the attachment holes provided in the base of the pump (see the section "OVERALL DIMENSIONS" for their position and dimension).

ATTENTION
THE MOTORS ARE NOT OF AN ANTI-EXPLOSIVE TYPE.
Do not install them where inflammable vapors can be present.

H4 CONNECTING THE TUBING

- Before connection, make sure that the tubing and the suction tank are free of dirt and thread residue that could damage the pump and its accessories.
- Before connecting the delivery tube, partially fill the pump body with diesel fuel to facilitate priming.
- Do not use conical threaded joints that could damage the threaded pump openings if excessively tightened.

SUCTION TUBING:
- Minimum recommended nominal diameter: 1-1/4”
- Nominal recommended pressure: 10 bar
- Use tubing suitable for functioning under suction pressure

DELIVERY TUBING
- Minimum recommended nominal diameter: 1”
- Nominal recommended pressure: 10 bar

ATTENTION
It is the installer's responsibility to use tubing with adequate characteristics.

The use of tubing unsuitable for use with Diesel fuel can damage the pump, injure persons and cause pollution.
Loosening of the connections (threaded connections, flanging, gasket seals) can cause serious ecological and safety problems.
Check all the connections after the initial installation and on a daily basis after that.
Tighten the connections, if necessary.

H5 CONSIDERATIONS REGARDING DELIVERY AND SUCTION LINES

DELIVERY
The choice of pump model must be made keeping the **characteristics of the system** in mind.

The combination of the length of the tubing, the diameter of the tubing, the flow rate of the diesel fuel and the line accessories installed can create back pressure **greater than the maximums anticipated** such as to cause the (partial) opening of the pump by-pass with the consequent noticeable reduction of the flow rate supplied.

In such cases, to allow correct functioning of the pump, **it is necessary to reduce system resistance,** using shorter tubing and/or of wider diameter and line accessories with less resistance (e.g., an automatic dispensing nozzle for greater flow rates).

SUCTION
Panther 56 and Panther 72 pumps are self-priming and characterized by good suction capacity.

In such cases, to allow correct functioning of the pump, it is necessary to reduce system resistance, using shorter tubing and/or of wider diameter and line accessories with less resistance (e.g., aDuring the start-up phase, with an empty suction tube and the pump wetted with fluid, the electric pump unit is capable of suctioning the liquid with a maximum difference in height of 2 meters. It is important to point out that the priming time can be as long as one minute and the presence of an automatic dispensing nozzle on the delivery line prevents the evacuation of air from the installation, and, therefore, prevents proper priming.
For this reason, it is always advisable to prime the pump without an automatic delivery nozzle, verifying the proper wetting of the pump. The installation of a foot valve is recommended to prevent the emptying of the suction tube and keep the pump wet. In this way, the pump will subsequently always start up immediately. automatic dispensing nozzle for greater flow rates).

When the system is functioning, the pump can work with pressure at the inlet as high as 0.5 bar, beyond which cavitation phenomena can begin, with a consequent loss of flow rate and increase of system noise.
As we have said up to this point, it is important to guarantee low suction pressure by using short tubing of a diameter equal to or larger than recommended, reducing curves to a minimum and using suction filters of wide cross-section and foot valves with the lowest possible resistance.
It is very important to keep the suction filters clean because, once clogged, they increase system resistance. The difference in height between the pump and the fluid level must be kept as small as possible and, at any rate, within the 2 meters anticipated for the priming phase.
If this height is exceeded, it will always be necessary to install a foot valve to allow for the filling of the suction tube and provide tubing of wider diameter. It is recommended that the pump not be installed at a difference in height greater than 3 meters.

ATTENTION
In the case that the suction tank is higher than the pump, it is advisable to install an antisiphon valve to prevent accidental diesel fuel leaks.
Dimension the installation in order to control the back pressures due to water hammering.

H6 LINE ACCESSORIES

The pumps are furnished without line accessories. Following is a list of the most common line accessories whose use is compatible with the proper functioning of the pumps.

DELIVERY:
- Automatic dispensing nozzle
- Manual dispensing nozzle
- Meter
- Flexible tubing

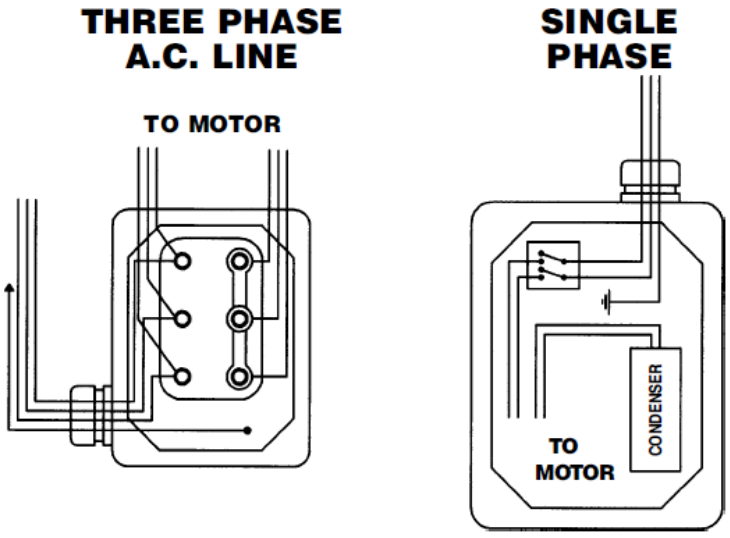
SUCTION:
- Foot valve with filter
- Rigid and flexible tubing

ATTENTION
It is the installer's responsibility to provide the line accessories necessary for the safe and proper functioning of the pump.
The use of accessories unsuitable for use with diesel fuel can damage the pump, injure persons and cause pollution.

H7 ELECTRICAL CONNECTIONS

SINGLE-PHASE MOTORS

Single-phase motors are supplied with a pre-existing 2-meter cable with electric plug. To change the cable, open the terminal strip cover and connect the line according to the following diagram:



Single-phase motors are supplied with a bipolar switch and capacitor wired and installed inside the terminal strip box (see diagram).

The characteristics of the capacitor are shown on the identification plate for each pump model.
The switch has the sole function of starting/stopping the pump and cannot in any way substitute for the main circuit breaker provided for in the applicable regulations.

THREE-PHASE MOTORS

Three-phase motors are supplied with a terminal strip box and terminal strip.
To connect the electric motor to the electric power line, open the terminal strip cover and connect the cables according to the diagram.

ATTENTION

Verify that the terminal strip blades are positioned according to the diagram provided for the available power supply voltage. Verify the correct direction of rotation of the motor (see the paragraph overall dimensions), and, if not correct, invert the connection of the two cables in the power supply plug or on the terminal strip.

The pumps are supplied without electrical safety equipment such as fuses, motor protectors, systems to prevent accidental restarting after power failures or others. It is indispensable to install an electric panel, upstream from the pump's power supply line, equipped with an appropriate residual current operated circuit breaker.

It is the installer's responsibility to perform the electrical connections with respect for the applicable regulations.

Respect the following (not exhaustive) instructions to ensure a proper electrical installation:

- During installation and maintenance, make sure that the electric supply lines are not live.
- Use cables characterized by the minimum cross-sections, nominal voltages and wiring-type adequate to the characteristics shown in Paragraph E2 - ELECTRICAL SPECIFICATIONS and the installation environment.
- In three-phase motors verify the correct direction of rotation (see Paragraph R - DIMENSIONS AND WEIGHTS)
- All motors are equipped with a ground terminal to connect to the ground line of the electrical network.
- Always close the cover of the terminal strip box before supplying electrical power, after ascertaining the integrity of the gasket seals that ensure protection grade IP 55.

I. INITIAL START-UP

- Always close the cover of the terminal strip box before supplying electrical power, after ascertainingCheck that the quantity of diesel fuel in the suction tank is greater than the amount you wish to transfer.the integrity of the gasket seals that ensure protection grade IP 55.
- Make sure that the residual capacity of the delivery tank is greater than the quantity you wish to transfer.
- Do not run the pump dry. This can cause serious damage to its components.
  Make sure that the tubing and line accessories are in good condition. Diesel fuel leaks can damage objects and injure persons.
- Never start or stop the pump by inserting or removing any plugs.
- Do not operate switches with wet hands.
- Prolonged contact with diesel fuel can damage the skin. The use of glasses and gloves is recommended.
- Single-phase motors are provided with an automatic thermal protection switch.

ATTENTION
Extreme operating conditions can raise the motor temperature and, consequently, cause the thermal protection switch to stop it.
Turn off the pump and wait for it to cool before resuming use. The thermal protection automatically turns off when the motor is sufficiently cool.

In the priming phase the pump must blow the air initially present in the entire installation out of the delivery line. Therefore it is necessary to keep the outlet open to permit the evacuation of the air.

ATTENTION
If an automatic type dispensing nozzle is installed on the end of the delivery line, the evacuation of the air will be difficult because of the automatic stopping device that keeps the valve closed when the line pressure is too low. It is recommended that the automatic dispensing nozzle be temporarily disconnected during the initial start-up phase.

The priming phase can last from several seconds to a few minutes, as a function of the characteristics of the system. If this phase is prolonged, stop the pump and verify:

- That the pump is not running completely dry;
- That the suction tubing is not allowing air to seep in;
- That the suction filter is not clogged;
- That the suction height is not greater than 2 meters (if the height is greater than 2 meters, fill the suction tube with fluid);
- That the delivery tube is allowing the evacuation of the air.

When priming has occurred, verify that the pump is operating within the anticipated range, in particular:

- That under conditions of maximum back pressure, the power absorption of the motor stays within the values shown on the identification plate;
- That the suction pressure is not greater than 0.5 bar;
- That the back pressure in the delivery line is not greater than the maximum back pressure anticipated for the pump.

J. DAILY USE

a) If using flexible tubing, attach the ends of the tubing to the tanks. In the absence of an appropriate slot, solidly grasp the delivery tube before beginning dispensing.
b) Before starting the pump make sure that the delivery valve is closed (dispensing nozzle or line valve).
c) Turn the ON/OFF switch to ON. The by-pass valve allows functioning with the delivery closed for only brief periods.
d) Open the delivery valve, solidly grasping the end of the tubing.
e) Close the delivery valve to stop dispensing.
f) When dispensing is finished, turn off the pump.

ATTENTION
Functioning with the delivery closed is only allowed for brief periods (2-3 minutes maximum). After use, make sure the pump is turned off.

LACK OF ELECTRIC POWER:
A lack of electric power, with the consequent accidental stopping of the pump, can be caused by:

- A safety device tripping
- A drop in line voltage

In either case, act as follows:
a) Close the delivery valve
b) Attach the end of the delivery to the slot provided on the tank
c) Turn the ON/OFF switch to the OFF position. Resume operations as described in Paragraph L - DAILY USE, after determining the cause of the stoppage.

K. PROBLEMS AND SOLUTIONS

Problem	Possible Cause	Correttive Action
THE MOTOR IS NOT TURNING	Lack of electric power	Check the electrical connections and the safety systems
	Rotor jammed	Check for possible damage or obstruction of the rotating components
	The motor protecting thermal switch has tripped	Wait for the motor to cool, verify that it restarts, and research the cause of the overheating
	Motor problems	Contact the Service Department
THE MOTOR TURNS SLOWLY WHEN STARTING	Low voltage in the electric power line	Bring the voltage back within the anticipated limits
LOW OR NO FLOW RATE	Low level in the suction tank	Refill the tank
	Foot valve blocked	Clean and/or replace the valve
	Excessive suction pressure	Lower the pump with respect to the level of the tank or increase the cross-section of the tubing
	High loss of head in the circuit (working with the by-pass open)	Use shorter tubing or of greater diameter
	By-pass valve blocked	Dismantle the valve, clean and/or replace it
	Air entering the pump or the suction tubing	Check the seals of the connections
	A narrowing in the suction tubing	Use tubing suitable for working under suction pressure
	Low rotation speed	Check the voltage at the pump. Adjust the voltage and/or use cables of greater cross-section
	The suction tubing is resting on the bottom of the tank	Raise the tubing
INCREASED PUMP NOISE	Cavitation occurring	Reduce suction pressure
	Irregular functioning of the by-pass	Dispense until the air is purged from the circuit
	Air present in the diesel fuel	Verify the suction connections
LEAKAGE FROM THE PUMP BODY	Seal damaged	Check and replace the mechanical seal

L. MAINTENANCE

Panther 56 and Panther 72 pumps are designed and constructed to require a minimum of maintenance.

- **On a weekly basis, check that the tubing joints have not loosened, to avoid any leakage.**
- **On a monthly basis, check the pump body and keep it clean of any impurities.**
- **On a monthly basis, check and keep the pump filter clean and any other filters installed.**
- **On a monthly basis, check that the electric power supply cables are in good condition.**

M. NOISE LEVEL

Under normal working conditions the noise emission from all models does not exceed the value of 70 db at a distance of 1 meter from the electric pump.

N. DISPOSAL

The components must be given to companies that specialise in the disposal and recycling of industrial waste and, in particular, the DISPOSAL OF PACKAGING.
The packaging consists of biodegradable cardboard which can be delivered to companies for normal recycling of cellulose.

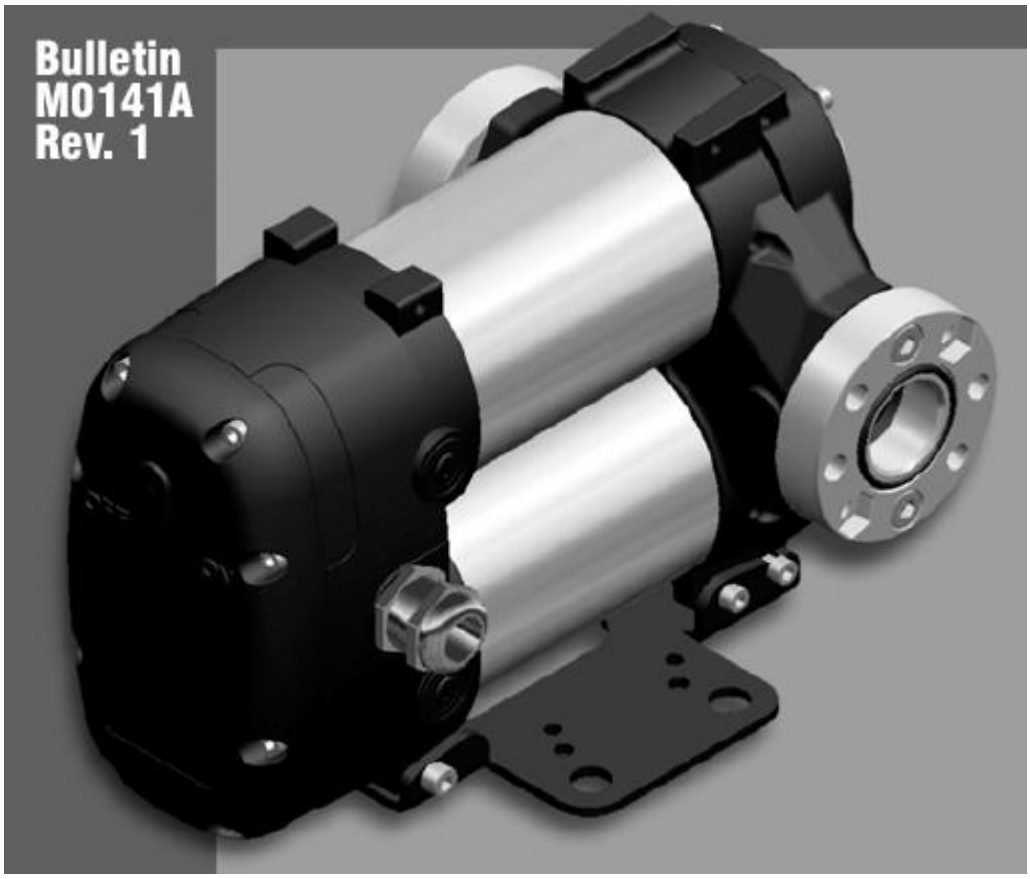
DISPOSAL OF METAL COMPONENTS
The metal components, both painted and stainless steel, are usually recycled by companies that are specialised in the metal-scrapping industry.

DISPOSAL OF ELECTRIC AND ELECTRONIC COMPONENTS:
these have to be disposed by companies that are specialised in the disposal of electronic components, in accordance with the instructions of 2002/96/EC (see text of Directive below).

ENVIRONMENTAL INFORMATION FOR CUSTOMERS IN THE EUROPEAN UNION
European Directive 2002/96/EC requires that the equipement bearing this symbol on the product and/or its packaging must not be disposed of with unsorted municipal waste. The symbol indicates that this product should be disposed of separately from regular household waste streams.It is your responsibility to dispose of this and other electric and electronic equipment via designated collection facilities appointed by the government or local authorities.

DISPOSAL OF OTHER PARTS:
The disposal of other parts such as pipes, rubber seals, plastic components and cables should be entrusted to companies that special in the disposal of industrial wate.

XIV. USE AND MAINTENANCE MANUAL BIPUMP 12V OR 24V DC



A. INDEX

B. MACHINE AND MANUFACTURER IDENTIFICATION

Available Models:

- **BIPUMP 12 V**
- **BIPUMP 24 V**

MANUFACTURER: **PIUSI SPA VIA PACINOTTI - Z.I. RANGAVINO 46029 SUZZARA (MN)**
IDENTIFICATION PLATE (EXAMPLE WITH THE FIELDS IDENTIFIED):

ATTENTION
Always check that the revision level of this manual coincides with what is shown on the identification plate.

C. DECLARATION OF CONFORMITY

DECLARATION OF INCORPORATION

The undersigned, representing the following manufacturer

PIUSI S.p.A.
Via Pacinotti, Z.I. Rangavino
46029 Suzzara (Mantova) – Italy

Declares under its own responsibility that the machine: **BIPUMP 12 / 24 V**

described below: **Machine designed for the transfer of diesel fuel**

is manufactured to be incorporated into a machine or to be assembled with other machinery to build a machine according to the Machine Directive 98/37/CE.
Moreover, we declare that the machinery cannot be put into operation until the machine in which it will be incorporated and of which it will become a component, has been identified and its compliance with the Machine Directive 98/37/CE has been declared.

Suzzara 01.01.2006

OTTO VARINI, Chairman

D. MACHINE DESCRIPTION

PUMP: Self-Priming, volumetric, rotating vane pump, equipped with by-pass valve.

MOTOR: Brush motor powered by intermittent direct current, low voltage, closed type, protection class IP55 according to CEI-EN 60034-5, flange-mounted directly to the pump body.

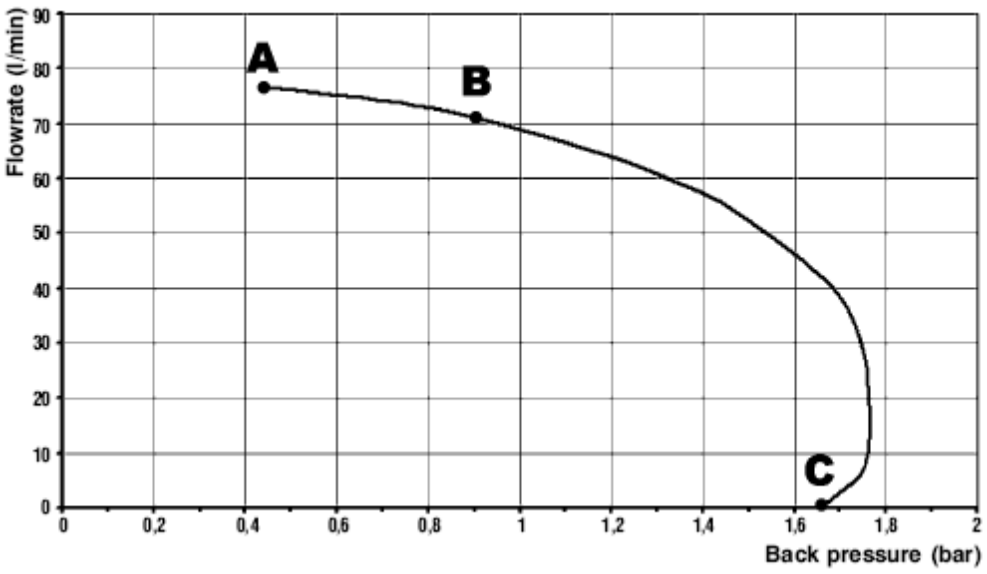
E. TECHNICAL SPECIFICATIONS

E1 PERFORMANCE SPECIFICATIONS

The performance diagram shows flow rate as a function of back pressure.

Functioning Point	Model	Flow Rate (l/min)	Back Pressure P2 bar	Absorption
A (max. flow rate)	Bipompa 12V	76 – 82	0.4	24-27
	Bipompa 24V	76 – 82	0.4	12-24
B (normal flow rate)	Bipompa 12V	72 – 76	0.9	29-32
	Bipompa 24V	72 – 76	0.9	15-17
C (Bypass)	Bipompa 12V	-	1.7	35-43
	Bipompa 24V	-	1.7	18-22

* Delivery plant consisting of K33/K44 meter, 5 mt. 1” tube and A80 nozzle.



ATTENTION
The curve refers to the following operating conditions:

Fluid	Diesel Fuel
Temperature	20°C
Suction Conditions	The tube and the pump position relative to the fluid level is such that a pressure of 0.3 bar is generated at the nominal flow rate.

Under different suction conditions higher pressure values can be created that reduce the flow rate compared to the same back pressure values.

To obtain the best performance, it is very important to reduce loss of suction pressure as much as possible by following these instructions:

- Shorten the suction tube as much as possible.
- Avoid useless elbows or throttling in the tubes.
- Keep the suction filter clean.
- Use a tube with a diameter equal to, or greater than, indicated (see Installation).

The burst pressure of the pump is of 20bar.

E2 ELECTRICAL SPECIFICATIONS

PUMP MODEL	RPM	ELECTRICAL POWER		CURRENT
		Current	Voltage (V)	Maximum (*) (Amp)
BIPUMP 12V	2200	DC	12	44
BIPUMP 24V	2200	DC	24	22,5

(*)Refers to functioning with maximum back pressure.

F. OPERATING CONDITIONS

F1 ENVIRONMENTAL CONDITIONS

TEMPERATURE: min. -20° C / max +60° C

RELATIVE HUMIDITY: max. 90%

ATTENTION
The temperature limits shown apply to the pump components and must be respected to avoid possible damage or malfunction.

F2 ELECTRICAL POWER SUPPLY

Depending on the model, the pump must be supplied by a single-phase alternating current line whose nominal values are shown in the table in Paragraph E2 - ELECTRICAL SPECIFICATIONS.

The maximum acceptable variations from the electrical parameters are:

Voltage: +/-5% of the nominal value

ATTENTION
Power from lines with values outside the indicated limits can damage the electrical components.

F3 WORKING CYCLE

Pumps are designed for intermittent use with an operating cycle of 30 minutes under conditions of maximum back-pressure.

ATTENTION
Functioning under by-pass conditions is only allowed for brief periods of time (2-3 minutes maximum).

F4 FLUIDS PERMITTED / FLUIDS NOT PERMITTED

PERMITTED:

- DIESEL FUEL at a VISCOSITY from 2 to 5.35 cSt (at a temperature of 37.8° C)
  Minimum Flash Point (PM): 55°C

NOT PERMITTED:

- GASOLINE
- INFLAMMABLE LIQUIDS with PM < 55° C
- LIQUIDS WITH VISCOSITY>20CsT
- WATER
- FOOD LIQUIDS
- CORROSIVE CHEMICAL PRODUCTS
- SOLVENTS
- AD-BLUE

RELATED DANGERS:

- FIRE – EXPLOSION
- FIRE – EXPLOSION
- MOTOR OVERLOAD
- PUMP OXIDATION
- CONTAMINATION OF THE SAME
- PUMP CORROSION
  INJURY TO PERSONS
- FIRE – EXPLOSION
  DAMAGE TO GASKET SEALS
- PUMP OXIDATION

G. MOVING AND TRANSPORT

Given the limited weight and size of the pumps (see overall dimensions), **moving the pumps does not require the use of lifting devices.**

The pumps were carefully packed before shipment.

Check the packing material on delivery and store in a dry place.

H. INSTALLATION

H1 DISPOSING OF THE PACKING MATERIAL

The packing material does not require special precautions for its disposal, not being in any way dangerous or polluting.

Refer to local regulations for its disposal.

H2 PRELIMINARY INSPECTION

- Check that the machine has not suffered any damage during transport or storage.
- Clean the inlet and outlet openings, removing any dust or residual packing material.
- If the pump is supplied with line cords, check that the electrical specifications correspond to those shown on the identification plate.

H3 POSITIONING THE PUMP

- The pump can be installed in any position (pump axis vertical or horizontal).
- Attach the pump using screws of adequate diameter for the attachment holes provided in the base of the pump (see the section "OVERALL DIMENSIONS" for their position and dimension).

ATTENTION
THE MOTORS ARE NOT OF AN ANTI-EXPLOSIVE TYPE.
Do not install them where inflammable vapours can be present.

H4 CONNECTING THE TUBING

- Before connection, make sure that the tubing and the suction tank are free of dirt and thread residue that could damage the pump and its accessories.
- Before connecting the delivery tube, partially fill the pump body with diesel fuel to facilitate priming.
- Do not use conical threaded joints that could damage the threaded pump openings if excessively tightened.
- The pump is not equipped with filter. Always install a suction filter.

SUCTION TUBING:
- Minimum recommended nominal diameter: 1"1/4.
- Nominal recommended pressure: 10 bar.
- Use tubing suitable for functioning under suction pressure.

DELIVERY TUBING:
- Minimum recommended nominal diameter: 1".
- Nominal recommended pressure: 10 bar.

ATTENTION
It is the installer's responsibility to use tubing with adequate characteristics.

The use of tubing unsuitable for use with diesel fuel can damage the pump, injure persons and cause pollution.
Loosening of the connections (threaded connections, flanging, gasket seals) can cause serious ecological and safety problems.
Check all the connections after the initial installation and on a daily basis after that.
Tighten the connections, if necessary.

H5 CONSIDERATIONS REGARDING DELIVERY AND SUCTION LINES

DELIVERY

The choice of pump model must be made keeping the **characteristics of the system** in mind.

The combination of the length of the tubing, the diameter of the tubing, the flow rate of the diesel fuel and the line accessories installed can create back pressure **greater than the maximums anticipated** such as to cause the (partial) opening of the pump by-pass with the consequent noticeable reduction of the flow rate supplied.

In such cases, to allow correct functioning of the pump, **it is necessary to reduce system resistance, using shorter tubing and/or of wider diameter** and line accessories with less resistance (e.g. an automatic dispensing nozzle for greater flow rates).

SUCTION

BIPUMP is a self-priming pump characterised by excellent suction capacity.

During the start-up phase, with an empty suction tube and the pump wetted with fluid, the electric pump unit is capable of suctioning the liquid with a maximum difference in height of 2 meters. It is important to point out that the priming time can be as long as one minute and the presence of an automatic dispensing nozzle on the delivery line prevents the evacuation of air from the installation, and, therefore, prevents proper priming.

For this reason, it is always advisable to prime the pump without an automatic delivery nozzle, verifying the proper wetting of the pump. The installation of a foot valve is recommended to prevent the emptying of the suction tube and to keep the pump wet. In this way, the pump will subsequently always start up immediately.

When the system is functioning, the pump can work with pressure at the inlet as high as 0.5 bar, beyond which cavitation phenomena can begin, with a consequent loss of flow rate and increase of system noise.

As we have said up to this point, it is important to guarantee low suction pressure by using short tubing of a diameter equal to or larger than recommended, reducing curves to a minimum and using suction filters of wide cross-section and foot valves with the lowest possible resistance.

It is very important to keep the suction filters clean because, once clogged, they increase system resistance.

The difference in height between the pump and the fluid level must be kept as small as possible and, at any rate, within the 2 meters anticipated for the priming phase.

If this height is exceeded, it will always be necessary to install a foot valve to allow for the filling of the suction tube and provide tubing of wider diameter. It is recommended that the pump not be installed at a difference in height greater than 3 meters.

ATTENTION
In the case that the suction tank is higher than the pump, it is advisable to install an antisiphon valve to prevent accidental diesel fuel leaks.
Dimension the installation in order to control the back pressures due to water hammering.

H6 ACCESSORIES

Following is a list of the most common accessories whose use is compatible with the proper functioning of the pumps.

DELIVERY

- Automatic dispensing nozzle
- Manual dispensing nozzle
- Meter
- Flexible tubing

SUCTION

- Foot valve with filter
- Rigid and flexible tubing
- Suction filter

ELECTRICAL POWER SUPPLY

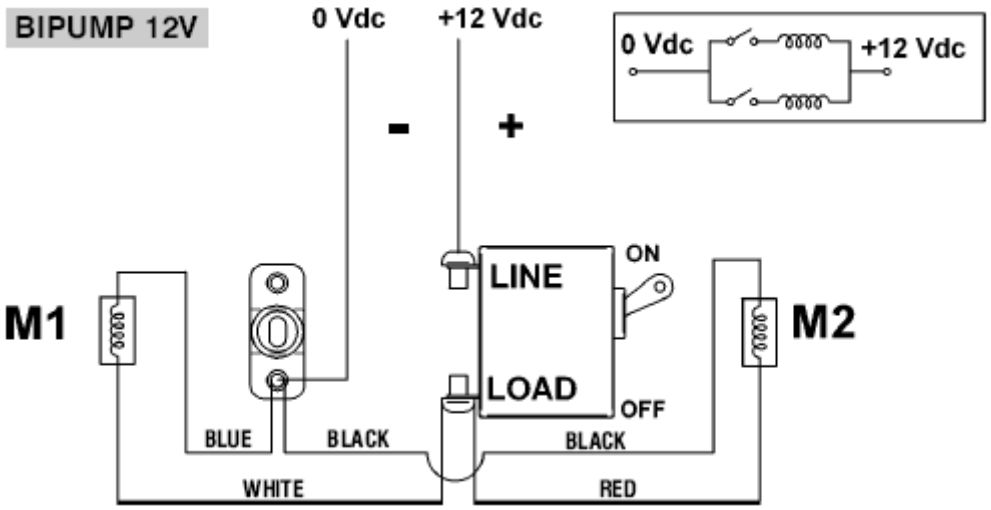
- Line cord, 2 m
- Line cord, 4 m

ATTENTION
It is the installer's responsibility to provide the accessories necessary for the safe and proper functioning of the pump.

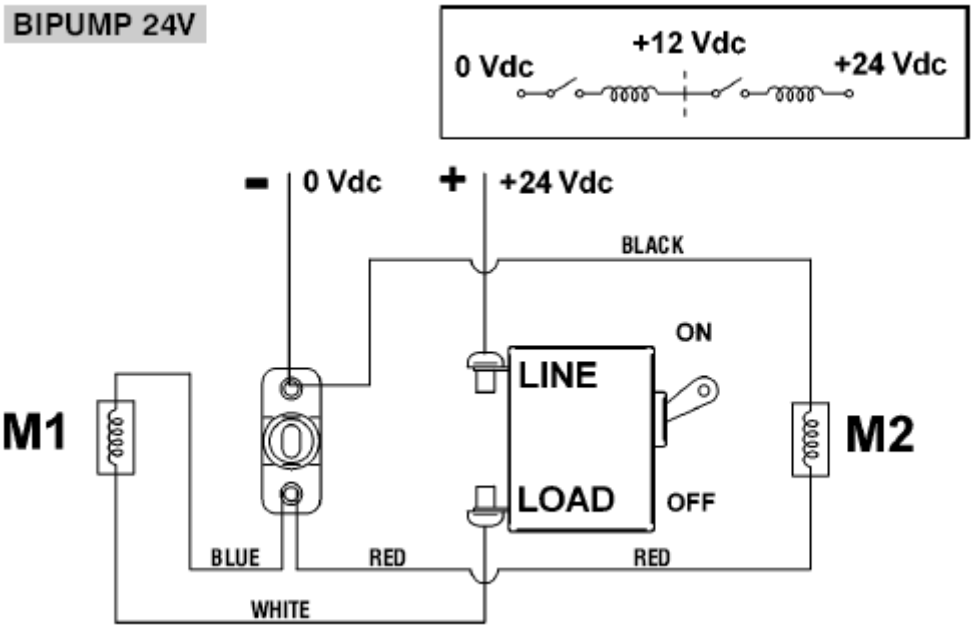
The use of accessories unsuitable for use with diesel fuel can damage the pump, injure persons and cause pollution.

H7 ELECTRICAL CONNECTIONS

The pump is supplied without power cord.



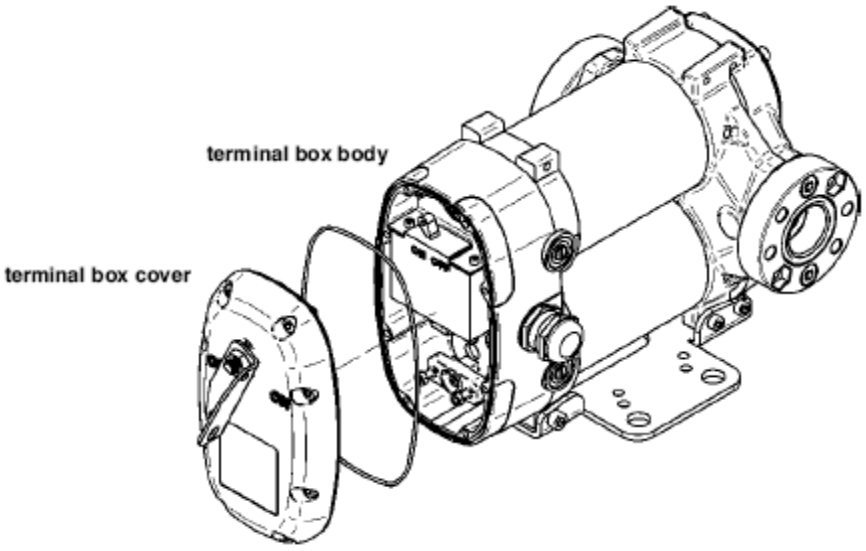
In the event of a 12V connection without switch, connect the white and red cables directly to the positive pole (+).



In the event of a 24V connection without switch, connect the white cable directly to the positive pole (+).

ATTENTION
IT IS THE INSTALLER'S RESPONSIBILITY TO PERFORM THE ELECTRICAL CONNECTIONS WITH RESPECT FOR THE APPLICABLE REGULATIONS.

Before closing the terminal strip box, apply a layer of grease to the seat of the Or-gasket.



Respect the following (not exhaustive) instructions to ensure a proper electrical installation.

- During installation and maintenance, make sure that the electric supply lines are not live.
- Use cables characterized by the minimum cross-sections, nominal voltages and wiring-type adequate to the electrical characteristics shown in Paragraph E2 - ELECTRICAL SPECIFICATIONS and the installation environment.
- Always close the cover of the terminal strip box before supplying electrical power.
- Make sure the electrical connections are suitably protected.

I. INITIAL START-UP

- Check that the quantity of diesel fuel in the suction tank is greater than the amount you wish to transfer.
- Make sure that the residual capacity of the delivery tank is greater than the quantity you wish to transfer.
- Do not run the pump dry. This can cause serious damage to its components.
- Make sure that the tubing and line accessories are in good condition. Diesel fuel leaks can damage objects and injure persons.
- Never start or stop the pump by connecting or cutting out the power supply.
- Do not operate switches with wet hands.
- Prolonged contact with diesel fuel can damage the skin. The use of glasses and gloves is recommended.

ATTENTION
Extreme operating conditions can raise the motor temperature.
Turn off the pump and wait for it to cool before resuming use.

In the priming phase the pump must blow the air initially present in the entire installation out of the delivery line.
Therefore it is necessary to keep the outlet open to permit the evacuation of the air.

ATTENTION
If an automatic type dispensing nozzle is installed on the end of the delivery line, the evacuation of the air will be difficult because of the automatic stopping device that keeps the valve closed when the line pressure is too low. It is recommended that the automatic dispensing nozzle be temporarily disconnected during the initial start-up phase.

The priming phase can last from several seconds to a few minutes, as a function of the characteristics of the system. If this phase is prolonged, stop the pump and verify:

- That the pump is not running completely dry;
- That the suction tubing is not allowing air to seep in;
- That the suction filter is not clogged;
- That the suction height is not higher than 2 m (if the height is higher than 2 m, fill the suction tube with fluid);
- That the delivery tube is allowing the evacuation of the air.

When priming has occurred, verify that the pump is operating within the anticipated range, in particular:

- That under conditions of maximum back pressure, the power absorption of the motor stays within the values shown on the identification plate;
- That the suction pressure is not greater than 0.5 bar;
- That the back pressure in the delivery line is not greater than the maximum back pressure anticipated for the pump.

L. DAILY USE

a) If using flexible tubing, attach the ends of the tubing to the tanks. In the absence of an appropriate slot, solidly grasp the delivery tube before beginning dispensing.
b) Before starting the pump make sure that the delivery valve is closed (dispensing nozzle or line valve).
c) Turn the ON/OFF switch on. The by-pass valve allows functioning with delivery closed only for brief periods.
d) Open the delivery valve, solidly grasping the end of the tubing.
e) Close the delivery valve to stop dispensing.
f) When dispensing is finished, turn off the pump.

ATTENTION
Functioning with the delivery closed is only allowed for brief periods (2 / 3 minutes maximum).
The operation in nominal conditions is restricted to a working cycle of 30 minutes.
After use, make sure the pump is turned off.

M. PROBLEMS AND SOLUTIONS

Problem	Possible Cause	Correttive Action
THE MOTOR IS NOT TURNING	Lack of electric power	Check the electrical connections
	Rotor jammed	Check for possible damage or obstruction of the rotating components
	Motor problems	Contact the Service Department
	Burn out fuse	Replace the fuse
THE MOTOR TURNS SLOWLY WHEN STARTING	Low voltage in the electric power line	Bring the voltage back within the anticipated limits
LOW OR NO FLOW RATE	Low level in the suction tank	Refill the tank
	Foot valve blocked	Clean and/or replace the valve
	Filter clogged	Clean the filter
	Excessive suction pressure	Lower the pump with respect to the level of the tank or increase the cross-section of the tubing
	High loss of head in the delivery circuit (working with the by-pass open)	Use shorter tubing or of greater diameter
	By-pass valve blocked	Dismantle the valve, clean and/or replace it
	Air entering the pump or the suction tubing	Check the seals of the connections
	A narrowing in the suction tubing	Use tubing suitable for working under suction pressure
	Low rotation speed	Check the voltage at the pump. Adjust the voltage and/or use cables of greater cross-section
	The suction tubing is resting on the bottom of the tank	Raise the tubing
INCREASED PUMP NOISE	Cavitation occurring	Reduce suction pressure
	Irregular functioning of the by-pass	Dispense fuel until the air is purged from the by-pass system
	Air present in the diesel fuel	Verify the suction connections
LEAKAGE FROM THE PUMP BODY	Seal damaged	Check and replace the seal

N. MAINTENANCE

BIPUMP is designed and constructed to require a minimum of maintenance.

- On a weekly basis, check that the tubing joints have not loosened, to avoid any leakage.
- On a monthly basis, check the pump body and keep it clean of any impurities.
- Check weekly and keep the installed suction line filter.
- On a monthly basis, check that the electric power supply cables are in good condition.
- Check monthly for the presence of grease on the contact surface between terminal box cover and terminal box body.

O. NOISE LEVEL

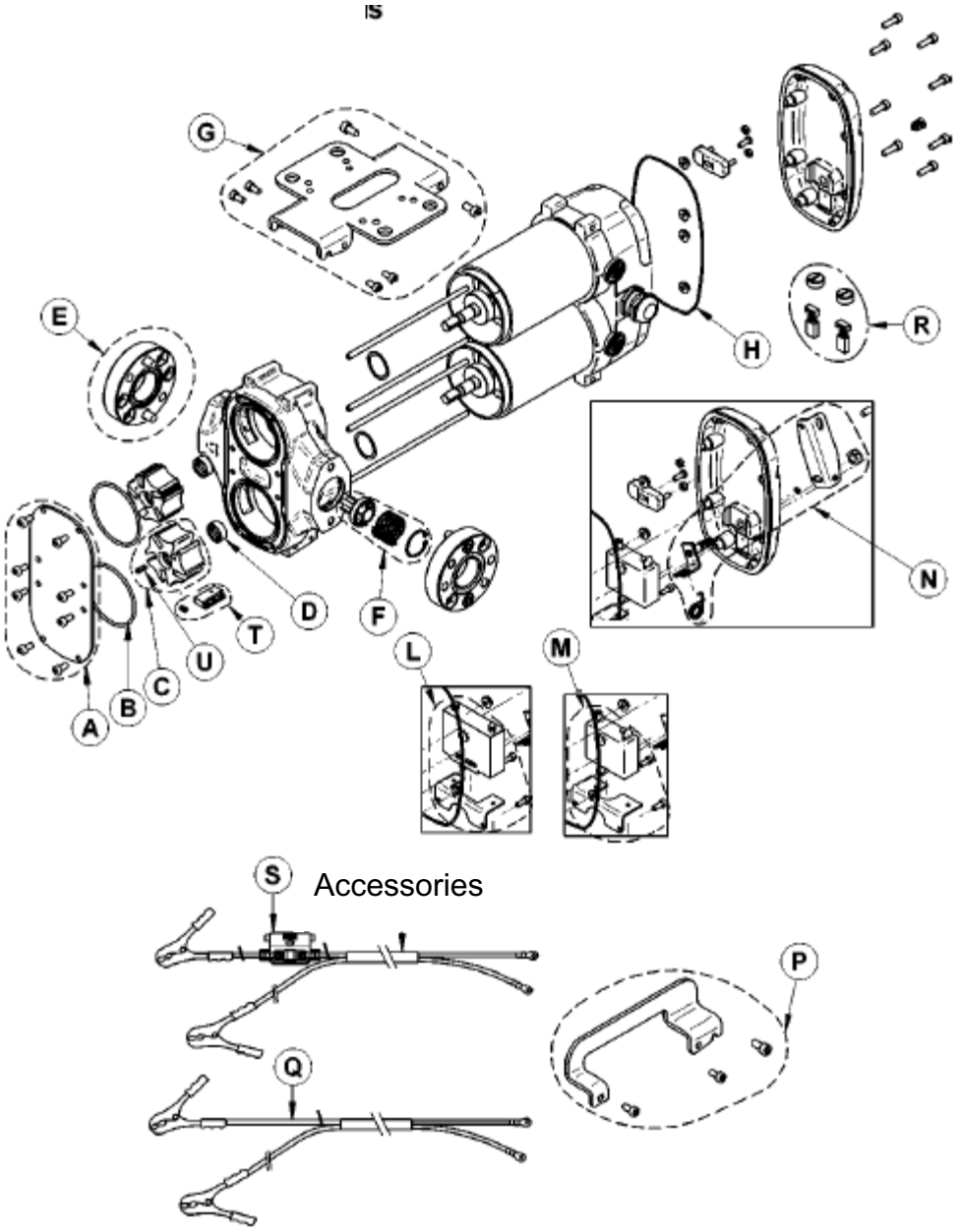
Under normal working conditions the noise emission from all models does not exceed the value of **70 db at a distance of 1 meter** from the electric pump.

P. DISPOSING OF CONTAMINATED MATERIALS

In the event of maintenance or demolition of the machine, do not disperse contaminated parts into the environment.

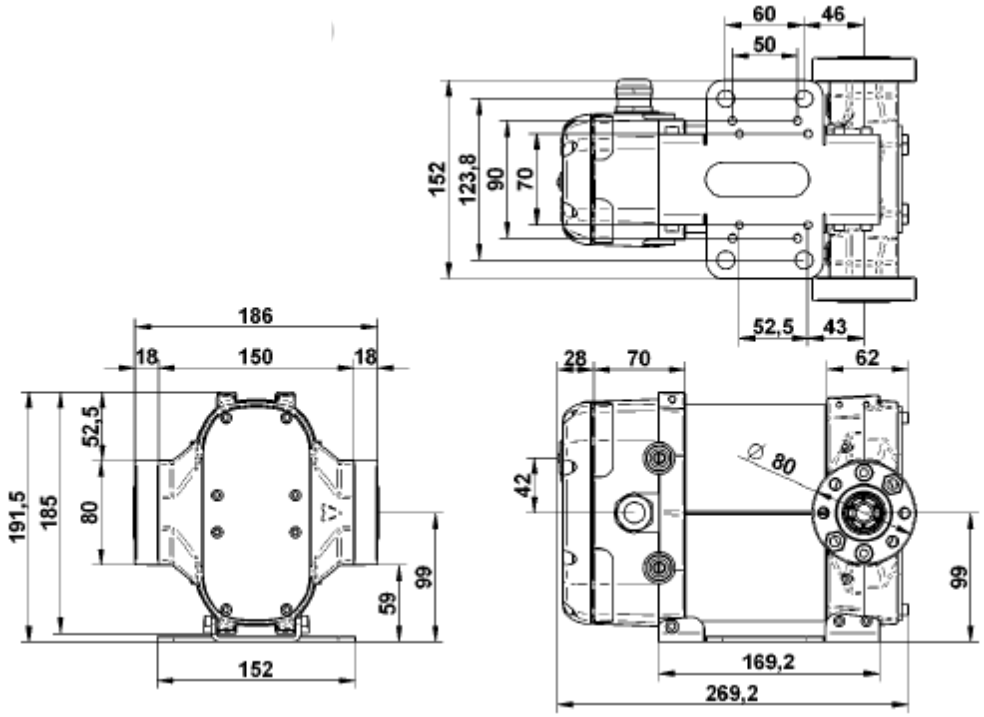
Refer to local regulations for their proper disposal.

Q. EXPLODED DIAGRAMS AND SPARE PARTS



R. DIMENSIONS AND WEIGHTS

Unit of measurement: mm



XV. USE AND MAINTENANCE MANUAL ECOKIT 12V DC

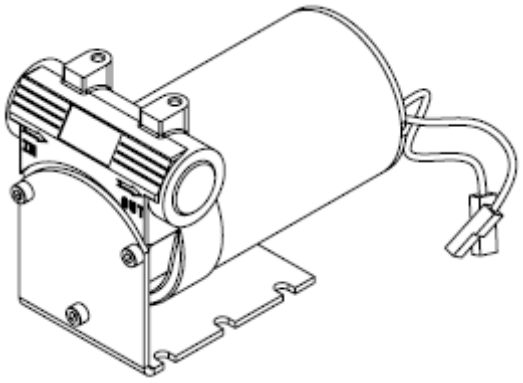


Figure 1 · Model ECOKIT 12/24 - 40

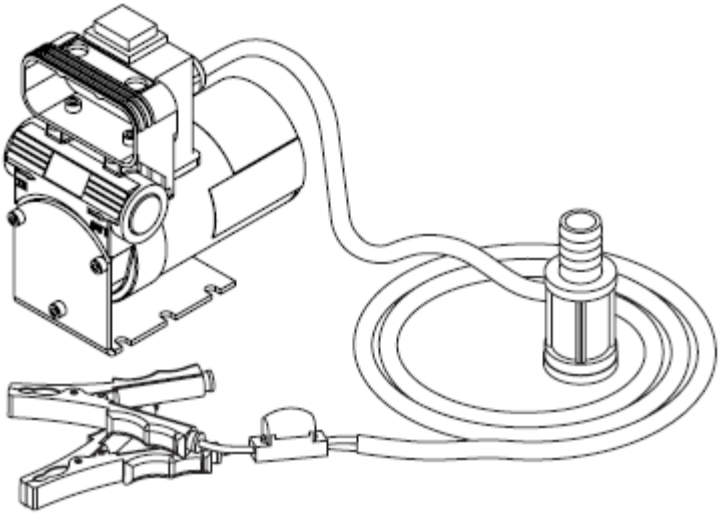


Figure 2 · Model ECOKIT 0 12/24 - 40

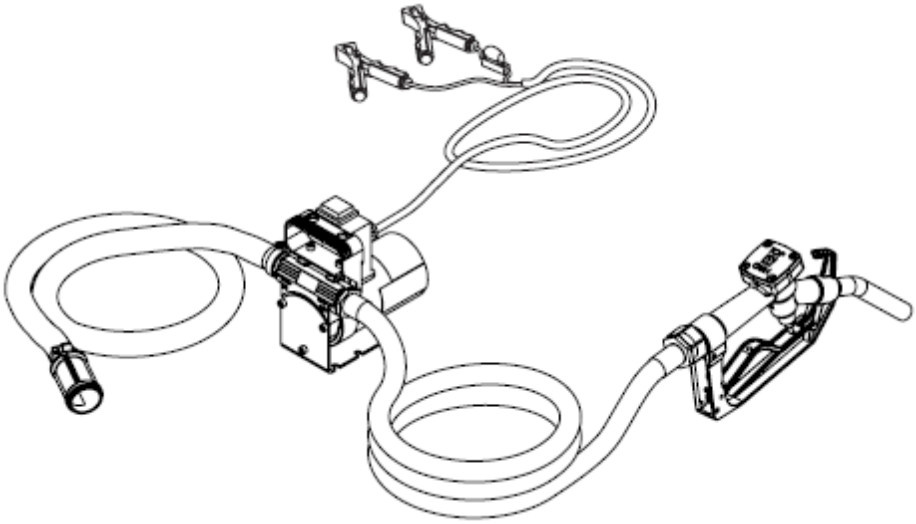


Figure 3 · Model ECOKIT 1 12/24 - 40

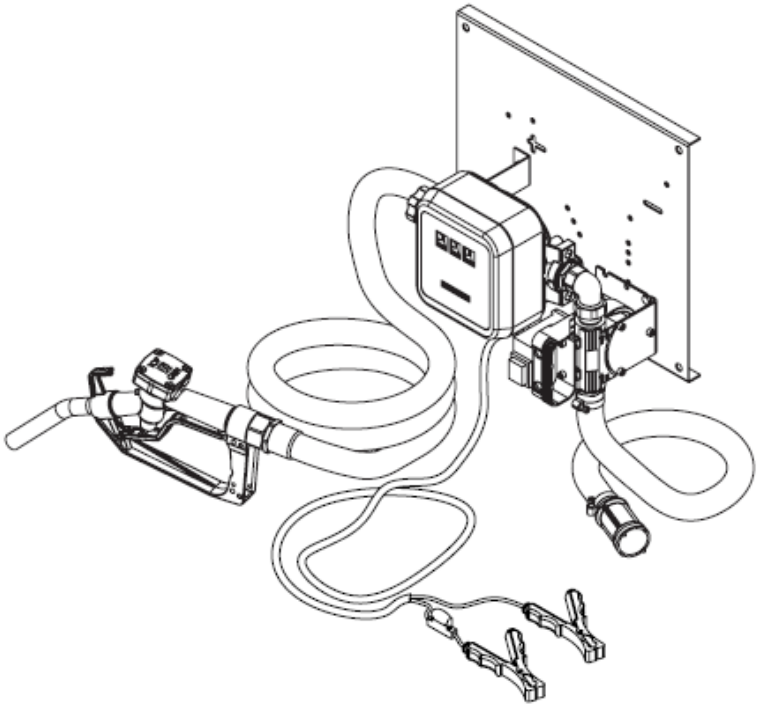


Figure 4 · Model WALLSTATION 1 12/24 – 40

Read and understand this Operating Manual before starting installation, maintenance or repair.

GENERAL DESCRIPTION AND ALLOWED USE
This diesel transfer system is designed for the delivery of diesel fuel (also for heating fuel and antifreeze) to vehicles and equipment from an open surface storage tank. The pump is a self priming, positive displacement, rotary vane machine which operates on 12V DC Power (models for 24V DC power are available), and delivers a flow of approximately 40 litres per minute. The pump has a built-in bypass valve that keeps the operating pressure below 1.3 Bar (18 psi). The motor has a 30 minute duty cycle.

SAFETY PRECAUTIONS AND FORBIDDEN USE
Improper use or installation of this product can cause serious bodily injury or death!

- Not for use with gasoline, alcohol, or other liquid with a flash point below 40°C (104°F).
- Not for use in hazardous locations.
- Not for use with fluids thicker than diesel fuel.
- Not for use to transfer fluids into an aircraft.
- Not for use with fluids for human consumption.
- Not for dispensing water.
- Not for continuous duty applications.

EC COMPLIANCE STATEMENT
TUTHILL ITALIA SPA, Via della Resistenza, 46/48, 41011 Campogalliano (Modena) - Italy, states, taking full responsibility, that the following Pump Series ECOKIT 12/24-40, ECOKIT 0 12/24-40, ECOKIT 1 12/24-40 & WALLSTATION 12/24-40, comply with the Directive for Machines 89/392/CEE (91/368/CEE, 93/44/CEE, 93/68/CEE), 89/336/CEE (93/68/CEE), 73/23/CEE, and with standards EN 60529, EN 60204-1, EN 55081-2, EN 55011C/.A, D.L. 277/91.

This document has been signed by:
Mr. Bernard Gilson, Via della Resistenza, 46/48,
41011 Campogalliano (Modena) - Italy, Phone +39 059 528128,
Fax +39 059 528437who has full legal authority to represent the firm in the European Community. Dated, 1st of February 2008.

Machine Identification - Label (typical example)

This Operating Manual should be considered as part of the machine. When the machine is sold, it must be transferred to the new owner.

A. MECHANICAL INSTALLATION

Do NOT install foot or check valves in the system unless they have pressure relief set at 3.5 Bar (50 psi) or less.

1. Use oil resistant pipe sealant or Teflon® tape on all pipe threads.
2. Note the direction of flow cast on to the front of the pump.
3. Assemble model ECOKIT 1 12/24 – 40 as shown in Figure 7 (page 4).
4. For the Models ECOKIT and ECOKIT 0 12/24 – 40 that includes the pump only:
   - Select hoses or pipes with an inside diameter of 19mm (3/4") that are compatible with diesel and rated for at least 3.5 Bar (50 psi). Pump fluid ports are ¾" BSPP.
   - Select a diesel compatible nozzle.
5. Install the strainer at the inlet to the suction hose or pipe to prevent debris from being drawn into the pump.
6. Tighten all threaded joints and hose clamps securely.
7. Position the assembled pump on a secure surface. Tanks or barrels should be anchored to prevent tipping in both the full and empty conditions.

B. ELECTRICAL INSTALLATION

1. Connect the battery clips on the motor power cord to a suitable battery, capable of delivering the necessary voltage and current (see the Technical Data, back page of this manual).
   - The RED clip is attached to the positive (+) battery terminal.
   - The BLACK clip is attached to the negative (-) battery terminal or to the vehicle frame.
2. If the power cable provided is not long enough, have it replaced by an authorized electrician.

Avoid sparks that could cause a fire. Do NOT use a patch cord to extend the power cables.

C. OPERATION

AVOID RUNNING PUMP DRY FOR MORE THAN 3 MINUTES.

1. Before use, wipe off any dirt or moisture that may have accumulated on the nozzle or hoses.
2. Insert nozzle into the container to be filled. Insert suction hose (if applicable) into the diesel storage tank.
3. Switch the motor on.
4. Operate the nozzle lever to dispense fluid.
5. When the desired amount of fluid has been dispensed, release nozzle lever to stop flow.
6. Immediately switch motor off.
7. Nozzle and hoses should be kept clean and dry when not in use..

D. MAINTENANCE (SEE FIGURES 5, 6 & 7)

1. Inspect and clean the strainer on the inlet hose or pipe monthly.
2. Clean the metal “mouth” portion of the battery clips with steel wool monthly to maintain good electrical connection to the battery.
3. Hoses should be inspected annually. Replace if cracked or worn.
4. Rotor and vanes will eventually wear, and should be replaced if pump performance degrades. See the “Operational Problems” section to determine if replacement is needed.
5. Drain hoses and pump and store in a clean, dry place when not in use.

® Teflon is a registered trademark of E.I. Du Pont De Nemours and Company.

E. OPERATIONAL PROBLEMS (SEE FIGURES 5, 6 & 7)

Relieve pressure by opening the nozzle and draining the hose, and disconnect power before servicing pump.

PROBLEM	POSSIBLE CAUSE	SOLUTION
Pump won't prime.	Suction line problem.	Check for leaks or obstruction in suction hose or pipe.
	Outlet is blocked.	Check to make sure outlet hose and nozzle are clear and operating correctly.
	Debris in Bypass valve.	Inspect bypass valve.
	Vanes are sticking.	Inspect vanes and slots in rotor for nicks or burrs.
	Excessive rotor and/or vane wear.	Replace rotor and vanes.
Pump hums but won't dispense fluid.	Dirt or rust in pump cavity.	Clean pump cavity.
	Broken rotor key.	Clean pump cavity and replace rotor key.
Low Flow.	Plugged Strainer.	Clean or replace strainer.
	Restriction on the outlet or in the inlet.	Long and small ID hoses, filters, and automatic nozzles will reduce the flow rate. Use higher flow components.
	Excessive Roter and/or vane wear.	Replace rotor and vanes.
Motor surface temperature gets hotter than 100°C (212°F).	Fluid is too thick.	Fluid must not be thicker than diesel fuel.
	Motor ran more than 30 minutes before allowing to cool down.	Motor is designed for a maximum "on" time of 30 minutes. Motor must be allowed to cool down before using again.
Motor will not turn on.	Poor electric al connection.	Use steel wool to clean the "mouth" of the battery clips on the power cord.
	Battery dead or low.	Check battery.
	Fuse in power cord is blown.	A blown fuse often indicates a problem with the free rotation of the motor. Inspect for dirt or debris in pump cavity. Replace fuse with a standard 30 amp automotive fuse. If fuse blows again, replace pump.
	Switch failure.	Replace switch.
Leak at Weep hole.	Worn or torn shaft seal.	Replace shaft seal. Make sure shaft and seal pocket in pump housing are clean before installing new seal.
	Incompatible fluid.	Fluid must be compatible with HNBR and Cast Iron.

NOTICE: ANY MODIFICATION PERFORMED ON THE UNITS WITHOUT „TUTHILL" WRITTEN PERMISSION WILL AUTOMATICALLY VOID ANY GUARANTEE AND FREE „TUTHILL" FROM ANY KIND OF RESPONSIBILITY.

F. REPAIR KITS (SEE FIGURE 5)

POS.	DESCRIPTION	REFERENCE	QTY
40 Lt REPAIR KIT		KIT40	
11	O-RING 2212 NBR		1
12	ROTARYRY SEAL 10197		1
14	PLASTIC DRIVE KEY		1
17	VANE		5
KIT BY PASS 40-45 Lt		41071000	
18	BY-PASS SPRING		1
15	BY PASS VALVE		1
16	BY-PASS CAP		1

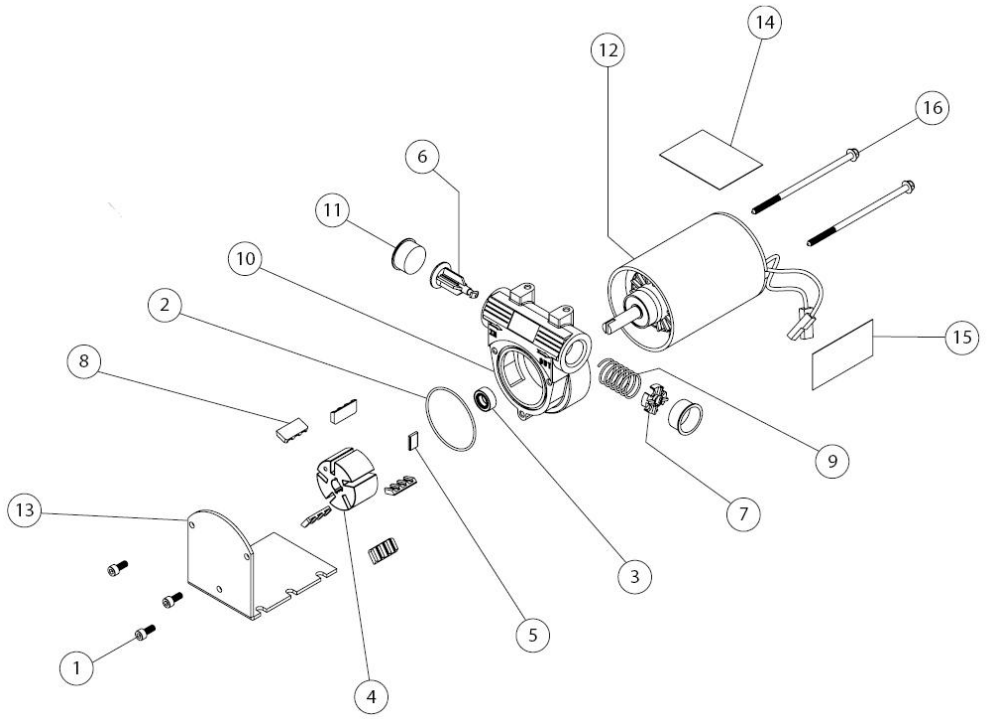


Figure 5 ECOKIT 12/24 - 40

ECOKIT 12/24 - 40 (FIG 5)

POS.	DESCRIPTION	REFERENCE		QTY
		12V	24V	
1	SCREW M5 X 12	13001013	13001013	3
2	O-RING 2212 NBR	18001014	18001014	1
3	ROTARYRY SEAL 10197	12010031000	12010031000	1
4	ROTOR Ø45	61000003	61000003	1
5	PLASTIC DRIVE KEY	71000517	71000517	1
6	BY-PASS VALVE	71000520	71000520	1
7	BY-PASS CAP	71000521	71000521	1
8	VANE	71000522	71000522	5
9	BY-PASS SPRING	71008006	71008006	1
10	PUMP HOUSING-40 ¾” BSPP	71000087	71000087	1

11	PLASTIC PLUG	163013300000	163013300000	2
12	MOTOR Ø77 WIRES BEHIND	231501700000	231501800000	1
13	ROTOR COVER SUPPORT	71000086	71000086	1
14	“DANGER” STICKER	71000653	71000653	1
15	PUMP AND MFG.DATE LABEL	220000000000	220000000000	1
16	HOUSING BOLT M5 X 115 mm	6100481150	6100481150	2

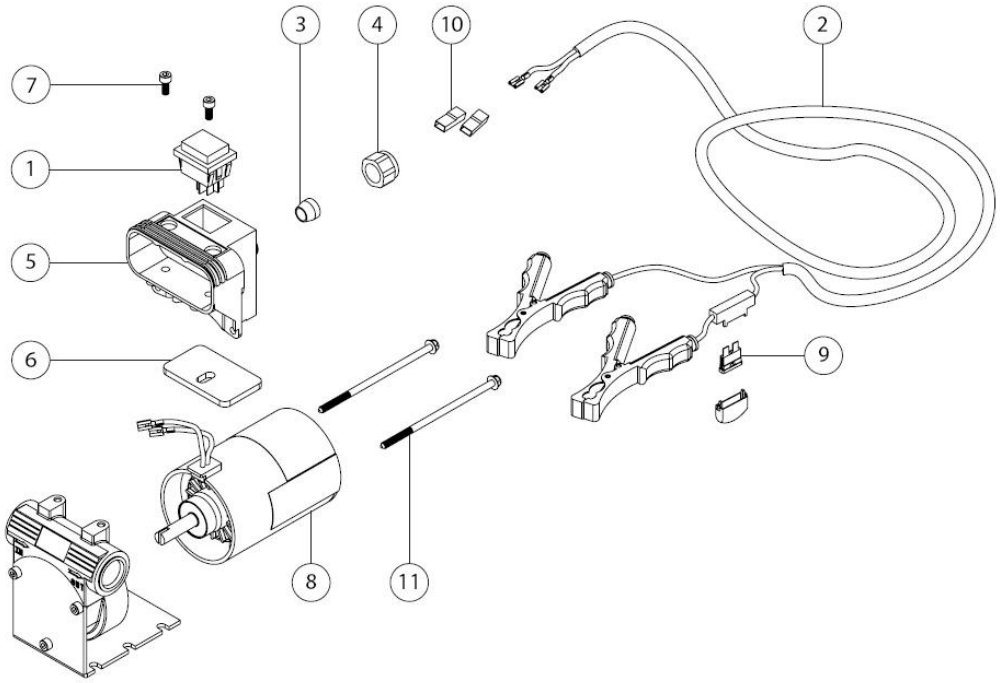


Figure 6 ECOKIT 0 12/24 - 40

ECOKIT 0 12/24 - 40 (FIG 6)

POS.	DESCRIPTION	REFERENCE		QTV
		12V	24V	
1	SWITCH	190050210000	190050210000	1
2	ELECTRIC CABLE ASSEMBLY	17001010	17001010	1
3	CABLE GROMMET	17001011	17001011	1
4	CABLE CONNECTOR NUT	17001012	17001012	1
5	PLASTIC HANDLE	71000585	71000585	1
6	SPONGE SEAL	71000590	71000590	1
7	SCREW M5 X 12	13001013	13001013	2
8	MOTOR Ø77 WIRES UP	71009045	71009046	1
9	FUSE	190170150000	190170130000	1
10	SPADE CONNECTOR COVER 6,3	190110000000	190110000000	2
11	HOUSING BOLT M5 X 115 mm	6100481150	6100481150	2

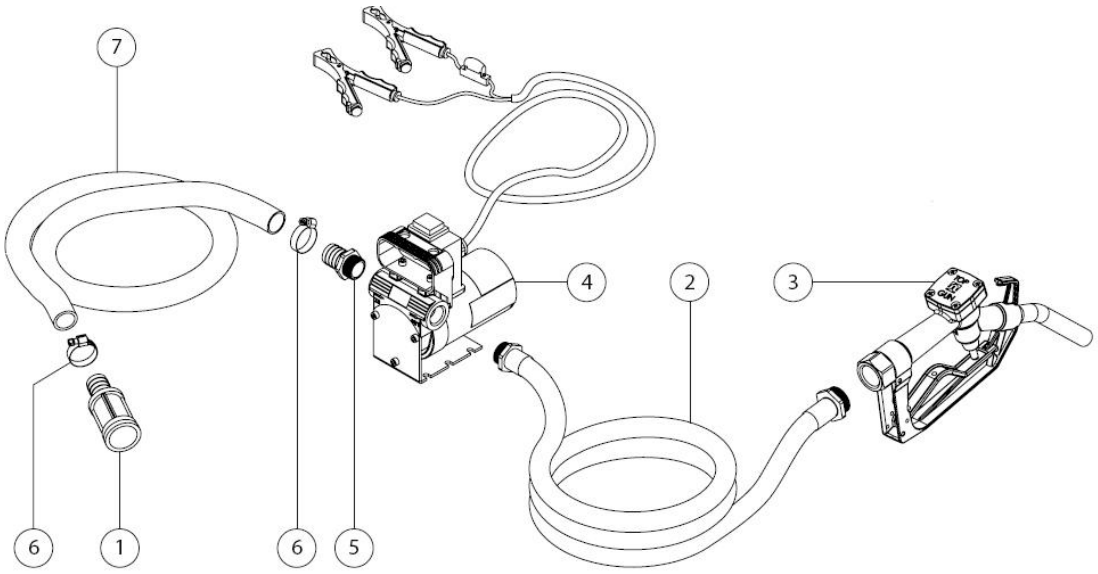


Figure 7 ECOKIT 1 12/24 - 40

ECOKIT 1 12/24 – 40 (FIG 7)

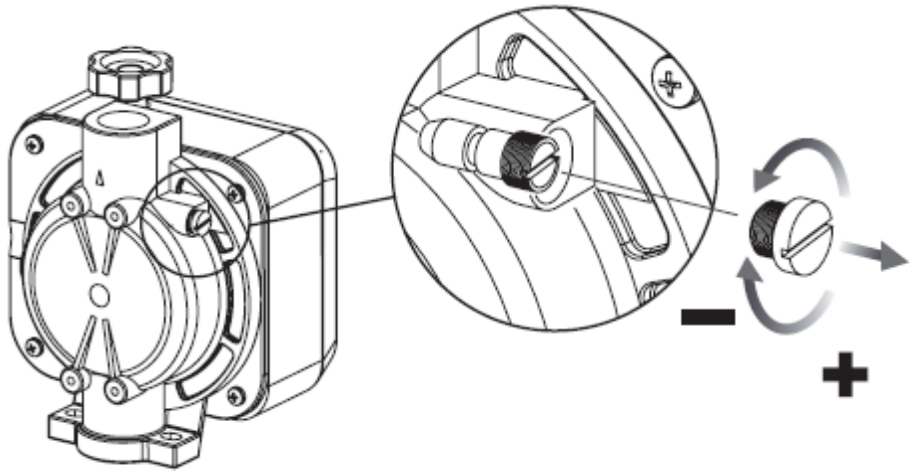
POS.	DESCRIPTION	REFERENCE		QTV
		12V	24V	
1	FILTER Ø25	121500700000	121500700000	1
2	DELIVERYRY HOSE ø19 4 MT 1” X ¾”	201015035010	201015035010	1
3	TOP GUN 1” BSPP MANUAL NOZZLE	2705150500020	2705150500020	1
4	ELECTRIC PUMP “ECOKIT 0”	2108510084002	2108512084002	1
5	HOSE BARB 3/4” X 25	240015016000	240015016000	1
6	HOSE CLAMP	91505270000	91505270000	2
7	SUCTION HOSE Ø25 2 Mt	20132500000	20132500000	1

G. FLOW METER CALIBRATION

Calibration is required when the meter is new, after disassembly, when metering a different fluid, or after significant wear. A proving container or a container of KNOWN volume will be needed for the calibration procedure. It is recommended that the container volume be at least 19 litres (5 gallons).

Procedure for calibration:
1. Fill container to a know volume.
2. If indicated amount on the flow meter does not match know volume, calibration is required. Insure pump power is off and system pressure relieved, then remove seal screw and turn calibration screw counter clockwise to reduce indicated amount or clockwise to increase the amount. A full turn will change the indicated amount by approximately 0.4L. Re-install seal screw.
3. Repeat step 2 until calibration is acceptable.

CALIBRATION PROCEDURE



Z98 FLOW METER (FIG 8)

POS.	DESCRIPTION	REFERENCE	QTV
1	FACE PLATE Z98	62121013000	1
2	RESET KNOB	62302000000	1
3	BLACK COVER R	140051000000	1
4	SCREW M4 X 10	80901439100	5
5	REGISTER- 3 DIGITS	62202000000	1
6	BEVEL GEAR R	61407000000	1
7	SCREW M5 X 12	80901814100	8
8	COVER HOUSING	155005000000	1
9	O-RING 2015	11010040200	1
10	SCREW Ø 5 X 35	80401838100	4
11	BUSH Ø4 X Ø12 sp4	61604000000	1
12	GEARED WHEEL SPINDLE Ø45	61404000000	1
13	GEARED WHEEL Ø36	61406000000	1
14	CALIBRATION CAP 1/8”	61000800000	1
15	CYLINDRIC GEAR Ø9	61402000000	1
16	TRIANGULAR BRACKET	61801000000	1
17	PIN WITH LEVER	60515000000	1
18	O-RING 108	11010100200	1
19	SPRPRING	33605060950	4

20	O-RING 20 x 3	11020300000	1
21	UPP UPP UPPER MEASURURING CHAMBER	61201000000	1
22	REVOLVING DISK	14030000000X	1
23	LOWER MEASURURING CHAMBER	61202000000	1
24	O-RING 4400	11010460600	1
25	ALUMUMINIUMUM BODY Y	60920000000	1
26	O-RING 2018	11010050200	1
27	CALIBRATION SCREW 1/8”	6100050000X	1
28	PIN Ø 2 x 17,5	60518000000	1

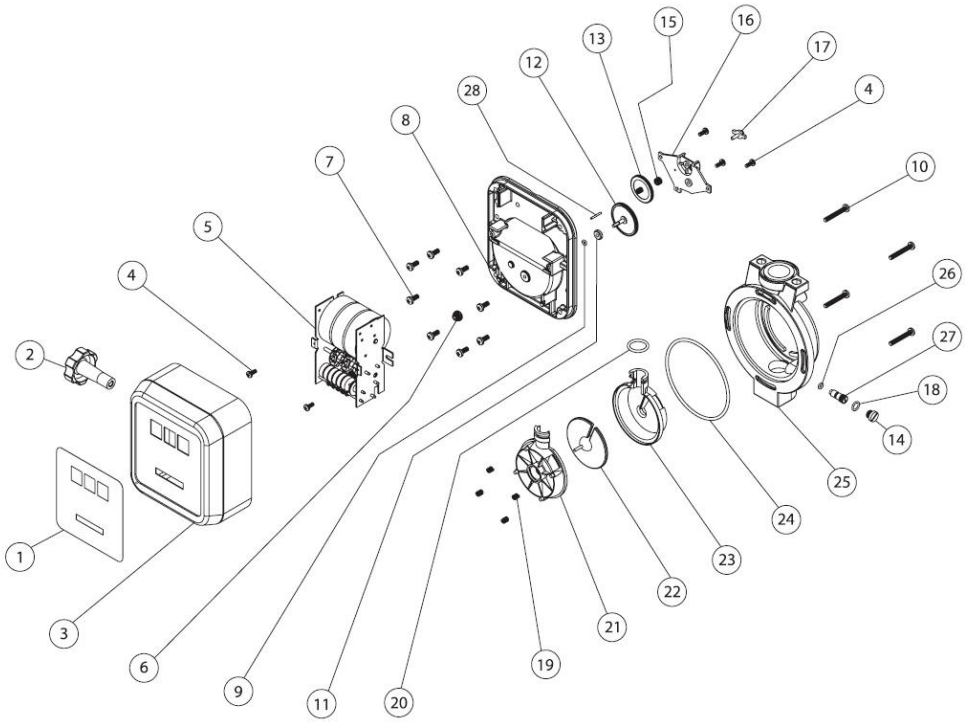


Figure 8 Z98 FLOW METER

WALLSTATION 12/24 – 40 (FIG 9)

POS.	DESCRIPTION	REFERENCE		QTV
		12V	24V	
1	TOP GUN 1” BSPP MANUAL NOZZLE	2705150500020	2705150500020	1
2	DELIVERYRY HOSE Ø19 4MT 1” X 1”	201015035030	201015035030	1
3	Z98 METER LEFT OUTLET	115307000751S	115307000751S	1
4	SCREW 6 X 14	80232320100	80232320100	3
5	METER SUPPORT	6180640000X	6180640000X	1
6	WASHER Ø5	83101810000	83101810000	1
7	SCREW 5 X 10	80501813100	80501813100	1
8	PANEL WALL STATION	61805400000	61805400000	1
9	FLANGED NUT M6	71000112	71000112	3
10	FILTER Ø25	121500700000	121500700000	1
11	HOSE CLAMP	91505270000	91505270000	2
12	SUCTION HOSE Ø25 2MT	20132500000	20132500000	1
13	HOSE BARB 3/4” X 25	240015016000	240015016000	1
14	ELECTRIC PUMP ECOKIT 0	2108510084002	2108512084002	1
15	PIPE UNION 3PCS 3/4”	250161500200	250161500200	1
16	REDUCTION 1” / 3/4”	250053254000	250053254000	1

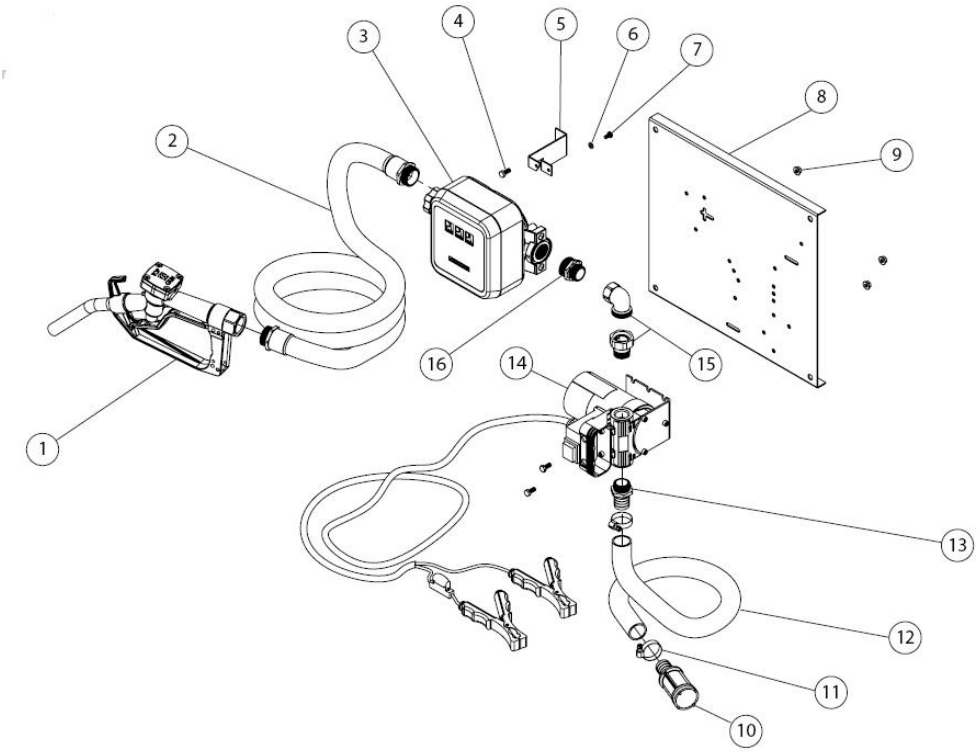
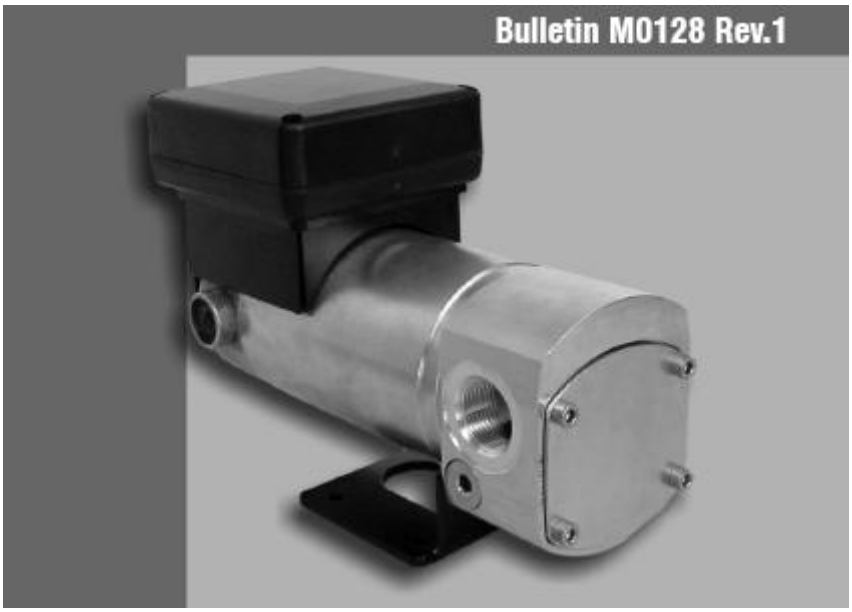


Figure 9 WALLSTATION 12/24 – 40

H. TECHNICAL DATA

MODEL	ECOKIT 12/24 - 40	ECOKIT 0 12/24 - 40	ECOKIT 1 12/24 - 40	WALLSTATION 12/24 - 40
Maximum Flow Rate	40 lpm	40 lpm	40 lpm	40 lpm
Maximum Pressure	1.3 Bar	1.3 Bar	1.3 Bar	1.3 Bar
Built in Bypass Valve	YES	YES	YES	YES
Voltage	12V DC (24V DC available)	12V DC (24V DC available)	12V DC (24V DC available)	12V DC (24V DC available)
Maximum Current	18 Amps (12)	18 Amps (12)	18 Amps (12)	18 Amps (12)
Duty Cycle (S2)	30 Minutes	30 Minutes	30 Minutes	30 Minutes
Fuse in battery cable	n.a.	30 Amps (15)	30 Amps (15)	30 Amps (15)
Inlet and Outlet threads	3/4” BSPP	3/4” BSPP	3/4” BSPP	3/4” BSPP - 1”BSPP *
Operating Temperature	-20°C/50°C	-20°C/50°C	-20°C/50°C	-20°C/50°C
Pump Housing Material	Cast Iron	Cast Iron	Cast Iron	Cast Iron
Rotor Material	Iron	Iron	Iron	Iron
Vane Material	Acetal	Acetal	Acetal	Acetal
Shaft Seal Material	HNBR	HNBR	HNBR	HNBR
Discharge Hose	no	no	YES	YES
Discharge Nozzle	no	no	YES	YES
Suction Hose	no	no	YES	no
Suction Filter	YES	YES	YES	YES

XVI. USE AND MAINTENANCE MANUAL VISCOMAT DC 12 AND 24V DC



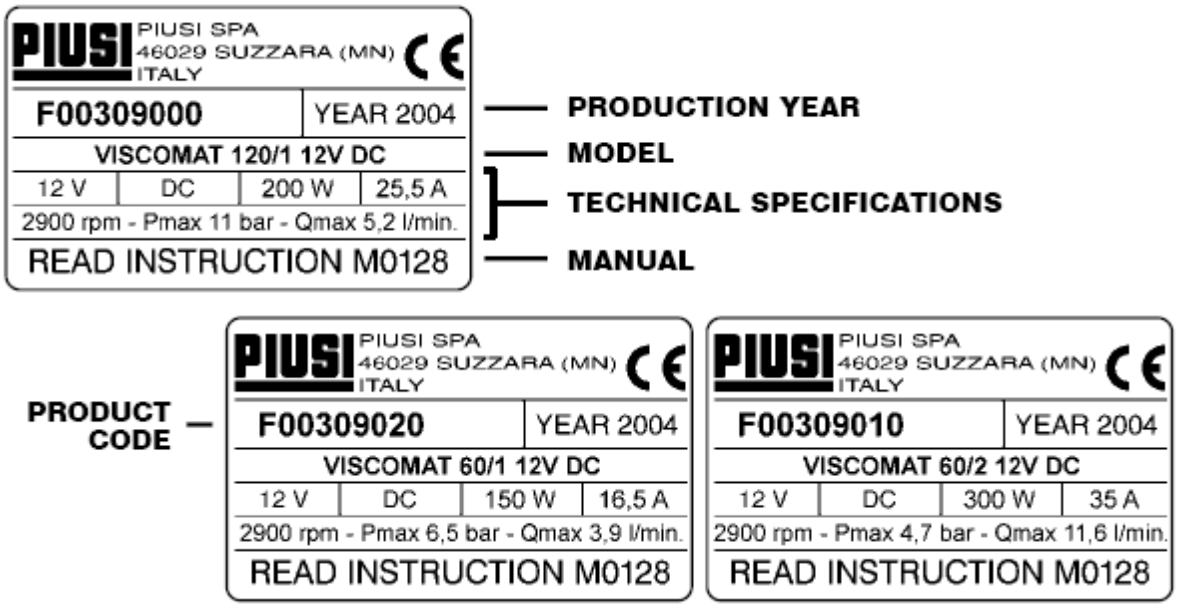
A. INDEX

B. MACHINE AND MANUFACTURER IDENTIFICATION

Available Models:

- **VISCOMAT 120/1 12V DC**
- **VISCOMAT 60/1 12V DC**
- **VISCOMAT 60/2 12V DC**

MANUFACTURER: **PIUSI SPA VIA PACINOTTI - Z.I. RANGAVINO 46029 SUZZARA (MN)**
IDENTIFICATION PLATE (EXAMPLE WITH THE FIELDS IDENTIFIED):



ATTENTION
Always check that the revision level of this manual coincides with what is shown on the identification plate.

C. DECLARATION OF CONFORMITY

DECLARATION OF CONFORMITY

The undersigned, representing the following manufacturer

PIUSI S.p.A.
46029 SUZZARA (MANTOVA) ITALY

hereby CERTIFIES that the equipment described below:

- **VISCOMAT 120/1 12V DC**
- **VISCOMAT 60/1 12V DC**
- **VISCOMAT 60/2 12V DC**

Complies with the following directives:

- **89/336 EEC** (Electromagnetic Compatibility Directive EMC) and subsequent amendments.
- **73/23 EEC** (Low-Voltage Directive) and subsequent amendments.
- **98/37 EEC** (Machine Directive) and subsequent amendments.

This is in conformity with the following International Standards (and their subsequent amendments):

EN 292-1 - Safety of Machinery - Basic Concepts, General Principles for Design - Terminology, Basic Methodology.
EN 292-2 - Safety of Machinery - Basic Concepts, General Principles for Design - Specifications and Technical Principles.
EN 294 - Safety of Machinery - Safe Distances to Prevent the Operator's Upper Limbs from Reaching Dangerous Areas.
EN 61000-6-1 - Electromagnetic compatibility - Generic standards - Immunity for residential, commercial and light-industrial environments.
EN 61000-6-3 - Electro-Magnetic Compatibility - Generic Emission Standards - Residential, Commercial and Light Industrial Environments.
EN 60204-1 - Safety of Machinery - Electric Equipment of Machines - General Rules.
EN 60335-1 - Household and similar appliances - Safety - General requirements.
EN 60335-2-41/A1 - Household and similar appliances - Safety - Particular requirements for pumps.
EN 60335-2-75 - Household and similar appliances - Safety - Particular requirements for commercial dispensing appliances and vending machines (electrical or gas powered).

And is in conformity with the following Italian National Decrees:
MD 31.07.1934 -Heading 1 No. XVII
Approval of the Applicable Safety Rules for the Storing, Use and Transport of Mineral Oils.
Last two figures of the year of CE marking: **04**

Suzzara 01.01.2004

OTTO VARINI, Chairman

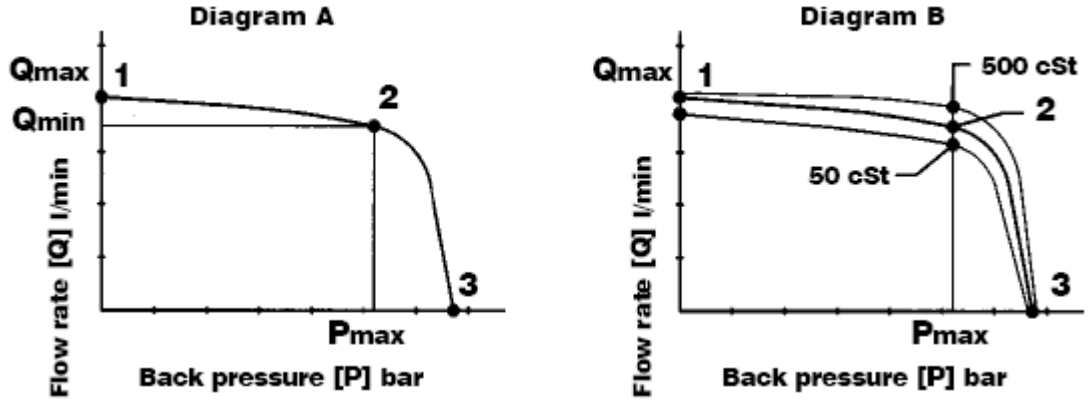
D. MACHINE DESCRIPTION

PUMP: Electric self-priming rotary external gear pump, equipped with a by-pass valve.

MOTOR: Brush motor powered by continuous current, low voltage, with intermittent cycle, closed type, IP55 protection class according to CEI EN 60034-5, flange-mounted directly to the pump body.

E. TECHNICAL SPECIFICATIONS

The performance data provided for the various pump models of the VISCOMAT family can be illustrated with curves that show the relationship between the **flow rate** supplied and the **back pressure** that the pump must overcome. Diagram "**A**" illustrates a **flow rate/back pressure** curve typical of all of the pumps in the VISCOMAT family.



Point "1" is the point at which the pump is functioning with practically no back pressure, in which case the pump supplies the maximum flow rate (Q max).
Point "2" is the functioning point characterized by the maximum back
pressure (P max) at which the pump supplies the minimum flow rate (Q min).
When the back pressure exceeds the value P max, thanks to the special design of the by-pass, there is a sudden opening of the by-pass, with a consequent sudden reduction of the flow rate supplied.
At flow rate zero (point "3") the entire flow rate supplied by the pump is recirculated in the by-pass, and the pressure in the delivery line reaches the value of P By-pass.

VISCOMAT pumps can, therefore, function in the face of any back pressure between zero and P max, supplying a flow rate varying little as a function of the back pressure between the values of Q max and Q min. The values for Q min, Q max, P max and P by-pass are provided for each model of pump in the Table below:

PUMP MODEL	Q max (litres/min)	Q min (litres/min)	P max (bar)	P by-pass (bar)	Current Max (A)*
VISCOMAT 120/1 12V	5.2	4.5	9	11	25.5
VISCOMAT 120/1 24V	5.3	4.6	9	11	12.5
VISCOMAT 60/1 12V	3.9	3.4	5	6.5	16.5
VISCOMAT 60/1 24V	4.2	4	5	6.5	8.5
VISCOMAT 60/2 12V	11.6	10.3	3	4.7	35
VISCOMAT 60/2 24V	12	10.8	3	4.7	18

data refer to pump performance with oil of viscosity 500cSt
* refers to functioning with maximum back pressure.

VISCOMAT pumps can pump oils of very different viscosities, within the limits indicated in the TECHNICAL INFORMATION, without requiring any adjustment of the by-pass.
The characteristic flow rate/back pressure curve illustrated in diagram "A" relates to functioning with oil of a viscosity equal to approximately 500 cSt (comparable, for example, to oil SAE W80 at a temperature of 20°C).
As the viscosity of the oil varies, the variation in the pump's performance will be more noticeable the greater the back pressure against which the pump is working.
Diagram "B" illustrates how the characteristic curve changes in the case of the maximum and minimum viscosities (respectively equal to 50 cSt and 2000 cSt), showing that, at the maximum workin g back pressure (Pmax), the flow rate Q min suffers a variation of between 10% and 15% with respect to the value relative to a viscosity of 500 cSt.

PUMP MODEL	Fuses (A)	Voltage (V)	Absorption (A) *	Power (W)	Q Max (litres/min)	P. by-pass** (bar)
VISCOMAT 120/1 12V	40	12	25,5	200	5,2	11
VISCOMAT 120/1 24V	30	24	12,5	200	5,3	11
VISCOMAT 60/1 12V	40	12	16,5	150	3,9	6,5
VISCOMAT 60/1 24V	30	24	8,5	150	4,2	6,5
VISCOMAT 60/2 12V	40	12	35	300	11,6	4,7
VISCOMAT 60/2 24V	30	24	18	300	12	4,7

* Data refer to functioning with maximum back pressure and oil with viscosity 500cSt.
** Data refer to operations in by-pass mode.

ATTENTION
Under different suction conditions higher pressure values can be created that reduce the flow rate compared to the same back pressure values.
To obtain the best performance, it is very important to reduce loss of suction pressure as much as possible by following these instructions:

- **Shorten the suction tube as much as possible.**
- **Avoid useless elbows or throttling in the tubes.**
- **Keep the suction circuit filter clean.**
- **Use a tube with a diameter equal to, or greater than, indicated (see Installation).**

The power absorbed by the pump depends on the functioning point and the viscosity of the oil being pumped.
The data for MAXIMUM CURRENT provided in the Table refer to pumps functioning at the point of maximum compression P max, with oils of a viscosity equal to approximately 500 cSt.

F. OPERATING CONDITIONS

F1 ENVIRONMENTAL CONDITIONS

TEMPERATURE: min. +5°C / max +60°C

RELATIVE HUMIDITY: max. 90%

ATTENTION
The temperature limits shown apply to the pump components and must be respected to avoid possible damage or malfunction.

It is understood, nevertheless, that for a given oil, the real functioning temperature range also depends on the variability of the viscosity of the oil itself with the temperature. Specifically:

- The minimum temperature allowed (+5°C) could cause the viscosity of some oils to greatly exceed the minimum allowed, with the consequence that the absorbed current of the pump would be excessive, risking damage to the pump motor.
- The maximum temperature allowed (+60°C) could, on the other hand, cause the viscosity of some oils to drop well below the minimum allowed, causing a degradation in performance with obvious reductions in flow rate as the back pressure increases.

F2 ELECTRICAL POWER SUPPLY

Depending on the model, the pump must be supplied by a single-phase alternating current line whose nominal values are shown in the table in Paragraph E2 - ELECTRICAL SPECIFICATIONS.

The maximum acceptable variations from the electrical parameters are:

Voltage: +/-5% of the nominal value

ATTENTION
Power from lines with values outside the indicated limits can damage the electrical components.

F3 WORKING CYCLE

The pumps are designed for INTERMITTENT use with a 30 - minute work cycle under conditions of maximum back pressure.

ATTENTION
Functioning under by-pass conditions is only allowed for brief periods of time (2-3 minutes maximum). After a work cycle of 30 minutes, wait for the motor to cool.

F4 FLUIDS PERMITTED / FLUIDS NOT PERMITTED

PERMITTED:

- OIL with a viscosity from 50 to 2000 cSt (at working temperature)
  (viscosity from 50 to 600 cSt for Viscomat 600/2 12V)

NOT PERMITTED:

- GASOLINE
- INFLAMMABLE LIQUIDS with PM < 55° C
- WATER
- FOOD LIQUIDS
- CORROSIVE CHEMICAL PRODUCTS
- SOLVENTS

RELATED DANGERS:

- FIRE – EXPLOSION
- FIRE – EXPLOSION
- PUMP OXIDATION
- CONTAMINATION OF THE SAME
- PUMP CORROSION
  INJURY TO PERSONS
- FIRE – EXPLOSION
  DAMAGE TO GASKET SEALS

G. MOVING AND TRANSPORT

Given the limited weight and size of the pumps (see overall dimensions), **moving the pumps does not require the use of lifting devices.**

The pumps were carefully packed before shipment.

Check the packing material on delivery and store in a dry place.

H. INSTALLATION

H1 DISPOSING OF THE PACKING MATERIAL

The packing material does not require special precautions for its disposal, not being in any way dangerous or polluting.

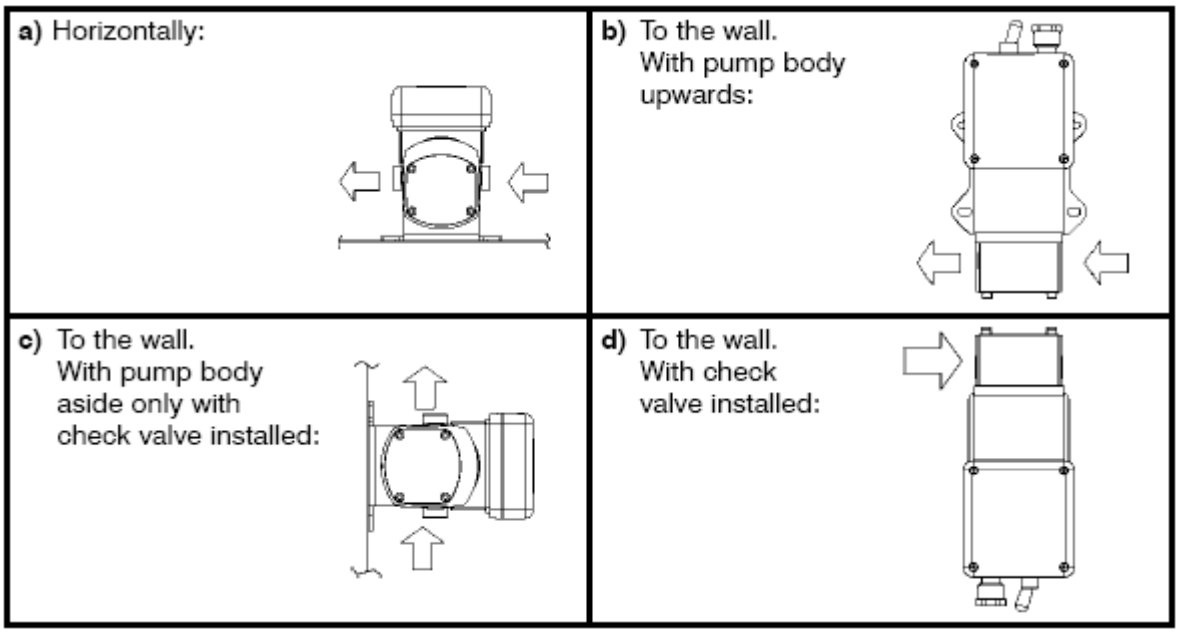
Refer to local regulations for its disposal.

H2 PRELIMINARY INSPECTION

- Check that the machine has not suffered any damage during transport or storage.
- Clean the inlet and outlet openings, removing any dust or residual packing material.
- Make sure that the motor shaft turns freely.
- Check that the electrical specifications correspond to those shown on the identification plate.

H3 POSITIONING THE PUMP

Viscomat series pumps can be installed as follows:



It is recommended to install a check valve in order to resume the system operation quickly and easily even after the first priming.

ATTENTION
Under conditions C and D, a check valve is to be installed. Moreover, during the initial start-up phase, the suction tube is to be filled with oil.

Fix the pump using screws of a diameter suitable for the provided fixing holes as indicated in the drawing "Dimensions and weights".

ATTENTION
THE MOTORS ARE NOT OF AN ANTI-EXPLOSIVE TYPE.
Do not install them where inflammable vapours could be present.

H4 HYDRAULIC CONNECTION

- Make sure that the hoses and the suction tank are free of dirt and filing residue that might damage the pump and accessories.
- Always install a metal mesh filter in the suction hose.
- Before connecting the delivery hose, partially fill the pump body with oil to avoid the pump running dry during the priming phase.
- Do not use conical threaded joints that could damage the threaded pump openings if excessively tightened.

The MINIMUM recommended characteristics for hoses are as follows:

SUCTION HOSE
- diameter: **20 mm**
- nominal pressure: **twice the P bypass pressure** (see table, par. E1)
- appropriate for use with suction

DELIVERY HOSE
- diameter: **1/2" for versions 60/1 and 60/2**
- diameter: **3/4" for version 120/1**
- nominal pressure: **twice the P bypass pressure** (see table, par. E1)

ATTENTION
It is the installer's responsibility to use tubing with adequate characteristics.
The use of hoses that are inappropriate for use with oil can cause damage to the pump or people as well as pollution.
The use of hoses and/or line components that are inappropriate for use with oil or have inadequate nominal pressures can cause damage to objects or people as well as pollution.
The loosening of connections (threaded connections, flanges, gasket seals) can likewise cause damage to objects or people as well as pollution.
Check all of the connections after installation and on a regular on-going basis with adequate frequency.
To avoid affecting the proper functioning of the pump, use a hose-end fitting with a thread of length less than 15 mm.

H5 CONSIDERATIONS REGARDING DELIVERY AND SUCTION LINES

DELIVERY
The choice of pump model to use should be made keeping in mind the viscosity of the oil to be pumped and the **characteristics of the system attached to the delivery of the pump**.
The combination of the oil viscosity and the characteristics of the system could, in fact, create back pressure **greater than the anticipated maximums (equal to P max)**, so as to cause the (partial) opening of the pump by-pass with a consequent noticeable reduction of the flow rate supplied.
In such a case, in order to permit the correct functioning of the pump equal to the viscosity of the oil being pumped, **it will be necessary to reduce resistance in the system by employing shorter hoses and/or of larger diameter**. On the other hand, if the system cannot be modified it will be necessary to select a pump model with a higher **P max**.

SUCTION
VISCOMAT series pumps are characterized by excellent suction capacity.
In fact, the characteristic flow rate/back pressure curve remains unchanged even at high pump suction pressure values.
In the case of oils with viscosity greater than **1000 cSt** the suction pressure can reach values on the order of **0.7 - 0.8 bar** without compromising the proper functioning of the pump. For Viscomat 60/2, the suction limit is reached with oil viscosity equal to **600 cSt**.
Beyond these suction pressure values, **cavitation phenomena** begin **as evidenced by accentuated running noise** that over time can cause pump damage, not to mention a degradation of pump performance.
As viscosity increases, the suction pressure at which cavitation phenomena begin decreases.
In the case of oils with viscosities equal to approximately **500 cSt**, the suction pressure must not exceed values of the order of **0.3 - 0.5 bar** to avoid triggering cavitation phenomena.
The **values indicated** above refer to the suction of oil that is substantially free of air.
If the oil being pumped is mixed with air, the cavitation phenomena can begin at lower suction pressures.
In any case, for as much as was said above, **it is important to guarantee low suction pressures** (short hoses and possibly of larger diameter than the inlet opening of the pump, fewer curves, filters of wide crosssection and kept clean).

ATTENTION
It is a good system practice to immediately install vacuum and air pressure gauges at the inlets and outlets of the pump which allow verification that operating conditions are within anticipated limits. To avoid emptying the suction hose when the pump is turned off, the installation of a foot valve is recommended.

H6 LINE ACCESSORIES

The pumps are supplied without line accessories. The most common line accessories are listed below. Their use is compatible with the proper use of the pumps.

DELIVERY
- Easy Oil nozzles
- Meters
- Flexible tubing

SUCTION
- Foot valve with filter
- Rigid and flexible tubing

ATTENTION
It is the installer's responsibility to provide the line accessories necessary for the safe and proper functioning of the pump.
The use of accessories that are inappropriate for use with oil can cause damage to the pump or people as well as pollution.

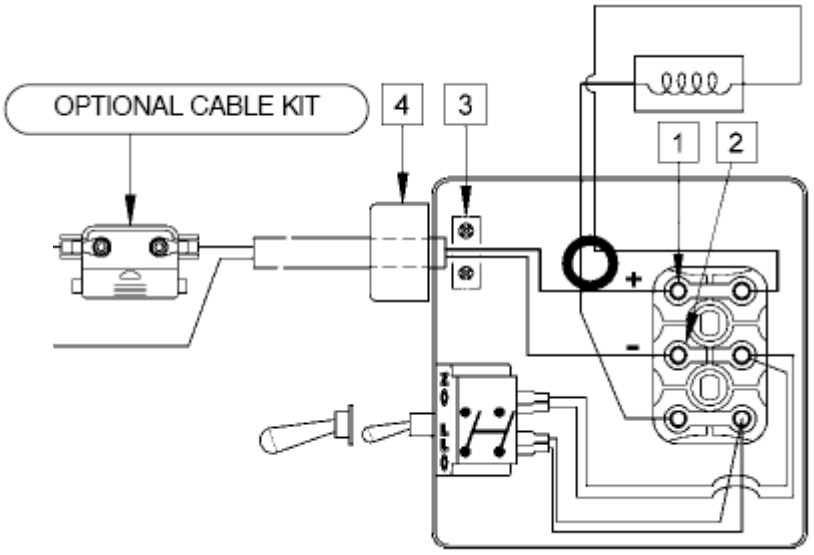
H7 ELECTRICAL CONNECTIONS

The electrical box of Viscomat 120/1 and 60/2 comes with a terminal board for connection of the power cord (optional). In case of connection of the cable kit with pincers (Piusi optional), proceed as follows:

- open the terminal box cover
- loosen the core hitch ring nut with rubber (4) and insert the cable
- open the cable clamp U-bolt (3) which is located inside the electrical box
- fix the eyelet (for screw M4) of the positive cable (blue) to the terminal, in position 1 (see reference in the diagram)
- fix the eyelet (for screw M4) of the negative cable (brown) to the terminal, in position 2 (see reference in the diagram)
- tighten the U-bolt (3)
- screw the ring nut (4)

With the Piusi cable kit, make sure that the red pliers are connected to the positive pole (+) and the black pliers are connected to the negative pole (-).

VISCOMAT DC 12V
WITH 40 A FUSE
Minimum cable section = 6 mm^3
VISCOMAT DC 24V
WITH 30 A FUSE
Minimum cable section = 4 mm^3



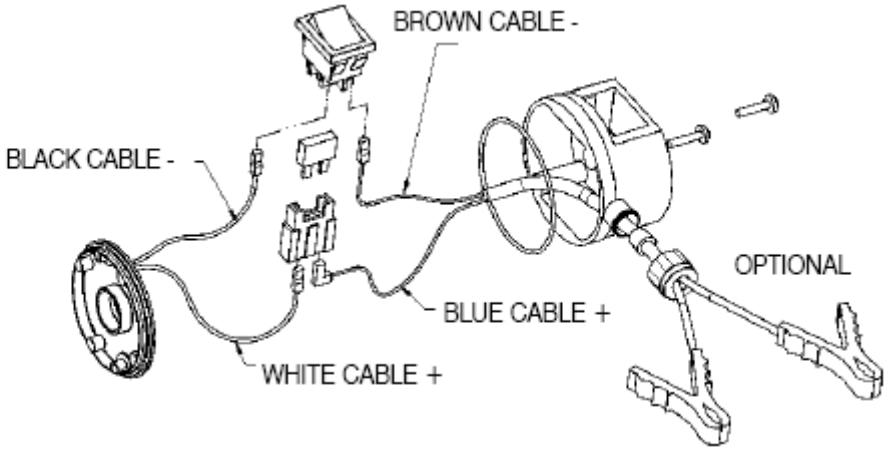
CABLE KIT + PLIERS (BATTERY KIT) VISCOMAT 60/1

- Cables fitted with faston type plugs for power connection;
- WHITE cable (or BROWN): positive pole (+);
- BLACK cable (or BLUE): negative pole (-);
- Terminal strip box (protection IP55 in conformance with EN 60034-5-97 regulations) complete with:
  - start/stop switch;
  - protection fuse against short circuits and overloads with following features:
    25A for 12V models o 15A for 24V models.

To carry out the electrical connection of Viscomat 60/1, follow the diagram below:

12V version
Fuse: 25A

24V version
Fuse: 15A



In the event of power connection with cable which is not supplied by Piusi, it is necessary to observe the following characteristics:

- for Viscomat DC 12V - use a bipolar cable with minimum section of 6 mm^2;
- for Viscomat DC 24V - use a bipolar cable with minimum section of 4 mm^2.

ATTENTION
It is important to use fuses as indicated in paragraph E, to prevent the pump motor from being damaged in the event of a short circuit.
It is the installer's responsibility to carry out the electrical connection with respect to the applicable regulations.

Comply with the following (not exhaustive) instructions to ensure a proper electrical connection:

- During installation and maintenance make sure that power to the electric lines has been turned off.
- Use cables characterized by the minimum sections, nominal voltages and wiring-type adequate to the electrical characteristics shown in Paragraph E2 - Electrical Specifications and the installation environment.
- Always close the cover of the strip box before supplying electrical power.

I. INITIAL START-UP

VISCOMAT series pumps are self-priming and, therefore, able to draw oil from the tank even when the suction hose is empty on start-up.
The priming height (distance between the surface of the oil and the inlet opening) must not exceed 2,5 meters.

ATTENTION
Wetting the Pump. Before starting the pump, wet the inside of the pump body with oil through the inlet and outlet openings.
If the pump is already installed, the operation can be performed by removing the cover of the chamber, filling the internal chamber with oil and placing the cover again, paying attention to the O-ring seal.

In the priming phase the pump must blow the air that was initially present in the tubing into the line. Therefore, it is necessary to keep the delivery open.
When the tube is filled with oil, the purging phase is concluded.

ATTENTION
If a foot valve was not installed, install the pump in a position so that oil is always present in the gear chamber (see chapter H3).
If the foot-valve seal is not perfectly tight, the suction tube may be emptied and the operation of initial start-up described above must be repeated.

The priming phase may last from several seconds to a few minutes, depending on the characteristics of the system.

If this phase is excessively prolonged, stop the pump and verify:

- that the pump is not running completely "dry";
- that the suction hose guarantees against air infiltration and is correctly immersed in the fluid to be drawn;
- that the filter in the suction circuit, if any, is not blocked;
- that the delivery hose allows for the easy evacuation of the air;
- that the priming height is not greater than 2,5 meters;
- the exact rotation direction of the motor: it must be in a counter-clockwise considering the motor from pos. 1 of the exploded diagram.

When priming has occurred, after reattaching the delivery nozzle, **verify that the pump is functioning within the expected ranges,** possibly checking:

1) that under conditions of maximum flow the energy drawn by the motor falls within the values indicated on the label.
2) that the suction pressure does not exceed the limits indicated in paragraph H5 - CONSIDERATIONS REGARDING SUCTION AND DELIVERY LINES.
3) that the back pressure in the delivery line does not exceed the values indicated in paragraph H5 - CONSIDERATIONS REGARDING SUCTION AND DELIVERY LINES.

For a complete and proper verification of points 2) and 3), the installation of vacuum and air pressure gauges at the inlet and outlet of the pump is recommended.

L. DAILY USE

No particular preliminary operation is required for every day use of VISCOMAT pumps.

- Before starting the pump, make sure that the ultimate shut-off device (delivery nozzle or line valve) is closed. If the delivery has no shut-off device (free delivery) make sure that it is correctly positioned and appropriately attached to the delivery tank.
- Make sure that the tank is filled with a quantity of oil greater than the quantity to be supplied (running dry could damage the pump).
- Turn the on-switch present on some pump models or the start/stop switch installed on the electrical power line.
- Open the delivery valve or activate the delivery nozzle, gripping it securely.

ATTENTION
Fluid exits at high pressure from a delivery nozzle fed by a VISCOMAT pump.
Never point the outlet of the nozzle towards any part of the body.

- Close the delivery nozzle or the line valve to stop delivery. The pump will automatically enter by-pass mode.

ATTENTION
Functioning with the delivery closed is only allowed for brief periods (2 to 3 minutes maximum). Functioning under nominal conditions is limited to a work cycle of 30 minutes. If this time is exceeded, you have to turn off the pump and wait for it to cool.
After use, make sure the pump is turned off.

- Stop the pump.

M. PROBLEMS AND SOLUTIONS

Problem	Possible Cause	Correttive Action
THE MOTOR IS NOT TURNING	Lack of electric power	Check the electrical connections and the safety systems
	Rotor jammed	Check for possible damage or obstruction of the rotating components
	Motor problems	Contact the Service Department
	Burnt out fuse	Replace the fuse
THE MOTOR TURNS SLOWLY WHEN STARTING	Low voltage in the electric power line	Bring the voltage back within the anticipated limits
	Excessive oil viscosity	Verify the oil temperature and warm it to reduce the excessive viscosity
LOW OR NO FLOW RATE	Low level in the suction tank	Refill the tank
	Foot valve blocked	Clean and/or replace the valve
	Filter clogged	Clean the filter
	Excessive suction pressure	Lower the pump with respect to the level of the tank or increase the cross-section of the tubing
	High loss of head in the delivery circuit (working with the by-pass open)	Use shorter tubing or of greater diameter
	By-pass valve blocked	Dismantle the valve, clean and/or replace it
	Air entering the pump or the suction tubing	Check the seals of the connections
	A narrowing in the suction tubing	Use tubing suitable for working under suction pressure
	Low rotation speed	Check the voltage at the pump. Adjust the voltage and/or use cables of greater cross-section
	The suction tubing is resting on the bottom of the tank	Raise the tubing
	Excessive oil viscosity	Verify the oil temperature and warm it to reduce the excessive viscosity
	Cover loosened	Tighten the screws of the cover
INCREASED PUMP NOISE	Cavitation occurring	Reduce suction pressure
	Irregular functioning of the by-pass	Dispense fuel until the air is purged from the by-pass system
	Presence of air in the oil	Wait for the oil in the tank to settle
LEAKAGE FROM THE PUMP BODY	Seal damaged	Check and replace the seal
HIGH ABSORPTION	The cover is screwed too tightly	Loosen the screws of the cover
	Excessive oil viscosity	Verify the oil temperature and warm it to reduce the excessive viscosity

N. MAINTENANCE

VISCOMAT series pumps are designed and constructed to require a minimal amount of maintenance.

- On a weekly basis, check that the tubing joints have not loosened, to avoid any leakage.
- On a monthly basis, check the pump body and keep it clean of any impurities.
- On a monthly basis check and clean the filters placed at the pump inlet.
- On a monthly basis, check that the electric power supply cables are in good condition.

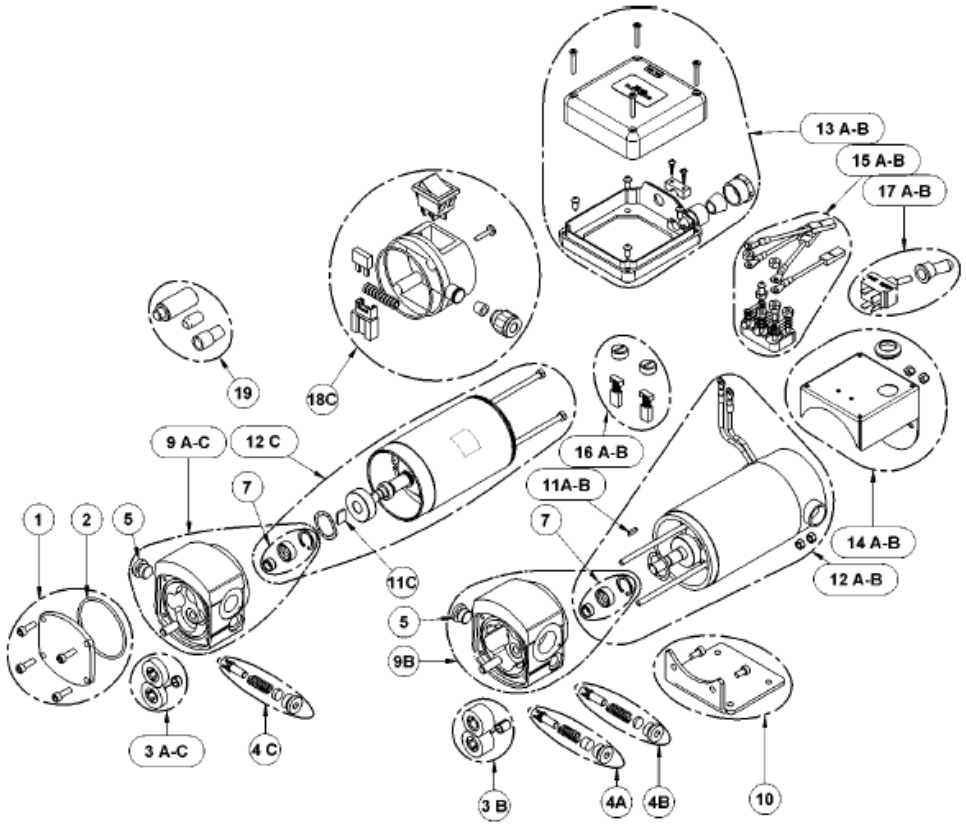
O. NOISE LEVEL

Under normal operating conditions noise emission for all models does not exceed the value of **70 dB "A" at a distance of 1 meter from the electric pump**.

P. DISPOSING OF CONTAMINATED MATERIALS

In the case of maintenance or destruction of the machine, do not disperse contaminated parts into the environment.
Refer to local regulations for their proper disposal.

Q. EXPLODED DIAGRAM AND SPARE PARTS

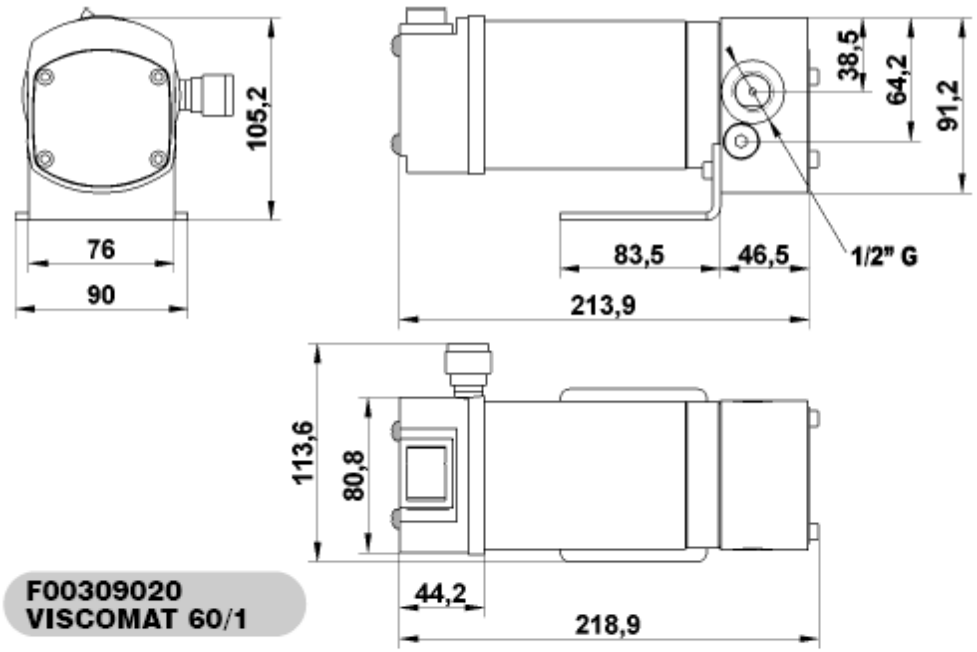


ATTENTION
Always specify the spare part position number with the product code and serial number.

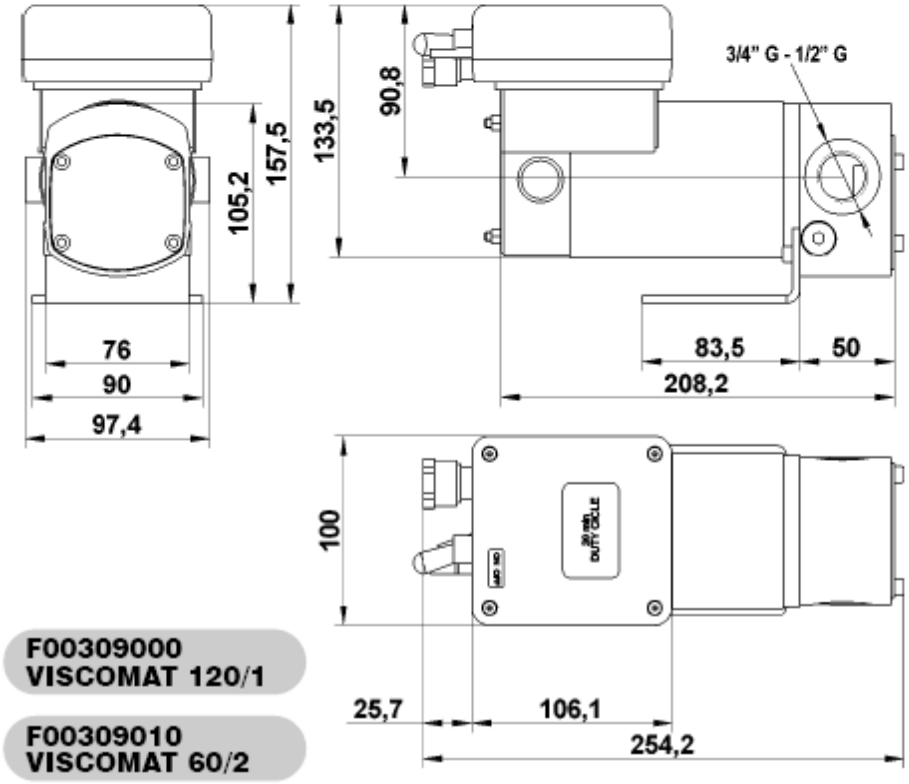
Position	Component Description	Quantity
1	Kit chamber cover Viscomat 120/1-60/2-60/1	1
2	Chamber cover gasket	1
3-A-C	Kit gears Viscomat 120/1 - 60/1	1
3-B	Kit gears Viscomat 60/2	1
4-A	Kit by-pass Viscomat 120/1	1
4-B	Kit by-pass Viscomat 60/2	1
4-C	Kit by-pass Viscomat 60/1	1
5	Pump body plug	1
7	Kit motor shaft seal	1
9-A-C	Kit pump body Viscomat 120/1 - 60/1	1
9-B	Kit pump body Viscomat 60/2	1
10	Kit foot	1
11 A-B	Tongue 3x3x12 VISC. 120/1 - 60/2	1
11 C	Tongue Viscomat 60/1	1
12-A-B	Motor Viscomat 120/1 - 60/2 dc 12v	1
12-C	Motor Viscomat 60/1 12vdc	1
13 A-B	Kit electrical box Viscomat 120/1 - 60/2	1
14 A-B	Kit electrical box support Viscomat 120/1 - 60/2	1
15 A-B	Kit terminal board + cables Viscomat 120/1 - 60/2	1
16 A-B	Kit brushes motor dc Viscomat 120/1 - 60/2	1
17 A-B	Kit switch	1
18 C	Kit electrical box Viscomat 60/1	1
19	Seal mounting tools	1

R. DIMENSIONS AND WEIGHTS

Unit of measurement: mm



F00309020
VISCOMAT 60/1



F00309000
VISCOMAT 120/1

F00309010
VISCOMAT 60/2

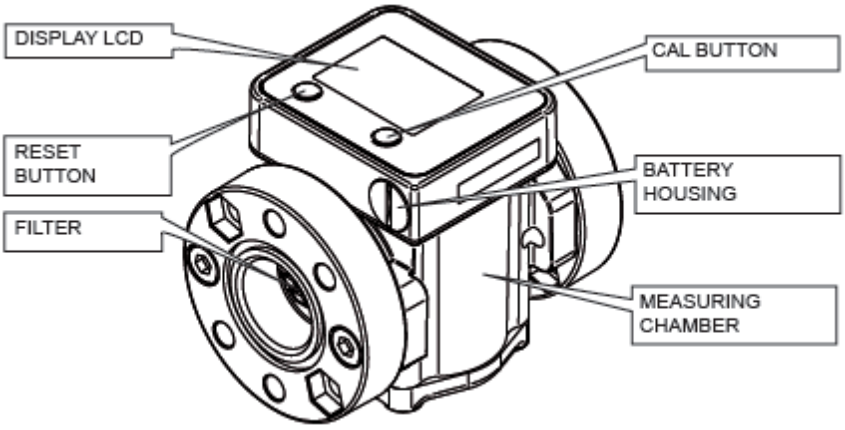
XVII. USE AND MAINTENANCE MANUAL K600 ELECTRONIC TURBINE METER

A. INDEX

B. HOW K600/3 WORKS: GENERAL

Its measurement principle is based on elliptical gears that provide high accuracy over a wide range of flow rates together with reduced loss of head. The fluid passing through the instrument turns the gears whose rotation transfers constant “fluid units”. The exact measurement of the fluid dispensed is carried out by counting the rotations of the gears and, thus, the “fluid units” transferred. The magnetic coupling, consisting of magnets installed in the gears and a magnetic switch located outside the measuring chamber, guarantees the seal of the measuring chamber and ensures the transmission of the impulses generated by the rotation of the gears to the microprocessor.
At the inlet opening, a filtering disk of stainless steel mesh is installed, which can be accessed from the outside by removing the flange close to the flow inlet side.

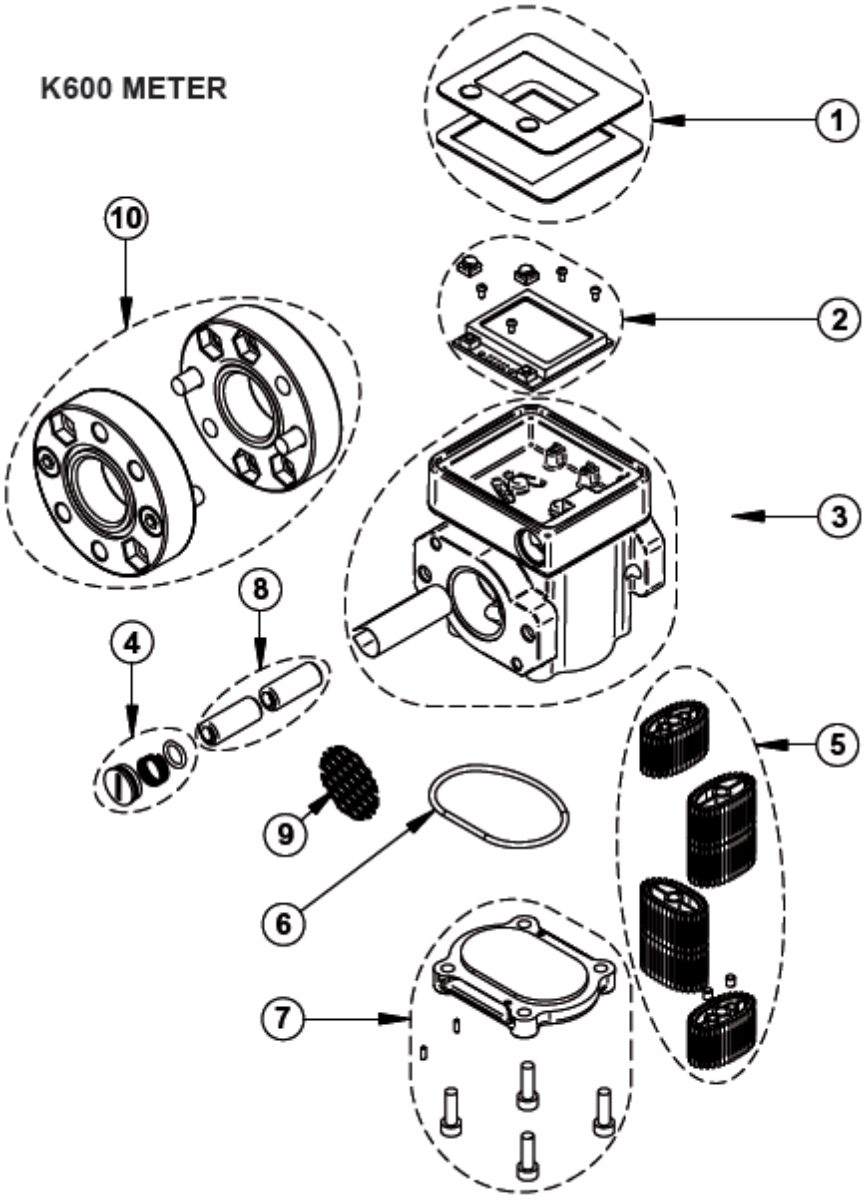
The user can choose between two different operating modes:
Normal Mode: Mode with display of Partial and Total dispensed quantities.
Flow Rate Mode: Mode with display of Flow Rate, as well as Partial dispensed quantity.
The METER features a non-volatile memory for storing the dispensing data, even in the event of a complete power break for long periods.



		K600/3 (deisel fuel)	
		Meter	Pulser
Resolution	L/pulse	33,5	33,5
	Gal/pulse	127	127
Flow-rate range	L/min	10 ÷ 100	
Operating pressure	bar	30	
Bursting pressure	bar	60	
Measurement system		Elliptical gears	
Storage temperature	°C	-20 ÷ +70	
Storage humidity	H.R.	95%	
Operating temperature (Max)	°C	-10 ÷ +60	
Loss of Head at maximum flow rate	bars	0.3 (diesel fuel @ 20°C)	
Compatible Fluids		diesel fuel	
Viscosity Range	cSt	2 ÷ 5,35	
Accuracy (within capacity range)		± 0.5	
Repeatability		0.2%	
Weight	Kg	1.6	
Input and Output Connection Thread		1” Gaz	
Batteries		2 x 1.5 Volt	
Battery Life (expected)		18-36 months	

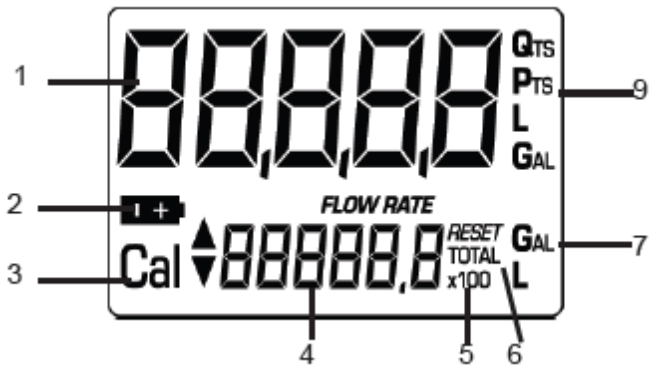
B1 MAIN COMPONENTS

The measurement electronics and the LCD display are fitted in the top part of the meter, isolated from the fluid-bath measuring chamber and sealed from the outside by means of a cover.



1) LCD display

The “LCD” of the METER features two numerical registers and various indications displayed to the user only when the applicable function so requires.



Key:
1. Partial register (5 figures with moving comma: 0.000 ÷ 99999), indicating volume dispensed from when the RESET button was last pressed;
2. Indication of battery charge;
3. Indication of calibration mode;
4. Totals register (6 figures with moving comma 0.0÷999999 x10 / x100), that can indicate two ypes of Total:
4.1. General Total that cannot be reset (TOTAL)
4.2. Resettable total (Reset TOTAL)
5. Indication of total multiplication factor (x10 / x100)
6. Indication of type of total, (TOTAL / Reset TOTAL);
7. Indication of unit of measurement of Totals: L=Litres Gal=Gallons
8. Indication of Flow Rate
9. Indication of unit of measurement of Partial:
Qts=Quarts Pts=Pints L=Litres Gal=Gallons

B2 USER BUTTONS

The meter features two buttons (RESET and CAL) which individually perform two main functions and, together, other secondary functions.
The main functions performed are:
- for the RESET key, resetting the partial register and Reset Total
- for the CAL key, entering instrument calibration mode

Used together, the two keys permit entering configuration mode where the desired unit of measurement can be set.

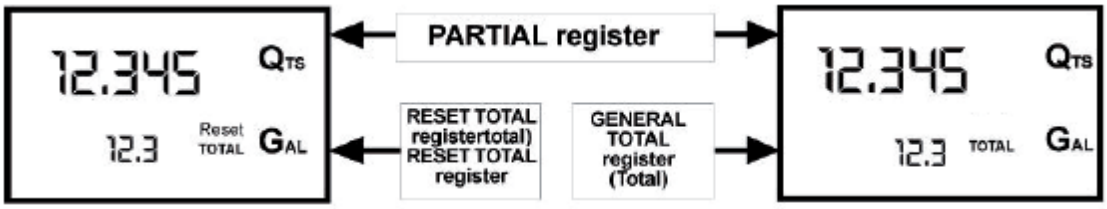
B3 BATTERY HOUSING

The METER is powered by two standard type 1.5V batteries (size N). The battery housing is closed by a threaded watertight cap that can be easily removed for quick battery change.

C. OPERATION PRINCIPLE

By applying a suitable calibration factor (meaning a “weight” associated with each pulse), the microprocessor – on-board on meter versions and remote on pulser versions - translates the pulses generated by the fluid volume rotation expressed in the set units of measurement, displayed on the partial and total registers of the LCD.

All meters are factory set with a calibration factor called FACTORY K FACTOR which is set according to the used fluid (diesel fuel), for optimal measurement performance.
Calibration settings can be changed following the instructions in this manual, but you can return to the factory calibration at any time



- The Partial register positioned in the top part of the display indicates the quantity dispensed since the RESET key was last pressed.
* The Resettable Total register, positioned in the lower part of the display, indicates the quantity dispensed since the last ResettableTotal resetting. The RESET Total cannot be reset until the Partial has been reset, while vice versa, the Partial can always be reset without resetting the RESET Total. The unit of measurement of the two Totals can be the same as the Partial or else different according to the factory or user settings.

The General TOTAL register (Total) can never be reset by the user. It continues to rise for the entire operating life of the meter.
The register of the two totals (Reset Total and Total) share the same area and digits of the display. For this reason, the two totals will never be visible at the same time, but will always be displayed alternately.
The meter is programmed to show one or the other of the two totals at very precise times:

THE GENERAL TOTAL (TOTAL) IS SHOWN DURING METER STANDBY

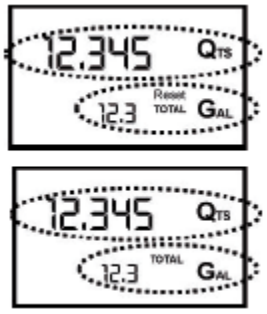
THE RESET TOTAL IS SHOWN:

- At the end of a Partial reset for a certain time (a few seconds).
- During the entire dispensing stage.
- For a few seconds after the end of dispensing. Once this short time has expired. Meter switches to standby and lower register display switches to General Total.

NOTE: 6 digits are available for Totals, plus two icons x 10 / x100.
The increment sequence is the following:
100000 x 10 →? 999999 x 10 →?
100000 x 100 →? 999999 x 100

C1 DISPENSING IN NORMAL MODE

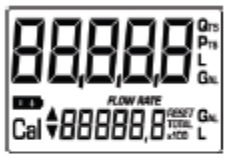
This is default dispensing during which, while the count is made, the Partial and Reset Total are displayed at the same time.
Should one of the two keys RESET or CAL be accidentally pressed during counting, this will have no effect.
A few seconds after dispensing has ended, on the lower register, the display switches from Resettable Total to General Total: the word RESET above the word TOTAL disappears, and the Reset Total is replaced by the General Total.
This situation is called STANDBY and remains stable until the user operates the meter again.



C2 PARTIAL RESET

The Partial Register can be reset by pressing the RESET key when the meter is in Standby, meaning when the display screen shows the word «TOTAL».

After pressing the RESET key, during reset, the display screen first of all shows all the lit-up digits and then all the digits that are not lit up.



At the end of the process, a display page is first of all shown with the reset Partial and the Reset Total

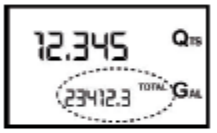
and, after a few moments, the Reset Total is replaced by the NON resettable Total (Total).

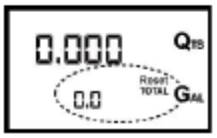
C3 RESETTING THE RESET TOTAL

The Reset Total resetting operation can only be performed after resetting the Partial register. The Reset Total can in fact be reset by pressing the RESET key at length while the display screen shows RESET TOTAL as on the following display page:

Schematically, the steps to be taken are:

1. Wait for the display to show normal standby display page (with Total only displayed).
2. Press the RESET key quickly.
3. The meter starts to reset the Partial.
4. While the display page showing the Reset Total is displayed press the Reset key again for at least 1 second.
5. The display screen again shows all the segments of the display followed by all the switched-off segments and finally shows the display page where the reset Reset Total is shown.

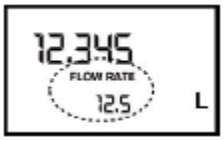




C4 DISPENSING IN FLOW RATE MODE

It is possible to dispense, displaying at the same time:

- the dispensed partial
- the Flow Rate in [Partial Unit / minute] as shown on the following display page:

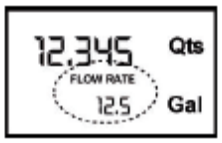


Procedure for entering this mode:

- wait for the meter to go to Standby, meaning the display screen shows Total only
- quickly press the CAL key
- Start dispensing

The flow rate is updated every 0.7 seconds. Consequently, the display could be relatively unstable at lower flow rates. The higher the flow rate, the more stable the displayed value.

WARNING
The flow rate is measured with reference to the unit of measurement of the Partial. For this reason, in case of the unit of measurement of the Partial and Total being different, as in the example shown below, it should be remembered that the indicated flow rate relates to the unit of measurement of the partial. In the example shown, the flow rate is expressed in Qts/min.



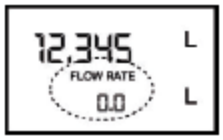
The word "Gal" remaining alongside the flow rate refers to the register of the Totals (Reset or NON Reset) which are again displayed when exiting from the flow rate reading mode.

To return to "Normal" mode, press the CAL key again. If one of the two keys RESET or CAL is accidentally pressed during the count, this will have no effect.

Warning: Even though in this mode they are not displayed, both the Reset Total and the General Total (Total) increase. Their value can be checked after dispensing has terminated, returning to "Normal" mode, by quickly pressing CAL.

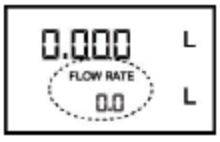
C5 PARTIAL RESET

To reset the Partial Register, finish dispensing and wait for the meter to show a Flow Rate of 0.0 as indicated in the illustration



then quickly press RESET

Unlike Normal mode, in this case during reset, you do not pass through the stages where the display segments are first lit up and then switched off, but rather the reset partial register is immediately displayed.



D. CALIBRATION

Calibration factor or “K Factor” : this is the multiplication factor applied by the system to the electrical pulses received, to transform these into measured fluid units Factory K Factor: Factory-set default factor. It is equal to 1,000.

This calibration factor ensures utmost precision in the following operating conditions:

Version for diesel fuel	Fluid motor oil type SAE10W40
Temperature:	20°C
Flow rate:	6-60 litres/min

Even after any changes have been made by the user, the factory K factor can be restored by means of a simple procedure.

- User K Factor: Customized calibration factor, meaning modified by calibration.

D1 CALIBRATION PROCEDURE

K600 METER permits making quick and precise electronic calibration by changing the Calibration Factor (K FACTOR).

Two procedures are available for changing the Calibration Factor:
1) In-Field Calibration, performed by means of a dispensing operation.
2) Direct Calibration, performed by directly changing the calibration factor.

The calibration phases can be entered (by keeping the CAL key pressed for a long time) to :
- Display the currently used calibration factor.
- Return to factory calibration (Factory K Factor) after a previous calibration by the user.
- Change the calibration factor using one of the two previously indicated procedures.

1) In calibration mode, the partial and total dispensed quantities indicated on the display screen take on different meanings according to the calibration procedure phase.
2) In calibration mode, the METER cannot be used for normal dispensing operations.
3) In “Calibration” mode, the totals are not increased.

ATTENTION
The METER features a non-volatile memory that keeps the data concerning calibration and total dispensed quantity stored for an indefinite time, even in the case of a long power break; after changing the batteries, calibration need not be repeated.

D2 DISPLAY OF CURRENT CALIBRATION FACTOR AND RESTORING FACTORY FACTOR

By pressing the CAL key while the appliance is in Standby, the display page appears showing the current calibration factor used.

Two cases can occur:

If no calibration has ever been performed, or the factory setting has been restored after previous calibrations, the following display page will appear:

The word “Fact” abbreviation for “factory” shows that the factory calibration factor is being used.

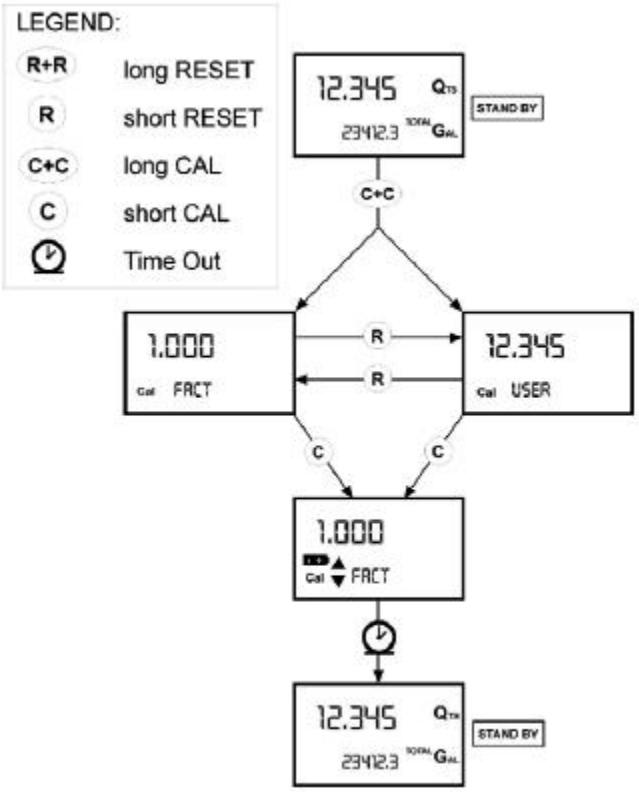
If, on the other hand, calibrations have been made by the user, the display page will appear showing the currently used calibration factor (in our example 0,998). The word “user” indicates a calibration factor set by the user is being used.

The flow chart alongside shows the switchover logic from one display page to another.

In this condition, the Reset key permits switching from User factor to Factory factor.

To confirm the choice of calibration factor, quickly press CAL while “User” or “Fact” are displayed.

After the restart cycle, the meter uses the calibration factor that has just been confirmed.



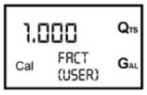
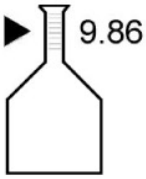
IMPORTANT
When the Factory Factor is confirmed, the old User factor is deleted from the memory.

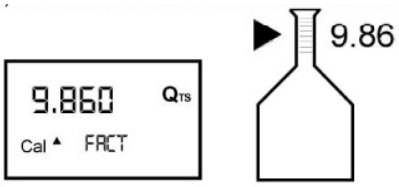
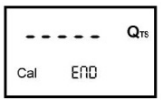
D3 IN-FIELD CALIBRATION

This procedure calls for the fluid to be dispensed into a graduated sample container in real operating conditions (flow rate, viscosity, etc.) requiring maximum precision.

ATTENTION
For correct METER calibration, it is most important to:

- **completely eliminate air from the system before calibrating;**
- **use a precise Sample Container with a capacity of not less than 5 litres, featuring an accurate graduated indicator;**
- **ensure calibration dispensing is done at a constant flow rate equivalent to that of normal use, until the container is full;**
- **not reduce the flow rate to reach the graduated area of the container during the final dispensing stage (the correct method during the final stages of sample container filling consists in making short top-ups at normal operation flow rate);**
- **after dispensing, wait a few minutes to make sure any air bubbles are eliminated from the sample container; only read the Real value at the end of this stage, during which the level in the container could drop;**
- **Carefully follow the procedure indicated below.**

	OPERATION	DISPLAY
1	**NONE** METER in normal mode, not in counting mode.	
2	**LONG CAL KEY KEYING** The METER enters calibration mode, shows <<CAL>> and displays the calibration factor in use instead of partial. The words “Fact” and “USER” indicate which of the two factors (factory or user) is currently in use. Important:	
3	**LONG RESET KEY KEYING** The METER shows “CAL” and the zero partial total. The meter is ready to perform in-field calibration.	
4	**DISPENSING INTO SAMPLE CONTAINER** Without pressing any button, start dispensing into the sample container.  Dispensing can be interrupted and started again at will. Continue dispensing until the level of the fluid in the sample container has reached the graduated area. There is no need to reach a preset quantity.   Indicated value Real value	
5	**SHORT RESET KEY KEYING** The METER is informed that the calibration dispensing operation is finished. Make sure dispensing is correctly finished before performing this operation. To calibrate the METER, the value indicated by the partial totaliser (example 9.800) must be forced to the real value marked on the graduated sample container. In the bottom left part of the display an arrow appears (upwards and downwards), that shows the direction (increase or decrease) of the USER K FACTOR value change when the operations 6 or 7 are performed.	
6	**SHORT RESET KEY KEYING** Changes the direction of the arrow. The operation can be repeated as many times as you wish..	
7	**SHORT/LONG CAL KEY KEYING** The indicated value changes in the direction indicated by the arrow - one unit for every short CAL key keying - continually if the CAL key is kept pressed. (for the first 5 units slowly and then quickly). If the desired value is exceeded, repeat the operations from point (6).	

8	**LONG RESET KEY KEYING** The METER is informed that the calibration procedure is finished. Before performing this operation, make sure the INDICATED value is the same as the REAL value.  Indicated value Real value The METER calculates the new USER K FACTOR ; this calculation could require a few seconds, depending on the correction to be made. During this operation the arrow disappears but the CAL indication remains. If this operation is performed after operation (5), without changing the indicated value, the USER K FACTOR would be the same as the FACTORY K FACTOR, thus it is ignored.	
9	**NO OPERATION** At the end of the calculation, the new USER K FACTOR is shown for a few seconds, after which the restart cycle is repeated to finally achieve standby condition. **IMPORTANT: From now on, the indicated factor will become the calibration factor used by the meter and will continue to remain such even after a battery change.**	
10	**NO OPERATION** METER stores the new calibration factor and is ready for dispensing, applying the newly defined USER K FACTOR.	

D4 DIRECT MODIFICATION OF K FACTOR

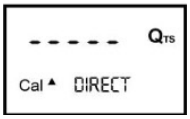
This procedure is especially useful to correct a “mean error” obtainable on the basis of several performed dispensing operations. If normal METER operation shows a mean percentage error, this can be corrected by applying to the currently used calibration factor a correction of the same percentage. In this case, the percentage correction of the USER K FACTOR must be calculated by the operator in the following way:

$$\text{New cal. Factor} = \text{Old cal Factor} \times \left(\frac{100 - E\%}{100}\right)$$

Example:

Error percentage found E%	- 0.9 %
CURRENT calibration factor	1,000
New USER K FACTOR	1,000 * [(100 – (- 0,9))/100]=
	1,000 * [(100 + 0,9)/100] = 1.009

If the meter indicates less than the real dispensed value (negative error) the new calibration factor must be higher than the old one as shown in the example. The opposite applies if the meter shows more than the real dispensed value (positive error).

	OPERATION	DISPLAY
1	**NONE** METER in normal mode, not in counting mode.	
2	**LONG CAL KEY KEYING** METER enters calibration mode, shows “CAL” and displays the calibration factor being used instead of the partial. The words “Fact” and “User” indicate which of the two factors (factory or user) is currently being used.	
3	**LONG RESET KEY KEYING** The METER shows “CAL” and the zero partial total. METER is ready to perform in-field calibration by dispensing – see previous paragraph.	
4	**LONG RESET KEY KEYING** We now go on to Direct change of the calibration factor: the word “Direct” appears together with the Currently Used calibration factor. In the bottom left part of the display, an arrow appears (upwards or downwards) defining the direction (increase or decrease) of change of the displayed value when subsequent operations 5 or 6 are performed.	
5	**SHORT RESET KEY KEYING** Changes the direction of the arrow. The operation can be repeated to alternate the direction of the arrow.	
6	**SHORT/LONG CAL KEY KEYING** The indicated value changes in the direction indicated by the arrow - one unit for every short CAL key keying - continually if the CAL key is kept pressed. The speed increase rises by keeping the key pressed. If the desired value is exceeded, repeat the operations from point (5).	
7	**LONG RESET KEY KEYING** The METER is informed that the calibration procedure is finished. Before performing this operation, make sure the indicated value is that required.	

8	**NO OPERATION** At the end of the calculation, the new USER K FACTOR is shown for a few seconds, after which the restart cycle is repeated to finally achieve standby condition. IMPORTANT: From now on, the indicated factor will become the calibration factor used by the meter and will continue to remain such even after a battery change.	
9	**NO OPERATION** METER stores the new calibration factor and is ready for dispensing, applying the newly defined USER K FACTOR.	

E. METER CONFIGURATION

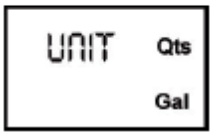
METER is fitted with a menu by which the user can select the main unit of measurement, Quarts (Qts), Pints (Pts), Litres (Lit), Gallons (Gal); The combination between the unit of measurement of the Partial Register and that of the Totals is set according to the following table:

Combination no.	Unit of Measurement Partial Register	Unit of Measurement Totals Register
1	Litres (Lit)	Litres (Lit)
2	Gallons (Gal)	Gallons (Gal)
3	Quarts (Qts)	Gallons (Gal)
4	Pints (Pts)	Gallons (Gal)

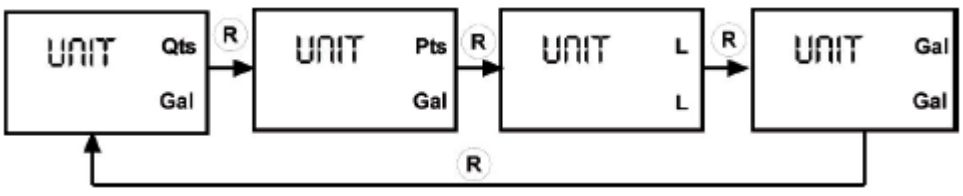
To choose between the 4 available combinations:

* Wait for the METER to go to Standby

* then press the CAL and RESET keys together. Keep these pressed until the word “UNIT” appears on the screen together with the unit of measurement set at that time (in this example Litres / Litres):



Every short press of the RESET key, the various combinations of the units of measurements are scrolled as shown below:



By pressing the CAL key at length, the new settings will be stored, the METER will pass through the start cycle and will then be ready to dispense in the set units.

ATTENTION
The Resettable Total and Total registers will be automatically changed to the new unit of measurement.

NO new calibration is required after changing the Unit of Measurement.

F. MAINTENANCE

The METER has been designed to require a minimum amount of maintenance.
The only maintenance jobs required are:

- Battery change – necessary when batteries have run down (ONLY FOR METER VERSIONS).
- Cleaning the measuring chamber. This may be necessary due to the particular nature of the dispensed fluids or due to the presence of solid particles following bad filtering.

F1 CHANGING THE BATTERIES

The METER is complete with 2 x 1.5 V. alkaline batteries SIZE N.

The METER features two low-battery alarm levels:

- When the battery charge falls below the first level on the LCD, the fixed battery symbol appears.

In this condition, the METER continues to operate correctly, but the fixed icon warns the user that it is time to change the batteries.

- If meter operation continues without changing the batteries, the second battery alarm level will be reached which will prevent operation. In this condition the battery icon starts to flash and is the only one to remain visible on the LCD.

ATTENTION
Do not discard the old batteries into the environment. Refer to local disposal regulations.

To change the batteries, with reference to the spare parts list positions, proceed as follows:

- Press RESET to update all the totals.
- Unscrew the battery cap (pos.8).
- Remove the old batteries.
- Place the new batteries in the same position as the old ones, making sure the positive pole is positioned as indicated on the cover (pos.9) Re-tighten the battery cap,making sure the seal (pos.1) are correctly positioned.
- The METER will switch on automatically and normal operation can be resumed.

The METER will display the same Reset Total, the same Total and the same Partial indicated before the batteries were changed.
After changing the batteries and, subsequently, every time there is a power break, the METER will start again and use the same calibration factor used when the break occurred. The meter does not therefore need calibrating again.

F2 CLEANING THE MEASURING CHAMBER

The K600 measuring chamber can be cleaned without removing the instrument from the line on which it is fitted. Make sure the gears are turning freely before closing the cover.

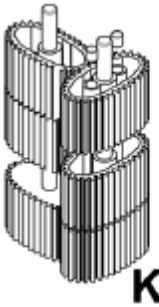
ATTENTION
Always make sure that the liquid has drained from the meter before cleaning.

To clean the chamber, proceed as follows (with reference to the exploded diagram positions):

- Loosen the four retention screws of the lower cover (pos. 7).
- Remove the cover (pos. 7) and the seal (pos. 6).
- Remove the oval gears.
- Clean where necessary. For this operation, use a brush or pointed object such as a small screwdriver. Be careful not to damage the body or the gears.
- To reassemble the instrument, perform the operations in the opposite sequence.

ATTENTION
Perform the assembly diagram to reassemble the gears.

ATTENTION
Only one of the two gears, modularly coupled as shown in the picture aside, features magnets. Observe the position of the gear with magnets, as shown in the figure. Fit the second gear (without magnets) with axis greater than 90° compared to the first gear.



K600/3

F3 CLEANING THE FILTER

The filter cleaning interval is to be defined depending on the impurities contained in the fluid. To perform this operation, remove the device from the line on which it is installed, as the filter is placed between the meter body and tube connection flange.

ATTENTION
Always make sure that the liquid has drained from the meter before cleaning.

To clean the filter, proceed as follows (with reference to the exploded diagram positions):

- To access the filtering disk of the K600/3, loosen the 2 fixing screws of the connection flange at the inlet. Remove both flanges if it is necessary for the system.
- Remove the meter from the line, being careful to remove also the gaskets between the flanges and threaded connections of K600.
- Slide out the filter (pos. 9).
- Clean the filter with compressed air.
- Carry out the reverse procedure to reassemble the filter.

G. MALFUNCTIONS

ELECTRONIC MALFUNCTIONS

Problem	Possible Cause	Remedial Action
LCD: no indications	Bad battery contact	Check battery contacts
Not enough measurement precision	Wrong K FACTOR	With reference to paragraph H, check the K FACTOR
	The meter works below minimum acceptable flow rate	Increase the flow rate until an acceptable flow rate range has been achieved
The meter does not count, but the flow rate is correct	Possible electronic board problems	Contact your dealer

MECHANICAL MALFUNCTIONS

Problem	Possible Cause	Remedial Action
Reduced or zero flow rate	Gears blocked	Clean the measuring chamber
The meter does not count, but the flow rate is correct	Incorrect installation of gears after cleaning	Repeat the reassembly procedure
Inaccuracy	Incorrect calibration of pulser version	Calibrate the device with the pulse receiver
	Working flow-rate outside the flowrate range	Reduce or increase the flowrate to return to the indicated flow-rate range.
High loss of head	Dirty filter	Clean the filter
	Braked gears	Clean the measuring chamber
It does not count	Wrong gear installation	Check the position of the gear with magnet.
	Faulty bulb	Change the bulb

H. DECLARATION OF CONFORMITY

Complies with the directive:
89/336 EEC (electromagnetic compatibility) and subsequent amendments

PIUSI S.p.A. - 46029 Suzzara (Mantova) Italy
declares that the following model of meter

K600

to which this declaration refers, conforms to the following applicable regulations:
European regulations: EN 61000-6-1; EN 61000-6-3; EN 55014-1-2000; EN55014-2-97

Suzzara, 01.01.06

OTTO VARINI, Chairman

XVIII. USE AND MAINTENANCE MANUAL K24 ELECTRONIC TURBINE METER

PIUSI
FLUID HANDLING
TECHNOLOGY

A. INDEX

B. BECOMING ACQUAINTED WITH K24

Electronic digital meter featuring a turbine measurement system, designed for precise measuring of low viscosity fluids.
It is divided into two using macrogroups:

1) With body made of inconductive plastic material of light colour, designed to be used with water / urea solution.
2) With body made of conductive plastic material of dark colour (assessed resistance: 50 ohm), designed to be used with DIESEL FUEL, WATER and windscreen fluids.

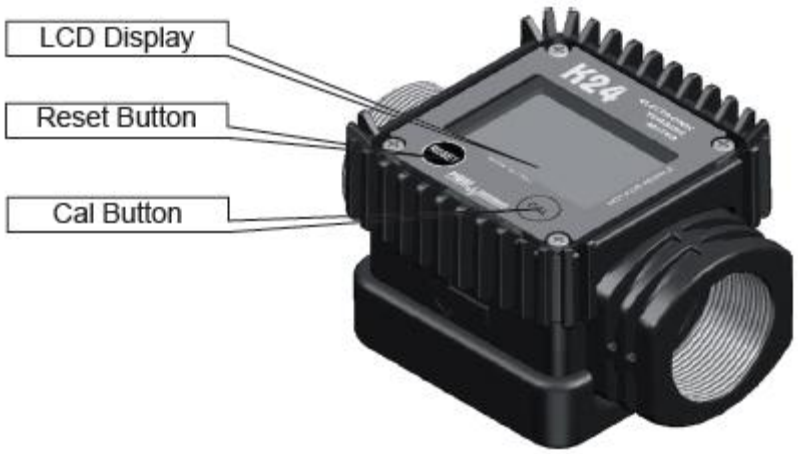
The card can be rotated with respect to its housing, thus allowing easy display readings in any position. The card housing, easily accessible, is closed by a plastic cover sealed through a rubber protection acting as a gasket as well. The whole unit can be easily removed by unscrewing the 4 screws fixing the card and the cover.

B1 MEASUREMENT SYSTEM

Turbine measurement system. The turbine is placed inside a hole through the body of K24, fitted with threaded inlet and outlet. The body of K24 is made of a plastic material that allows several types of threads with relevant combinations.
K24 has 2 rubber protections, designed to act as gaskets, too, and thus reducing the number of its components.
The liquids compatible with K24 must be at low viscosity, namely:

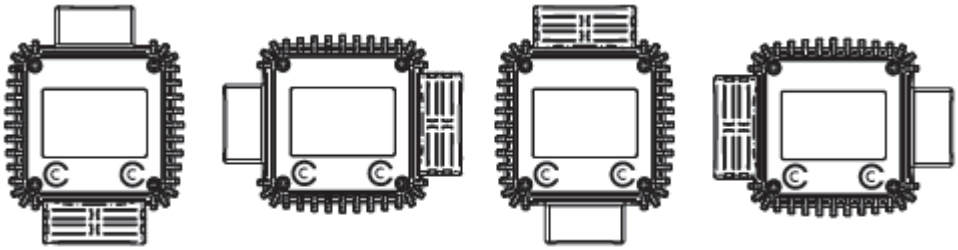
- Diesel fuel
- Water
- Water/urea solution
- Kerosene
- Windscreen
- Petrol

Main components:



B2 DISPLAY POSITIONING

The square shape of the k24 body allows the card to be rotated in its housing, thus ensuring great versatility in positioning.



ATTENTION
While fixing the K24 card, make sure the battery contact cable is not placed above the circular housing of the bulb.

B3 OPERATING MODES

The user can choose between two different operating modes:

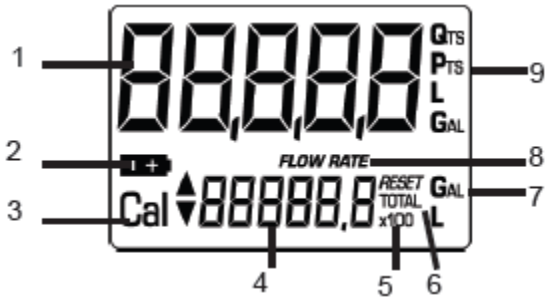
- Normal Mode: Mode with display of Partial and Total dispensed quantities.
- Flow Rate Mode: Mode with display of Flow Rate, as well as Partial dispensed quantity.

The meter features a non-volatile memory for storing the dispensing data, even in the event of a complete power break for long periods.
The measurement electronics and the LCD display are fitted in the top part of the K24 which remains isolated from the fluid-bath measurement chamber and sealed from the outside by means of a cover.

B4 LCD DISPLAY

The “LCD” of the METER features two numerical registers and various indications displayed to the user only when the applicable function so requires.

Key:



1) Partial register (5 figures with moving comma FROM 0.1 to 99999) indicating the volume dispensed since the reset button was last pressed;
2) Indication of battery charge;
3) Indication of calibration mode;
4) Totals register (6 figures with moving comma FROM 0.1 to 999999), that can indicate two types of Total:
   4.1. General Total that cannot be reset (TOTAL)
   4.2. Resettable total (Reset TOTAL)
5) Indication of total multiplication factor (x10 / x100);
6) Indication of type of total, (TOTAL / Reset TOTAL);
7) Indication of unit of measurement of Totals: L=Litres Gal=Gallons;
8) Indication of Flow Rate mode;
9) Indication of unit of measurement of Partial: Qts=Quarts
   Pts=Pints
   L=Litres
   Gal=Gallons

B5 USER BUTTONS

The k24 features two buttons (reset and cal) which individually perform two main functions and, together, other secondary functions.
The main functions performed are:

- For the reset key, resetting the partial register and resettable total (reset total).
- For the cal key, entering instrument calibration mode.

Used together, the two keys permit entering configuration mode, useful for changing the units of measurements and calibration factor.

B6 BATTERY HOUSING

The k24 is powered by two standard type 1.5 V batteries (size AAA).
The battery housing, easily accessible, is closed by a metal cover sealed through a rubber protection acting as a gasket as well. The whole unit can be easily removed by unscrewing the 4 screws fixing the cover and the protection to the body.

C. INSTALLATION

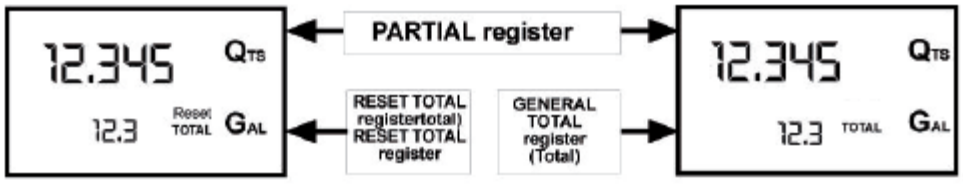
K24 features a threaded, perpendicular inlet and outlet (1" gas or ntp male and female that can be combined together). It has been designed to be easily installed in any position: fixed in-line or mobile on a dispensing nozzle.
In order to improve the life of the turbine, it is recommended to fit a strainer before the meter itself.

ATTENTION
At the female inlets, tighten the couplings at a max. torque of 55N/m.

D. DAILY USE

The only operations that need to be done for daily use are partial and/or resettable total register resetting. The user should use only the dispensing system of k24. Occasionally the meter may need to be configured or calibrated. To do so, please refer to the relevant chapters.

Below are the two typical normal operation displays. One display page shows the partial and reset total registers. The other shows the partial and general total. Switchover from resettable total to general total display is automatic and tied to phases and times that are in factory set and cannot be changed.

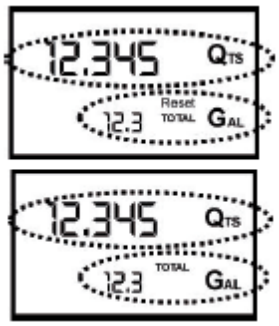


NOTE
6 digits are available for Totals, plus two icons x 10 / x100.
The increment sequence is the following:
0.0 → 99999.9 → 999999 → 100000 x 10 → 999999 x 10 → 100000 x 100 → 999999 x 100

D1 DISPENSING IN NORMAL MODE

Normal mode is the standard dispensing. While the count is made, the partial and resettable total are displayed at the same time (reset total).

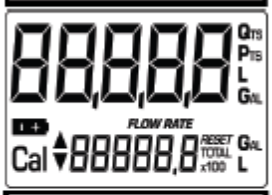
Should one of the keys be accidentally pressed during dispensing, this will have no effect.
A few seconds after dispensing has ended, on the lower register, the display switches from resettable total to general total: the word reset above the word total disappears, and the reset total is replaced by the general total.
This situation is called standby and remains stable until the user operates the k24 again.



D1.1 PARTIAL RESET

The partial register can be reset by pressing the reset key when the meter is in standby, meaning when the display screen shows the word “TOTAL”.

After pressing the reset key, during reset, the display screen first of all shows all the lit-up digits and then all the digits that are not lit up.



At the end of the process, a display page is first of all shown with the reset partial and the reset total

and, after a few moments, the reset total is replaced by the non resettable Total.

D1.2 RESETTING THE RESET TOTAL

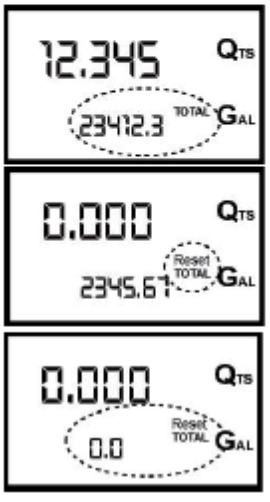
The reset total resetting operation can only be performed after resetting the partial register. The reset total can in fact be reset by pressing the reset key at length while the display screen shows reset total as on the following display page:

Schematically, the steps to be taken are:

1) Wait for the display to show normal standby display page (with total only displayed).

2) Press the reset key quickly.

3) The meter starts to reset the partial.



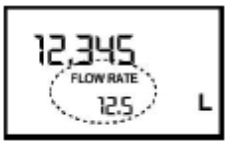
4) While the display page showing the reset total is displayed. Press the reset key again for at least 1 second.

5) The display screen again shows all the segments of the display followed by all the switched-off segments and finally shows the display page where the reset Reset Total is shown.

D2 DISPENSING WITH FLOW RATE MODE DISPLAY

It is possible to dispense fluids, displaying at the same time:

- the dispensed partial
- the Flow Rate in [Partial Unit / minute] as shown on the following display page:

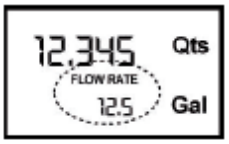


Procedure for entering this mode:

- wait for the Remote Display to go to Standby, meaning the display screen shows Total only
- quickly press the CAL key.
- Start dispensing

The flow rate is updated every 0.7 seconds. Consequently, the display could be relatively unstable at lower flow rates. The higher the flow rate, the more stable the displayed value.

IMPORTANT
The flow rate is measured with reference to the unit of measurement of the Partial. For this reason, in case of the unit of measurement of the Partial and Total being different, as in the example shown below, it should be remembered that the indicated flow rate relates to the unit of measurement of the partial. In the example shown, the flow rate is expressed in Qts/min.
The word "Gal" remaining alongside the flow rate refers to the register of the Totals (Reset or NON Reset) which are again displayed when exiting from the flow rate reading mode.



To return to "Normal" mode, press the CAL key again. If one of the two keys RESET or CAL is accidentally pressed during the count, this will have no effect.

IMPORTANT
Even though in this mode they are not displayed, both the Reset Total and the General Total (Total) increase. Their value can be checked after dispensing has terminated, returning to "Normal" mode, by quickly pressing CAL.

D2.1 PARTIAL RESET

To reset the Partial Register, finish dispensing and wait for the Remote Display

to show a Flow Rate of 0.0 as indicated in the illustration then quickly press RESET.

E. CALIBRATION

E1 DEFINITIONS

Calibration factor or “k factor” :
Multiplication factor applied by the system to the electrical pulses received, to transform these into measured fluid units.

FACTORY K FACTOR:
Factory-set default factor. It is equal to 1,000. This calibration factor ensures utmost precision in the following operating conditions:

Fluid **diesel fuel**
Temperature: **20°c**
Flow rate: **10-120 litres/min**

Even after any changes have been made by the user, the factory k factor can be restored by means of a simple procedure.

USER K FACTOR:
Customized calibration factor, meaning modified by calibration.

E2 WHY CALIBRATE

When operating close to extreme conditions, such as for instance with fluids close to acceptable range extremes (like diesel fuel at low temperatures) or in extreme flow rate conditions (close to minimum or maximum acceptable values), an on-site calibration may be required to suit the real conditions in which the k24 is required to operate.

E3 CALIBRATION PROCEDURE

K24 permits making quick and precise electronic calibration by changing the calibration factor (k factor).

There are 2 different ways of calibration:
1) On-site calibration, performed by means of a dispensing operation.
2) Direct calibration, performed by directly changing the k factor.

To enter the calibration phases it is necessary to press and hold down the “cal” button.

Why enter the calibration phases?

- Display the currently used calibration factor.
- Return to factory k factor after a previous calibration with user k factor.
- Change the calibration factor using one of the two previously indicated procedures.

In calibration mode, the partial and total dispensed quantities indicated on the display screen take on different meanings according to the calibration procedure phase. During the calibration, the k24 cannot perform any normal dispensing operations. In calibration mode, the totals are not increased.

WARNING
The k24 features a non-volatile memory.
It keeps the calibration and dispensing data stored even after replacing new batteries or long periods of inactivity.

E3.1 DISPLAY OF CURRENT "K FACTOR" AND RESTORING "FACTORY K FACTOR"

By pressing the cal key while the appliance is in standby, the display page appears showing the current calibration factor used.

If you are using k24 with "factory k factor", the display page shown in the diagram will be displayed, with the word "fact".

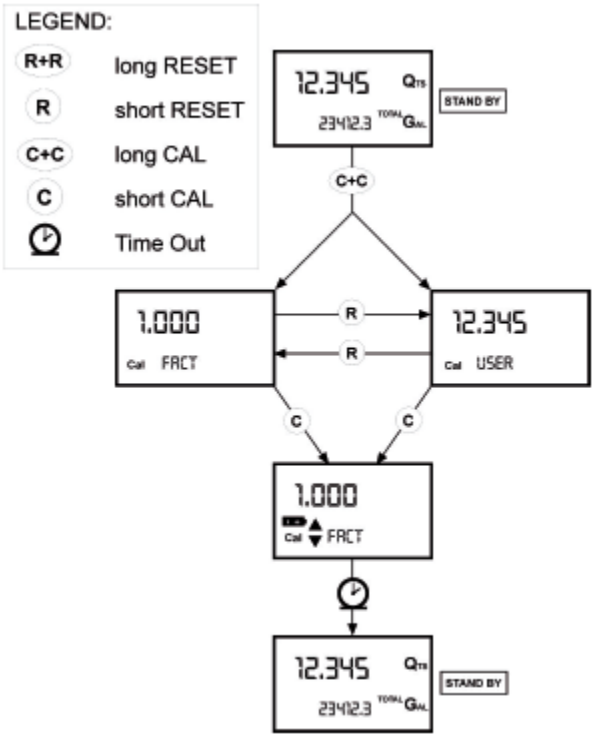
If one "user k factor" has been set, the calibration factor set by the user (in our example 0.998) will be displayed. The word "user" indicates a calibration factor set by the user is being used.

The flow chart alongside shows the switchover logic from one display page to another.

In this condition, the Reset key permits switching from User factor to Factory factor.

To confirm the choice of calibration factor, quickly press CAL while "User" or "Fact" are displayed.

After the restart cycle, the meter uses the calibration factor that has just been confirmed.



ATTENTION
When the Factory Factor is confirmed, the old User factor is deleted from the memory.

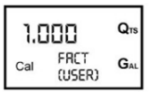
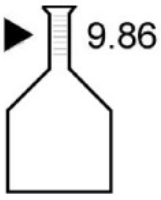
E3.2 IN-FIELD CALIBRATION

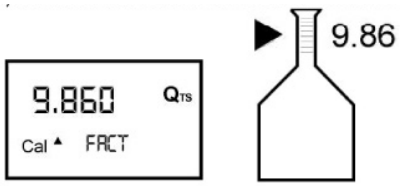
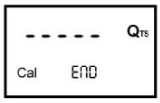
This procedure calls for the fluid to be dispensed into a graduated sample container in real operating conditions (flow rate, viscosity, etc.) requiring maximum precision.

WARNING
For correct K24 calibration, it is most important to:

- **completely eliminate air from the system before calibrating;**
- **use a precise Sample Container with a capacity of not less than 5 litres, featuring an accurate graduated indicator;**
- **ensure calibration dispensing is done at a constant flow rate equivalent to that of normal use, until the container is full;**
- **not reduce the flow rate to reach the graduated area of the container during the final dispensing stage (the correct method during the final stages of sample container filling consists in making short topups at normal operation flow rate);**
- **after dispensing, wait a few minutes to make sure any air bubbles are eliminated from the sample container; only read the Real value at the end of this stage, during which the level in the container could drop;**
- **if necessary, carefully follow the procedure indicated below.**

E3.2.1 IN-FIELD CALIBRATION PROCEDURE

	OPERATION	DISPLAY
1	**NONE** K24 IN STAND BY	
2	**LONG CAL KEY KEYING** K24 enters calibration mode, shows ”CAL” and displays the calibration factor in use instead of total. The words “Fact” and “USER” indicate which of the two factors is currently in use.	
3	**LONG RESET KEY KEYING** K24 shows “CAL” and the partial at zero. K24 is ready to perform on-site calibration.	
4	**DISPENSING INTO SAMPLE CONTAINER** Without pressing any button, start dispensing into the sample container.  Dispensing can be interrupted and started again at will. Continue dispensing until the level of the fluid in the sample container has reached the graduated area. There is no need to reach a preset quantity.   Indicated value Real value	
5	**SHORT RESET KEY KEYING** K24 is informed that the calibration dispensing operation is finished. Make sure dispensing is correctly finished before performing this operation. To	

	calibrate the K24, the value indicated by the partial totaliser (example 9.800) must be forced to the real value marked on the graduated sample container. In the bottom left part of the display an arrow appears (upwards and downwards), THAT SHOWS the direction (increase or decrease) of the USER K FACTOR value change when the operations 6 or 7 are performed.	
6	**SHORT RESET KEY KEYING** Arrow direction changes. The operation can be repeated IF NECESSARY.	
7	**SHORT/LONG CAL KEY KEYING** The indicated value changes in the direction indicated by the arrow - one unit for every short CAL key keying - continually if the CAL key is kept pressed. (for the first 5 units slowly and then quickly). If the desired value is exceeded, repeat the operations from point (6).	
8	**LONG RESET KEY KEYING** K24 is informed that the calibration procedure is finished. Before doing this, make sure the DISPLAYED factor is the ACTUAL factor.  Indicated value Real value K24 calculates the new USER K FACTOR. This calculation could require a few seconds, depending on the correction to be made. During this operation the arrow disappears but the CAL indication remains. If this operation is performed after operation (5), without changing the indicated value, the USER K FACTOR would be the same as the FACTORY K FACTOR, thus it is ignored.	
9	**NO OPERATION** **At the end of the calculation, the new USER K FACTOR is shown for a few seconds, after which the restart cycle is repeated to finally achieve standby condition.** **ATTENTION: From now on, the indicated factor will become the calibration factor used by the meter and will continue to remain such even after a battery change.**	
10	**NO OPERATION** K24 stores the new calibration factor and is ready for dispensing, applying the newly defined USER K FACTOR.	

E3.3 DIRECT MODIFICATION OF K FACTOR

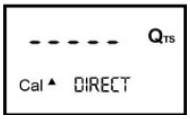
This procedure is especially useful to correct a “mean error” obtainable on the basis of several performed dispensing operations. If normal K24 operation shows a mean percentage error, this can be corrected by applying to the currently used calibration factor a correction of the same percentage. In this case, the percentage correction of the USER K FACTOR must be calculated by the operator in the following way:

$$\text{New cal. Factor} = \text{Old cal Factor} \times \left(\frac{100 - E\%}{100}\right)$$

Example:

Error percentage found E% - 0.9 %
CURRENT calibration factor 1,000
New USER K FACTOR 1,000 * [(100 – (- 0,9))/100]=
1,000 * [(100 + 0,9)/100] = 1.009

If the meter indicates less than the real dispensed value (negative error) the new calibration factor must be higher than the old one as shown in the example. The opposite applies if the meter shows more than the real dispensed value (positive error).

	OPERATION	DISPLAY
1	**NONE** K24 in STAND BY: not in counting mode.	
2	**LONG CAL KEY KEYING** K24 enters calibration mode, shows “CAL” and displays the calibration factor being used instead of the partial. The words “Fact” and “USER” indicate which of the two factors (factory or user) is currently being used.	
3	**LONG RESET KEY KEYING** K24 shows “CAL” and the partial at zero. K24 is ready to perform on-site calibration by dispensing.	
4	**LONG RESET KEY KEYING** We now go on to Direct change of the calibration factor: the word “Direct” appears together with the Currently Used calibration factor. In the bottom left part of the display, an arrow appears (upwards or downwards) defining the direction (increase or decrease) of change of the displayed value when subsequent operations 5 or 6 are performed.	
5	**SHORT RESET KEY KEYING** Arrow direction changes. The operation can be repeated to alternate the direction of the arrow.	
6	**SHORT/LONG CAL KEY KEYING** The indicated value changes in the direction indicated by the arrow - one unit for every short CAL key keying - continually if the CAL key is kept pressed. The speed increase rises by keeping the key pressed. If the desired value is exceeded, repeat the operations from point (5).	
7	**LONG RESET KEY KEYING** K24 is informed that the calibration procedure is finished. Before performing this operation, make sure the indicated value is that required.	
8	**NO OPERATION** At the end of the calculation, the new USER K FACTOR is shown for a few seconds, after which the restart cycle is repeated to finally achieve standby condition. IMPORTANT: From now on, the indicated factor will become the calibration factor used by the meter and will continue to remain such even after a battery change.	
9	**NO OPERATION** The K24 stores the new work calibration factor and is ready to begin dispensing, using the USER K FACTOR that has just been calculated.	

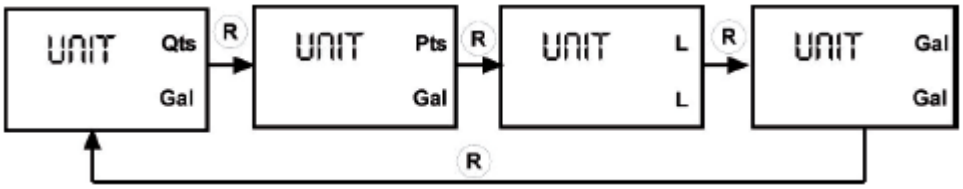
F. METER CONFIGURATION

Some models of meter feature a menu with which the user can select the main measurement unit, Quarts (Qts), Pints (Pts), Litres (Lit), Gallons (Gal);
The combination of the unit of measurement of the Partial register and that of the Totals is predefined according to the following table:

Combination no.	Unit of Measurement Partial Register	Unit of Measurement Totals Register
1	Litres (Lit)	Litres (Lit)
2	Gallons (Gal)	Gallons (Gal)
3	Quarts (Qts)	Gallons (Gal)
4	Pints (Pts)	Gallons (Gal)

To choose between the 4 available combinations:

- wait for K24 to go to Standby;
- press the CAL and RESET keys together. Keep these pressed until the word “UNIT” appears on the screen together with the unit of measurement set at that time (in this example Litres / Litres);
- Press the reset key to select the desired combination of unit of measurement, amongst those shown below;
- Save the new combination by pressing the cal key at length. K24 will pass through the start cycle and will then be ready to dispense in the set units.



WARNING
The Resettable Total and Total registers will be automatically changed to the new unit of measurement. NO new calibration is required after changing the Unit of Measurement.

G. MAINTENANCE

K24 has been designed to require a minimum amount of maintenance.
The only types of maintenance required are the following:
1) Battery change – necessary when the batteries have run down.
2) Cleaning of the turbine with washing or mechanically-handling.

1) Battery Replacement
K24 is complete with 2 x 1.5 V. alkaline batteries SIZE AAA.
K24 features two low-battery alarm levels:

1) When the battery charge falls below the first level on the LCD, the fixed battery symbol appears.

In this condition, K24 continues to operate correctly, but the fixed icon warns the user that it is ADVISABLE to change the batteries.

2) If K24 operation continues without changing the batteries, the second battery alarm level will be reached which will prevent operation. In this condition the battery icon starts to flash and is the only one to remain visible on the LCD.

WARNING
Do not discard the old batteries in the environment. Refer to local disposal regulations.

To change the batteries, with reference to the exploded diagram positions, proceed as follows:
- Press RESET to update all the totals.
- Loosen the 4 fixing screws of the lower cover.
- Remove the old batteries.
- Place the new batteries in the same position as the old ones.
- Close the cover again, by positioning the rubber protection as a gasket.
- K24 will switch on automatically and normal operation can be resumed.

The K24 will display the same Reset Total, the same Total and the same Partial indicated before the batteries were changed.
After changing the batteries, the meter does not need calibrating again.

2) Cleaning
Only one operation is necessary to clean the k24.
AAfter removing k24 from the plant where it was built in, any residual elements can be removed by washing or mechanically-handling.
If this operation does not restore a smooth rotation of the turbine, it will have to be replaced.

WARNING:
Do not use compressed air onto the turbine in order to avoid its damage because of an excessive rotation.

H. MALFUNCTIONS

Problem	Possible Cause	Remedial Action
LCD: no indications	Bad battery contact	Check battery contacts
Not enough measurement precision	Wrong K FACTOR	With reference to paragraph H, check the K FACTOR
	The meter works below minimum acceptable flow rate	Increase the flow rate until an acceptable flow rate range has been achieved
Reduced or zero flow rate	TURBINE blocked	Clean the TURBINE
The meter does not count, but the flow rate is correct	Possible electronic board problems	Contact your dealer
	Incorrect installation of gears after cleaning	Repeat the reassembly procedure

I. TECHNICAL SPECIFICATIONS

Measurement system		TURBINE
Resolution (nominal)	Hi Flow	0.010 lit/pulse
	Low Flow	0.005 lit/pulse
Flow Rate (Range)	K24 COL. BLACK Flowrates:	5 ÷ 120 (Litres/minute) FOR DIESEL FUEL, WATER
	K24 COL. BLACK Flowrates:	5 ÷ 120 (Litres/minute) FOR DIESEL FUEL, WATER
Operating pressure (Max)		10 (Bar) 145 (psi)
Bursting pressure (Min)		40 (Bar)
Storage temperature (Range)		-20 ÷ + 70 (°C)
Storage humidity (Max)		95 (% RU)
Operating temperature (Range)		-10 ÷ + 50 (°C)
Flow resistance		0.30 Bar at 100 lit/min.
Viscosity (Range)		2 ÷ 5.35 cSt
Accuracy		±1% after calibration within 10÷90 (litres/min) 2,65÷23,8 (gallons/min) range
Reproducibility (Typical)		±0,3 (%)
Screen		Liquid crystals LCD. Featuring: - 5-figure partial - 6-figure Reset Total plus x10 / x100 6-figure non reset Total plus x10 / x100
Power Supply		2x1.5 V alkaline batteries size AAA
Battery life		18 ÷ 36 months
Weight		0.25 Kg (included batteries)
Protection		IP65

L. DISPOSAL

The components must be given to companies that specialise in the disposal and recycling of industrial waste and, in particular, the

DISPOSAL OF PACKAGING
The packaging consists of biodegradable cardboard which can be delivered to companies for normal recycling of cellulose.

DISPOSAL OF METAL COMPONENTS
The metal components, both painted and stainless steel, are usually recycled by companies that are specialised in the metal-scrapping industry.

DISPOSAL OF ELECTRIC AND ELECTRONIC COMPONENTS
these have to be disposed by companies that are specialised in the disposal of electronic components, in accordance with the instructions of 2002/96/EC (see text of Directive below).

ENVIRONMENTAL INFORMATION FOR CUSTOMERS IN THE EUROPEAN UNION
European Directive 2002/96/EC requires that the equipement bearing this symbol on the product and/or its packaging must not be disposed of with unsorted municipal waste. The symbol indicates that this product should be disposed of separately from regular household waste streams. It is your responsibility to dispose of this and other electric and electronic equipment via designated collection facilities appointed by the government or local authorities.

DISPOSAL OF OTHER PARTS
The disposal of other parts such as pipes, rubber seals, plastic components and cables should be entrusted to companies that special in the disposal of industrial waste.

DECLARATION OF CONFORMITY

In accordance with directive:
89/336/EEC (electromagnetic compatibility) and subsequent amendments

PIUSI S.p.A. - 46029 Suzzara (Mantova) Italy
declares that the following flowmeter model

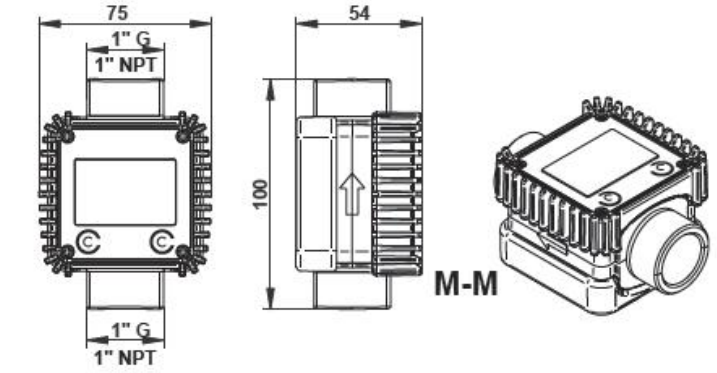
K24

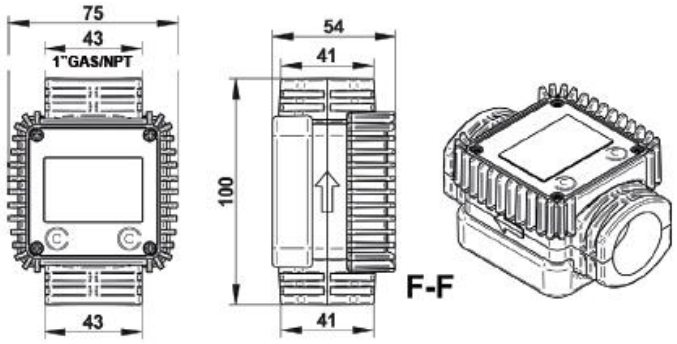
which this declaration refers to, complies with the following applicable norms:
European norms: EN 61000-6-1; EN 61000-6-3; EN 55014-1-2000; EN55014-2-97

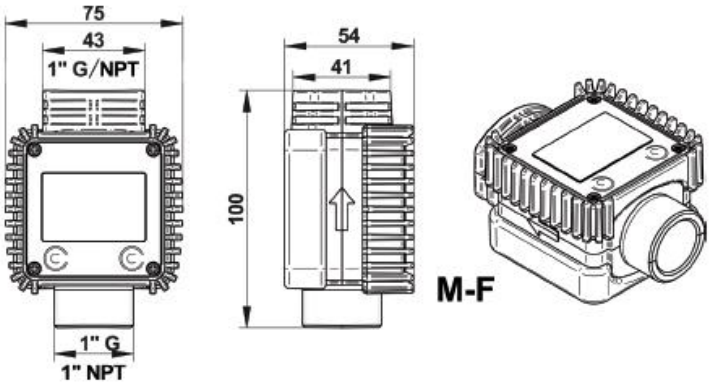
Suzzara, 01/10/2007

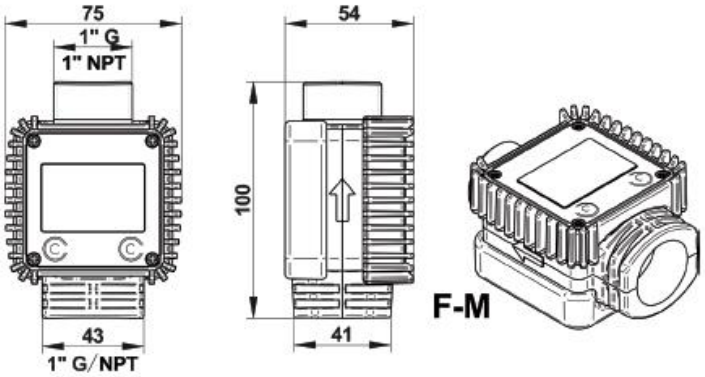
OTTO VARINI, Chairman

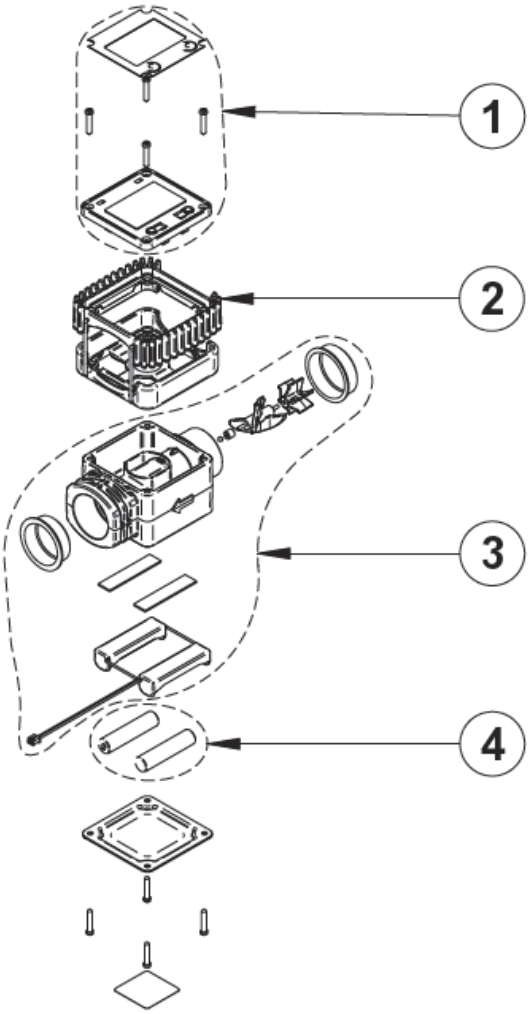
M. EXPLODED VIEWS AND OVERALL DIMENSIONS










1
2
3
4

XIX. FAULT REPORT FORM

TITAN

FAULT REPORT FORM

SERVICE CLAIM

Date: .....

CLAIM NO (filled in by Kingspan Environmental)

To:	**Customer:** **Customer's code:**
Kingspan Environmental Sp. z o.o. 62-090 Rokietnica ul. Topolowa 5, Poland tel.:+48 61 814 44 00 fax:+48 61 814 54 99	COMPANY: ADDRESS: CONTACT: phone: …….. fax: .....

"R" DOCUMENT
REF. NO .....
DATE .....

ADJUSTMENT NOTE
REF. NO .....
DATE .....

"D" DOCUMENT
REF. NO .....
DATE .....

SENT BY: .....
REF. NO .....
DATE .....

Exact address of product location:

COMPANY: ……..……..

ADDRESS: ….……..

CONTACT PERSON ……..

phone: …….. fax: .....

Date and time when the product can be serviced/picked up:
.....

Defective product will be returned to Kingspan Environmental:	YES / NO
This new product will be sent subject to return of defective product:	YES / NO
Serial no.:	
Date of purchase:	Guarantee card no.:

TruckMaster Type*	OTM00200DG		OTM00420DG		OTM00900DG	
Power supply*	12 V DC		24 V DC		230 V AC	
Pump Type*	By pass	Panther AC	Panther DC		BIPUMP	Viscomat DC
Flowmeter*	without		K600		K24	

* tick as appropriate

REASONS FOR CLAIM / FAULT DESCRIPTION:

Name ..... **Signature** ……..……

NOTE: If it has been specified that the fault during guarantee period resulted from incorrect use or incorrect product installation, or if the fault has been observed after the guarantee period, the reporting party shall be charged with service costs.

DECISION (Sales Administration Department):

Name ..... **Signature** ……..……

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ISO 9001:2008
FM 57348

Tested according EN13071 by AIDIMA

Kingspan
Environmental