Installation and maintenance manual

High torque Radial Piston Motors

Fixed, dual and variable displacement

CALZONI HYDRAULICS

Conversion factors

1 kg ..... 2.20 lb
1 N ..... 0.225 lbf
1 Nm ..... 0.738 lbf ft
1 bar .....14.5 psi
1 l .....0.264 US gallon
1 cm3 .....0.061 cu in
1 mm ..... 0.039 in
1 °C ..... (5/9)(°F-32)
1 kW ..... 1.34 hp

Conversion factors

1 lb ..... 0.454 kg
1 lbf .....4.448 N
1 lbf ft .....1.356 Nm
1 psi ..... 0.068948 bar
1 US gallon ..... 3.785 l
1 cu in 16.387 cm3
1 in ..... 25.4 mm
1 °F ..... (9/5)(°C) + 32
1 hp ..... 0.7457 kW

WARNING – USER RESPONSIBILITY

This document and other information from Calzoni Hydraulics provide product or system options for further investigation by users having technical expertise.

The user, through its own analysis and testing, is solely responsible for making the final selection of the system and components and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application, follow applicable industry standards, and follow the information concerning the product in the current product catalog and in any other materials provided from Calzoni Hydraulics.

To the extent that Calzoni Hydraulics provide component or system options based upon data or specifications provided by the user, the user is responsible for determining that such data and specifications are suitable and sufficient for all applications and reasonably foreseeable uses of the components or systems.

Content Page

General Information

This section must be read before viewing the rest of the documentation and before taking actions with Calzoni Hydraulics motor.

Reading this document is mandatory for all those people who interact with Calzoni Hydraulics motor (transportation, installation, maintenance, ecc.).

Purpose of the manual

The purpose of the manual is to illustrate the correct use of the radial piston hydraulic motors:

- **MR Series –**
  Fixed Displacement Motors (single star)
- **MRT Series** –
  Fixed Displacement Motors (multi- star)
- **MRD Series** –
  Dual Displacement Motors (single star)
- **MRV Series** –
  Variable Displacement Motors (single star)

All essential information of interest for users as well as for designers are available in the “Technical Catalogue” dedicated to each above listed motor series, while in the present manual you can find the procedures to be followed for:

- Handling & Storage
- Installation
- Use and Maintenance
- Repairs
- Scrapping

This manual also provides important information concerning the safety of the people assigned to the assembly, use and maintenance of the radial piston motors; consequently, it is necessary that this manual is carefully read and the indications here reported strictly followed.

In case this manual gets lost or damaged, a replacement copy can be required directly to Calzoni Hydraulics by using the code of this manual.

Symbols

The symbolism shown inside this documentation is intended to highlight any situations of danger to people and/or things.

DANGER

Dangerous situation which will involve in death or serious injury.

CAUTION

Dangerous situation which could involve in minor to moderate injury.

WARNING

Dangerous situation which will involve in death or serious injury.

NOTICE

Techinical information of particular importance, not to be overlooked.

Additional documentation

Along with the present manual, upon request, the following additional documentation can be provided for each product:

- exploded view;
- spare parts list;
- overall dimensions drawing (the overall dimensions for each standard motor type can also be found in the “Technical Catalogue”).

Your documentation request can be addressed to Calzoni Hydraulics.

Safety instructions

General safety warning

When using industrial machinery and systems, one must be aware that moving parts (both linear and rotary), high-voltage electrical parts, any high-temperature parts, etc. may cause serious damage to people and property.

Those responsible for system security must ensure that:

- all improper use and operations are avoided;
- safety devices are not removed or tampered with;
- maintenance operations are regularly performed;
- all precautions, individual protection, etc. required by safety regulations and legislation valid in the user's country are duly adopted;
- only original spares are used, especially for components that perform a safety function.

For this purpose, it is essential that:

- this documentation is filed, by a duly assigned person, in a suitable location in order to be always accessible for consultation, and always in good condition.
- only adequately trained personnel are assigned to the machinery.

The "Machine Directive" (2006/42/EC) defines with the term "OPERATOR" "the person or persons installing, operating, adjusting, maintaining, cleaning, repairing or moving machinery".

To better define the degree of preparation, the field of operation and the level of responsibility of the "OPERATORS", in this manual we define the following terms:

• **OPERATOR:** person who does not necessarily have a strong technical background, trained to run the machine in ordinary production regarding: start-up, stop at the end of the shift, simple maintenance operations (cleaning, etc.);

• **MAINTENACE TECHNICIAN** (mechanical or electrical): qualified technician assigned to the more complex operations of installation, maintenance, repair, etc. within his/her specific field of competence (mechanical or electrical).

It is essential that assigned operators have read and well understood the manual sections of their own competence. In particular:

- the OPERATOR must consult the sections relevant to "General Information" and "Use";
- the MAINTENANCE TECHNICIAN assigned to installation, maintenance, repair, etc. must consult all sections of this manual.

ATEX regulatory notes

In this manual there are additions regarding the use of the motors in areas with danger of explosion according to ATEX Directive 2014/34/EU.

These notices are recognizable through the symbols:

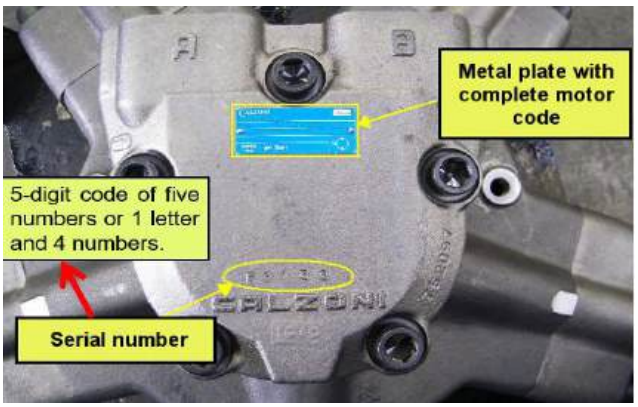
Prescriptions describe near these symbols are referred to ATEX Directive 2014/34/EU. Operations referred to this symbology must be performed by professionally qualified persons with specific expertise on safety issues related to areas characterized by the presence of a potentially explosive atmosphere. Prescriptions, where disregarded, can entail serious risks for the safety people/environment, also being able to affect the conformity of the motor respect the ATEX Directive.

Product identification

On the rotary valve housing a metal plate is applied, with complete motor coding which describes the configuration (see "technical catalogue") and the value of maximum continuos working pressure.

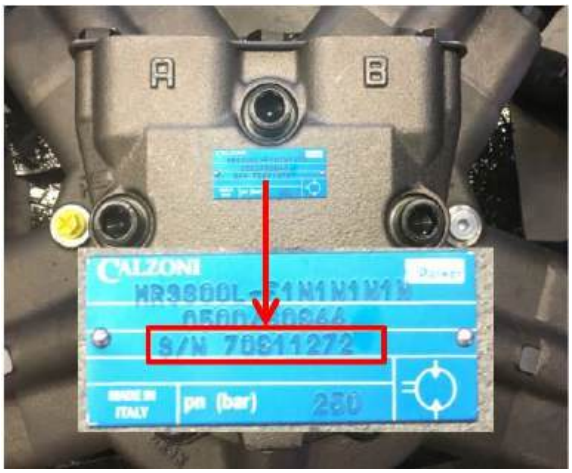
Please find below the indication to locate and identify serial number.

Motors supplied till June 30th 2014: Each motor reports the serial number punched on the rotary valve housing, consisting of a numeric code of 5 digits or alpha-numeric of 1 letter and 4 digits.



Motors supplied from July 1st 2014: the serial number, always punched on the rotary valve housing, has become a numeric code of 8 digits, beginning with **709** (e.g.70900504).

Motors supplied from November 1st 2016: the 8-digits serial number beginning with **709** is reported directly on the name plate and not anymore punched on the rotary valve housing.



Motors supplied from April 1st 2024: the 8-digits serial number is still reported directly on the name plate only, but it begins with **909.**

For a correct identification of the motor is necessary to refer to the serial number or to the motor coding. You must refer to these data in case of spare parts, information and service requests. For motor code interpretation, please refer to the “Technical Catalogue”**.**

Motors destined to operate in potentially explosive atmospheres classified according to Directive 2014/34/EU can be recognised thanks to a special plate that you can find on

the motor rotary valve housing, in additionto the one that indicates the motor code.

The special plate appears as the one illustrated below**:**

This identifying plate has to be kept in conditions so that all data on it can always be clearly read; consequently, a periodic cleaning of the plate is required.

Technical support request

Any kind of technical support request has to be addressed to Calzoni Hydraulics, by communicating the data you can find on the motor metal plate, the motor serial number, the approximate number of service hours of the unit and the kind of failure experienced, as indicated on the “Data collection format”.

Manufacturer’s responsibility

The manufacturer declines any responsibility in case of:

product usage not according to the safety regulations and legislation valid in the user’s country;

product usage in operating conditions not allowed according to the product technical documentation;

improper installation: the instructions given in this manual are not followed or not properly followed;

hydraulic system problems;

modification or manumission of the product;

operations executed by personnel not properly trained or not assigned to such a kind of operations.

The safety of the product depends upon the strict observation of the indications given in this manual; in particular, it is necessary:

- to always operate within the working conditions allowed for the product (pls. refer to the “Technical Catalogue” for the unit in usage);
- to always perform an accurate ordinary maintenance activity;
- to assign the inspection activity as well as the maintenance activity to duly trained personnel;
- to only use original spares;
- to always use the product according to the indications you find in this manual.

The instructions on this manual are in addition to the obligations you are required to comply with in accordance to the currently valid safety regulations and legislations and do not replace them.

Product-specific safety instruction

DANGER

Excessively high pressure

Above the maximum permissible pressure the components can explode and the fluid can escape from the motor case.

The motor works only within the maximum permissible pressure.

Suspended loads

The motor could fall downwards due to an erroneous maneuver, generating danger to things and/or people.

It’s essential observe the national laws on work, health protection and transportation.

Noboby can stand under or near suspended loads.

Everybody must use the personal protective equipment: safety glasses, safety gloves, safety shoes and suitable working clothes.

Lifting ropes, chains, jib cranes can be used, with the necessary precautions, to move the motors.

Pressurized system

It’s necessary to be careful when the machines are working and have not been turned off.

The operator must not disconnect any line connections, ports or components if the machine is pressurized.

WARNING

Escaping oil mist

There are risks of fire, explosion and pollution.

If there is a leak, depressurize the machine and repair it.

Keep motors away from open flames and excessive heat sources.

CAUTION

Noise

A high noise can generate, in the long term, serious hearing damage.

The noise of the motor is function of speed and pressure.

It’s advisable to use hearing protectors for operators close to the running motor.

Hot surfaces

A high operating temperature of the motor can generate a risk of burns.

Recommend the use of heat protective gloves.

Hydraulic fluid

Avoid contact with hydraulic fluid: if the fluid comes into contact with eyes, is swallowed or inhalated, contact a doctor immediately.

It’s advisable use protective equipment (safety glasses, safety gloves, safety shoes and suitable working clothes).

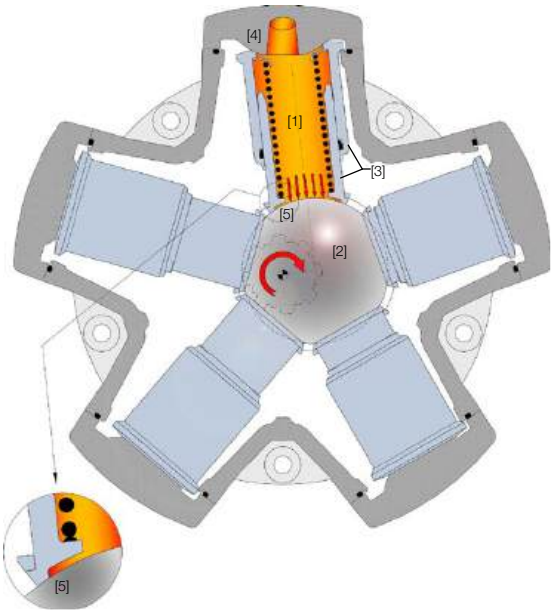
Technical description

These motors are used to convert the energy generated by working fluid pressure into kinetic energy of a rotating shaft. The motor provides a torque proportional to the feeding hydraulic pressure and a speed proportional to the feeding flow rate from the system pump.

The hydraulic radial piston motors, object of this manual, fall into the range of “Low Speed High Torque” (LSHT) motors. One fundamental feature of these motors is the capability to develop a very high starting torque, able to win a high resistant torque and start up the system.

This information represents an initial approach to become familiar with the products object of this manual; more specific and detailed information on various topics is contained in the following sections.

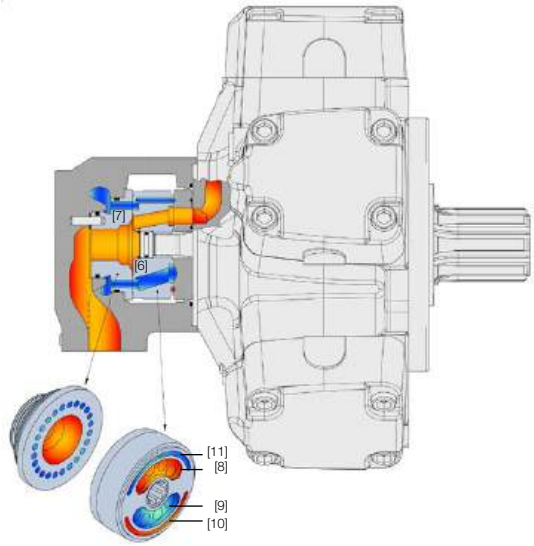
Functional description



The main concept of this unique and outstanding technology is to convert fluid power (pressure and flow) into mechanical power (torque and speed) by means of pressurized columns of fluid [1] which act directly on a spherical eccentric shaft [2], thereby avoiding the use of conventional connecting rods, pistons, and pins.

In each propulsion unit, the pressurized fluid is contained within a telescopic cylinder [3] that is sealed by two spherical surfaces, one on the propulsion cover [4] and one on the eccentric shaft [5]. The two spherical surfaces guide the telescopic cylinder so that no side forces are generated during the shaft rotation.

Thanks to the limited friction and wear caused by the “metal to metal” contact, the fluid column propulsion system guarantees high values of volumetric and mechanical efficiency, combined with smooth and precise movements of the motor shaft, even at the lowest speeds.

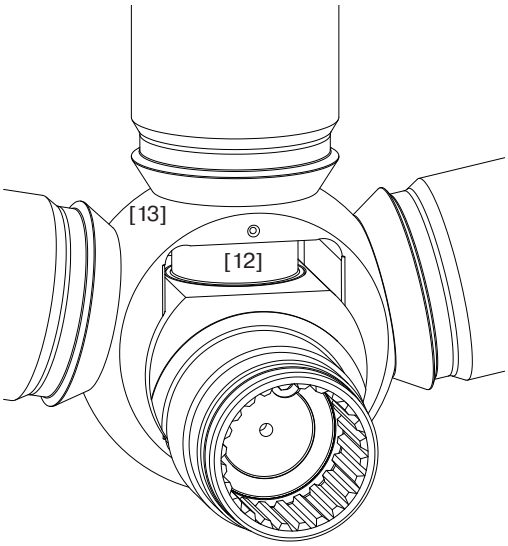


The timing system - consisting of the rotary valve [6] and the reaction ring [7] - supplies the columns of fluid precisely in the correct sequence to generate a smooth motor output torque. While the reaction ring is used to adjust the clearance and to compensate for thermal shocks, the rotary valve rotates at the same speed as the eccentric shaft and connects the reaction ring to the piston chambers by means of two slots [8] and [9]. Two additional balancing slots [10] and [11] cancel the tilting moments (patented), guaranteeing consistent performance for the entire service life.

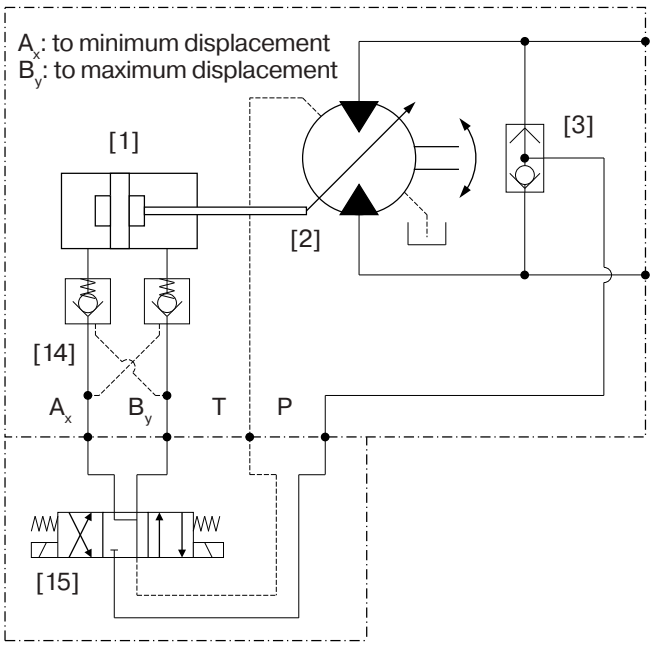
The MRD series dual displacement models have two pre-set displacements which can be chosen from a wide range to suit specific application requirements. The change of displacement can take place in motion, guaranteeing reliability and high performances

of the entire circuit. The motors displacement can be modified by means of displacement control pistons [12] that act on the spherical cam [13], changing its eccentricity and varying the motor displacement.

The MRV series variable displacement models have the additional capability to lock the displacement at any intermediate value in between the maximum and the minimum. This feature is obtained by means of a dual pilot operated check valve [14] assembled on



the motor: when the three position / four way directional control valve [15] operates in neutral position, the displacement value is locked at the current position thanks to the fluid sealed inside the displacement control pistons due to the dual pilot check



valve Due to their special design, the calzoni motors deliver their maximum performance when the application requires high torque values. The calzoni motors combine precise and smooth movements, both at low speed and during acceleration and deceleration transitions. In addition, the high starting torque (up to 96%) allows the user to select a smaller displacement of the motor, optimizing the size of all the other system's components.

Motors can be customized by selecting different types of shafts, speed sensors, seals, and connection flanges. Optional accessories and options are available to suit the customer needs.

Regulatory compliance

Calzoni Hydraulics motors can be provided in conformity to the essential safety requirements according to the ATEX Directive 2014/34/EU as per the specifications below:

The motors, if destined to operate in potentially explosive atmospheres, are designed and realised in conformity to the Safety Essential Requirements (RES) of Annex II of the ATEX Directive 2014/34/EU. The Directive provides the following classification:

- Group II, category 2, operation in gaseous and dusty environment zone 1 and 21;
- Group II, category 3, operation in gaseous and dusty environment zone 2 e 22;
- Maximum surface temperature: class of temperature T4.

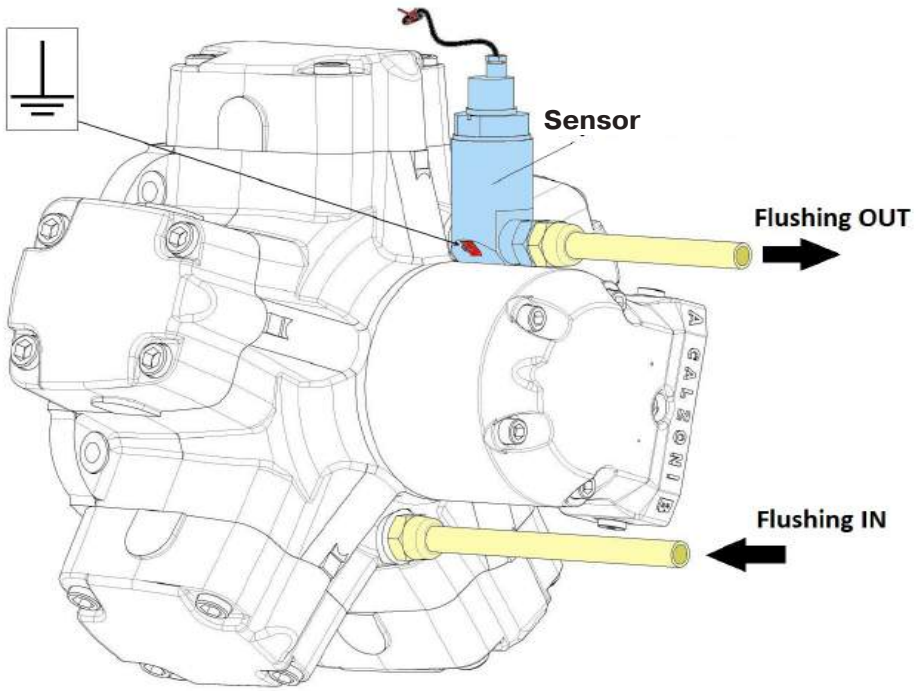
SAFETY SPECIFICATIONS FOR MOTORS CONFORMING TO THE ATEX DIRECTIVE 2014/34/EU:

- the motor must be connected to ground by means of the dedicated threaded hole identified by means of the proper symbol (pls. refer to the picture below);
- only mineral oil with flashpoint higher than 185°C can be used;
- motor seals must be in VITON®;
- the motor must be always flushed in whatever operating condition;
- the motor must be equipped with a system to detect the oil level inside the motor case: motor case must be always full of oil;
- no creeping metal elements external to the motor are allowed;
- plastic parts that might accumulate electrostatic charges are not allowed; their presence is accepted only if shielded;
- for installations in zones 21 and 22, the user has to adopt a scheduled periodic cleaning plan of the machinery surface and recesses in order to prevent any dust deposit exceeding the thickness of 5 mm.

Before servicing motors that operate in potentially explosive atmospheres, the assigned personnel must deactivate the inlet feeding, putting the motor in “out of service” condition; attention has to be paid to any situation that might lead to the undesired restart up of the motor or to the undesired and not predicted movement of motor’s parts.

All additional environmental safety regulations must be undertaken (i.e. degassing process and residual dust cleaning process of the atmosphere).

It is forbidden to use a motor not designed and realised in conformity to the dedicated standards in potentially explosive atmospheres or where the usage of anti-deflagration components is required.



Hydraulic fluids

Operating fluids

Performance data of this manual is valid when motors are operating with mineral oil based fluids, according to DIN 52525. The fluid should contain anti-oxidant, antifoam, demulsifying and antiwear or EP additives.

The viscosity, quality and cleanliness of operating fluids are decisive factors in determining the reliability, performance and life-time of an hydraulic component.

The maximum life time and performances of the motor are achieved within the recommended viscosity range. For applications exceeding this range, we recommend to contact Calzoni Hydraulics.

- ν_{rec} = recommended operating viscosity 30....50 cSt.

This viscosity range is referred at the same time to the temperature of the fluid entering the motor and to the temperature of the fluid inside the motor housing (case temperature).

!
WARNING

Temperature must never exceed 80°C anywhere in the system.

For critical operation conditions the following values apply:

$\nu_{min.peak}$ = 10 cSt in emergency, short term;

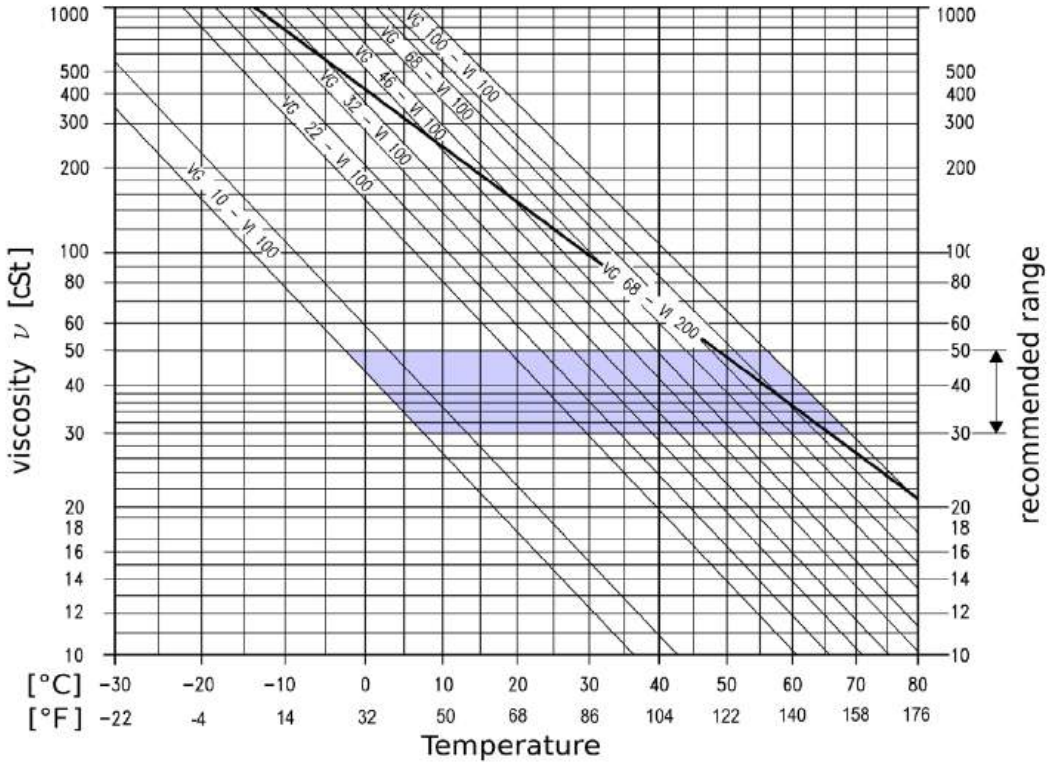
$\nu_{min.peak}$ = 18 cSt for continuos operation at reduced performances;

$\nu_{min.peak}$ = 1000 cSt short term upon cold start.

The motor operating temperature is defined as the higher between that of the inlet feeding fluid entering the motor and that of the fluid inside the motor case (case temperature).

It is recommended that you choose the viscosity of the fluid based on the maximum operating temperature so that the motor might operate within the recommended viscosity range. If these viscosity requirements cannot be met, due to extreme operating parameters or high environment temperature, motor case flushing is strictly

recommended in order to operate within the viscosity limits. Should it be absolutely necessary to use a viscosity exceeding the recommended range, pls. first contact Calzoni Hydraulics.



Types of fluids allowed

HLP oils according to standard DIN 51 524 part 2 (with wear-proof, oxidation-proof and corrosion-proof additives) and part 3 (with a high viscosity index, suitable for applications subject to broad operating temperature variations) are recommended.

The use of water-based fluids is allowed only with specifically designed motors; the motor performances get reduced according to the class the oil belongs to: HFA, HFB or HFC (pls. contact Calzoni Hydraulics about the use of motors with water based fluids).

The use of synthetic fluids (type HFD) is allowed with motors supplied with seals in FPM material (pls. contact Calzoni Hydraulics about the use of motors with synthetic fluids).

Seals in FPM material are necessary for HFD/U fluids only if expressly indicated by the fluid manufacturer.

The use of synthetic fluids (type HFD) does not imply any motor performances reduction.

Three families of environmentally acceptable fluids are currently available in the market:

1. Vegetable-based fluids HETG;
2. Polyglycol-based synthetic fluids HEPG;
3. Ester-based synthetic fluids HEE.

At the present time very little practical experience and information has been gathered with regard to the possible performances and ageing characteristics of the various fluids belonging to the HETG class. In case of working pressure exceeding 200 bar, the generation of sludge is a side effect of the use of a fluid belonging to this class. As a consequence, the fluid has to be frequently monitored and an operating temperature below 45°C is recommended.

HEPG fluids have excellent working characteristics thanks to their usual high viscosity.

For information concerning HEE fluids you can refer to the operating parameters of the HLP oils.

CAUTION

As for mineral based fluids, environmentally acceptable fluids must be disposed of in accordance to current regulations.

Class	Description	Pressure	Speed	Power	Temperature	
-	-	(% of nominal pressure)	(% of max speed)	(% of max power)	Max	Ideal
HFA	Oil-water emulsion	50	50	25	50 °C 122 °F	40 °C 104 °F
HFB	Water-oil emulsion	80	80	60	60 °C 140 °F	45 °C 113 °F
HFC	Water-based solution (mostly with glycol)	60	60	30	60 °C 140 °F	45 °C 113 °F
HFD	Synthetic fluids (water free)	100	100	100	80 °C 176 °F	50 °C 122 °F

CAUTION

For HFD/U fluids, FPM seals should be used only if required by the fluid manufacturer.

It is compulsory to use only oils whose flashpoint is higher than 185°C in case the motor is destined to be used in potentially explosive atmospheres (ATEX Directive 2014/34/EU).

Fluid filtration

To ensure a smooth and reliable motor operation, the fluid must comply with one of the following filtration classes:

1. class 9 according to NAS 1638;
2. class 6 according to SAE, ASTM, AIA;
3. class 20/17/16 according to ISO 4406:1999.

CAUTION

In order to ensure a long motor life time, class 8 according to NAS 1638 is recommended; it is obtainable by using $\beta_5 = 100$ filtration quotient.

In case the above listed filtration classes cannot be respected, pls. contact Calzoni Hydraulics.

Mixing different oils

Mixing oils of different brands or different oils of the same brand may lead to the formation of sediment and sludge. Consequently a rapid, irreversible deterioration of the system is induced.

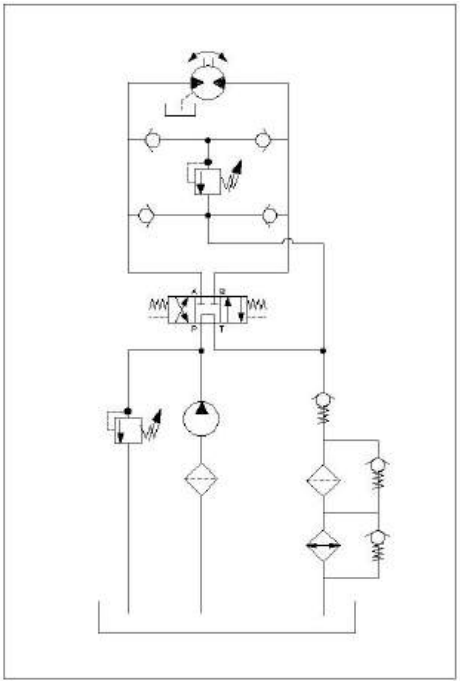
Pump operation: boost pressure requirements

In case the motor is used as a pump or driven by the load (even for a short time) it is necessary to ensure an adequate boost pressure to the inlet line.

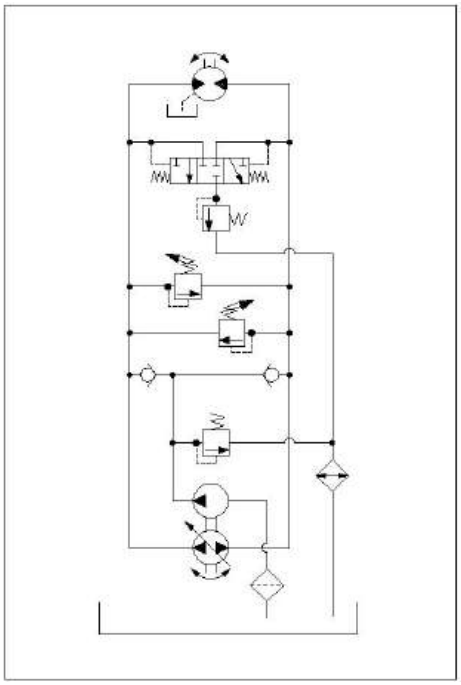
The diagrams relevant to the minimum boost pressure required by the motor when working as a pump can be found in the “Technical Catalogue” of the series the motor belongs to.

CAUTION

The hydraulic circuit has to be built so that to protect the motor from insufficient boosts pressure. The two circuits below are just general examples to how to solve the problem.



Open loop circuit



Closed loop circuit

Transport and storage

This section contains the essential instructions to operators for packing removal and motors handling. The information of this section is intended for qualified technical personnel (mechanical and electrical maintenance technicians) with adequate skills to work appropriately and safely with lifting equipment, harnesses, lift trucks, bridge cranes, etc.

DANGER

Only qualified technical personnel, trained in the specific field of intervention, should perform lifting, handling and placement activities as well as execute mechanical, hydraulic and electrical connections.

Supply conditions

The motors are supplied in the following conditions:

- for **shipments within Italy**, motors are packed and fixed to skids (pallets) or packed in dedicated cardboards or wooden crates, according to motors size and/or to specific customers' requests;
- for **international shipments**, motors are packed in dedicated cardboards or wooden crates, according to motors size, type of shipment (truck, ocean freight, air freight) and/or to specific customers' requests;
- standard motors supply is without any paint; a layer of anti-rust primer paint is available upon request (the coupling surfaces are not painted);
- motors to be shipped by ocean freight are placed inside dedicated humidity absorber plastic bags;
- before shipment, all motors are tested according to Calzoni Hydraulics internal functional test procedures.
- motors are supplied with empty motor case; the motor internal components are protected by the layer of oil residual from the test performed before delivery.

Transportation

During transportation it is advisable to treat motors as delicate goods so that to avoid collisions that might cause damage to the packing as well as to the content.

DANGER

During in- house transport, the utmost care is recommended while manoeuvring the vehicle and a low speed is suggested so that to avoid collisions and jerks that can damage the output shaft or other delicate parts.

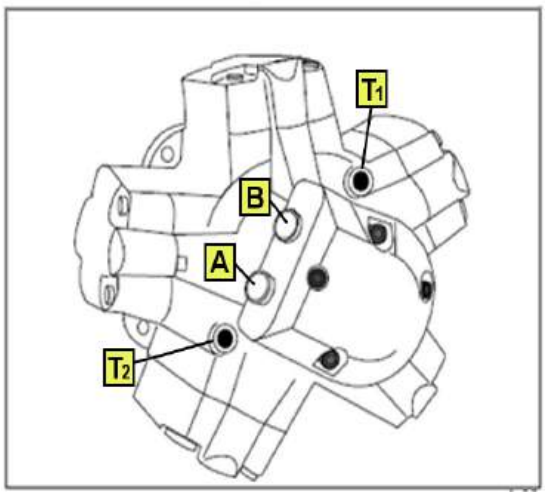
Storage

It is strongly recommended to avoid storing the motors outdoor, in excessively damp sites or positioned directly on the ground.

Motors can be stored in a warehouse, in the same conditions it was supplied, for no longer than 3 months.

Should the motors be stored for a longer period or should they be stored in a damp site, they have to be filled in with filtered hydraulic oil by using one of the two drain holes T1, T2 positioned in the motor case and by using the inlet ports A, B on the rotary valve housing; at the end of this operation, drain holes and inlet ports have then to be duly plugged.

The oil used to fill in the motor has possibly to be the same that will be used in the system the motor will operate on, so that to avoid risks of mixing different fluids.



CAUTION

The motors may be seriously damaged if they are stored at critical temperatures before installation. Do not expose the motors to temperatures below -30°C or above 80°C; these two temperature values must be considered the absolute lower and upper extremes.

Packing removal

As illustrated in the previous section, the motor is simply packed on a wooden skid or on a skid with cardboard or wooden crate. The wooden crate must be opened with order, starting from the cover, then removing the side panels and finally taking out the end panels.

WARNING

The distinct parts of the crates must be made harmless for people; thus, before storing them, dangerous parts must be removed; dangerous parts are: wooden pins, screws, nails, sharply pointed to edged parts, etc.

CAUTION

The operators assigned to handle and remove the packing must adopt individual protection devices (gloves, helmet, and safety shoes) and respect the general safety regulations required by EC directives and legislations valid in the user's country.

WARNING

Once the packing has been completely removed, in case the motor has been partially of fully subject to a corrosion-proof treatment, it is necessary to clean the treated parts thoroughly so that to eliminate the anti-oxidant; this operation has to be performed by using cloths soaked in solvent.

Materials used as packing material, like boards, wooden walls, and waterproof covers, can be stored and successively re-used as loose material.

In no case may they be disposed in the environment; in particular do not burn water-proof covers. They must be disposed in an authorized site for differentiated waste disposal.

CAUTION

Calzoni Hydraulics does not hold any responsibility for improper use of packing material as well as for successive handling of the motor.

Contents control

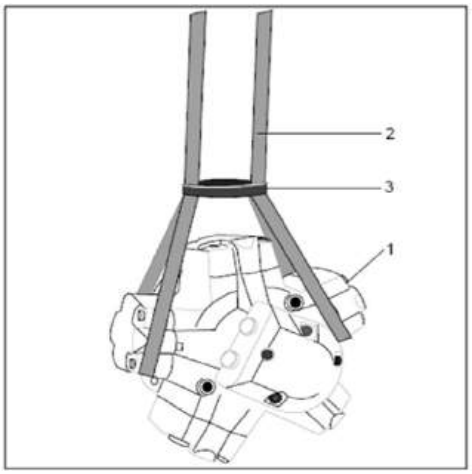
Check carefully that the received material complies with the shipping documents and has not been damaged during the transportation. Notify immediately any discrepancies or damages. For any kind of assistance request or communication concerning a motor, the user must inform about the unit complete model code (information reported on the motor metal plate) and serial number.

Handling

For handling motors during assembly and disassembly from the application, the following procedures are recommended.

MR, MRD,MRV Series

- Lifting by means of Nylon belt: harness the motor (1) by means of a Nylon belt (2) as shown in the picture below.



DANGER

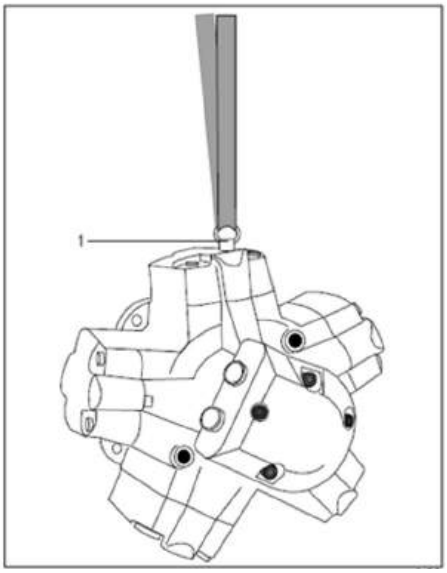
The belt size must be chosen according to the motor weight (the weight of the motors can be found in the relevant “Technical Catalogue”).

Use a metal ring (3) to “throttle” the belt (2), adjusting the height of the metal ring before tensioning the cable.

- Lifting by means of eyebolt: for some kinds of applications, as shown in the following picture, upon request of the customer it is possible to provide motors with dedicated eyebolt holes (1) on one or more cylinder heads.

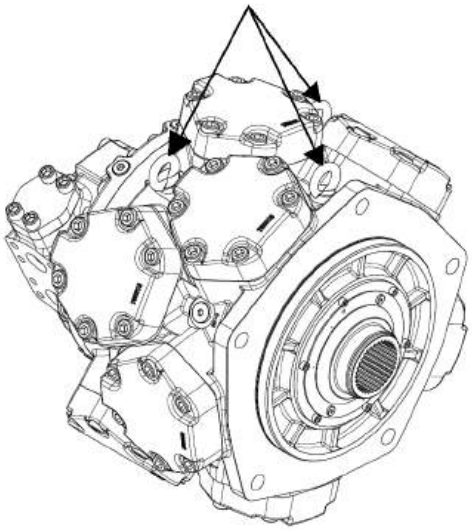
CAUTION

For motor types MR 6500 - MR 7000 - MRE 8200 - MRA 9000, 2 holes for each cylinder head are foreseen.

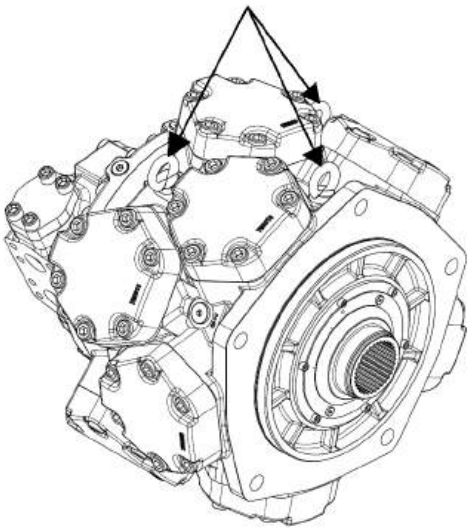


MRT Series

Motors from MRT Series belonging to class P are provided with three eyebolt holes on the motor case for lifting purposes. During the lifting, the motor weight has to be distributed on all the eyebolts.

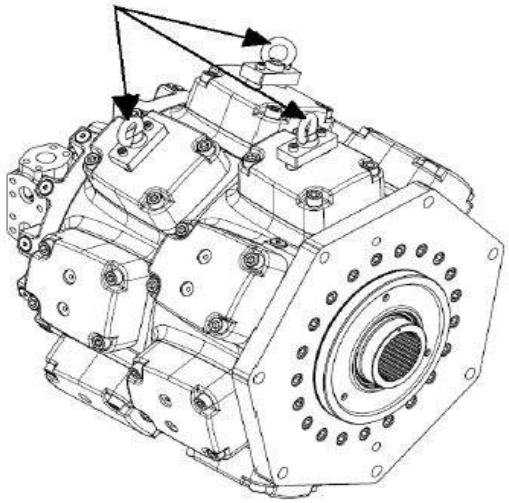


Frame size “P”



Frame size “R”

Motors from MRT Series belonging to classes Q, R, T and U are equipped with three lifting tools on three cylinder heads as per the pictures on this page. During the lifting, the motor weight has to be distributed on all the three tools.



Frame size “Q” - “T” - “U”

Installation

This section is intended for personnel (Mechanical Maintenance Technician) assigned to install the motor on the machine or system for which the unit has been purchased. Therefore the importance of this section is emphasised since the optimaloperation of the group machine/system – motor is the consequence of the correct assembly of the parts; the correct installation will also limit the possible sources of danger for people working near the structure.

Applying the motor to the system

Manufacture the assembly flange on the machine/system on which the motor has to be installed; the relevant surface has to be perfectly smooth, completely de-greased and non-deformable.

The motor must be assembled by using bolts whose size must be selected based on fixing holes dimensions; appropriate lock washers must be used.

The tightening torque must be proportional to the momentum generated by the motor; if necessary, the 70% of the bolt yield load can be reached.

Use fixing bolts belonging to resistance class 8.8 or higher.

In case of working with high speed, frequent reversals, sharp start-up and stops, it is necessary to foresee the use of two calibrated fixing bolts.

In case a rigid coupling is used, it is necessary to verify the perfect alignment between the motor output shaft and the machine shaft; the fitment between motor shaft and application's driven shaft must be executed so that no radial or axial pre-load is generated; these extra loads reduce the bearings expected lifetime.

The motor can be assembled horizontally or vertically, with output shaft facing up or output shaft facing down; in any case there are no special rules to be followed about the positioning of the main hose connections (inlet and outlet lines), while special rules have to be followed for the drain line connections.

CAUTION

During installation, place first the motor against the machine assembly flange and then insert and tighten the fixing bolts.

Motor positioning obtained as a result of the fixing bolts tightening process might generate on the motor shaft axial and radial loads that will lead to bearings lifetime reduction.

Hydraulic connections

Main inlet hoses connections

In standard configuration, on the rotary valve housing the motor has two ports, which may be both inlet or outlet ports depending on the application, and 6 threaded holes.

WARNING

Remove the plastic plugs from the inlet ports before connecting the hoses.

Standard Calzoni Hydraulics threaded holes or SAE flanges (pls. refer to the "Technical Catalogue") are supplied upon request; these flanges have grooves for the sealing gaskets (O-Rings).

In case the application foresees rigid pipes, they must be made in drawn, polished steel and must be connected to the flange by means of cutting-ring fittings (such as ERMETO).

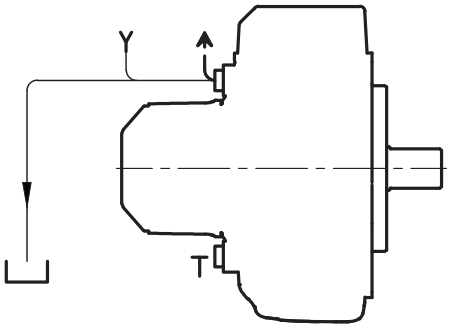
We recommend not to use welded pipes; should it be necessary to use them, they must be internally cleaned thoroughly around the welds using both mechanical means and chemical pickling so that to prevent welding residue from entering the oil circuit. Steel pipes must be chemically pickled and then neutralised and flushed when they show traces of oxidation or in any case they are not perfectly clean.

TIGHTENING TORQUES FOR MOTORS MOUNTING SCREWS					
MOTOR TYPE	**FRAME SIZE**	**NOMINAL DIAMETER OF THE SCREWS (mm)**	**MAXIMUM TORQUE (daNm)**		
			CLASS 8.8	**CLASS 10.9**	**CLASS 12.9**
MR	B	M14	13.46	18.92	22.70
	C	M10	4.97	7.00	8.37
MR / MRD	D	M10	4.97	7.00	8.37
MR / MRD / MRV	E	M12	8.46	11.90	14.30
	F	M12	8.46	11.90	14.30
	G	M14	13.46	18.92	22.70
	H	M16	20.40	28.80	34.60
	I	M18	28.40	40.00	48.00
	L	M22	53.00	74.50	90.00
	M	M24	70.00	98.00	117.00
MRT	P	M30	130.00	182.00	217.00
	R	M30	130.00	182.00	217.00
	Q	M33	153.00	215.00	256.00
	T	M36	240.00	300.00	400.00
	U	M42	380.00	500.00	600.00

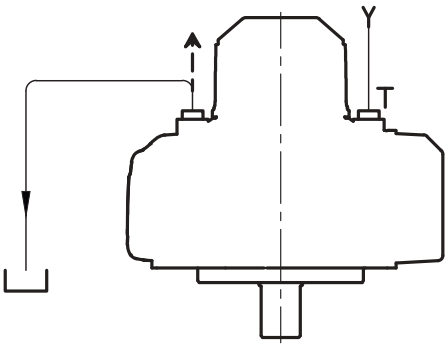
Drain line connections

The motor drain line must be connected directly to tank (without filter) by means of a F 1/2" or F 3/8" size pipe, not too long and without unnecessary bends and bottlenecks. The pressure inside the motor case must not exceed 5 bars to prevent from damaging the shaft seal, or 15 bar if the motor is equipped with a high pressure shaft seal.

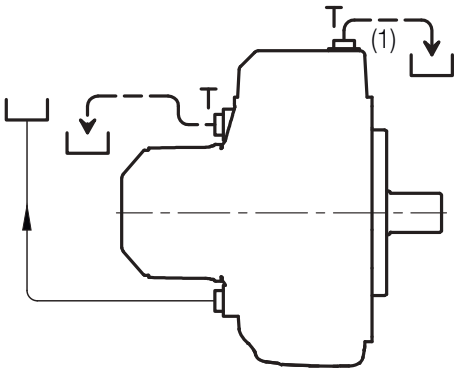
Horizontal mounting



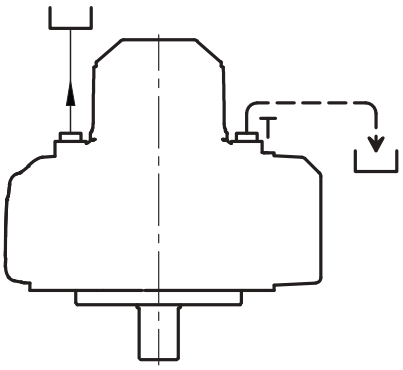
Vertical mounting, shaft downwards



Horizontal mounting, tank located in higher position

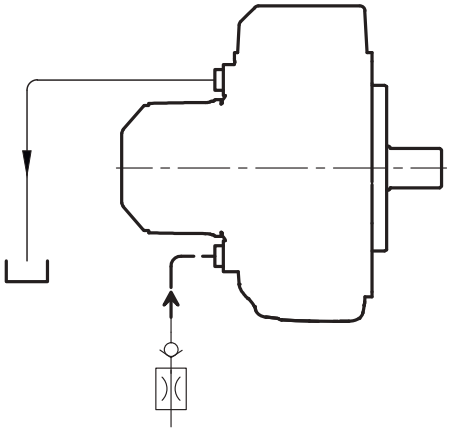


Vertical mounting, shaft downwards, tank located in higher position

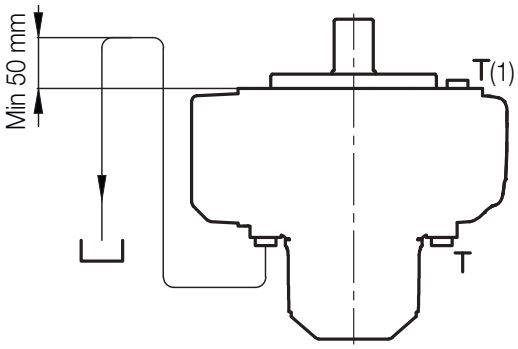


(1) = Bleed screw (on enquiry)

Cooling circuit for high power continuous operation



Vertical mounting, shaft upwards



(1) = Bleed screw (on enquiry)

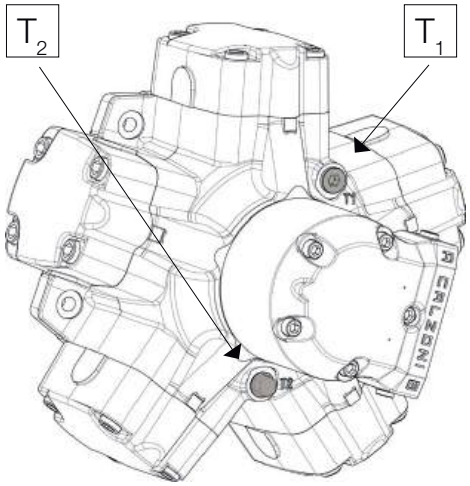
T = Seal Y = Motor housing feeding line --> = Air bleed

Flushing of motor case

Operating within the “Continuos operating area without flushing” does not require any additional cooling of the motor case.

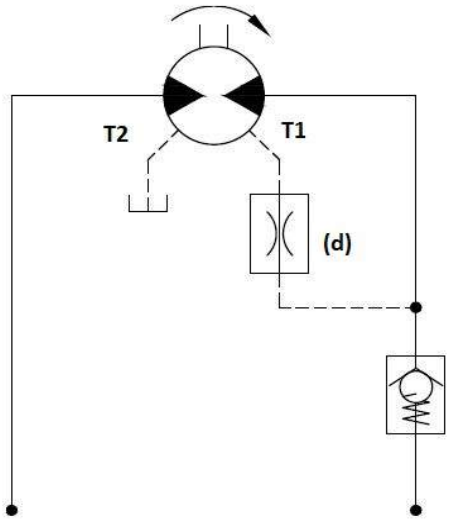
For operating conditions out of the “Continuos operating area without flushing”, additional oil cooling is required to avoid high temperature in the motor case.

Flushing can be also necessary when the motor works inside the “Continuos operating area without flushing”, but the system is not able to ensure the minimum viscosity conditions requested by the motor.

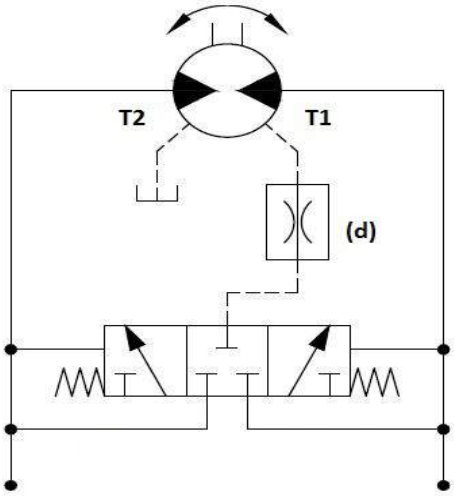


Motor drain and flushing connections (T1, T2)

Flushing circuit examples (Flushing valve available on request).



Flushing - Monodirectional rotation



Flushing - Bidirectional rotation

WARNING

If the drainage value is to be checked, it's absolutely necessary exclude the flushing system.

For each motor, the maximum admissible pressure in motor case is 5 bar for standard shaft seal option "N1" (15 bar for high pressure shaft seal option "F1); for higher values, contact Calzoni Hydraulics.

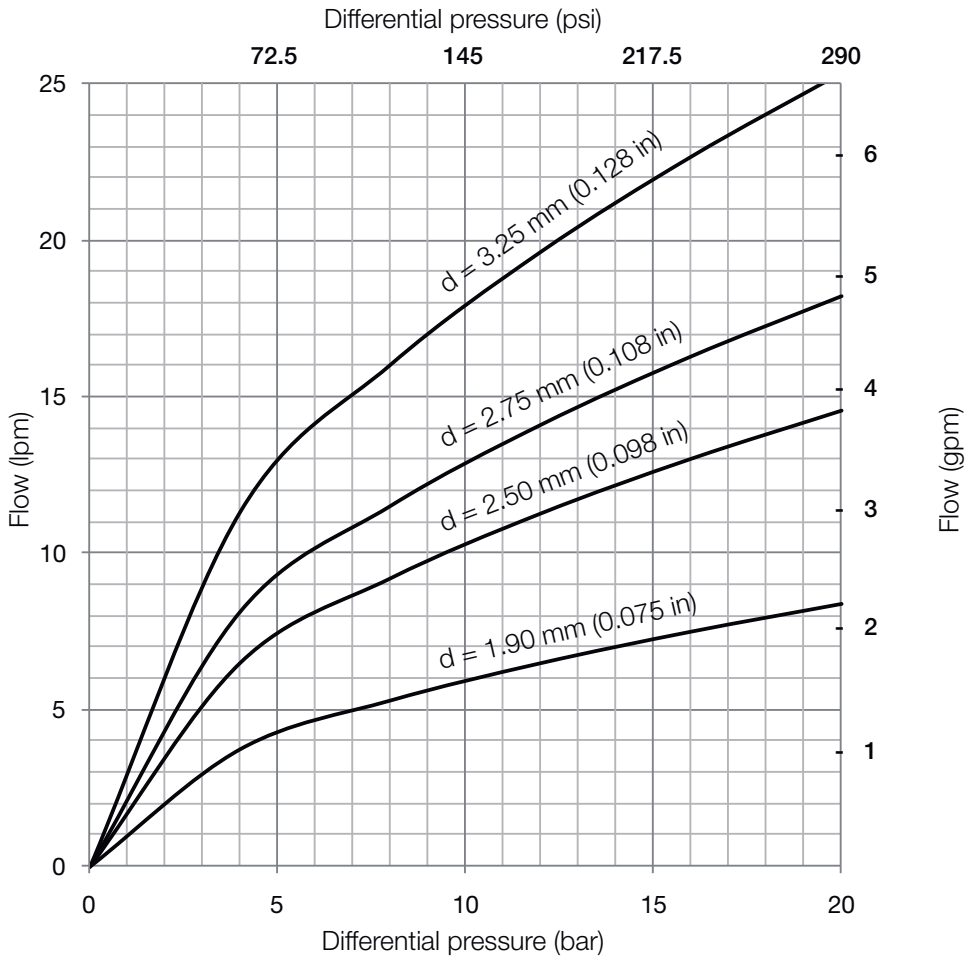
In order to avoid the emptying of motor case, return line must be positioned as drainage line.

In the table right, the values of the flushing flow rate are shown according to the motor frame size used.

Motor type	Frame Size	Flushing flow	
		lpm	gpm
MR	B	5	1.3
	C	6	1.6
MR/MRD	D		
MR/MRD/MRV	E	8	2.1
	F	10	2.6
	G		
	H	15	4
	I	20	5.3
	L		
	M		
MRT	P	23	6.1
	R		
	Q		
	T		
	U		

The motor return line can be used as source flow to flush the motor case.

The requested flow rate can be obtained selecting the correct restrictor diameter (d) according to the differential pressure between the motor case and the return line.



Flushing is mandatory when the motor is used in a potentially explosive atmosphere: lubrification is guaranteed where there is friction and temperature rises are controlled.

Motors compliant with the ATEX Directive 2014/34/EU are equipped with a sensor for detecting the presence of oil in motor case.

The sensor is mounted on flushing return line.

The electric signal supplied by the sensor must be used to interrupt the power supply to the motor if oil lack is signaled in motor case.

WARNING

For the electrical connections of the sensor, refer to the sensor documentation itself, supplied with the motor.

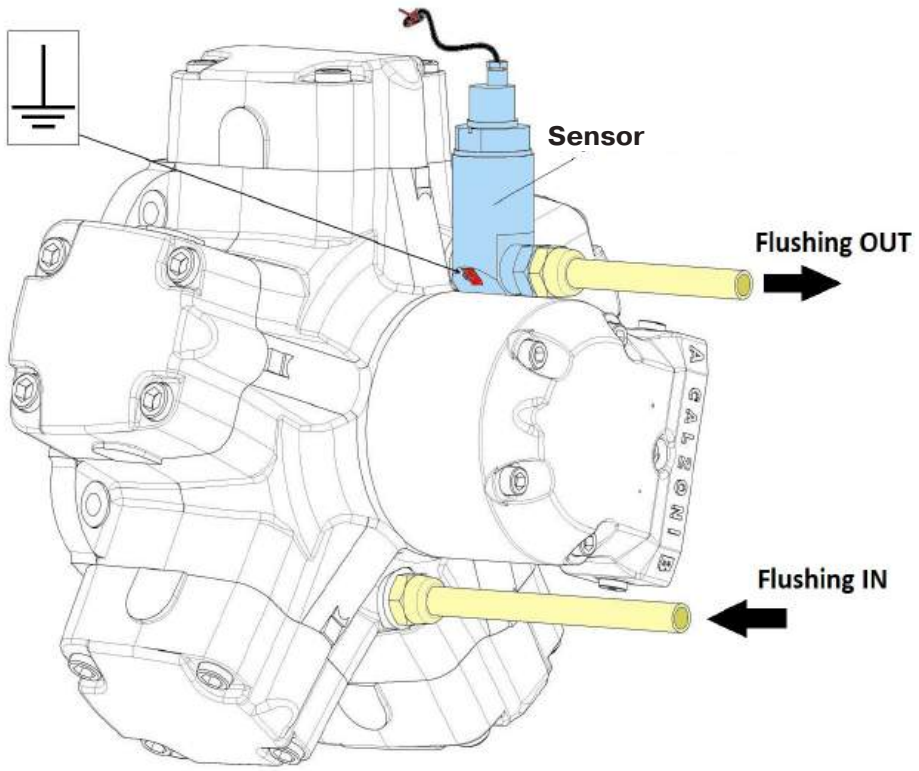
Pilot pipes

Dual and variable displacement motors are equipped with CETOP 4.2-4- 03-320 connection for piloting. In case of monodirectional operation, the piloting pressure can be taken directly from working pressure through manometric port (1/4" BSP) on distributor cover.

On customer request, we can supply the motors with auto-piloting configuration.

Maximum pilot pressure is the maximum permissible maximum pressure for the motor.

For more information, see MRD and MRV technical catalogues.



Commissioning

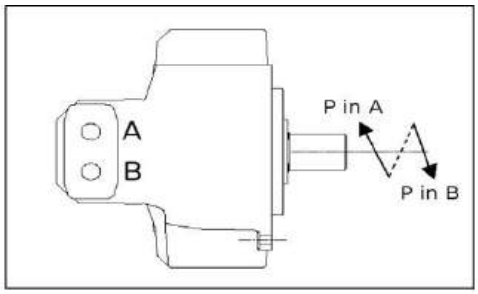
In this section the operations are indicated to allow the motor to start-up.

These information are directed to the technical personnel qualified to the maintenance of the machine and to the machine operator.

Pre-start checks

Before starting the motor for the first time, check these points below:

- Check the correct rotation of the motor. For motors with standard rotation (seen from shaft side): clockwise with inlet pressure from port A or anti-clockwise with inlet pressure from port B.



- Select the correct hydraulic fluid.
- Check the exact connections of the supply, drainage and pilot pipes.
- In case of a motor works in “continuos operating area with flushing” or if the system is unable to supply the oil viscosity conditions required by the motor, a motor case flushing system is carried out.
- Check that all couplings and plugs are properly tightened to prevent leaks.

Motor case oil filling

CAUTION

All motors are supplied without lubrificating oil. Before start-up, the motor case must be filled in by using the same hydraulic oil used to operate the motor.

- The two case drain holes are both plugged, one with a metal plug and the other one with a plastic plug. To fill in the motor case, it’s necessary:
- to place the motor in its working position, making sure to close the lower case drain hole by means of the metal plug;
- to use the upper case drain hole to fill in the motor case up to the level required, by using the same hydraulic oil used in the system, in order to ensure the perfect lubrification of two bearings.

Motor type	Frame Size	Motor case oil	
		liters	gallons
MR	B	1.5	0.40
	C	1.7	0.45
MR/MRD	D	2.0	0.53
MR/MRD/MRV	E	2.8	0.74
	F	3.3	0.87
	G	6.0	1.58
	H	9.5	2.50
	I	13.0	3.43
	L	19.0	5.02
	M	27	7.13
MRT	P	40	10.57
	R	64	16.91
	Q	90	23.78
	T	115	30.38
	U	150	39.63

Motor start-up

The motor does not require any special running in, but all residual impurities in the system must be eliminated by running the motor at low speed and with no applied load, ensuring the minimum necessary inlet pressure.

After a brief period in service, the system filters should be cleaned. This operation will also lead to the air venting from motor cylinders; air inside the motor cylinders may increase the possible noise at the start-up of the motor.

WARNING

Make sure the motor case has been filled (see paragraph “Motor case oil filling”)

ATEX “check list”

In addition to the standard controls listed in the previous sections, in case the motor is destined to be used in potentially explosive atmospheres, the maintenance operator must check that:

- Motor presents a conformity identification plate according to ATEX Directive 2014/34/EU;
- Motor is connected to the ground by means a special threaded hole (marked with a special symbol);
- Use of oils with a flash higher than 185°C;
- Motor is flushed in any operating condition;
- Use the control system for check motor case oil filling;
- No creeping metal elements external to the motor;
- Absent plastic parts capable of accumulating electrostatic or shielded charges;
- For installations in zone 21 and 22, a periodic surface cleaning plan must be activated to prevent any dust deposits from exceeding the thickness of 5 mm.

Maintenance

In this section the operations are indicated to allow the correct maintenance of the motor to guarantee required performances.

These information are directed to the technical personnel qualified to the maintenance of the machine and to the machine driver.

It's mandatory use of non-sparking safety tools in case of motor maintenance in presence of a potentially explosive atmosphere.

Periodic maintenance of hydraulic system

Minimum periodic maintenance for a hydraulic system, with regular intervals:

- Check any leaks in complete hydraulic system. In case of leaks:
- Tighten fixing screws with a torque wrench (in case of alternate/high stresses during first period of operation);
- Replace broken and/or worn seals.
- Inspect and keep clean each filters (air, oil and magnetic).
  - Replace obstructed filters;
  - Inspect the tank and check the presence of water or humidity.
- During the system operation, check that pressure and temperature values are similar to the calculated ones.
- Check the characteristics of hydraulic fluid used.
- Check that the hydraulic system is not clogged with external agents.
- It is advisable to keep a log to record data collected during maintenance operations.

WARNING

In a cleaned hydraulic system, any leaks and/or defects are more easily traceable.

Motor maintenance

To maintain the motor in perfect working order, minimum maintenance must be observed.

FILTERS CLEANING

The system filters must be changed after the first 200 hours of operation.

Cleaning and/or any subsequent replacements must be done every 3 months or 500 hours of operation (in the presence of an indicator, as soon as the clogging indicator lights up).

OIL CHANGE AND WORKING FLUID

The periodicity of the oil change depends on working conditions of the motor, environmental conditions and quantity of circulating oil.

It's advisable to analize oil in order to verify viscosity, oxidation, water presence and degree of contamination.

VISCOSITY

Verify that the viscosity degree complies always respects the indicated values.

OXIDATION

Mineral oils oxidize due to use and temperature. Oxidation is detected by the change in color, the bad smell and the increase in acidity of the oil.

WATER PRESENCE

The presence of water in the oil is identified by taking samples of oil from the bottom of the tank: the water, if present, is deposited on the bottom. In this situation the water must be purged at regular intervals.

WARNING

The presence of water in the hydraulic circuit can cause serious damage to the motor.

DEGREE OF CONTAMINATION

A high degree of contamination leads to wear of all hydraulic components.

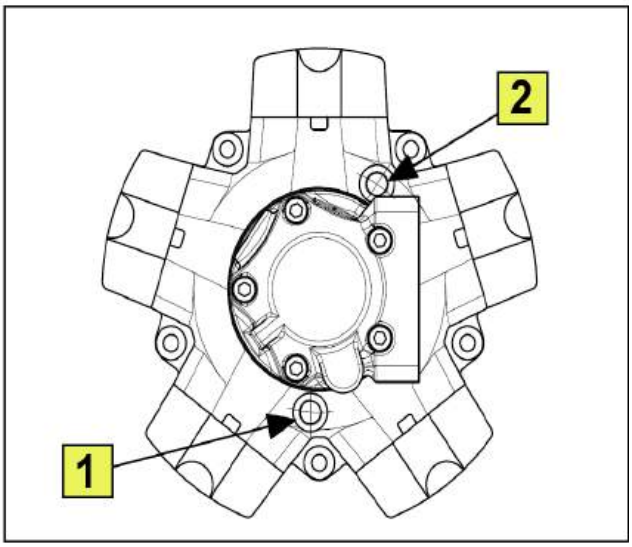
It is recommended to change the oil at 12 month intervals.

In order to avoid mixing different oils, at the time of replacement it is necessary to empty all the equipments and pipes to carry out thorough cleaning, especially of the tank.

EMPTYING

For the complete emptying of the motor, it's necessary:

- Unscrew the first cap (1) as shown in the figure below;
- Let the fluid flow out;
- Unscrew the second cap (2) to speed up the emptying;
- At the end of emptying, replace the two caps.



CAUTION

Once the motor has been emptied, deliver the fluid to the authorized collection points.

The landfill in the sewage system is absolutely prohibited.

Troubleshooting

This section provides technical support in case of motor faults during operation.

There are also the general rules governing the maintenance of the guarantee.

These information are directed to the technical personnel qualified to the maintenance of the motor.

GENERALITY

In the event that assistance and repair work is required on the motors, the service must be performed at an authorized service center or at headquarters service.

During repair all engine parts are checked to make sure that these comply with the drawings and technical specifications.

If a motor is sent to service, it is necessary to report:

- Motor coding;
- Serial number;
- Hours of operation;
- Malfunctions found;
- Type of application;
- Working parameters (cycle, pressure, temperature,…);
- Oil type and temperature;
- Oil filtration level.

MALFUNCTIONS: IDENTIFICATION OF POSSIBLE CAUSES

Provide the necessary information to identify the possible causes of a malfunction of the motor and the possible actions to be taken to solve the problem.

If the proposed remedies do not eliminate the malfunction, contact the Customer Service.

Any motor anomalies are often highlighted by evident variations in the drainage flow in terms of flow rate or impurities.

WARNING

If the motor case is flushed, it is necessary to exclude the flushing system before checking the drainage.

TROUBLESHOOTING		
MALFUNCTIONS	**POSSIBLE CAUSE**	**REMEDY**
Motor does not rotate	1. Mechanical transmission block. 2. The motor does not generate enough torque because the pressure delta is too low. 3. The electric motor is not supplying enough power. 4. Pilot pressure is too low (MRD&MRV only). 5. Pilot system failure (MRD&MRV only).	1. Check pressure in the system. In case the pressure exceeds the setting value of the relief valve, remove the load from the transmission. 2. Check the pressure level in the system and, if necessary, correct the setting value of the pressure limiting valve. 3. Check the hydraulic system. 4. Increase the piloting pressure up to the required value. 5. Contact Calzoni Hydraulics Service Center.
Motor rotates in the wrong direction	6. The hydraulic inlet and outlet connections A and B are reversed.	1. Correct the connections.

TROUBLESHOOTING		
MALFUNCTIONS	**POSSIBLE CAUSE**	**REMEDY**
Motor does not run smoothly	1. Pressure and/or flow fluctuations in the hydraulic system. 2. Displacement fluctuations (only MRV).	1. Look for the cause in the hydraulic circuit or in the mechanical transmission. 2. Check the hydraulic system used for feeding the pilot system for the change of displacement or inspect the motor pilot system itself (pls contact Calzoni Hydraulics Service Center).
Motor is noisy	1. Timing system still running in. 2. Too low boost pressure. 3. Residual air inside the motor driving system. 4. Resonance inside the pipes. 5. Bearings.	1. After the first few running hours, the noise (squeaking) generated by the contact surfaces of the timing system disappears. 2. Set the boost pressure value. 3. After the first few running hours, the air inside the motor driving system will be mixed with the fluid and vented out. 4. Optimize size and type of hydraulic pipe connections to the motor. For any information and support, pls contact Calzoni Hydraulics. 5. When running at idle, the bearings noise can be heard; this noise disappears as soon as load is applied to the motor shaft. Bearings at end of life: pls contact Calzoni Hydraulics.
External oil leaks	1. Seepage of oil between the coupling surfaces on the motor (i.e. between motor case and cylinder head becasue of oil residues and anti-rust fluid). 2. Porosity in castings. 3. Shaft seal leakage.	1. Clean thoroughly the motor and verify whether the leakage persists. 2. Please contact Calzoni Hydraulics. 3. Please contact Calzoni Hydraulics.
Drive of the displacement is reversed (only MRV motors)	1. Incorrect execution of the displacement pilot system (reversed pilot control).	1. Re-set properly the displacement pilot control.

If the proposed solutions do not solve the problem, or in case of doubts or malfunctions not listed in the table above, pls. contact Calzoni Hydraulics.

Many irregularities of the motors are often highlighted by a drastic drain leakage increase, in terms of flow rate and impurities present in the fluid.

DANGER

It is absolutely essential to disable the flushing system before checking the motor case leakage.

Scrapping

The purpose of this section is to provide instructions and suggestions for properly scrapping the motor.

The information in this section is intended for all qualified technical personnel responsible for motor maintenance.

Shut-down and dismantling

Safety warnings

- The machine must be dismantled and scrapped by qualified personnel familiar with safety regulations related to the type of intervention to be executed.
- During disassembly, the operator must wear personal protective equipment, appropriate to the type of residual or intrinsic hazard of the dismantling process. In addition, the operator must make sure that the motor parts to be removed have not an excessive weight and may be lifted individually by an operator (maximum 25 kg are allowed) and that there is no danger of weights falling.

Instructions

The motors belonging to MR, MRD, MRV and MRT Series are basically made up of the following materials:

- Ferrous material;
- Plastic/Rubber material (gaskets);
- Operating Fluid.

Ferrous Material

The motor must be dismantled appropriately in order to separate the different materials of which it consists. All materials must be scrapped at authorised demolition centres.

DANGER

Make sure that the motor parts to be removed have not an excessive weight and may be lifted individually by an operator (maximum 25 kg are allowed) and that there is no danger of weights falling.

Plastic/Rubber Material (gaskets)

The sealing rings (O-Rings) in the motor are the only components made of plastic/rubber material.

CAUTION

The collected fluid must be sent to an authorised disposal center.
IT IS STRICTLY FORBIDDEN TO DISPOSE USED OIL THROUGH THE SEWAGE SYSTEM.

Data collection form

DATA COLLECTION FORM	
Motor identification code	
Serial number	
Application	• Industrial • Mobile • Other (specify: .....)
Work environment	• Marine • Mining • Foundry • With ATEX certification request • Other (specify: .....)
Motor mounting position	• Shaft output, horizontal position • Shaft output, vertical position upward • Shaft output, vertical position downwards • Other (specify: .....)
Working fluid	• Oil ISO VG • Water based HFA type • Water based HFB type • Water based HFC type • Water based HFD type • Biodegradable type ..... • Other (specify: .....)
Maximum working pressure (bar)	
Maximum working speed (rpm)	
Maximum working power (kW)	
Maximum motor temperature (°C)	
Hours of use	
Flushing	• Yes (.....l/min) • No
Defect found / Broken	
Notes	

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