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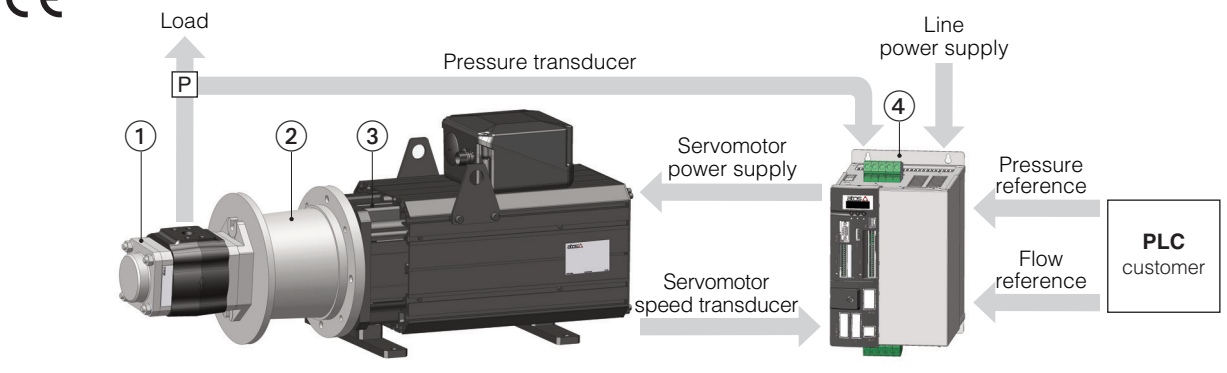
INDEX

PUMPS & SERVOPUMPS

Basics for Smart Servopumps - SSP

The SSP servopumps represent a considerable step forward in the generation and control of hydraulic power, combining the typical advantages of fluid dynamics with the ease of control and adjustment of an electric drive.



① Internal gear pumps
② Bell with high precision joint
③ Permanent magnet servomotor
④ Vector control drive

1 GENERAL DESCRIPTION

The SSP servopumps are electro-hydraulic units designed to efficiently and accurately generate and regulate the flow rate and pressure through the continuous modulation of the pump rotational speed.
They guarantee high power density, high dynamics and precision, significant reduction in energy consumption and noise level, reliability and construction robustness.
The SSP servopumps are composed by a fixed displacement internal gear pump, driven by a permanent magnet synchronous servomotor, controlled by an electronic drive. The latter controls the speed of the servomotor and therefore of the pump, to adjust the flow rate or pressure of the system in closed loop based on the reference signals Q and P received from the machine PLC.

An angular position transducer, integrated in the servomotor, provides information on the instantaneous rotational speed of the pump and therefore the flow rate generated, while a pressure transducer, installed on the pump delivery, provides information about the actual pressure of the line. Atos has developed specific Smart Functions that offer flexibility of use and simplified commissioning, with significant advantages for the user.

Benefits of Smart Pumps - SSP

- **Energy savings** up to 80%
- **Simplification of the hydraulic circuit and reduction of overall dimensions**
- **Noise reduction** up to 20 db less
- **Integrated P/Q control** developed for hydraulics by industrial electrohydraulic specialists
- **Smart Start-up** for quick and easy commissioning
- **Smart Tuning** to select the optimal pressure control among the 3 dynamics levels available
- **Multiple axis** for the optimization of the parameters for each axis of movement of the machine
- **S-SW-SETUP,** dedicated software with a simple and easy to use graphic interface
- **S-SW-SIZING,** for quick sizing of the SSP servopump

2 MAIN ADVANTAGES OF SERVOPUMPS

Servopumps offer general advantages over "traditional" systems equipped with fixed or variable displacement pump, operated by asynchronous motor:

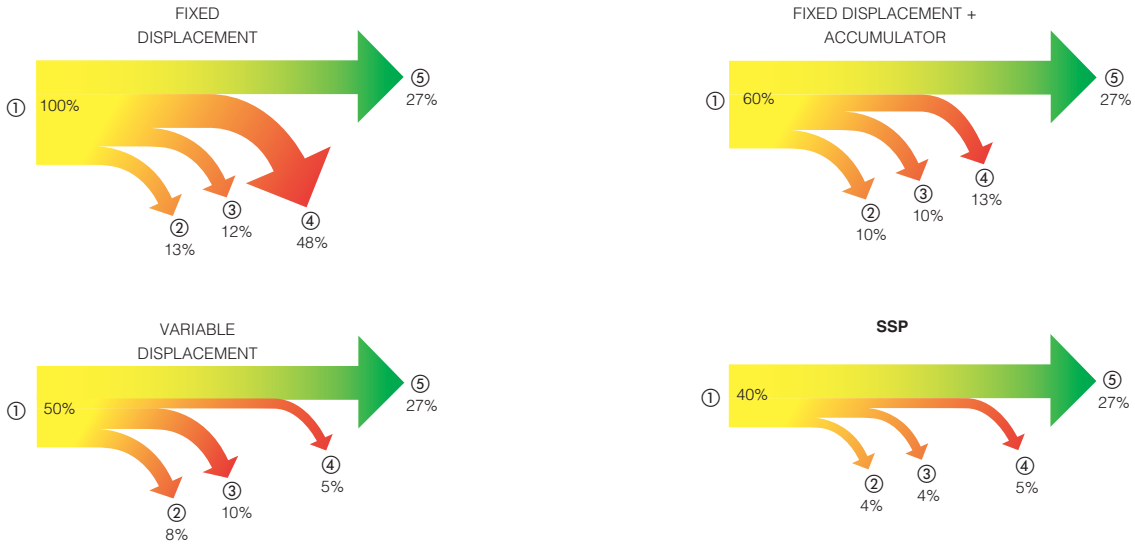
Efficiency

In traditional systems the pumps operate at constant speed regardless of the flow actually required at the different stages of the machine cycle, generating excessive power, which is then dissipated as heat.
In SSP servo pumps the flow rate is modulated through the change in the rotational speed, up to values close to zero when no flow is required, with a substantial advantage in terms of energy savings.

Compared to traditional systems, SSP is able to reduce energy consumption by up to 60/80%.

The lower figures represent a comparison between the consuption of a generic industria machine equipped with traditional systems and the same machine with an SSP servopump system.

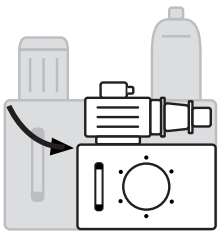
① Absorbed electrical power
② Energy losses due to electric motor performance (and drive)
③ Energy losses due to hydraulic pump efficiency
④ Energy losses by rolling through control valves
⑤ Useful hydraulic power



Smart ServoPump is in line with all climate protection initiatives and the European Green Deal, which invites machine manufacturers to use energy-efficient solutions.

Reduction of tank size and heat exchanger

The high efficiency of SSP results in less heating of the oil thanks to the reduction of the heat-dissipated power. This allows to contain the size of the tank and heat exchangers with the possibility, in some cases, even to avoid them.



Pump displacement reduction

The possibility of reaching maximum rotational speeds of up to 3000 rpm allows to reduce the displacement of the pump compared to traditional systems with asynchronous motor.

Simplification of the hydraulic circuit

Thanks to the high dynamic response and dedicated algorithms, SSP allows to directly control the speed of movement and the strength of hydraulic actuators with optimal levels of precision and repeatability allowing the use of simple ON/OFF directional valves.

Noise reduction

The internal gear pump that equips the SSP allows a general reduction of noise compared to other types of pumps. This, combined with the rotational speed modulation, especially in the static phases of the machine cycle, allows a reduction of up to 20 db compared to traditional systems and allows the user a lower investment to meet noise protection measures.

3 INTEGRATED P/Q CONTROL P/Q CONTROL

Atos has exploited its unique know-how in electro-hydraulic systems to develop a specific P/Q control algorithm entirely dedicated to SSP servopumps and capable of satisfying the needs of any industrial machine.
SSP's P/Q control is specifically designed for hydraulic axes and is able to automatically manage the hydraulic properties of the working fluid.

The algorithm automatically selects which pressure-to-flow control is activated at each phase of the cycle according to the load conditions, always ensuring optimal management, free from sudden passages from P to Q and vice versa, pressure peaks and vibrations.

In this way the customer will be lightened by the construction of his own control algorithm and will only have to send to the D-MP drive the pressure and flow rate reference signals required at each phase of the machine cycle.

Q CONTROL PHASE

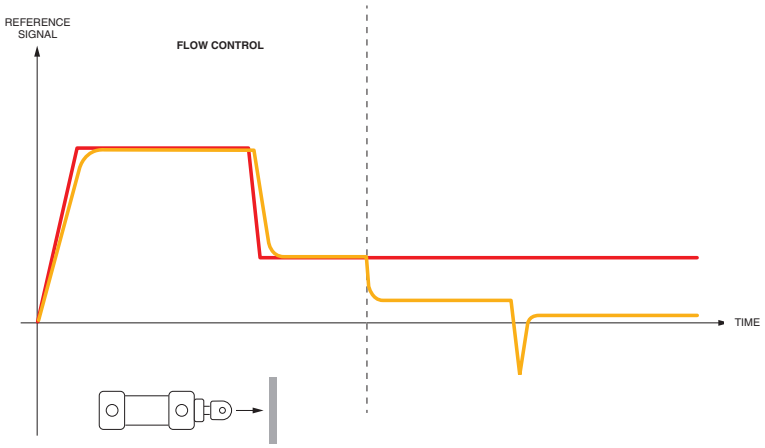
These phases are characterized by hydraulic axis translation with a normally low applied load, such as the translation of a mold before arriving in mechanical stop.

The SSP servopump will then follow the flow reference by adjusting the speed of the motor in such a way that the pump will deliver the required flow rate according to the below equation:

$$Q = \frac{CC_{pump} \cdot n_{engine}}{1000}$$

Where:

Q	[l/min]	= flow rate
cc_{pump}	[cm^3/rev]	= pump displacement
n_{engine}	[rpm]	= servo motor rpm

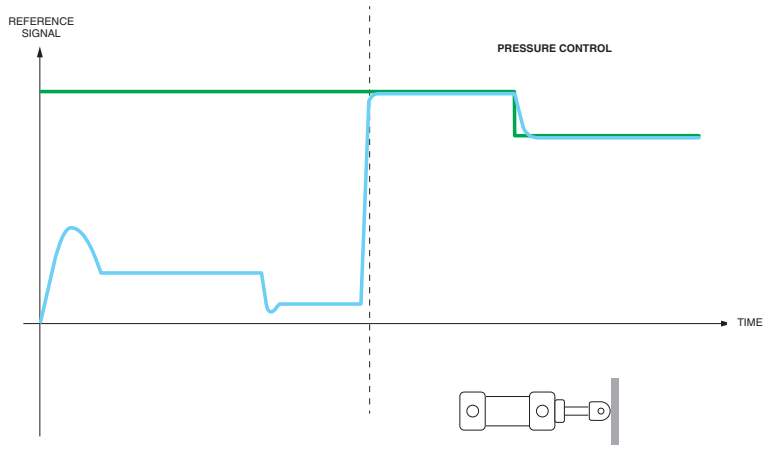


During the flow control phases the pressure reference signal is still present and has the function of limiting the maximum pressure of the system and therefore the force applied by the hydraulic actuator ensuring the safety of the machine.

P CONTROL PHASE

When, during translation, the axis encounters a strong load and the line pressure increases to a value close to the reference signal, pressure control is automatically activated. The D-MP drive controls the speed of the servo motor to limit and maintain the pressure exerted on the load to the value imposed by the reference signal.

These pressure stage can occur for example during the tonnage phase of a press or during the deformation of the metal material of a bending machine.



If, during the pressure control phases, a line depressurization is required, the PGI/PGIL pump is able to rotate in the opposite direction for a short period of time.
Simply reduce the pressure reference and D-MP drive will temporarily reverse the pump's rotation direction to discharge oil from the hydraulic circuit. During the pressure control phases, however, the flow rate reference signal is present and represents a limitation of the speed imposed on the load if the line pressure suddenly drops below the reference.

4 SSP SMART FUNCTIONS

Smart features allow to exploit the most of the potential of SSP, making the system simple to use and at the same time extremely flexible.

4.1 Smart Start-Up

The procedure supports the user during the commissioning phases of the SSP system, through a series of guided and intuitive procedures:

- **General settings**

It allows to choose the communication interface with the system (via Signals Analog or Fieldbus), configure analog signals (Voltage or Current) and set the protection features (see sect. 6).

- **Motor-check**

It performs an automatic control of the motor phases, verifying that they match the direction of rotation of the resolver and sending an alarm to the PLC if they are not. It also performs a self-calibration of resolver signals. The function is essential to allow the start-up of SSP, as it allows to verify the correctness of the electrical connections

- **Autotuning**

It automatically determines the optimal parameters of the pressure control, to adapt the dynamic response of the SSP and guarantee control precision and stability, regardless of the type of machine or the hydraulic circuit. Once the procedure is started, the servopump is subjected to an automatic cycle of a few seconds at the end of which the hydraulic parameters of the system will be estimated and the various control parameters set, based on the volume of oil controlled and the elasticity of the circuit. If the procedure is not carried out, the SSP servopump will use the factory parameters.

The S-SW-SETUP software can autonomously detect whether the Smart Start-Up procedure has been performed or not.

As any Atos products, through the S-SW-SETUP Software it is possible to save the system parameters on the PC and to load them again on the D-MP Drive if necessary.

4.2 Smart tuning

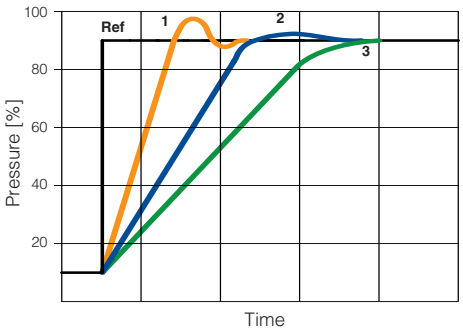
Once the Smart Start-Up procedure is complete, the Smart tuning feature allows to further refine the pressure control response by choosing from 3 different levels of performance:

- dynamic, high dynamic and minimized response time (factory setting)

- balanced, for fast response times with limited overshoot/undershoot

- smooth, attenuated response time, for soft adjustment that avoids undershoot/overshoot

The chosen setting can be changed at any time via the S-SW-SETUP Software, or via fielbus or digital inputs of the D-MP Drive.



1 = dynamic
2 = balanced
3 = smooth

In case of necessity, performance can be further customized by directly modifying the individual control parameter via S-SW-SETUP.

4.3 Multiple axis

SSP servo pumps allow to create 4 possible sets of parameters, related to:

- Flow/pressure limits
- Flow/pressure ramps
- Parameters for pressure control and P/Q logics

Since most of industrial machines perform different movements, each driven by specific cylinders/motors of different sizes and with different pressure and flow requirements, the use of a single set of parameters could lead to inaccuracies in P/Q control with the possibility of unwanted vibrations or undesired response times.

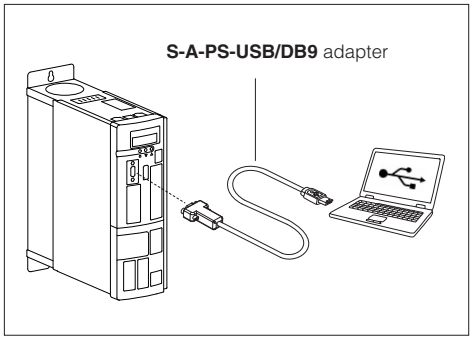
The multiple axis setting allows to optimize the different features for the different conditions of the machine cycle ensuring maximum performance at all stages of the cycle.

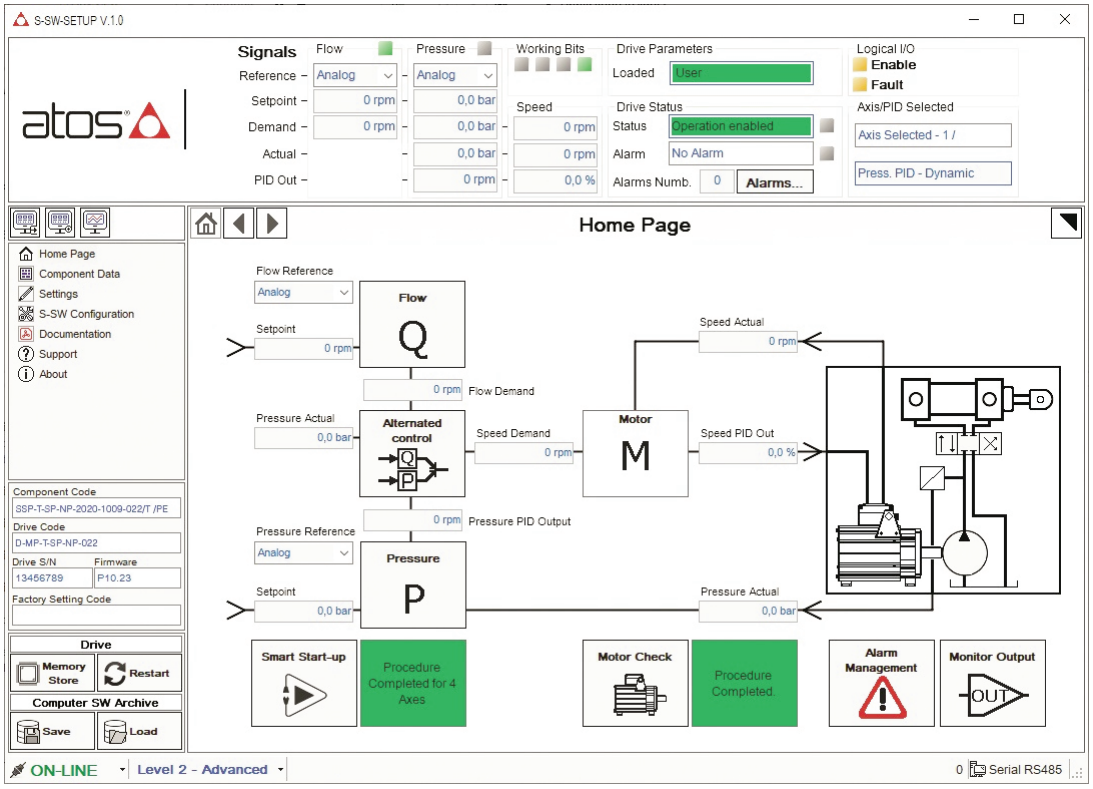
The active axis can be selected in real time via fieldbuses or digital inputs of the D-MP drive.

5 PROGRAMMING SOFTWARE

SSP systems can be configured using Atos S-SW-SETUP programming software.
This can be easily used by connecting PC to the D-MP drive via the RS485 port

S-SW-SETUP is specifically developed for servopump systems as opposed to competitive General Purpose Software, which must be customized by the user for the servopump application.
At the first start up, the software will invite the user to follow the Smart Start-Up guided procedure (see 4.1) for setting all the parameters needed for the correct start-up and operation of the system.
All the main functions can be reached and modified thanks to a simple and intuitive graphics.
Furthermore, the software allows to monitor in real-time the signals managed by the drive (References, Feedback, Temperatures, Currents, Voltages, etc.) and the status of each individual alarm.
S-SW-SETUP includes an internal oscilloscope to visualize the trend over time of the above signals.





All parameters available on the drive can be monitored with S-SW-SETUP or shared with the customer's PLC via fieldbus

6 SIZING SOFTWARE

It is a software developed by Atos to allow the customer to size the servopump that best suits the requirements of their machine cycle.

In the software S-SW-SIZING it is simply required to generate the machine cycle by entering the pressure, flow rate and cycle time data of each phase. It is possible to enter the data manually or load the acquired data recorder from the cycle of an existing machine.
The software shows the different parameters of the cycle and automatically selects the individual components for the SSP system, adapted to the machine cycle introduced.
The complete ordering code is automatically generated by the software.
It is also possible to navigate in detailed pages for each component to view the working conditions with respect to the maximum performance that the component can achieve.
The software also provides an estimate of energy saving compared to traditional systems such as variable displacement pump/fixed displacement pump.

S-SW-SIZING sizing tool software is available for free on the Atos website, you can download it from

7 PROTECTION FEATURES

SSP systems integrate logics specifically developed to prevent stressful working conditions of individual system components, thus avoiding sudden failures and consequent downtime.

7.1 Pump protection systems

The pump is the most stressed element of the SSP system and requires special attention to prevent sudden failures and ensure longer durability. To do so, special safety features have been implemented on the D-MP drive.

Smart cooling

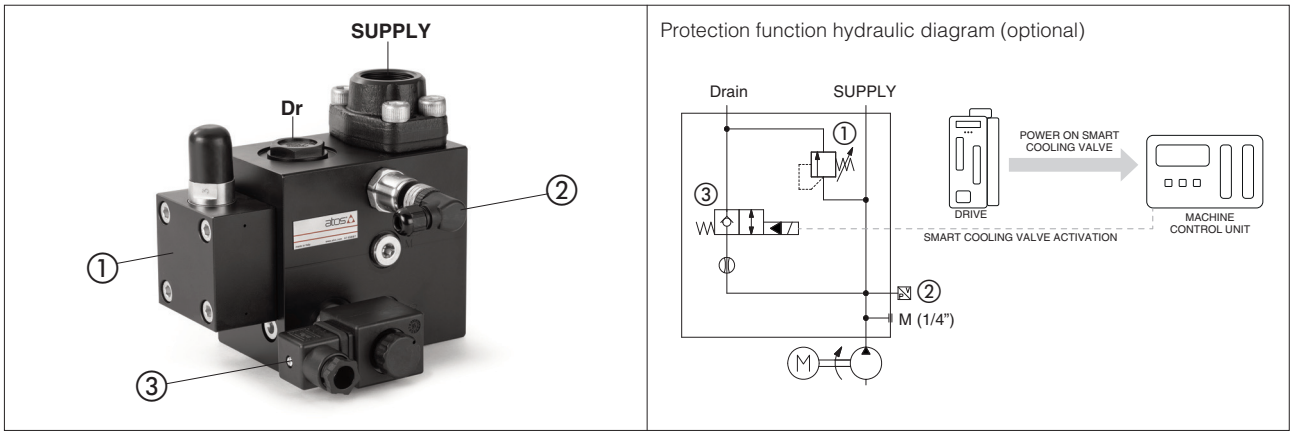
In prolonged pressure control phases, the pump tends to overheat due to internal leakages. An algorithm is implemented in the D-MP Drive to avoid this condition; the drive provides a digital output that indicates when to activate, via PLC of the machine, the dedicated valve that allows a small oil recirculation. This feature is provided in the built-in block available as an option - see tec. table AS300.

This block, flanged directly on the pump, offers a complete and ready-to-use solution. It includes:

① Relief valve, for system protection

② Pressure transducer, to be wired to drive, required for P/Q control

③ Smart Cooling valve, dedicated to pump cooling



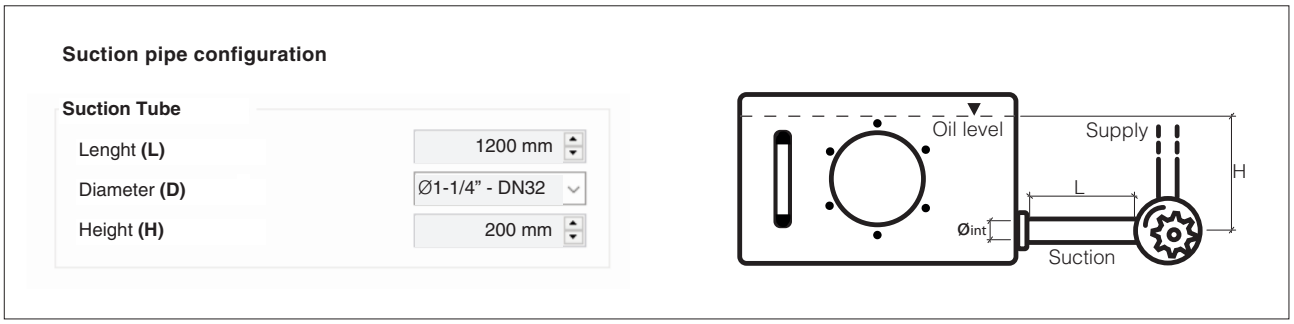
Depending on machine cycle, the Sizing Tool software (see sect. 9) will suggest whether or not the optional manifold is recommended.

Protection from cavitation

One of the main causes of excessive wear of pumps is cavitation.
This function allows to set the angular acceleration limits of the servomotor, in accordance to the geometry of the pump intake line, to prevent this phenomenon from occurring.

To do this, simply enter the following parameters during the Smart Start-up procedure that will automatically define the servomotor acceleration limits:

- Suction pipe length
- Diameter of the suction pipe
- Suction port height compared to the oil's free level



Limiting minimum pressure

The drive always guarantees a minimum pressure in the pump supply line (10 bar) that allows to always work in the best conditions.

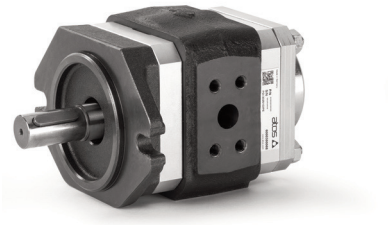
7.2 Servomotor and drive temperature control

Both the servomotor and D-MP drive temperatures are monitored with dedicated temperature probes in order to protect these components from overheating as a result of incorrect installations or excessively heavy working conditions.
In the event of overheating of the D-MP drive or servomotor, the drive sends an alarm to the central unit and blocks the SSP system to avoid sudden failures.
The servomotor is stopped by means of a deceleration ramp, so to obtain a soft slowdown of the load avoiding system ram blows and pump cavitation.
These features are an additional protection for SSP system although the correct sizing and use prescribed in the user manual allow to exclude problems of overheating of servo motor or drive.

8 COMPONENT DESCRIPTION

The SSP servopumps are composed by following components:

Fixed displacement Internal gears pump - PGI / PGIL



This type of pump is the ideal solution for servopump application as it guarantees reduced pressure pulses and a wide range of rotational speeds with the possibility of going down to a few revolutions per minute, essential characteristics to achieving accurate P/Q control.

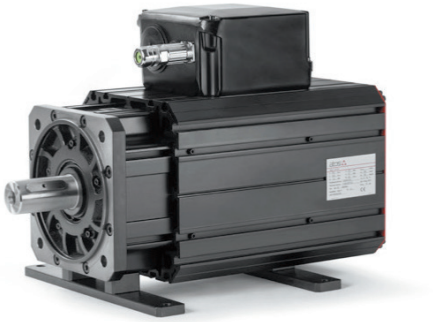
The high efficiency allows to maximize the energy savings of the system, in addition the construction peculiarity allows a reduction in noise emissions up to 20 dB compared to traditional systems.

Two versions are available depending on the required operating pressures:

- **PGI**, cast iron body version, ideal for applications with maximum continuous pressures up to 330 bar – see tec. table **AS300**
- **PGIL**, aluminum body version, for applications with maximum continuous pressures up to 250 bar – see tec. table **AS350**

Both versions cover a wide range of displacements, from 10 cm3/rpm to 125 cm3/rpm, ensuring maximum flow rates up to 350 l/min.

Permanent magnet synchronous servomotor - PMM, tec. table **AS400**



It relies on the most performing technology available on the market for electric motors.

Synchronous servo motors exploits a surface permanent magnet rotor that allows high performance.

They differ from traditional asynchronous motors by:

- high electrical efficiency (up to 94% under nominal conditions)
- smaller footprints
- high control dynamics, due to low rotor inertia combined with a high overload

The servomotor is equipped with an integrated speed transducer (resolver), to control the rotational speed in closed loop.
A temperature transducer allows to monitor any overheating of the servomotor.
PMM servomotors are equipped with a cooling fan, which is activated automatically only under the most demanding conditions of use.
They are available in 8 sizes with rated power from 9 kW to 100 kW and with an overload capacity of 200%.

Servomotor - Pump Coupling

The coupling between servomotor and pump ensures maximum levels of precision in motion transmission, effective vibration damping and mechanical misalignment compensation.
The joint consists of a torsionally rigid lamellar package, which can compensate for axial, angular and radial misalignments.
The peculiar geometry and the materials chosen allow to withstand the torque generated by the servomotor.

Vector control Drive - D-MP, tec. table **AS500**

It represents the "brain" that manages and controls the entire SSP system, taking advantage of the most modern technology used in servo drives.
The Drive electrically powers and adjusts the servomotor speed to obtain flow and pressure values according to the reference signals received from the machine PLC.
It is interfaced with the servomotor angular transducer and the pressure transducer installed on the pump delivery for flow rate and pressure closed loop control.
A dedicated algorithm for P/Q control is implemented on the unit in order to optimally adjust the pressure and flow rate of the hydraulic system.
In accordance with industry 4.0, D-MP drive collects all the hydraulic and electrical parameters of the system in real time, allowing the user a simple monitoring of the status and performance of the machine.
In addition, any error is detected by the drive and returned to the central unit, protecting the system from incorrect conditions of use.

D-MP drives are available in 9 sizes with rated current from 22A to 210A and with 200% overload capacity.

9 FIELDBUS

The Fieldbus interface allows direct communication between the SSP and the machine control unit.
The bus allows the exchange of the following information:

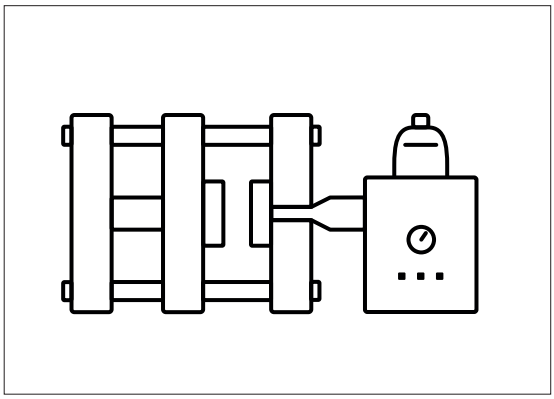
- speed and pressure reference signals and logic inputs (example: enable signal)
- speed and pressure feedbacks
- diagnostic information
- all the configuration parameters of the SSP system

10 APPLICATION EXAMPLES

The following paragraphs examine real machine cases highlighting the advantages that SSP servopumps offer over traditional systems.

10.1 Example of die casting machines: 65% more energy efficiency

The die casting machines were designed to guarantee extreme speed in the production process and extreme precision in the workpiece. For this reason, reliable and performing components are constantly being sought to increase productivity and reduce cycle times.



In this scenario, SSP systems are the optimal choice.

Hydraulic robustness, high power density and load sealing capacity are the strengths that make servopumps the ideal choice for the harsh environmental conditions of die casting machines.

The high acceleration/deceleration of the servo motor's permanent magnet technology, guarantees an absolute dynamic that allows the reduction of machine cycle times that resulting in a subsequent increase in productivity.

In addition, the use of SSP instead of traditional technologies with constant speed systems allows the simplification of the hydraulic circuit.

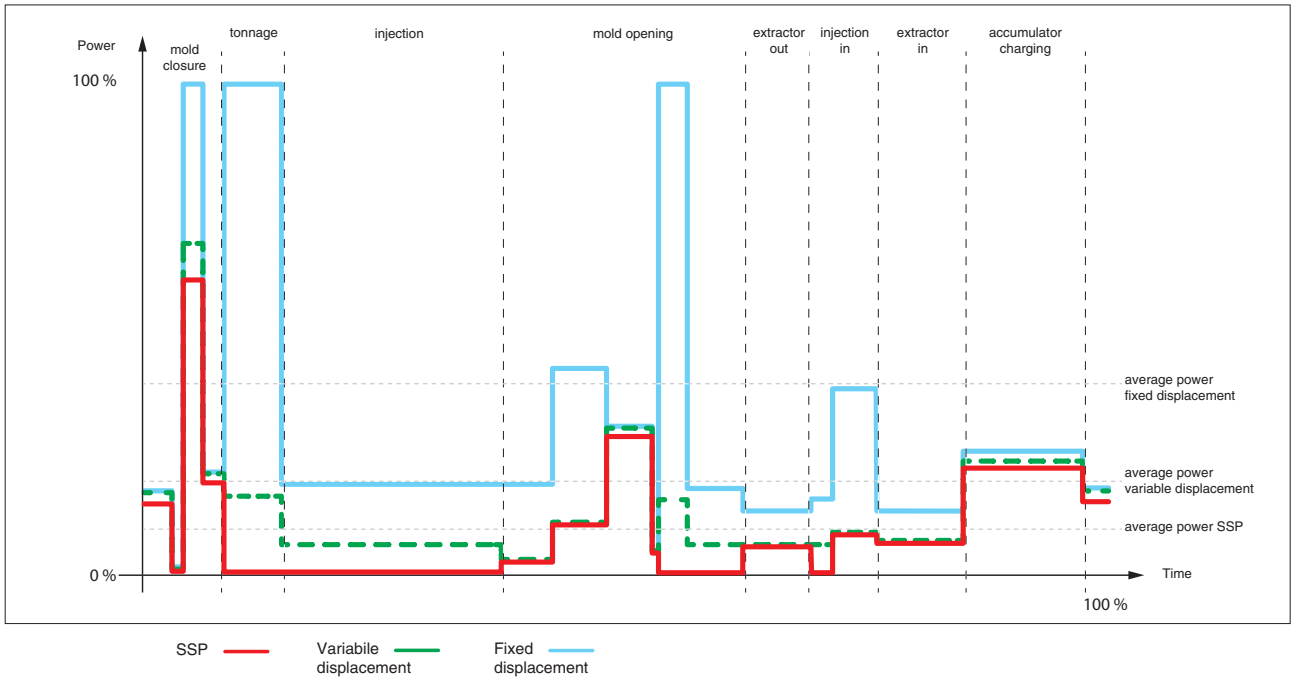
With traditional systems, in fact, it was necessary to have two pumps, one for rapid movements, characterized by very high flow rates, and a second for the slowest movements with high operating pressures.

Now, an SSP system is enough to handle both high-flow and low-flow phases. In addition, thanks to its high dynamics and control precision, it can also allow the replacement of some proportional valves with simple ON/OFF valves.

In die casting machines, the injection phase, which represents one of the most delicate movements, was previously made with accumulator and managed completely by proportional cartridges.

Now it is possible to manage the entire first part of the injection, which requires a very precise cylinder speed control and with very accentuated speed ramps, with the servopump, eliminating the huge energy losses generated by the use of high pressure oil of the accumulator throttled by proportional valves.

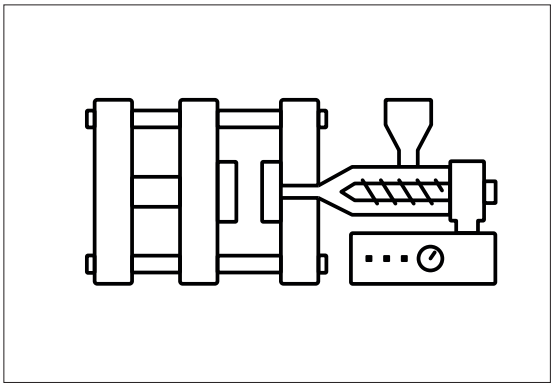
During the second part of the injection, which instead needs very high dynamics and for this reason must be carried out with accumulators, it is possible to stop the pump by bringing the speed reference to values close to 0% and reducing energy consumption and noise.



In the cycle shown in the graph, the SSP pump ensures energy savings of up to 65% compared to traditional systems.
The phases that benefit the most from an energy point of view are those characterized by low flow rate and high pressure, such as the tonnage phase and some phases of opening and closing molds, in which the servopump delivers exactly the required flow rate.

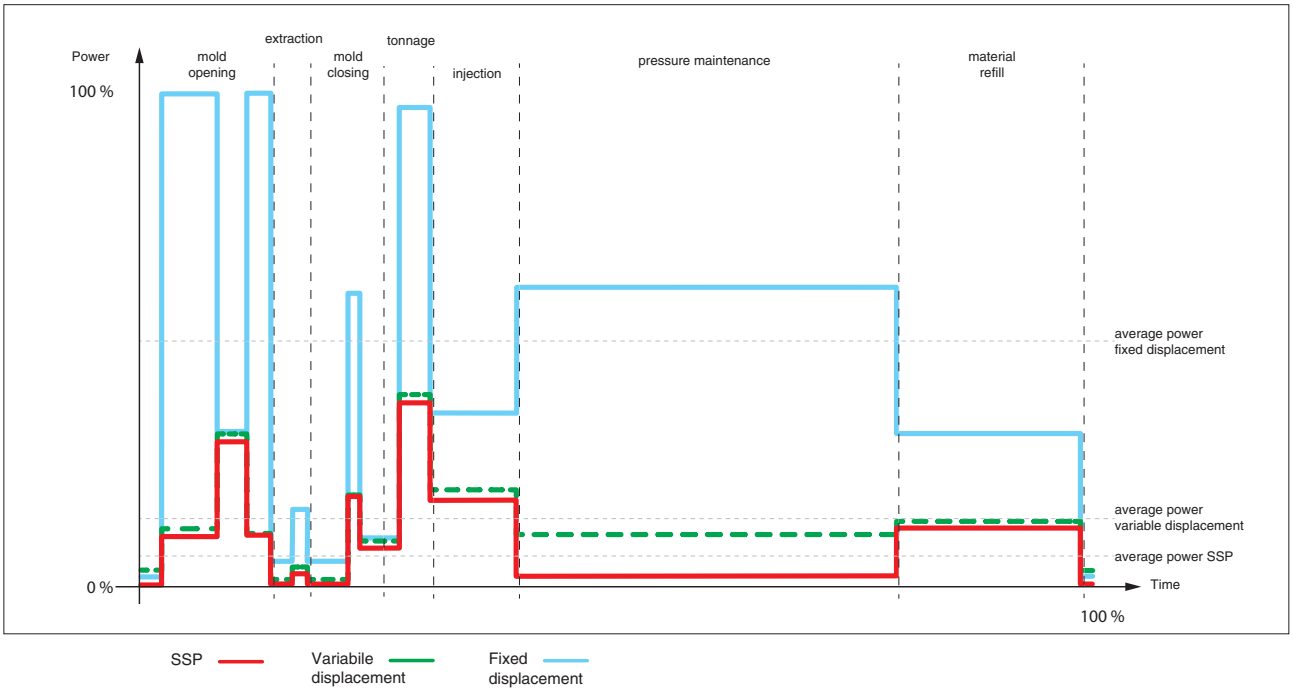
10.2 Example of plastic/rubber injection machines: 65% to 80% energy saving

Plastic/rubber injection presses require high dynamics, precision and maximum repeatability at every stage of the machine cycle together with the reliability of the entire system.



SSP servo pumps ensure high dynamics with engine speed step response times of 0-100% 50 ms for optimal control during all phases of the machine cycle.
The wide speed range allows to manage both the fast mold movement phase and the clamp saving phase, during which it is necessary to maintain a very low speed.

The various phases of the machine cycle usually rely on actuators with different areas and strokes with the consequence of having very different oil volumes to be controlled. With the multi-axis function it will be possible to use different set of parameters and always optimized for every movement, obtaining the optimal control for both larger cylinders that require high dynamics, as the injection cylinders, and with smaller actuators that need softer movements, as the extraction cylinders of the piece from the mold.



In the graph it is possible to detect in detail the great advantages of SSP in term of energy saving compared to other traditional systems.
It is especially during the holding pressure phase, that you have the greatest benefits in terms of energy saving are achieved.
During this phase the pump rotation speed is almost 0 as it has just to compensate for the oil leakage losses of the system (of the pump itself or of other hydraulic components), keeping the line pressure constant.
Depending on the duration of this phase, SSP can achieve energy savings of 65% to 80% per machine cycle.

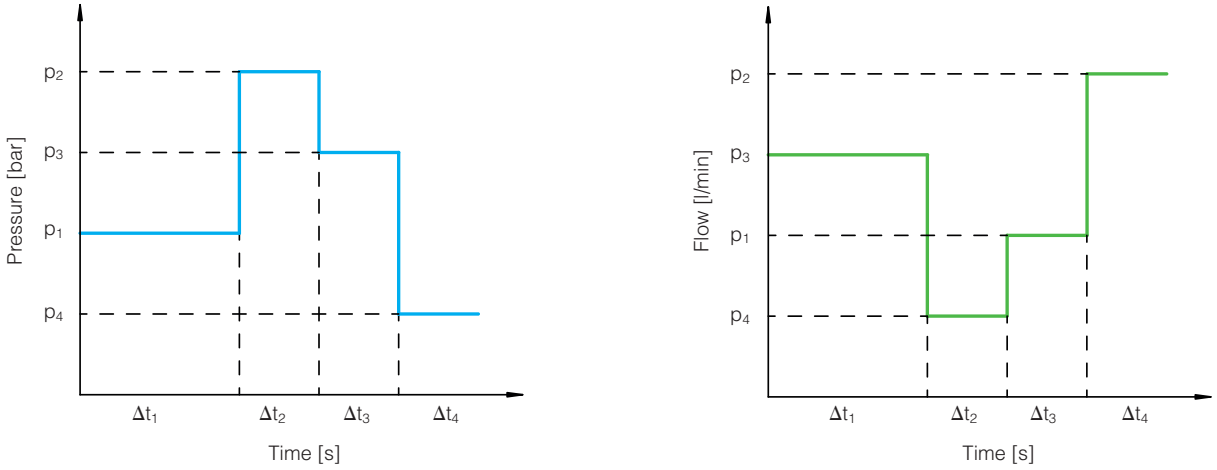
11 RELATED DOCUMENTATION

AS100	SSP Smart Servopumps	**AS800**	Programming tools for pumps & servopumps
AS200	Sizing criteria for servopumps	**AS810**	Accessories for servopumps
AS300	PGI cast iron internal gear pumps, high pressure	**AS910**	Operating and maintenance information for servopumps
AS350	PGIL aluminium internal gear pumps	**S-MAN-HW**	Servopumps installation manual
AS400	PMM high performance synchronous servomotors	**S-MAN-SW**	Servopumps programming software manual
AS500	D-MP electronic drives	**S-MAN-STO**	Servopumps Safe Torque Off manual
AS510	Fieldbus		

Sizing criteria for Servopumps - SSP

For the sizing must refer to the following Tab.1 and Tab.2 tables, respectively, for servopumps SSP equipped with PGI pumps with cast iron body and pressure up to 330 bar, or PGIL with aluminum body for pressure (up to 250 bar) - see sizing example in section 1.1

Example machine cycle



STEP 1 - Pump sizing

The pump must be selected to satisfy the following equation:

$$\begin{cases} Qmax,pump > Qmax,cycle \\ Ppeak,pump > Pmax,cycle \end{cases}$$

where:

Qmax,pump = *maximum flow rate of the pump*
Qmax,cycle = *maximum flow machine cycle*
Ppeak,pump = *maximum pump pressure*
Pmax,cycle = *maximum machine cycle pressure*

STEP 2 - Sizing of the electric servomotor and drive

The electric servomotor and the drive are selected according to the maximum average pressure *Pmed,SSP* that the servopump SSP can guarantee, according to the equation:

$$\begin{cases} Pmed,SSP > Prms,cycle \\ Pmed,SSP > \dfrac{Pmax,cycle}{2} \end{cases}$$

where:

Pmed,SSP = SSP maximum continuous mean pressure (see Tab.1 and Tab.2)

$$Prms,cycle = \frac{p_1^2\ \Delta t_1 + p_2^2\ \Delta t_2 + \ldots + p_n^2\ \Delta t_n}{\Delta t_1 + \Delta t_2 + \ldots + \Delta t_n}$$

p_1 , p_2 ... p_n = pressures [bar] in each phase of the cycle

Δt_1 , Δt_2 ... Δt_n = duration [s] of each phase of the cycle

The procedure described must be considered only for a preliminary sizing of the servopump.
For optimal sizing, use the S-SW-SIZING software. Download it from

1.1 Sizing example

Machine cycle data:

$Q_{max,cycle}$ = 140 l/min; $P_{max,cycle}$ = 290 bar; $P_{rms,cycle}$ = 200 bar;

STEP 1 - pump sizing

In the "Cycle data" column of the tables Tab.1 and Tab.2 identify the first row of Qmax, pump and Ppeak, pump values that are immediately higher than both machine cycle data:

$Q_{max,pump}$ > 140 l/min; $P_{peak,pump}$ > 290 bar;

In this case, the identified values that satisfy the machine cycle data are present only in Tab.1:

$Q_{max,pump}$ = *150* l/min and $P_{peak,pump}$ = 300 bar, corresponding to the **PGI-2050** pump

STEP 2 - PMM servomotor sizing and combination with D-MP drive

In the row corresponding to the identified pump (PGI-2050), move to the right in the table until you find the value of Pmed, SSP that meets the condition:

$P_{med,SSP}$ > 200;

$P_{med,SSP} > \frac{290}{2}$

In this case, the Pmed, SSP identified value is = 227

Moving along the column corresponding to the value of Pmed, SSP identified, it is possible to select:

the electric servomotor: **PMM-2042**;

the drive: **D-MP-090**

The complete code of the SSP servopump is therefore: **SSP**-T-SP-**-**2050-2042-090-***-***

Tab.1 - Sizing of the SSP servopump equipped with PGI pump (cast iron body)

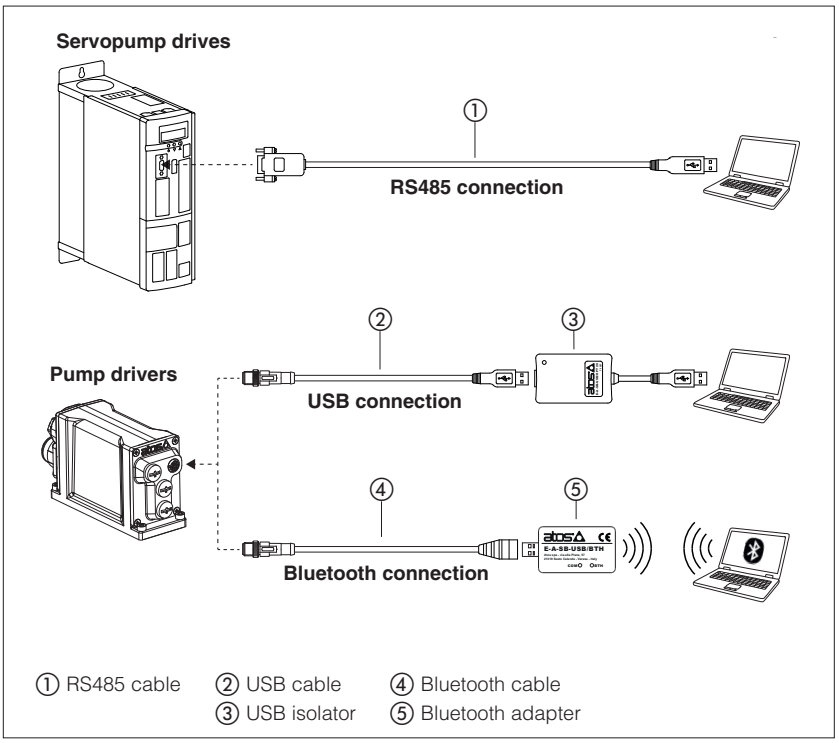
CODE	CYCLE DATA		PGI PUMP	PMM MOTOR								
	$Q_{max,pump}$ (l/min)	$P_{peak,pump}$ (bar)	Code	1009	1015	1024	1032	2042	2055		2080	2100
				$P_{med,SSP}$ (bar)								
SSP-*	32	350	**1011**	223	330							
	60	350	**2020**	122	203	297	330					
	96	350	**2032**	76	126	185	252	330				
	120	300	**2040**		101	148	202	280				
	120	340	**4050**		81	119	162	227	270	297	330	
	150	300	**2050**		81	119	162	227	270	280		
	155	330	**4064**			93	127	177	211	232	330	
	175	330	**4080**			74	101	142	169	186	270	300
	195	290	**3064**			93	127	177	211	232	280	
	220	330	**4100**				81	113	135	149	216	270
	240	290	**3080**			74	101	142	169	186	270	280
	300	290	**3100**				81	113	135	149	216	270
				022	**032**	**046**	**060**	**090**	**100**	**140**	**165**	**210**
				DRIVE **D-MP**								

Tab. 2 - Sizing of the SSP servopump equipped with PGIL pump (aluminum body)

CODE	CYCLE DATA		PGIL PUMP	PMM MOTOR								
	$Q_{max,pump}$ (l/min)	$P_{peak,pump}$ (bar)	Code	1009	1015	1024	1032	2042	2055		2080	2100
				$P_{med,SSP}$ (bar)								
SSP-*	60	320	**2020L**	122	203	250						
	96	320	**2032L**	76	126	185	250					
	120	300	**2040L**		101	148	202	250				
	150	280	**2050L**		81	118	161	225	250			
	195	270	**3064L**			91	124	174	207	227	250	
	240	270	**3080L**			74	101	141	168	185	250	
	300	270	**3100L**				74	113	134	148	215	250
	350	280	**4125L**					91	108	119	173	216
				022	**032**	**046**	**060**	**090**	**100**	**140**	**165**	**210**
				DRIVE **D-MP**								

Programming tools for pumps & servopumps

Atos PC software, adapters, cables and terminators



The S-SW and E-SW programming software can be easily installed on a desktop or a notebook computer.

The intuitive graphic interface allows:

- set up servopump drive and pump driver functional parameters
- verify the actual working conditions
- identify and quickly solve fault conditions
- adapt the factory preset parameters to the application requirements
- store the customized setting into servopump drive and pump driver
- archive the customized setting into the PC

The graphic interface is organized in pages related to different specific groups of functions and parameters.

The software automatically recognizes the connected servopump or pump model and adapts the displayed parameter groups, according to the selected access level.

Features:

- automatic servopump or pump recognition
- multilevel graphic interface
- numeric parameters settings (e.g. scale, bias, ramp, linearization, dither, etc.)
- real-time parameters modification
- diagnostic and monitor signals
- preset data storing into permanent memory
- internal oscilloscope function
- internal database of customized preset

1 PROGRAMMING SOFTWARE

Servopump drive and pump driver functional parameters can be easily set up respectively with S-SW and E-SW programming software using proper connection to the digital electronics.

S - SW	-	SETUP

S-SW= for servopump drives

Supported servopumps communication:

SETUP	= NP (Serial)	BC (CANopen)	BP (PROFIBUS DP)
		EH (EtherCAT)	EP (PROFINET)

Note: S-SW-SETUP software free downloaded, see section 1.1

E - SW	-	BASIC/PQ	-	*

E-SW= for pump drivers

Supported pumps communication:

BASIC/PQ	= NP (USB)	PS (Serial)	IR (Infrared)
FIELDBUS/PQ	= BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
	EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)

Supplies:

- = first supply

N = next supply

Note: E-SW-FIELDBUS/PQ supports also pumps without fieldbus communication

Atos Download Area

Direct access to latest releases of programming software, manuals, USB drivers and fieldbus configuration files in MyAtos area at An automatic mailing message will inform all the registered users whenever a new software update is available.

S-SW / E-SW minimum PC requirements

Personal Computer	Pentium® processor 1GHz or equivalent	**Memory**	512 MB RAM + Hard Disk with 250MB free space
Operating System	Windows XP SP3	**Device**	DVD reader (only for E-SW)
Monitor Resolution	1024 x 768	**Interface**	Serial RS232 port (only for PS) or USB port

1.1 S-SW Programming software - only for servopumps

Only one software version is available to connect the servopump drives.

Note: the S-SW software is free downloaded from Atos web site and it is not supplied in DVD format

Web download, free programming software:

S-SW-SETUP The software can be downloaded from MyAtos area upon web registration at :
- technical assistance for the software included for 1 year, starting from web registration; the access to the service may happen by telephone, e-mail, or at the Atos Headquarters

1.2 E-SW Programming software versions - only for pumps

Different software versions are available according to the pump drivers type to be connected and communication interface.

Note: the E-SW software is supplied in DVD format

DVD first supply of programming software, to be ordered separately:

E-SW-BASIC/PQ
E-SW-FIELDBUS/PQ The software can be activated from MyAtos area upon web registration at using the serial number printed on the DVD:
- technical assistance for the software included for 1 year, starting from web registration; the access to the service may happen by telephone, e-mail, or at the Atos Headquarters

Upon web registration user receives via email the Activation Code (purchased software license)

The software remains active for 10 days from the installation date and then it stops until the user inputs the Activation Code.

DVD next supply of programming software, to be ordered separately:

E-SW-BASIC/PQ-N
E-SW-FIELDBUS/PQ-N Available only for supplies after the first, these software cannot be activated from MyAtos area:
- technical assistance for the software not included

The software can be activated only with the Activation Code received upon **DVD first supply** registration and it is recommended only for supplies that require additional DVD physical copies of the software.

Note: E-SW-FIELDBUS/PQ programming software can program digital electronics through USB communication port for all industrial executions of pump drivers

DVD contents

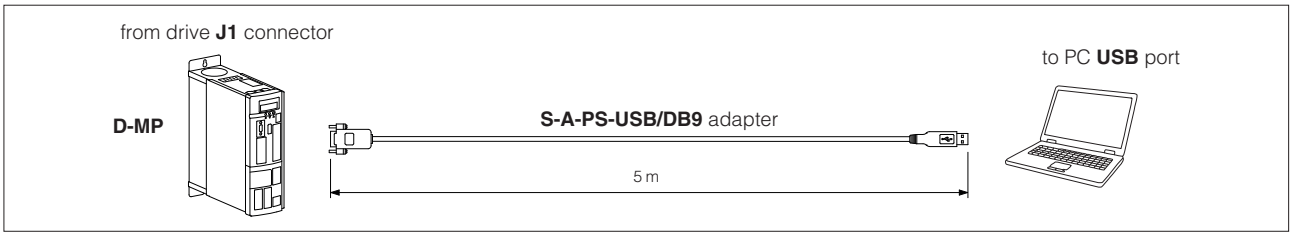
Include software installer, user manuals and fieldbus configuration files:
EDS for BC - GSD for BP - XML for EH - XDD for EW - EDS for EI - GSDML for EP

2 S-SW PROGRAMMING TOOL - only for servopumps

S-SW software permit servopump's parameterization through serial RS485 port.

Serial RS485 connection

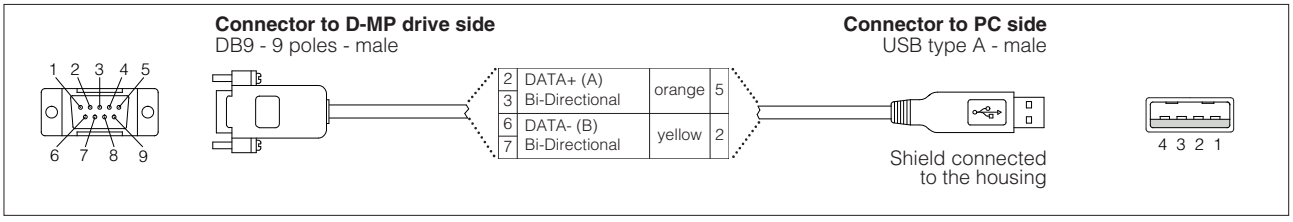
Adapter shown in the image below has to be ordered individually.



S-A-PS-USB/DB9 - technical specifications

- DB9 male 9 poles connector according to serial RS485 specification
- USB male connector, type A
- Tx and Rx visual traffic indication via LEDs - transparent USB connector
- Data transfer rates from 300 baud to 3 Mbaud
- USB 2.0 Full Speed compatible
- -40°C to +85°C operating temperature range
- external power supply not required
- RoHS, FCC and CE compliant

S-A-PS-USB/DB9 - 5 m cable

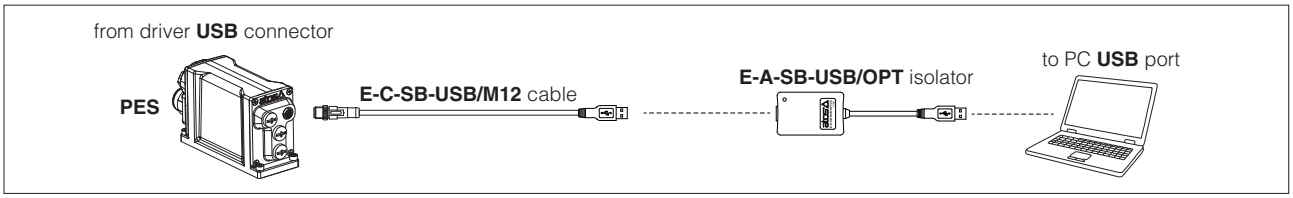


3 E-SW PROGRAMMING TOOL - only for pumps

E-SW software permit pump's parameterization through USB port.

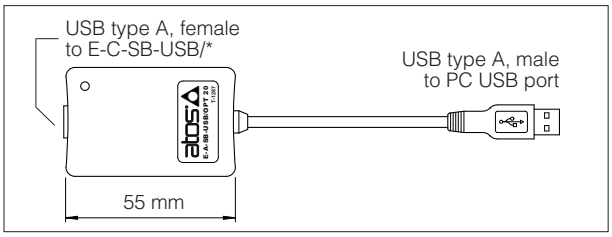
3.1 USB connection

Isolator and cables shown in the image below can be ordered individually or in a single solution purchasing a dedicated kit: **E-KIT-USB**



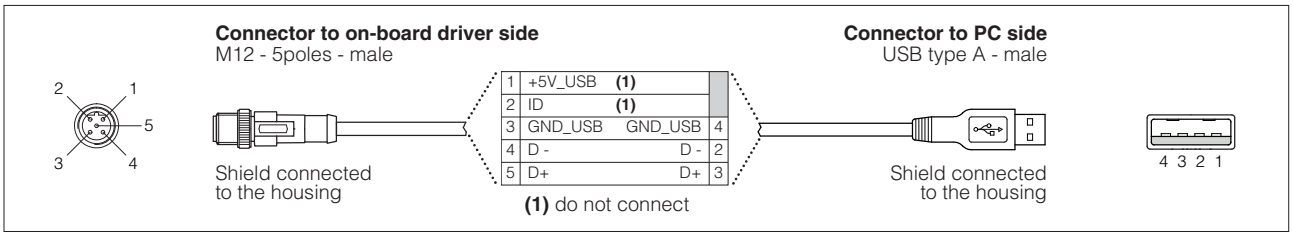
WARNING: the USB port of drivers is not isolated and use of USB isolator adapter is highly recommended!
Wrong earthing connections may cause high potential difference between GNDs, generating high currents that could damage drivers or the connected PC.

E-A-SB-USB/OPT - 0,10 m cable - isolator adapter



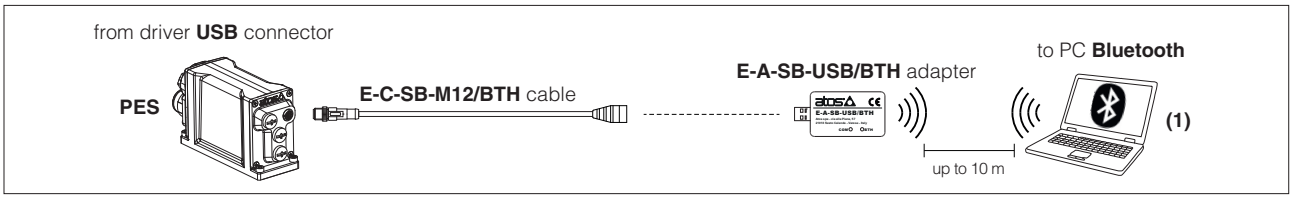
- USB 2.0 Full speed (12 MBps)
- electrical isolation 3 kV
- temperature range, -40°C ÷ +80°C
- external power supply not required
- PC driver not required
- status LED

E-C-SB-USB/M12 - 4 m cable



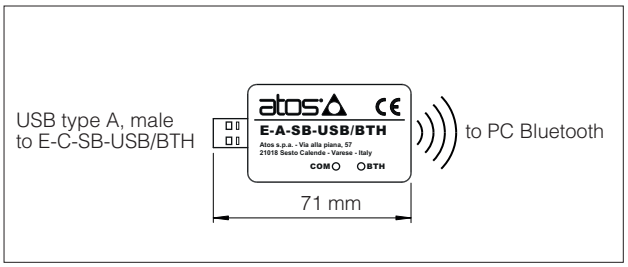
3.2 BLUETOOTH connection

Adapter and cables shown in the image below can be ordered individually or in a single solution purchasing a dedicated kit: **E-KIT-BTH**



(1) If PC has not built-in Bluetooth, use standard USB to Bluetooth dongle compatible with E-A-SB-USB/BTH specification (please refer to STARTUP-BLUETOOTH guide)

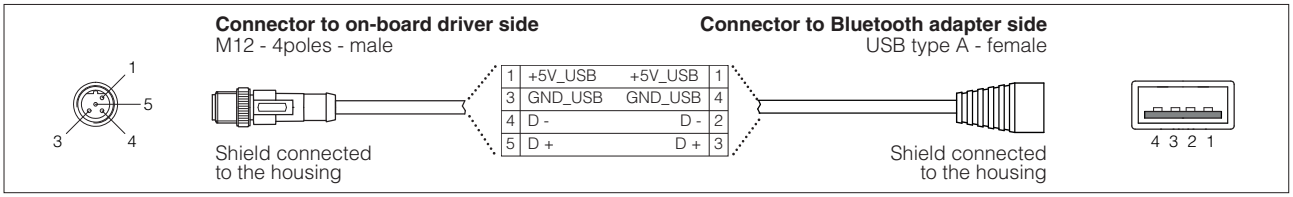
E-A-SB-USB/BTH - Bluetooth adapter



- USB male connector, type A
- type of radio interface: Bluetooth Class 2
- temperature range, -20 ÷ +70 °C (storage -40 ÷ +70 °C)
- external power supply not required (from Atos drivers/axis cards only)
- protocol: Bluetooth Classic Version 2.x , 3.x supporting Serial Port Profile
- max RF transmission power: Class 2 Output Power (+1.5 dBm typical)
- frequency: 2.402 GHz to 2.480 GHz
- LEDs indicate the actual working condition
- IP20 protection degree

WARNING: Bluetooth adapter is available only for Europe, USA, Canada, China, Japan, India, Korea markets!
Bluetooth adapter is certified according to RED (Europe), FCC (USA), ISED (Canada), SRRC (China), MIC (Japan), BIS (India), KC (Korea) directives

E-C-SB-M12/BTH - 0,4 m cable



4 FIELDBUS TERMINATORS - only for **BC** and **BP** pumps

The fieldbus terminators are required when output fieldbus connector has to be used as network end point.

E - TRM	-	BC	-	M12	/	5PM

Terminator

Fieldbus interfaces:
BC = CANopen
BP = PROFIBUS DP

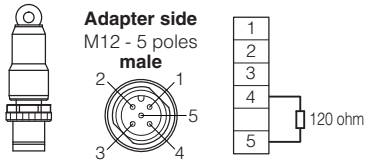
Connector:
M12 = from M12 output fieldbus connector

Connector:
5PM = to BC executions
4PF = to BP executions

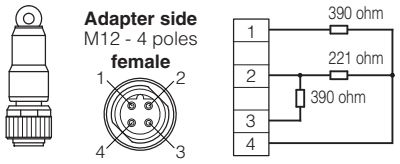
Note: fieldbus terminators are available for on-board PES series 40 or higher

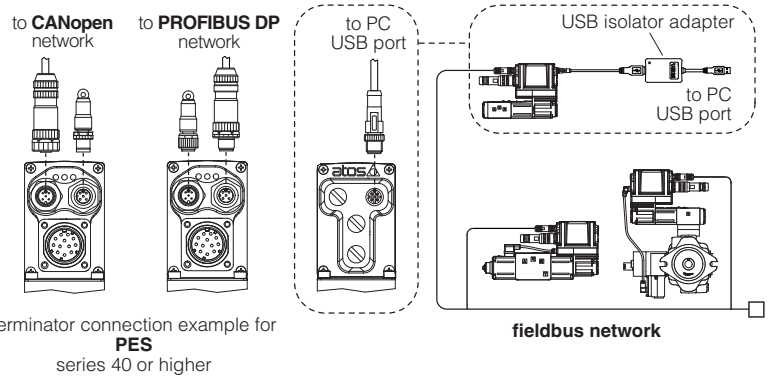
Terminators

E-TRM-BC-M12/5PM network CANopen terminator



E-TRM-BP-M12/4PF network PROFIBUS DP terminator





terminator connection example for **PES** series 40 or higher

5 FIRMWARE UPDATE - only for pumps

It is possible to update the firmware of the pump drivers, using proper USB communication port.
The firmware update is allowed starting from on-board PES series 40 or higher.

6 OBSOLETE TOOLS SELECTION - only for pumps

	Model Code	Series	Software	Cable	USB Adapter	Terminator
PS	PES	31	E-SW-BASIC/PQ	E-C-PS-DB9/M12	E-A-PS-USB/DB9	
BP	PES	31	E-SW-FIELDBUS/PQ	E-C-BP-DB9/M12	E-A-BP-USB/DB9	E-TRM-BP-DB9/DB9
BC	PES	31	E-SW-FIELDBUS/PQ	E-C-BC-DB9/M12	E-A-BC-USB/DB9	E-TRM-BC-DB9/DB9

Smart Servopump - SSP

high performance P/Q control and energy saving

SMART TUNING

P/Q CONTROL

SMART START-UP

MULTIPLE AXIS

SSP-T-SP-NP-2032L-1015-032-*/T **/PE

① Internal gear pump
② Bellhousing with zero backlash coupling
③ Permanent magnets Servomotor
④ Drive

SSP systems combine the typical advantages of hydraulic power transmission with the ease of control and adjustment of an electric drive while also ensuring maximum levels of energy efficiency.
They are used in high performance machines mainly for the plastic, die-casting and deformation sectors.

Maximum flow:	**350 l/min**
Maximum rated power:	**100 kW**
Maximum continuous pressure:	
cast iron pump	**330 bar**
aluminium pump	**250 bar**

They consist of a fixed displacement internal gear pump, driven by a permanent magnet synchronous servomotor controlled by an electronic drive. The latter controls the speed of the servomotor and therefore of the pump, to adjust the flow rate or pressure of the system based on the reference signals received from the PLC of the machine.
A dedicated algorithm optimizes the P/Q function by automatically selecting the activation of the flow or pressure control.
Compared to traditional systems, SSPs offer the following advantages:

- significant reduction in energy consumption, as the pump operates at the speed strictly necessary to generate the required flow rate / pressure
- high dynamics and precision of P/Q control thanks to a dedicated algorithm
- reduction of the noise level, thanks to the design of the pump and the variable speed
- maximum flexibility thanks to dedicated software
- simplified commisioning thanks to the Smart start-up and Smart tuning functions
- possibility of customization up to 4 axes with Multiple axis function

For more details see technical table AS050

1 MODEL CODE

SSP	-	T-SP	-	NP	-	2020L	-	1024	-	046	/	C	/	T	/	*	/	PE

SSP — Smart servopump

T-SP — **Control logic**:
T-SP = alternated P/Q control with resolver

NP — **Fieldbus interface,** serial port always present:
NP = Not present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EP = PROFINET RT/IRT

2020L — **Pump**

PGI, cast iron pump, Pmax 330 bar **(1)** - see table AS300:

1011 = 10,9 cm³/rev	**2050** = 50 cm³/rev	**3080** = 80 cm³/rev
2020 = 20 cm³/rev	**4050** = 50 cm³/rev	**4080** = 80 cm³/rev
2032 = 32,1 cm³/rev	**3064** = 64 cm³/rev	**3100** = 100 cm³/rev
2040 = 40,1 cm³/rev	**4064** = 64 cm³/rev	**4100** = 100 cm³/rev

PGIL, aluminium pump, Pmax 250 bar - see table AS350:

2020L = 20 cm³/rev	**2050L** = 50 cm³/rev	**3100L** = 100 cm³/rev
2032L = 32,1 cm³/rev	**3064L** = 64 cm³/rev	**4125L** = 125 cm³/rev
2040L = 40,1 cm³/rev	**3080L** = 80 cm³/rev	

(1) Pmax depends on the pump displacement

1024 — **Motor** PMM - see table AS400:

1009 = 8,7 kW	**1032** = 30 kW	**2080** = 80 kW
1015 = 15 kW	**2042** = 42 kW	**2100** = 100 kW
1024 = 24 kW	**2055** = 55 kW	

046 — **Drive** D-MP - see table AS500:

022 = 22 A	**060** = 57 A	**140** = 140 A
032 = 32 A	**090** = 87 A	**165** = 165 A
046 = 46 A	**100** = 100 A	**210** = 210 A

C — **Hydraulic option** see section 8:
C = integrated block with relief valve and pressure transducer
D = as option C plus Smart Cooling functionality
Electronic option see section 9:
K = Drive with Safe Torque Off

T — **Port orientation** see section 10:
T = standard
U, **V** = optional

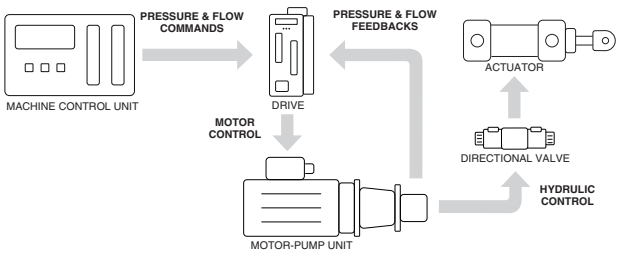
***** — Series number

PE — Seals material
PE = FKM

For optimal sizing, download the sizing software from

2 FUNCTIONING DESCRIPTION

SSP servopumps are designed to efficiently and accurately generate and regulate hydraulic power at every stage of the machine cycle. The ability to modulate the required flow rate or pressure by varying the number of revolutions gives it a substantial advantage in terms of energy savings compared to traditional systems that operate at constant speed. Thanks to the high dynamics and dedicated algorithms, the SSP allow you to directly control the speed of movement and the force of the hydraulic actuators with optimal levels of precision and repeatability.
They consist of an internal gear pump, a permanent magnet servomotor and an electronic drive.
The drive is connected to an angular transducer which measures the rotation speed of the servomotor and to a pressure transducer. It manages the motor power supply, the operating logic and system diagnostics.



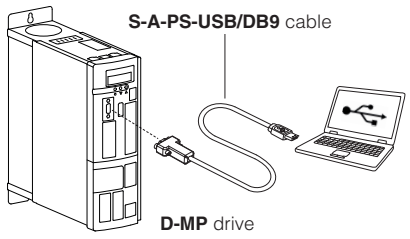
3 PROGRAMMING TOOLS

The functional parameters and configurations of the SSP servopumps can be easily set and optimized using the Atos S-SW-SETUP programming software by connecting the PC to the drive via the RS485 serial port.
The software allows the parameterization of the drive via the RS485 serial port even if the drive is connected to the machine central unit via fieldbus.

S-SW-SETUP support: NP (Serial) BC (CANopen) EH (EtherCAT)
BP (PROFIBUS DP) EP (PROFINET)

Note: For detailed descriptions of settings, wiring and installation procedures, refer to the user manual included in S-SW-SETUP

PC connection



4 FIELDBUS

Fieldbus allows direct communication between the Drive and the machine control unit for digital reference, extended diagnostics and servopump settings. However, the fieldbus versions allow the servopump to be controlled also through analog references.

5 GENERAL CHARACTERISTICS

Installation position	Motor and pump: horizontal position Drive: wall mounting, vertical position
Ambient temperature range	Motor and pump: -20°C ÷ 40°C Drive: 0°C ÷ 40°C motor and drive derate in power for higher temperature
Altitude	up to 1000 m, motor and drive derate in power for higher altitude
Compliance	CE according to EMC directive 2014/30/EU and LVD 2014/35/EU Rohs directive 2011/65/EU as last update by 2015/863/EU

6 HYDRAULIC CHARACTERISTICS

Hydraulic fluid		HL, HLP DIN 51524...535, for other fluids contact Atos technical office	
Fluid temperature range		-20°C ÷ 80°C	
Recommended viscosity		10 ÷ 300 mm²/s - cold start max 2000 mm²/s	
Max fluid contamination level	normal operation	ISO4406 class 20/18/15 NAS1638 class 9	see also fiter section at or KTF catalog
	longer life	ISO4406 class 18/16/13 NAS1638 class 7	
Min/max inlet pressure	(bar abs)	from 0.8 to 2 bar. Recommended ⩾ 1	

7 DRIVE ELECTRICAL CHARACTERISTICS

Rated IN voltage [V]	200 V -10% ÷ 460 V +10% @ 45 ÷ 65 Hz for drive 022 ÷ 060 380 V -15% ÷ 460 V +10% @ 45 ÷ 65 Hz for drive 090 ÷ 210			
DC Bus voltage [V]	280 V -10% ÷ 620 V +10% for drive 022 ÷ 060 530 V -15% ÷ 650 V +10% for drive 090 ÷ 210			
24VDC input power supply	24 VDC ±10% @ max 1,0 A for drives type 022, 032, 090, 100, 140, 165, 210 24 VDC ±10% @ max 1,6 A for drives type 046, 060			
24VDC output power supply	24 VDC ±10% @ max 500 mA - only for drives type 090, 100, 140, 165, 210			
Digital inputs	24 VDC ±10% @ max 10 mA			
Digital outputs	30 VDC @ max 60 mA			
Analog inputs	±10 V @ max 0,5 mA or 4 ÷ 20 mA (Dip-switch selectable - see user manual)			
Analog outputs	±10 V @ max 2 mA			
Protection degree to DIN EN60529	Motor: IP54 (IP65 on request); Drive: IP20 for sizes 022 ÷ 100, IP00 for sizes 140 ÷ 210			
Communication interface	Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, PROFINET IO RT / IRT EC 61158
Communication physical layer	insulated RS485	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insuated 100 Base TX

8 HYDRAULIC OPTION

C = This option provides a hydraulic block mounted directly on the pump outlet, which integrates a mechanical pressure relief valve with safety function on the maximum system pressure and a pressure transducer for the feedback of the actual pressure on the delivery line.

① Mechanical pressure relief valve; the valve is supplied with zero adjustment, and must be adjusted by the user at a pressure slightly higher than the maximum pressure required by the system.

② Pressure transducer E-ATR-8/400/I - see technical table GS465

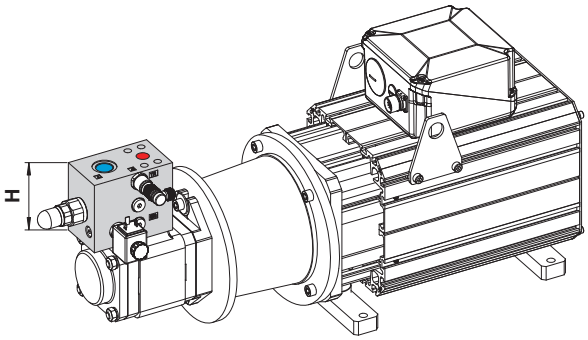
D = This option allows to protect the pump from overheating when it is subjected to particularly heavy duty cycles, in particular in the prolonged phases of static pressure control.
This option includes a hydraulic block with relief valve and pressure transducer, as for the /C option, with also integrated:

③ Smart Cooling cartridge valve JO-DL-4-2/NC-X 24DC - see technical table E105

When a temperature considered critical is reached, the Smart Cooling valve opens ③ as to cause a small recirculation of oil through the pump which protects it from dangerous overheating.

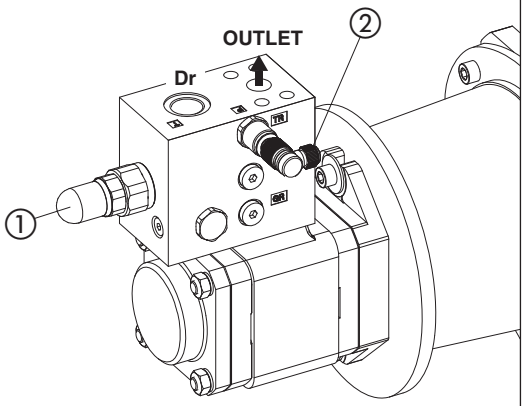
The sizing software for SSP suggests the need for the /D option based on the machine cycle.

Options **C** and **D** dimensions

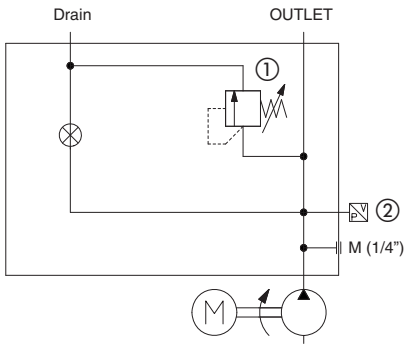


SSP CODE	OUTLET	**Dr** (drain)	**H** (mm)
SSP-T-SP-1011***	1/2" SAE3000	G1/2"	105
SSP-T-SP-2020***	3/4" SAE3000	G3/4"	110
SSP-T-SP-2032***			
SSP-T-SP-2040***	1" SAE3000	G1"	115
SSP-T-SP-2050***			
SSP-T-SP-4050**	1" SAE6000	G1"	115
SSP-T-SP-3064***	1" SAE6000	G1 1/4"	125
SSP-T-SP-4064**			
SSP-T-SP-3080***	1 1/4" SAE6000	G1 1/2"	140
SSP-T-SP-4080***			
SSP-T-SP-3100***			
SSP-T-SP-4100**			
SSP-T-SP-4125***	1 1/2" SAE6000	G 2"	140

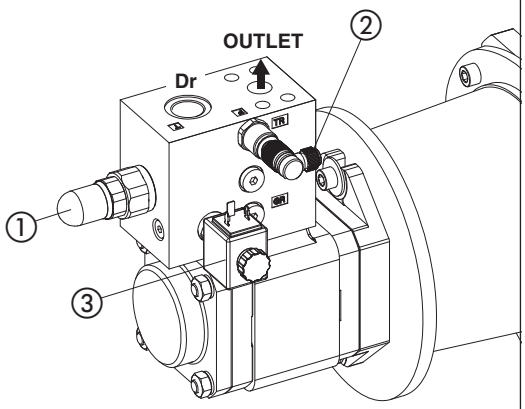
Detail option **C**



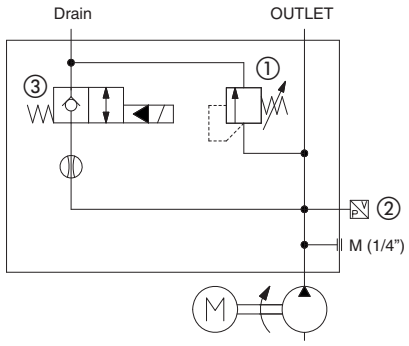
Hydraulic scheme option C



Detail option **D**



Hydraulic scheme option D



9 ELECTRONIC OPTION

K = Safe Torque Off (STO) safety function to prevent accidental starting of the servo pump, in accordance with the Machinery Directive 2006/42/EC (MD) - standard EN 61800-5-2

The STO function is implemented in the D-MP Drive and is activated by two digital signals sent by the control unit of the machine that allow to remove the power supply to the servomotor in order to prevent unwanted start-up.

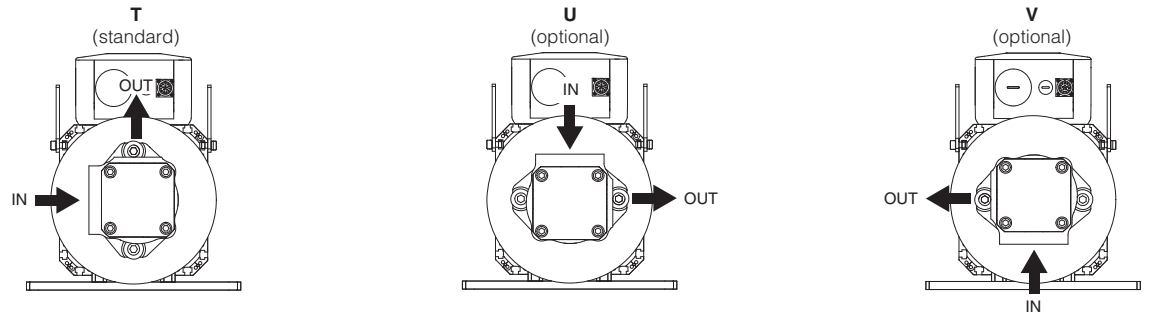
At the same time, two digital signals are generated by the Drive to confirm that the power supply to the motor has been removed and the absence of other anomalies. These signals are read by the machine control unit for safety management.

For more information see the S-MAN-STO manual.

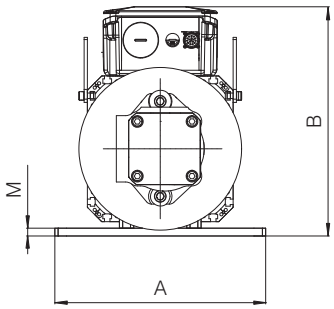
Possible combined option:
/CK, /DK

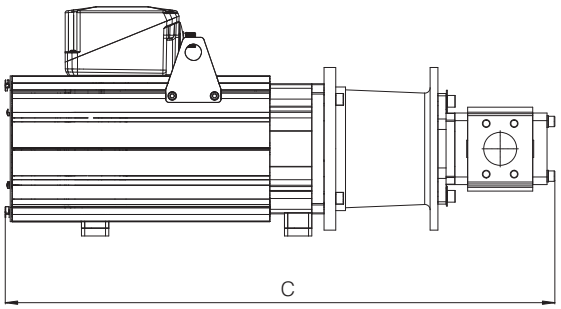
10 PORTS ORIENTATION

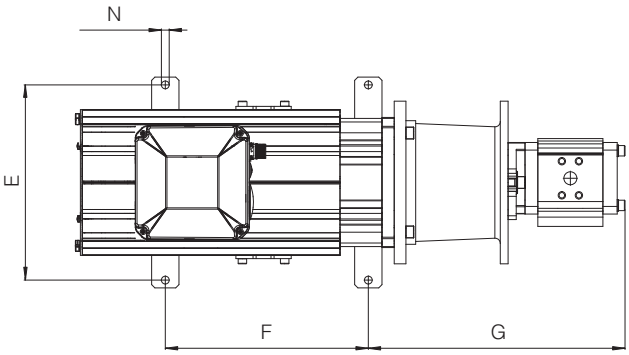
The pump can be supplied with inlet and outlet ports oriented in different configurations, as shown in the figure (seen from the bottom of the pump)

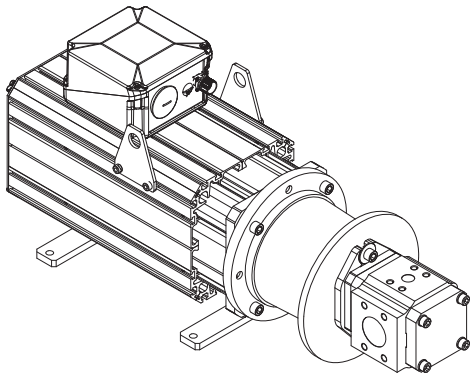


11 INSTALLATION DIMENSIONS - motor pump unit [mm] for drive dimensions see AS500

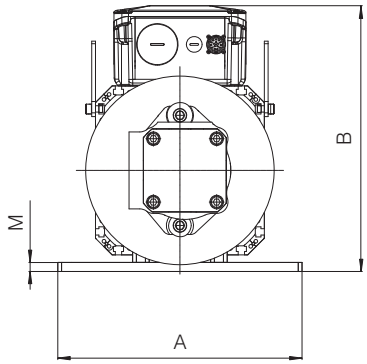


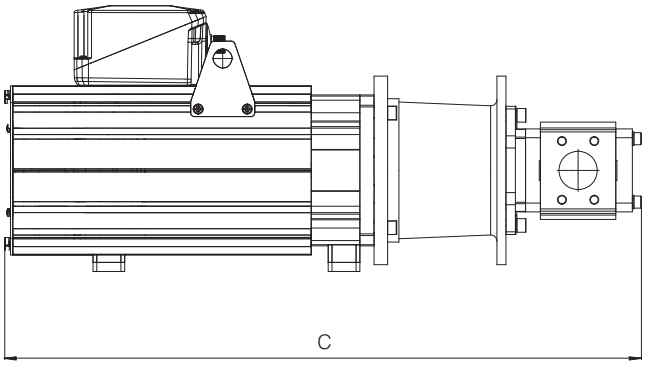


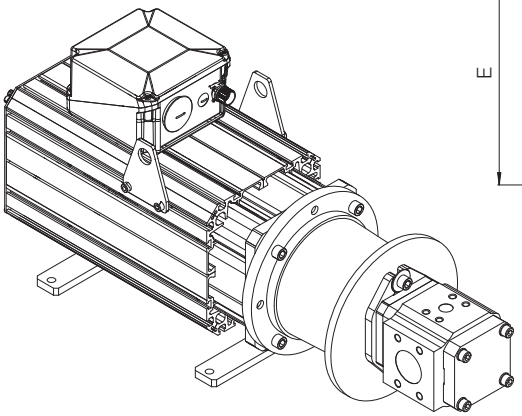


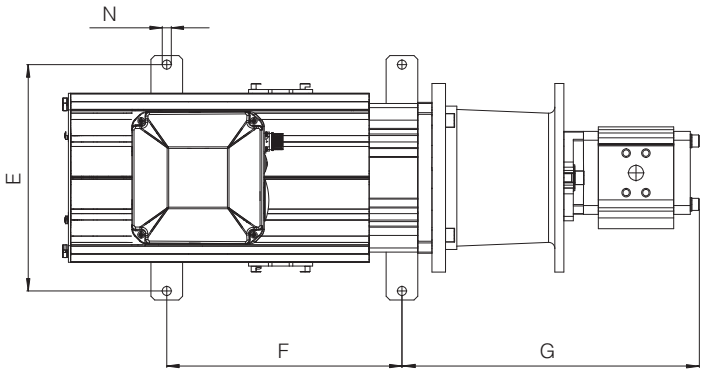


MODEL CODE	A	B	C	E	F	G	M	N	Mass [Kg]
SSP-*-**1011-1009**-*	324	335	630	300	168	324	12	12	56
SSP-*-**1011-1015**-*		355	700		240				68
SSP-*-**2020*-1009**-*	324	335	680	300	168	373	12	12	62
SSP-*-**2020*-1015**-*		355	750		240				74
SSP-*-**2020*-1024**-*			820		312				90
SSP-*-**2020-1032**-*			890		385				105
SSP-*-**2032*-1009**-*	324	335	670	300	168	368	12	12	63
SSP-*-**2032*-1015**-*		355	750		240				76
SSP-*-**2032*-1024**-*			820		312				91
SSP-*-**2032*-1032**-*			890		385				107
SSP-*-**2032-2042**-*	384	435	890	356	275	417	14	18	145
SSP-*-**2040*-1015**-*	278	355	760	300	240	381	12	12	79
SSP-*-**2040*-1024**-*			830		312				94
SSP-*-**2040*-1032**-*			900		385				110
SSP-*-**2040*-2042**-*	384	435	900	356	275	430	14	18	148
SSP-*-**2050*-1015**-*	324	355	770	300	240	395	12	12	81
SSP-*-**2050*-1024**-*			840		312				96
SSP-*-**2050*-1032**-*			910		385				112
SSP-*-**2050*-2042**-*	384	435	910	356	275	444	14	18	150
SSP-*-**2050*-2055**-*		450	970		330				172

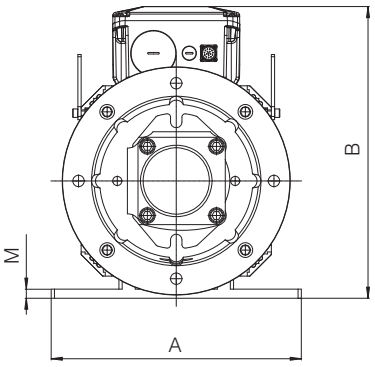


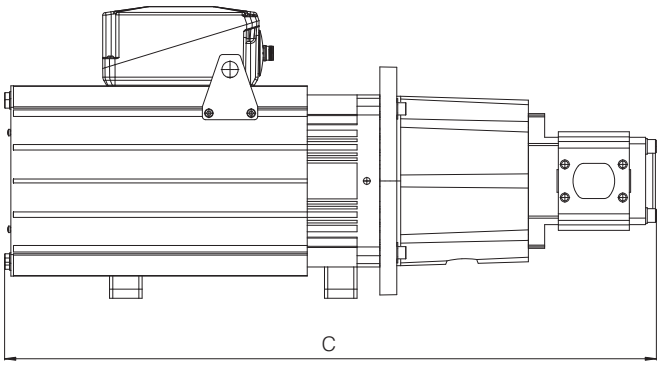


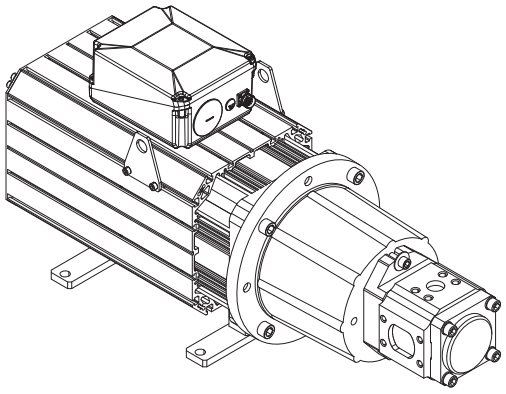


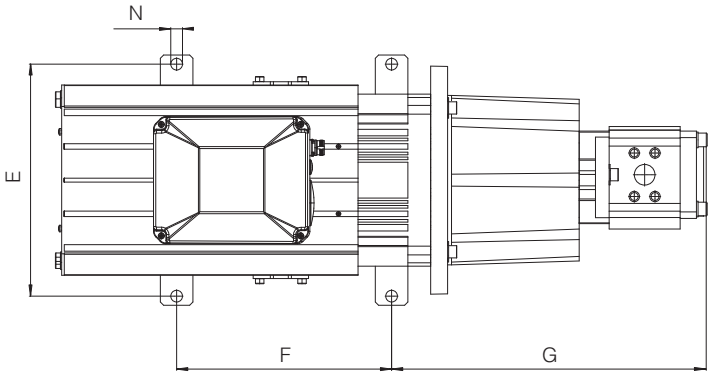


MODEL CODE	A	B	C	E	F	G	M	N	**Mass** [Kg]
SSP-*-**3064*-1024**-*	324	355	830	300	312	383.5	12	12	94
SSP-*-**3064*-1032**-*			900		385				111
SSP-*-**3064*-2042**-*	384	435	930	356	275	456.5	14	18	149
SSP-*-**3064*-2055**-*		450	980		330				170
SSP-*-**3064*-2080**-*			112		476				213
SSP-*-**3080*-1024**-*	324	355	840	300	312	395.5	12	12	97
SSP-*-**3080*-1032**-*			920		385				113
SSP-*-**3080*-2042**-*	384	435	940	356	275	468.5	14		151
SSP-*-**3080*-2055**-*		450	1000		330				172
SSP-*-**3080*-2080**-*			1123		476				216
SSP-*-**3080-2100**-*			1200		583				257
SSP-*-**3100*-1032**-*	324	355	930	300	385	411.5	12	12	115
SSP-*-**3100*-2042**-*	384	435	950	356	275	484.5	14	18	152
SSP-*-**3100*-2055**-*		450	1011		330				174
SSP-*-**3100*-2080**-*			1140		476				217
SSP-*-**3100*-2100**-*		490	1210		583				258
SSP-*-**4050-1015**-*	324	355	810	300	240	427	12	12	108
SSP-*-**4050-1024**-*			870		312				122
SSP-*-**4050-1032**-*			950		385				138
SSP-*-**4050-2042**-*	384	435	950	356	275	481	14	18	166
SSP-*-**4050-2055**-*		450	1011		330				187
SSP-*-**4050-2080**-*			1155		476	500			239









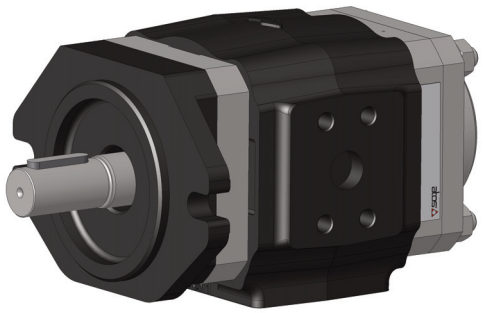
MODEL CODE	A	B	C	E	F	G	M	N	Mass [Kg]
SSP-*-**4064-1024**-*	324	355	860	300	312	438	12	12	124
SSP-*-**4064-1032**-*			960		385				140
SSP-*-**4064-2042**-*	384	445	48	356	275	492	14	18	168
SSP-*-**4064-2055**-*		450	1020		330				189
SSP-*-**4064-2080**-*			1166		476	511			241
SSP-*-**4080-1024**-*	324	355	890	300	312	447	12	12	126
SSP-*-**4080-1032**-*			970		385				142
SSP-*-**4080-2042**-*	384	435	970	356	275	501	14	18	170
SSP-*-**4080-2055**-*		450	1032		330				191
SSP-*-**4080-2080**-*			1175		476	520			243
SSP-*-**4080-2100**-*			1250		583				284
SSP-*-**4100-1032**-*	324	355	980	300	385	460	12	12	145
SSP-*-**4100-2042**-*	384	435	980	356	275	514	14	18	173
SSP-*-**4100-2055**-*		450	1040		330				194
SSP-*-**4100-2080**-*			1188		476	533			246
SSP-*-**4100-2100**-*			1260		583				287
SSP-*-**4125L-2042**-*	384	435	980	356	275	509	14	18	162
SSP-*-**4125L-2055**-*		450	1032		330				183
SSP-*-**4125L-2080**-*			1150		476	528			229
SSP-*-**4125L-2100**-*		490	1183		583				234

12 RELATED DOCUMENTATION

AS050 Basics for Smart Servopumps - SSP
AS200 Sizing criteria for servopumps
AS300 PGI cast iron internal gear pumps, high pressure
AS350 PGIL aluminium internal gear pumps
AS400 PMM high performance synchronous servomotors
AS500 D-MP electronic drives
AS510 Fieldbus
AS800 Programming tools for pumps & servopumps
AS810 Accessories for servopumps
AS910 Operating and maintenance information for servopumps
S-MAN-HW Servopumps installation manual
S-MAN-SW Servopumps programming software manual
S-MAN-STO Servopumps Safe Torque Off manual

Cast iron internal gear pumps for SSP servopumps

fixed displacement, high pressure



PGI-2032/1D* /PE

PGI are fixed displacement cast iron internal gear pumps designed for high pressure application and are suitable for use in SSP system with variable speed drives to provide variable flow rate.

Their particular design allows outstanding efficiencies due to radial and axial gap compensation, low pressure pulsation and very low noise level.

The internal gear is supported by a hydrodynamic/hydrostatic lubrication film, which allows operation at low viscosities and low/high speeds.

Max displacement: up to **100 cm³/rev**

Max pressure: up to **330 bar**

1 **MODEL CODE**

PGI	-	**2**	**020**	/	**1**	**D**	*	/	**PE**
Internal gear pump							Series number		**Seals material**: **PE** = FKM

Size, see section **2** : **1**, **2**, **3**, **4**

Displacement (cm³/rev), see section **2** : **011**, **020**, **032**, **040**, **050**, **064**, **080**, **100**

Direction of rotation, viewed at the shaft end: **D** = clockwise

Shaft, SAE Standard: **1** = keyed

2 **HYDRAULIC CHARACTERISTICS** - based on mineral oil ISO VG 46 at 50 °C

Size code		**1**	**2**				**3**			**4**			
Displacement code		**011**	**020**	**032**	**040**	**050**	**064**	**080**	**100**	**050**	**064**	**080**	**100**
Displacement	(cm³/rev)	10,9	20	32,1	40,1	50,3	65,3	80,4	100,5	50,6	65,3	80	101,2
Continuous pressure	(bar)	330	330	330	280	280	280	280	280	330	315	300	300
Peak pressure **(1)**	(bar)	350	350	350	300	300	290	290	290	340	330	330	330
Recommended pressure on inlet port	(bar)	from 0,8 to 2 (absolute pressure)											
Max speed **(2)**	(rpm)	4000	3400	3000	3600	3600	3000	3000	3000	2400	2400	2200	2200
Volumetric efficiency **(3)**		93	93	94	95	95	94	95	95	93	94	94	95
Hydromechanical efficiency **(3)**		92	91	92	93	93	92	93	93	89	89	90	90
Noise **(3)**	(dBA)	58	62	64	65	66	69	70	71	73	74	75	76

(1) 15% duty cycle, max 10 sec continuously

(2) For SSP system max speed please consider table **AS100**;

(3) Measuring data with: n = 1450 rpm; Δp = 250 bar;

3 GENERAL CHARACTERISTICS

Assembly position	Any position.
Loads on the shaft	Axial and radial loads are not allowed on the shaft
Ambient temperature range	-20°C ÷ +80°C
Compliance	REACH Regulation (EC) n°1907/2006

4 HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

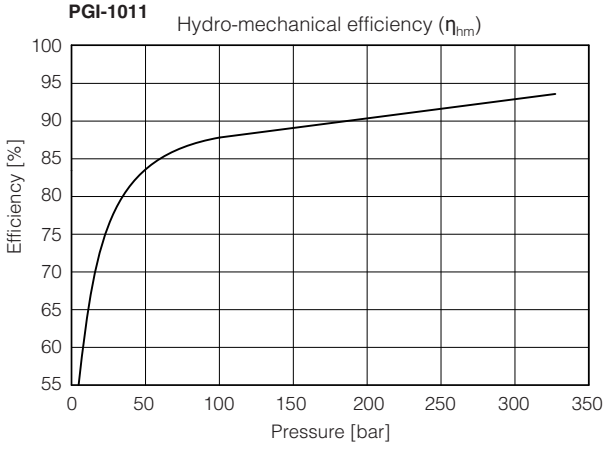
Fluid temperature		-20°C ÷ +80°C	
Recommended viscosity		10 ÷ 300 mm²/s - max at cold start 2000 mm²/s	
Max fluid contamination level	normal operation	ISO4406 class 20/18/13 NAS1638 class 9	see also filter section at or KTF catalog
	longer life	ISO4406 class 18/16/11 NAS1638 class 7	
Hydraulic fluid		**Classification**	**Ref. Standard**
Mineral oils		HL, HLP, HLPD, HVLP, HVLPD	DIN 51524

5 DIAGRAMS at 1450 rpm (based on mineral oil ISO VG 46 at 40°C)

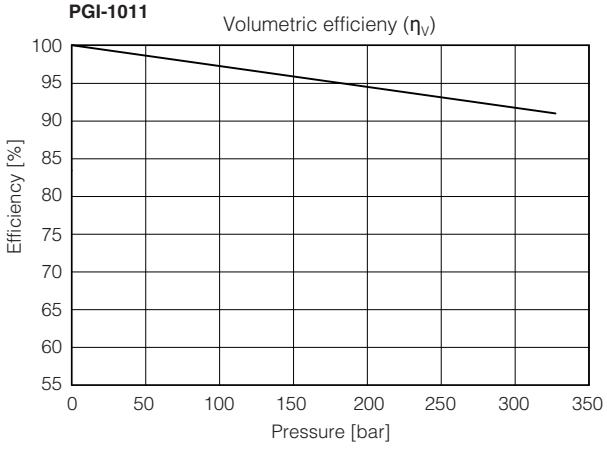
5.1 Efficiency

Efficiency is the ratio of useful output energy in relation to the input energy fed to a component.
In fluid power, pump efficiency can split in two different contributes:
- hydro-mechanical efficiency (η_{hm}), that describes the losses created by frictional forces (both mechanical and viscous)
- volumetric efficieny (η_V), that accounts for the flow leakages of a pump

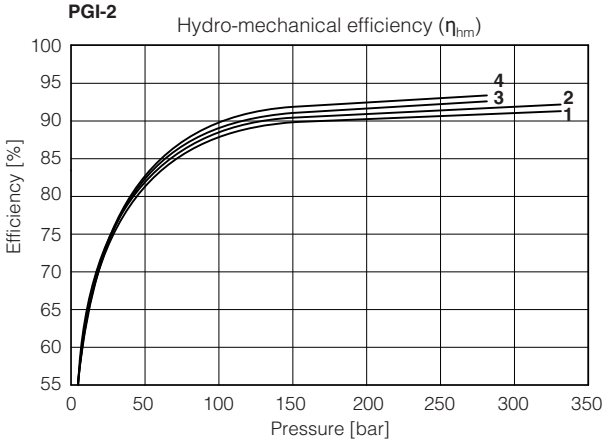
PGI-1011



PGI-1011

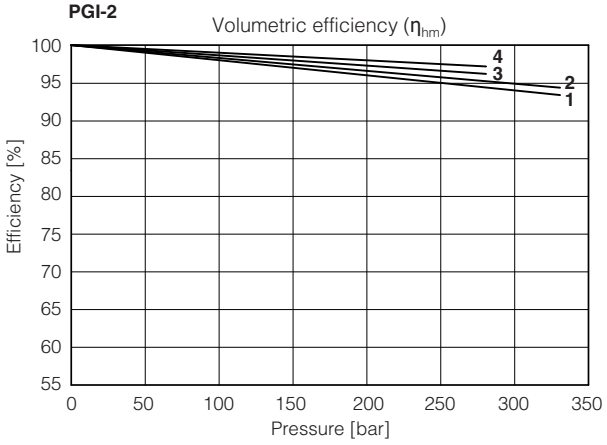


PGI-2



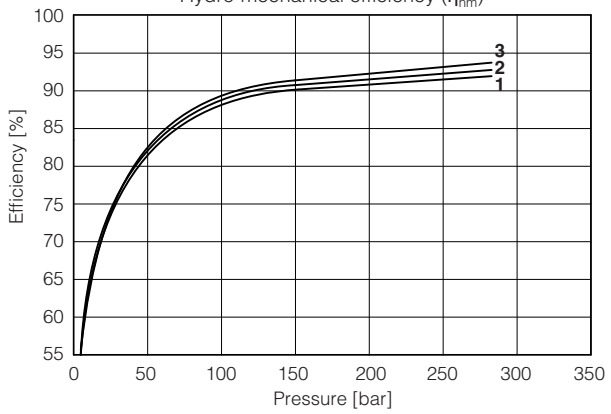
1 = PGI-2020 **2** = PGI-2032 **3** = PGI-2040 **4** = PGI-2050

PGI-2



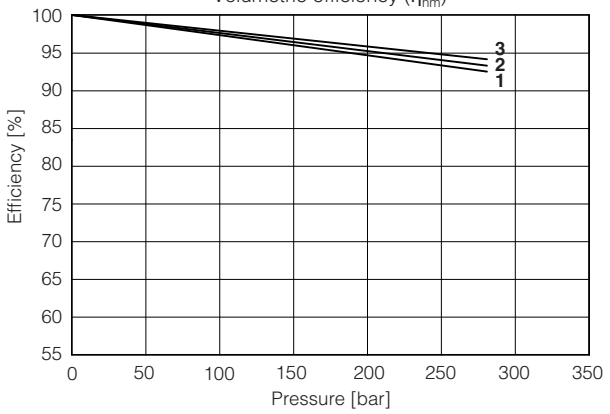
1 = PGI-2020 **2** = PGI-2032 **3** = PGI-2040 **4** = PGI-2050

PGI-3



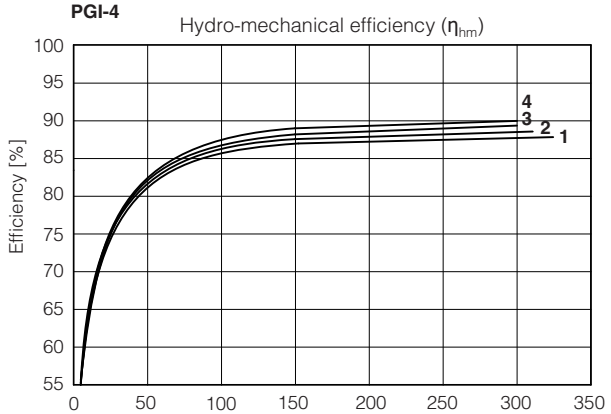
1 = PGI-3064 **2** = PGI-3080 **3** = PGI-3100

PGI-3



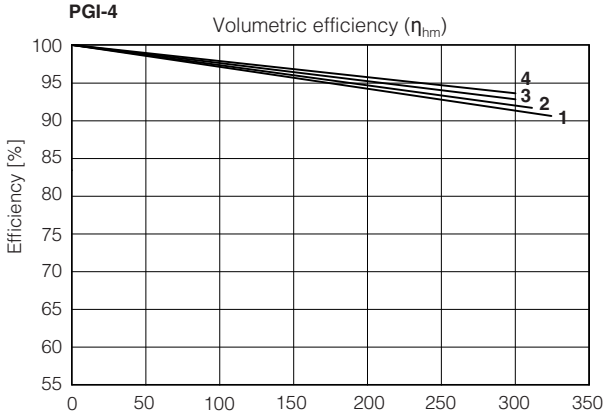
1 = PGI-3064 **2** = PGI-3080 **3** = PGI-3100

PGI-4



1 = PGI-4050 **2** = PGI-4064 **3** = PGI-4080 **4** = PGI-4100

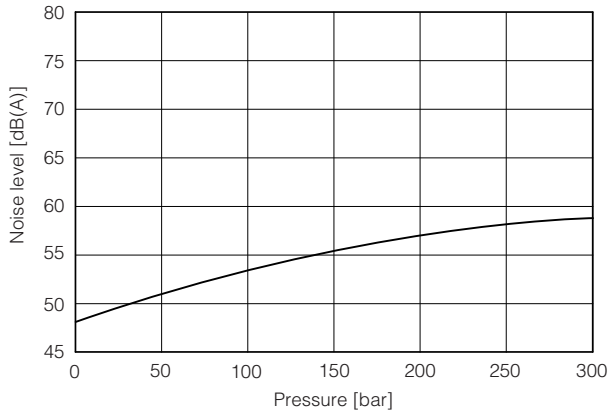
PGI-4



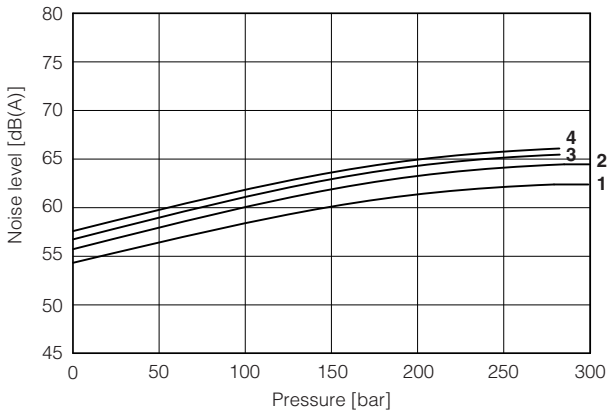
1 = PGI-4050 **2** = PGI-4064 **3** = PGI-4080 **4** = PGI-4100

5.2 Noise level

PGI-1011

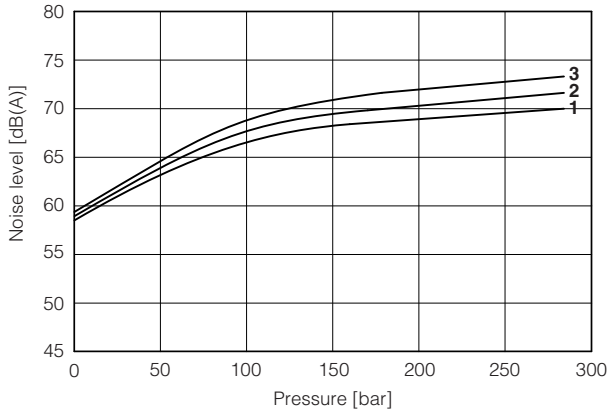


PGI-2



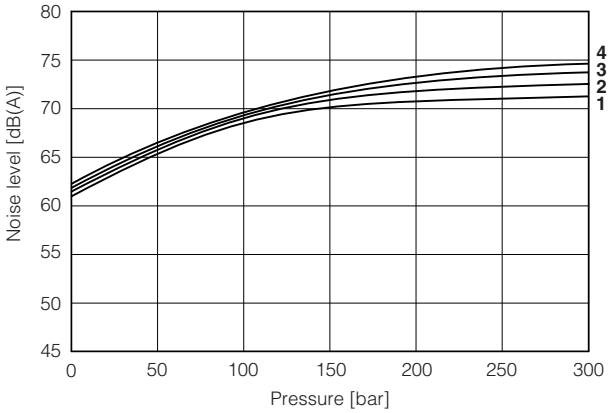
1 = PGI-2020 **2** = PGI-2032 **3** = PGI-2040 **4** = PGI-2050

PGI-3



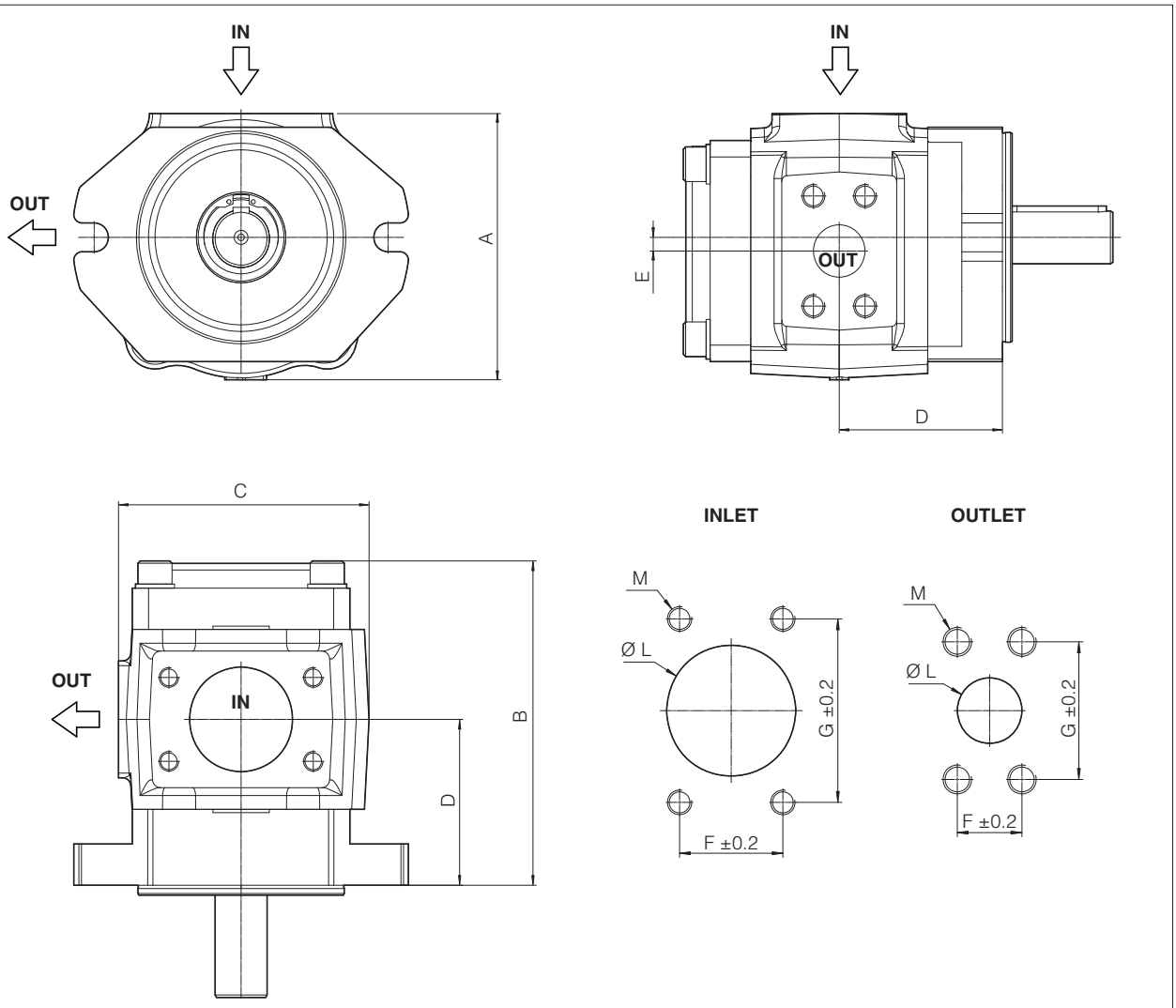
1 = PGI-3064 **2** = PGI-3080 **3** = PGI-3100

PGI-4



1 = PGI-4050 **2** = PGI-4064 **3** = PGI-4080 **4** = PGI-4100

6 DIMENSIONS



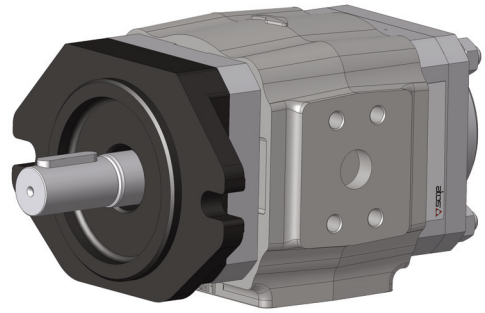
Pump code	Dimensions [mm]															Mass [kg]
	A	B	C	D	E	INLET port					OUTLET port					
						F	G	L	M	SAE Flange	F	G	L	M	SAE Flange	
PGI-1011	110	125	106	60.5	5.5	26.2	52.4	25	M10x15	1" SAE3000	17.5	38.1	14	M8x15	1/2" SAE3000	5.4
PGI-2020	126	158	129	75	6.5	30.2	58.7	32	M10x17	1 1/4" SAE3000	22	47.5	18	M10x17	3/4" SAE3000	10.5
PGI-2032	126	175	129	83.2	6.5	30.2	58.7	32	M10x17	1 1/4" SAE3000	22	47.5	18	M10x17	3/4" SAE3000	12
PGI-2040	135	186	138	88.7	6.5	42.9	77.8	51	M12x17	2" SAE3000	26.2	52.4	20	M10x17	1" SAE3000	15
PGI-2050	135	200	138	95.7	6.5	42.9	77.8	51	M12x17	2" SAE3000	26.2	52.4	20	M10x17	1" SAE3000	17
PGI-3064	160	168.5	155	86.5	8.3	42.9	77.8	51	M12x21	2" SAE3000	27.8	57.2	25.4	M12x22	1" SAE6000	15.3
PGI-3080	160	180.5	155	92.5	8.3	42.9	77.8	51	M12x21	2" SAE3000	31.8	66.7	31.75	M14x24	1 1/4" SAE6000	17.5
PGI-3100	160	196.5	155	100.5	8.3	50.8	88.9	63.5	M12x21	2 1/2" SAE3000	31.8	66.7	31.75	M14x24	1 1/4" SAE6000	18.7
PGI-4050	198	186	192.5	86.5	9.8	35.7	69.9	40	M12x25	1 1/2" SAE3000	27.8	57.2	20	M12x22	1" SAE6000	32
PGI-4064	198	195	192.5	91	9.8	35.7	69.9	40	M12x25	1 1/2" SAE3000	27.8	57.2	20	M12x22	1" SAE6000	34
PGI-4080	198	204	192.5	95.5	9.8	42.9	77.8	50	M12x25	2" SAE3000	31.8	66.7	30	M14x25	1 1/4" SAE6000	36
PGI-4100	198	217	192.5	102	9.8	42.9	77.8	50	M12x25	2" SAE3000	31.8	66.7	30	M14x25	1 1/4" SAE6000	39

7 RELATED DOCUMENTATION

AS050 Basics for Smart Servopumps - SSP
AS100 SSP Smart Servopumps
AS200 Sizing criteria for servopumps
AS350 PGIL aluminium internal gear pumps
AS400 PMM high performance synchronous servomotors
AS500 D-MP electronic drives
AS510 Fieldbus
AS800 Programming tools for pumps & servopumps
AS810 Accessories for servopumps
AS910 Operating and maintenance information for servopumps
S-MAN-HW Servopumps installation manual
S-MAN-SW Servopumps programming software manual
S-MAN-STO Servopumps Safe Torque Off manual

Aluminium internal gear pumps for SSP servopumps

fixed displacement



PGIL-2032/1D* /PE

PGIL are fixed displacement internal gear pumps suitable for use in SSP system with variable speed drives to provide variable flow rate.

Their particular design allows outstanding efficiencies due to radial and axial gap compensation, low pressure pulsation and very low noise level.

The internal gear is supported by a hydrodynamic/hydrostatic lubrication film, which allows operation at low viscosities and low/high speeds.

Max displacement: up to **125 cm³/rev**

Max pressure: up to **250 bar**

1 MODEL CODE

PGIL	-	**2**	**020**	/	**1**	**D**	*	/	**PE**
Internal gear pump		**Size,** see section 2 : **2**, **3**, **4**	**Displacement (cm³/rev),** see section 2 : **020**, **032**, **040**, **050**, **064**, **080**, **100**, **125**		**Shaft,** SAE Standard: **1** = keyed	**Direction of rotation,** viewed at the shaft end: **D** = clockwise	Series number		**Seals material**: **PE** = FKM

2 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Size code		**2**				**3**			**4**
Displacement code		**020**	**032**	**040**	**050**	**064**	**080**	**100**	**125**
Max displacement	(cm³/rev)	20	32,1	40,1	50,3	65,3	80,4	100,5	125,7
Continuous pressure	(bar)	250	250	250	250	250	250	250	250
Peak pressure **(1)**	(bar)	320	320	300	280	270	270	270	280
Recommended pressure on inlet port	(bar)	from 0,8 to 2 (absolute pressure)							
Max speed **(2)**	(rpm)	3900	3700	3600	3600	3000	3000	3000	2800
Volumetric efficiency **(3)**		93	94	95	95	94	95	95	94
Hydromechanical efficiency **(3)**		91	92	93	93	92	93	93	90
Noise **(3)**	(dBA)	62	64	65	66	69	70	71	76

(1) 15% duty cycle, max 10 sec continuously
(2) For SSP system max speed please consider table **AS100**;
(3) Measuring data with: n = 1450 rpm; Δp = 250 bar;

3 GENERAL CHARACTERISTICS

Assembly position	Any position.
Loads on the shaft	Axial and radial loads are not allowed on the shaft
Ambient temperature range	-20°C ÷ +80°C
Compliance	REACH Regulation (EC) n°1907/2006

4 HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

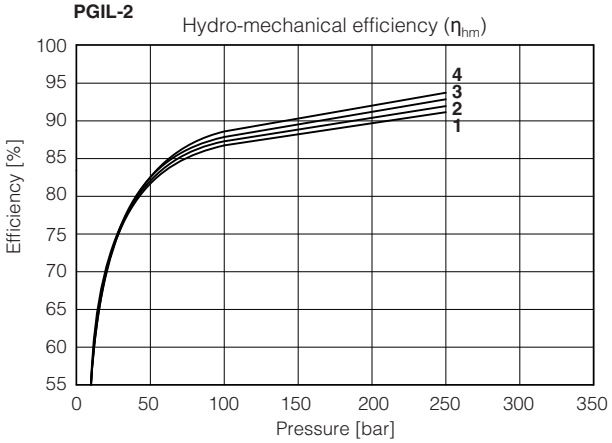
Fluid temperature		-20°C ÷ +80°C	
Recommended viscosity		10 ÷ 300 mm²/s - max at cold start 2000 mm²/s	
Max fluid contamination level	normal operation	ISO4406 class 20/18/13 NAS1638 class 9	see also filter section at or KTF catalog
	longer life	ISO4406 class 18/16/11 NAS1638 class 7	
Hydraulic fluid		**Classification**	**Ref. Standard**
Mineral oils		HL, HLP, HLPD, HVLP, HVLPD	DIN 51524

5 DIAGRAMS at 1450 rpm (based on mineral oil ISO VG 46 at 40°C)

5.1 Efficiency

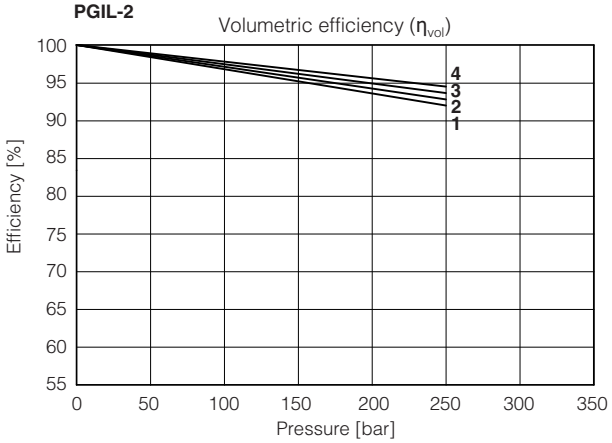
Efficiency is the ratio of useful output energy in relation to the input energy fed to a component.
In fluid power, pump efficiency can split in two different contributes:
- hydro-mechanical efficiency (η_{hm}), that describes the losses created by frictional forces (both mechanical and viscous)
- volumetric efficieny (η_V), that accounts for the flow leakages of a pump

PGIL-2



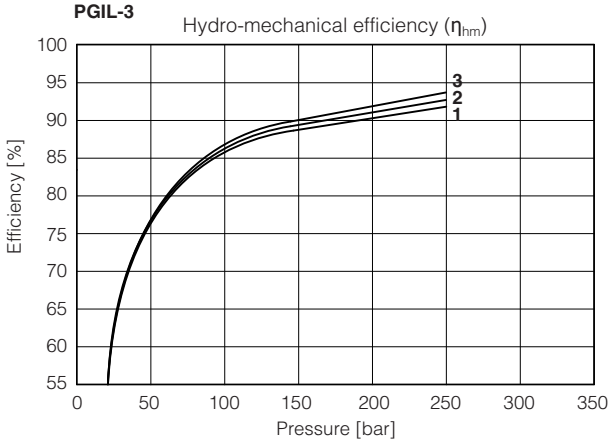
1 = PGIL-2020 **2** = PGIL-2032 **3** = PGIL-2040 **4** = PGIL-2050

PGIL-2



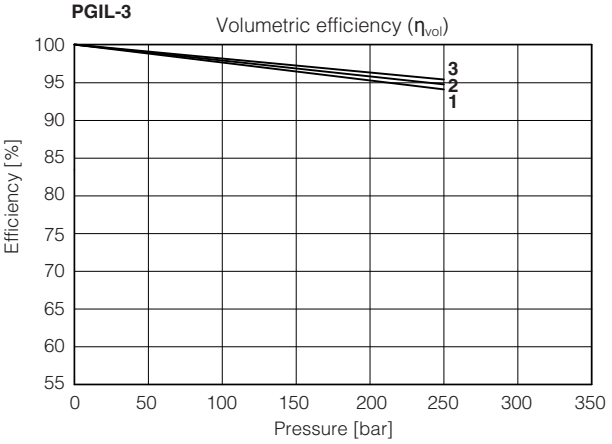
1 = PGIL-2020 **2** = PGIL-2032 **3** = PGIL-2040 **4** = PGIL-2050

PGIL-3



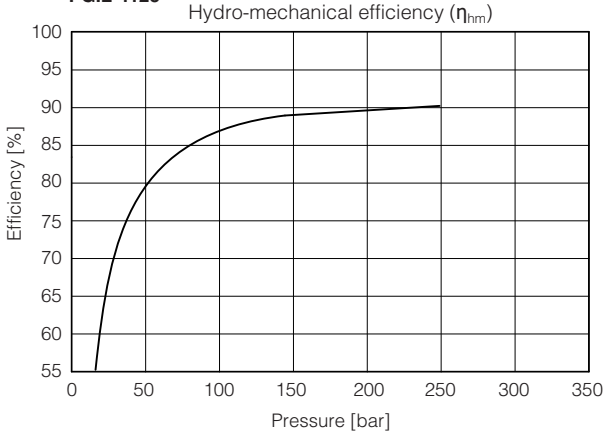
1 = PGIL-3064 **2** = PGIL-3080 **3** = PGIL-3100

PGIL-3

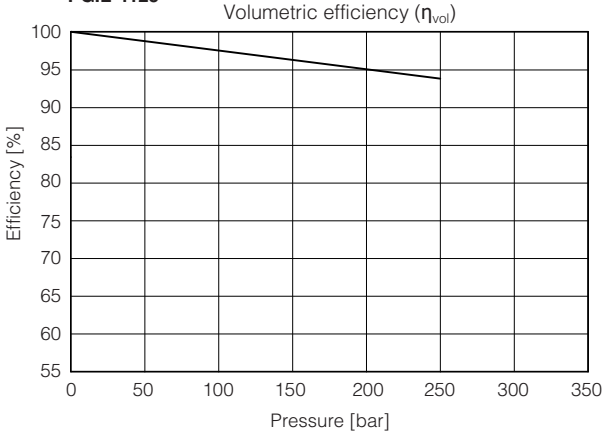


1 = PGIL-3064 **2** = PGIL-3080 **3** = PGIL-3100

PGIL-4125

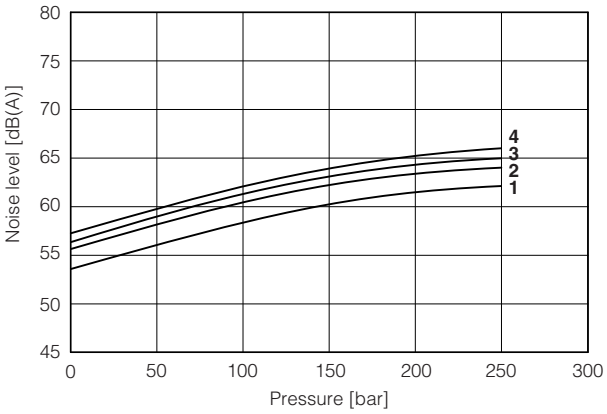


PGIL-4125



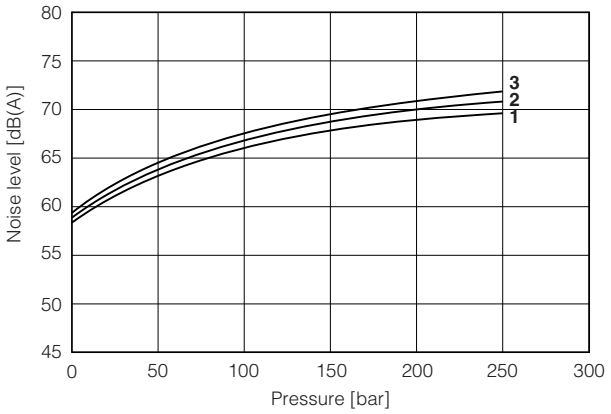
5.2 Noise level

PGIL-2



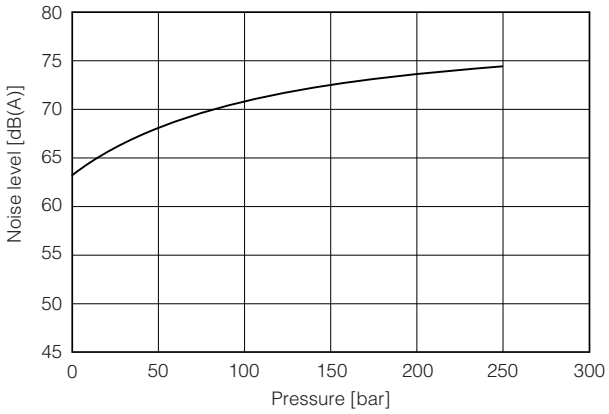
1 = PGIL-2020 **2** = PGIL-2032 **3** = PGIL-2040 **4** = PGIL-2050

PGIL-3

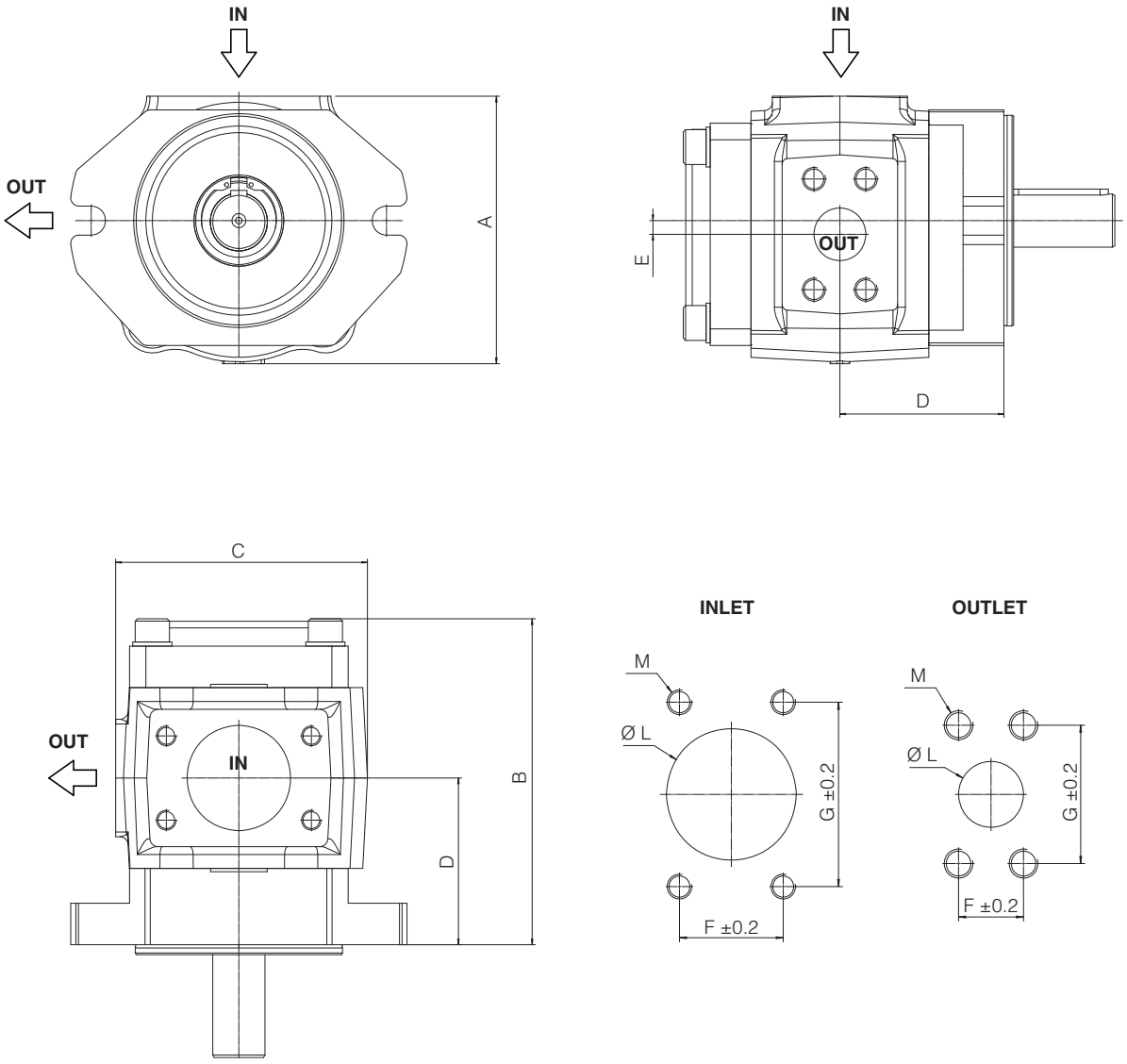


1 = PGIL-3064 **2** = PGIL-3080 **3** = PGIL-3100

PGIL-4125



6 DIMENSIONS



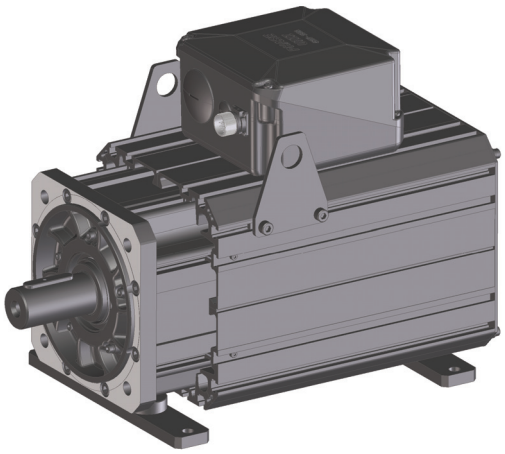
Pump code	Dimensions [mm]															Mass [kg]
	A	B	C	D	E	INLET port					OUTLET port					
						F	G	L	M	SAE flange	F	G	L	M	SAE flange	
PGIL-2020	126	158	129	75	6.5	30.2	58.7	32	M10x17	1 1/4" SAE3000	22	47.5	18	M10x17	3/4" SAE3000	8.3
PGIL-2032	126	153	129	83.2	6.5	30.2	58.7	32	M10x17	1 1/4" SAE3000	22	47.5	18	M10x17	3/4" SAE3000	9.2
PGIL-2040	135	166	138	88.7	6.5	42.9	77.8	51	M12x17	2" SAE3000	26.2	52.4	20	M10x17	1" SAE3000	9.8
PGIL-2050	135	180	138	95.7	6.5	42.9	77.8	51	M12x17	2" SAE3000	26.2	52.4	20	M10x17	1" SAE3000	10.5
PGIL-3064	160	168.5	155	86.5	8.3	42.9	77.8	51	M12x21	2" SAE3000	27.8	57.2	25.4	M12x22	1" SAE6000	11.5
PGIL-3080	160	180.5	155	92.5	8.3	42.9	77.8	51	M12x21	2" SAE3000	31.8	66.7	31.75	M14x24	1 1/4" SAE6000	13
PGIL-3100	160	196.5	155	100.5	8.3	50.8	88.9	63.5	M12x21	2 1/2" SAE3000	31.8	66.7	31.75	M14x24	1 1/4" SAE6000	13.5
PGIL-4125	189.6	212	185	109.5	9.8	50.8	88.9	63.5	M12x22	2 1/2" SAE3000	36.5	79.4	38.1	M16x27	1 1/2" SAE6000	27.5

7 RELATED DOCUMENTATION

AS050 Basics for Smart Servopumps - SSP
AS100 SSP Smart Servopumps
AS200 Sizing criteria for servopumps
AS300 PGI cast iron internal gear pumps, high pressure
AS400 PMM high performance synchronous servomotors
AS500 D-MP electronic drives
AS510 Fieldbus
AS800 Programming tools for pumps & servopumps
AS810 Accessories for servopumps
AS910 Operating and maintenance information for servopumps
S-MAN-HW Servopumps installation manual
S-MAN-SW Servopumps programming software manual
S-MAN-STO Servopumps Safe Torque Off manual

Electric motors for SSP servopumps

high performance, synchronous, permanent magnets



PMM-T-1032-20-F

PMM are AC brushless servo motors. Based on rare earth Permanent Magnets, they provide the highest level of efficency and of dynamic performance, making them the best choice for SSP systems.

These motors, equipped with cooling fan, allow high power density for very compact solutions.

Atos PMM includes 8 different rated power from 9 kW to 100 kW, divided in 2 sizes front flange.

Power range: **9 kW** to **100 kW**

1 MODEL CODE

PMM	-	T	-	1	009	-	20	-	F	*

Permanent Magnet Synchronous Motor

Speed sensor
T = Resolver

Size, see section 2 :
1 = for rated power 009, 015, 024, 032
2 = for rated power 042, 055, 080, 100

Rated speed [rpm], see section 2:
20 = 2000

Cooling
F = Fan cooling

Series number

Rated power [kW], see section 2 :
009 = 9 kW **015** = 15 kW **024** = 24 kW **032** = 32 kW
042 = 42 kW **055** = 55 kW **080** = 80 kW **100** = 100 kW

2 TECHNICAL CHARACTERISTICS

Code	Rated Power [kW]	Rated Torque [Nm]	Max Torque [Nm]	Rated Speed [rpm]	Max Speed [rpm]	Rated Current [A]	Max Current [A]	Torque constant [Nm/A]	Efficiency [%]	Inertia [kg cm^2]
PMM-*-1009-20	8,8	41,9	105	2000	3000	16,77	49	2,7	92	50
PMM-*-1015-20	16,5	78,7	210			29,68	92	2,86	94	90
PMM-*-1024-20	24,8	118,2	310			44,58	134	2,86	95	130
PMM-*-1032-20	31,4	145,2	410			61,34	199	2,54	95	170
PMM-*-2042-20	42,4	202,2	415			79,98	201	2,77	95	283
PMM-*-2055-20	55,6	265,2	550			110,87	264	2,6	97	390
PMM-*-2080-20	79,6	380,1	830			146,24	384	2,83	97	590
PMM-*-2100-20	100,7	480,9	1100			203,48	548	2,56	97	780

3 ELECTRIC CHARACTERISTICS

Type	Brushless Permanent Magnet 3 Phase AC servomotors
Insulation	Motor: class F according to DIN 0530; Winding: class H according to DIN 0530
Thermal protection	PT1000/PTC130 (except for motor 55 kW: KTY84/PTC130)
Protection	IP54
Cooling	Fan
Mounting	B35
Concentricity and sqaureness	Grade R according to IEC 72-DIN
Bearings	Heavy duty, life lubricated

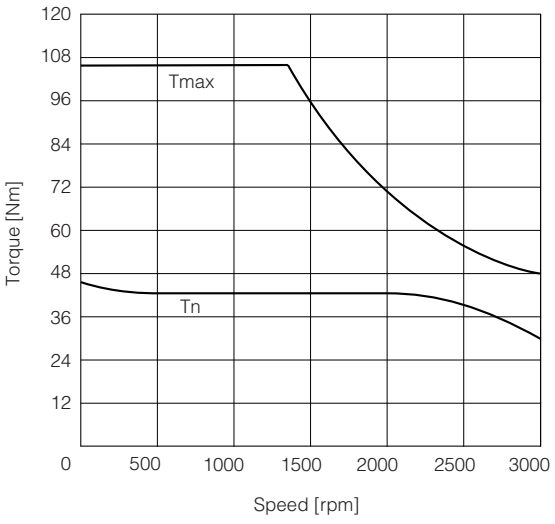
4 GENERAL CHARACTERISTICS

Assembly position	Any position
Ambient temperature	-20 ÷ +40°C de-rating for higher temperature
Altitude	up to 1000m, de-rating for higher altitude
Loads on the shaft	Axial and radial loads are not allowed on the shaft
Surface protection (motor body)	Black painting RAL9005
Compliance	CE according to EMC Directive 2014/30/EU and LVD Directive 2014/35/EU RoHs Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/200

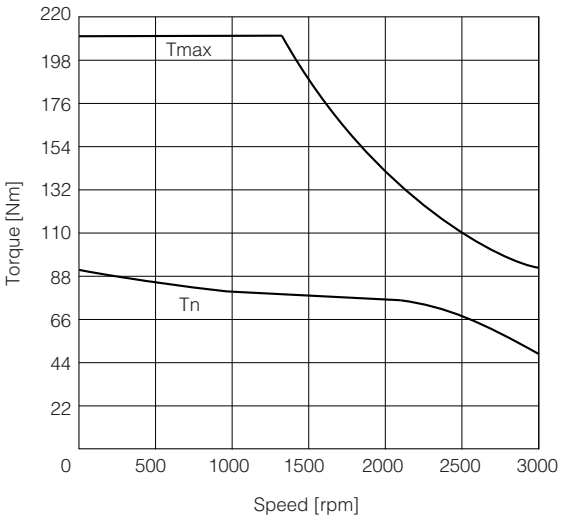
5 DIAGRAMS

Tn = Rated torque. It is the maximum torque admissible for a S1 operating conditions
Tmax = Maximum torque. It is the peak torque allowable for very short time, according to the specific working cycle.

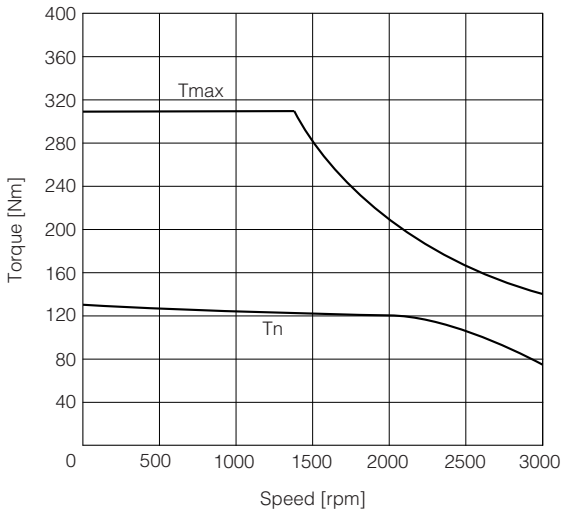
PMM-*-1009-20



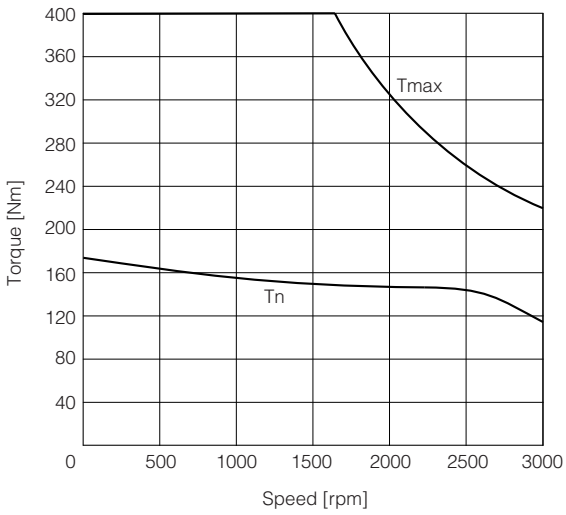
PMM-*-1015-20



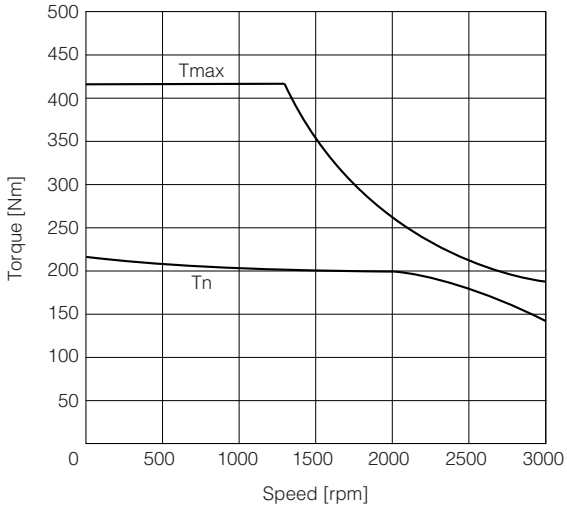
PMM-*-1024-20



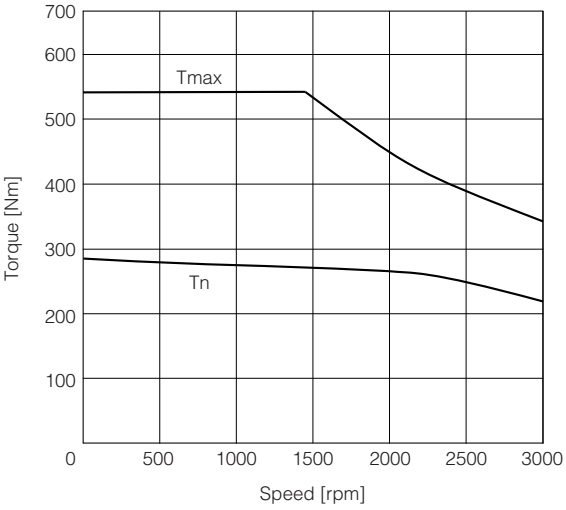
PMM-*-1032-20



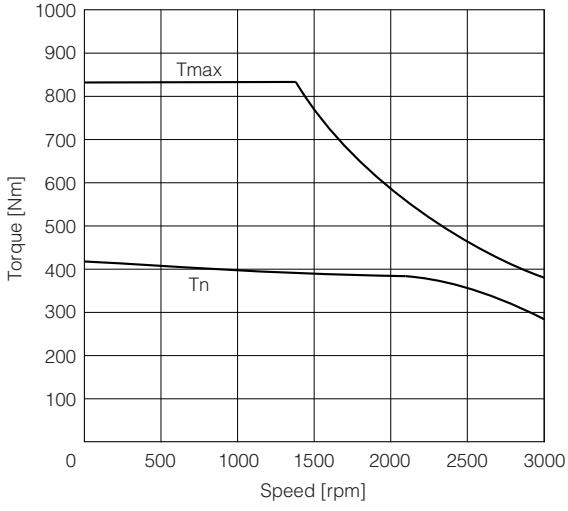
PMM-*-2042-20



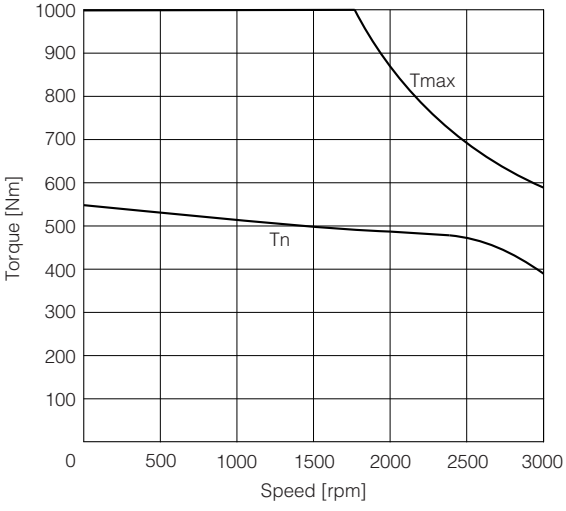
PMM-*-2055-20



PMM-*-2080-20



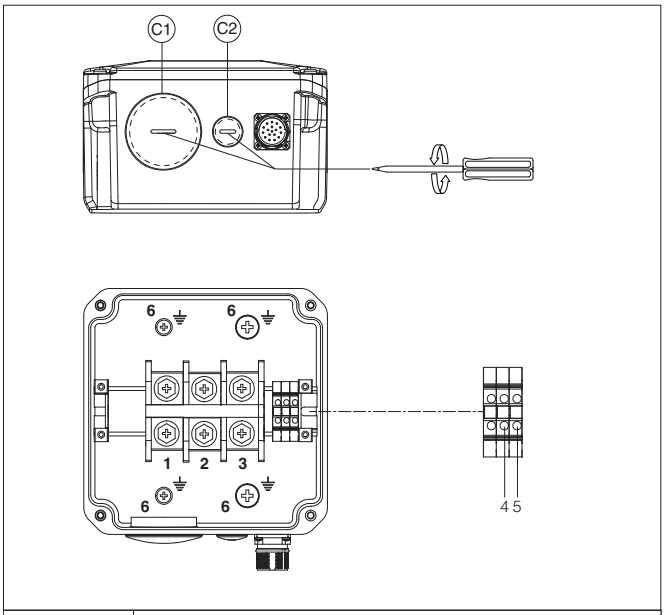
PMM-*-2100-20



6 ELECTRIC CONNECTIONS

6.1 Power connection - 4 phases (C1)

PIN	TECHNICAL SPECIFICATION	NOTES
1	Phase W	Input - power supply
2	Phase V	Input - power supply
3	Phase U	Input - power supply
6	GND	Gnd - power supply



Connections	Motor size							
	1009	1015	1024	1032	2042	2055	2080	2100
(C1)	M40	M50	M50	M50	M50	M63	M63	M63
(C2)	M20	M20	M20	M20	M20	M20	M20	M50

6.2 Fan power connection (C2)

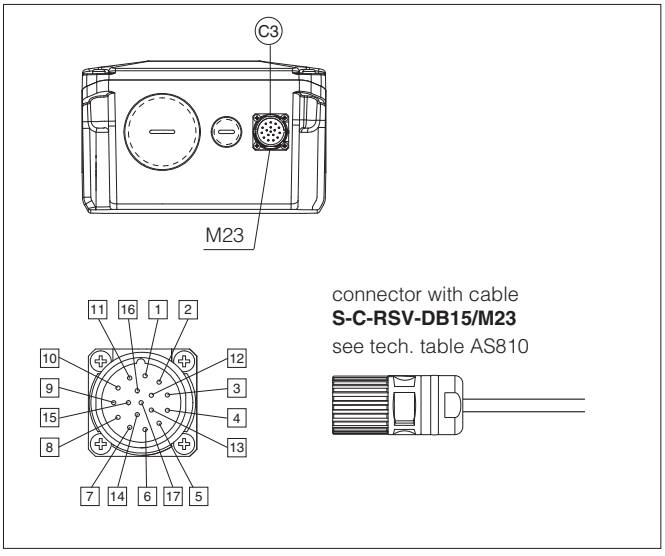
PIN	TECHNICAL SPECIFICATION	NOTES
4	Fan	Input - power supply
5	Fan	Input - power supply

The fan automatically starts with motor temperature over 85°C

Power Input: 53W
Current draw: 0.33A
Power supply: 230 V @ 50 ÷ 60 Hz

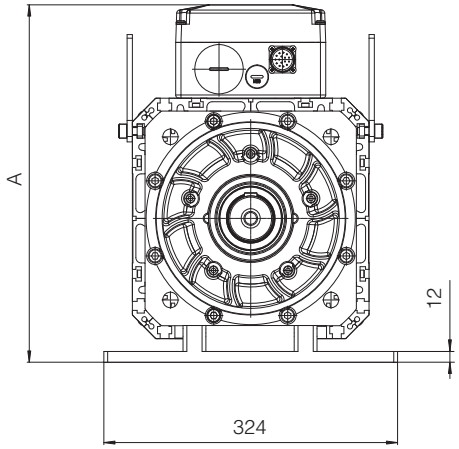
6.3 Signal connector - 17 pin (C3)

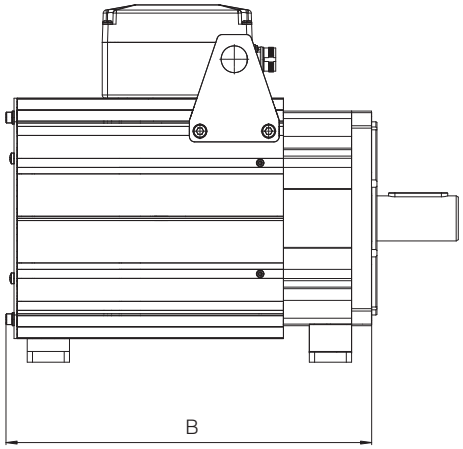
PIN	TECHNICAL SPECIFICATION
1	NC
2	NC
3	NC
4	SIN- , 1C/R
5	COS+ , 1C/R
6	COS- , 1C/R
7	RESEX+
8	Thermal sensor+
9	Thermal sensor-
10	RESEX-
11	NC
12	NC
13	NC
14	SIN+ , 1C/R
15	NC
16	NC
17	NC

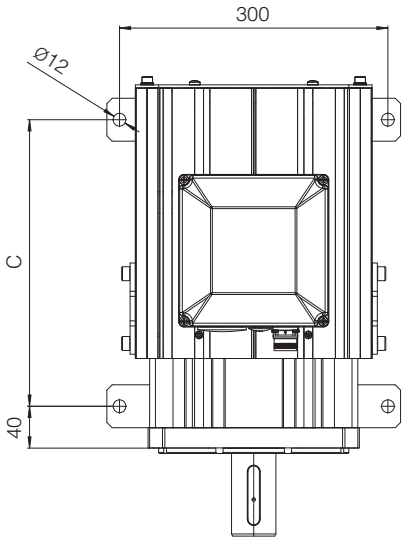


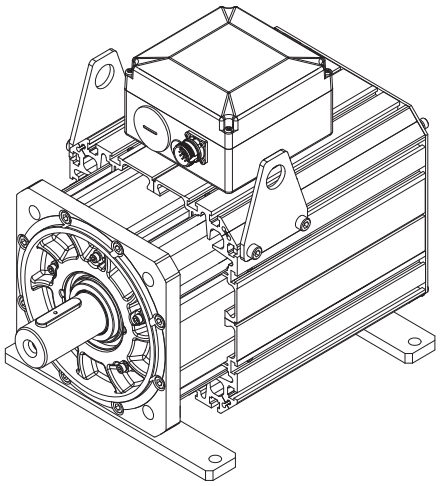
7 DIMENSIONS

PMM-T-1*



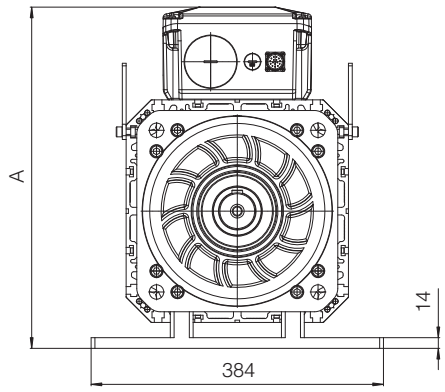


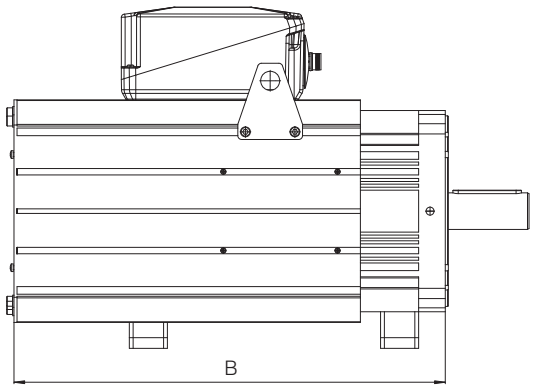


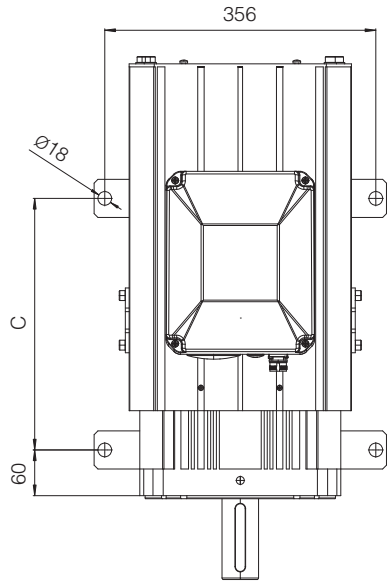


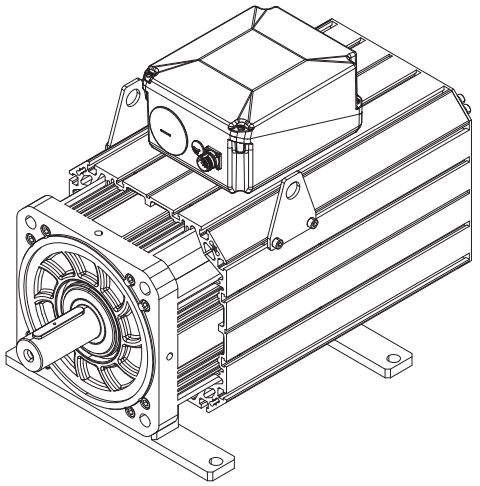
Motor code	Dimensions [mm]			Mass [kg]
	A	B	C	
1009	335	342	168	46
1015	355	414	240	59
1024	355	483	312	72
1032	355	555	385	87

PMM-T-2*









Motor code	Dimensions [mm]			Mass [kg]
	A	B	C	
2042	435	525	275	120
2055	450	580	330	141
2080	450	715	476	182
2100	490	785	583	223

15 RELATED DOCUMENTATION

AS050	Basics for Smart Servopumps - SSP
AS100	SSP Smart Servopumps
AS200	Sizing criteria for servopumps
AS300	PGI cast iron internal gear pumps, high pressure
AS350	PGIL aluminium internal gear pumps
AS500	D-MP electronic drives
AS510	Fieldbus
AS800	Programming tools for pumps & servopumps
AS810	Accessories for servopumps
AS910	Operating and maintenance information for servopumps
S-MAN-HW	Servopumps installation manual
S-MAN-SW	Servopumps programming software manual
S-MAN-STO	Servopumps Safe Torque Off manual

Digital electronic drives for SSP servopumps

fieldbus, smart start-up

SMART TUNING

P/Q CONTROL

SMART START-UP

MULTIPLE AXIS

D-MP-T-SP-NP-022/K

① Drive power supply - input
② Servomotor power supply - output
③ Serial RS485 communication port
④ IN/OUT signals
⑤ Fieldbus
⑥ Servomotor resolver

D-MP

Electronic drive exploits the modern technology of servo drives to accurately control pressure and flow in hydraulic systems through Smart Servopumps (SSP).
Atos PC software allows to customize the SSP configuration and via the Smart Start-up function guides the user step by step during the commissioning phases (see AS050).
Multiple axis function allows to manage customized settings for up to 4 axes (see AS050).

General Features:

- DB9 serial port RS485 always present
- Fieldbus communication connector for CANopen and PROFIBUS DP
- RJ45 ethernet communication connectors input/output for EtherCAT, PROFINET
- DB15 resolver connector always present
- Operating temperature range: 0 ÷ +40 °C
- IP20: for drives type 022 ÷ 100
- IP00: for drives type 140 ÷ 210
- CE mark according to LVD and EMC directive

Software Features:

- Intuitive graphic interface
- Smart Start-up
- Multiple axis
- Smart tuning
- Setting of SSP functional parameters
- Complete diagnostics
- Internal oscilloscope function

1 MODEL CODE

D-MP	-	T-SP	-	NP	-	022	/	*

Electronic drive
in wall mounting format

Control mode:
T-SP = high performances P/Q control

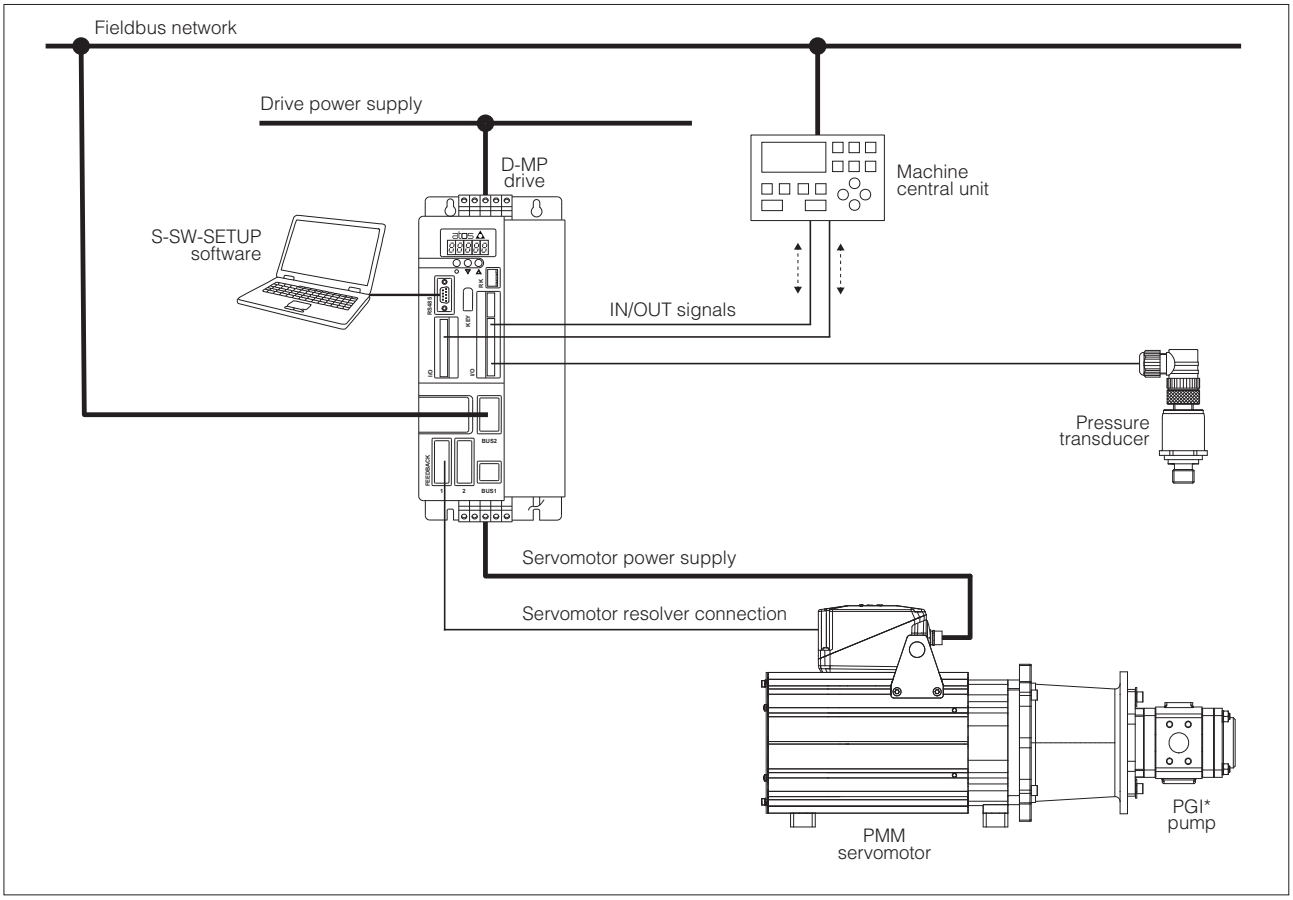
Fieldbus interface, serial port RS485 always present:
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EP = PROFINET RT/IRT

Rated current [Arms], see section 6 :

022 = 22 A	**060** = 57,5 A	**140** = 140 A
032 = 32 A	**090** = 87 A	**165** = 165 A
046 = 46 A	**100** = 100 A	**210** = 210 A

Option, see section 12 :
K = Safe Torque Off (STO)

2 BLOCK DIAGRAM EXAMPLE



3 DRIVE SETTINGS AND PROGRAMMING TOOLS - see tech. table **AS800**

Drive functional parameters and configurations, can be easily set and optimized using Atos S-SW-SETUP programming software connected via serial port RS485 to the drive.
For fieldbus versions, the software permits drive parameterization through serial port RS485 also if the drive is connected to the central machine unit via fieldbus.

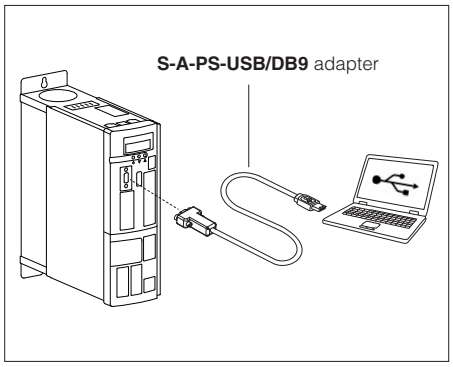
S-SW-SETUP permits to have many features so as Smart Start-up, Multiple axis and Smart tuning for an easy and rapid commissioning. For detailed info refer to **AS050**.

S-SW-SETUP support:

NP (Serial)	
BC (CANopen)	EH (EtherCAT)
BP (PROFIBUS DP)	EP (PROFINET)

Note: for detailed descriptions of settings, wirings and installation procedures, please refer to the user manual included in the S-SW-SETUP

Serial port RS485 connection



4 FIELDBUS - see tech. table **GS510**

Fieldbus allows drive direct communication with machine control unit for digital reference, drive diagnostics and settings. These execution allow to operate the drive through fieldbus or analog signals available on the connectors.

5 GENERAL CHARACTERISTICS

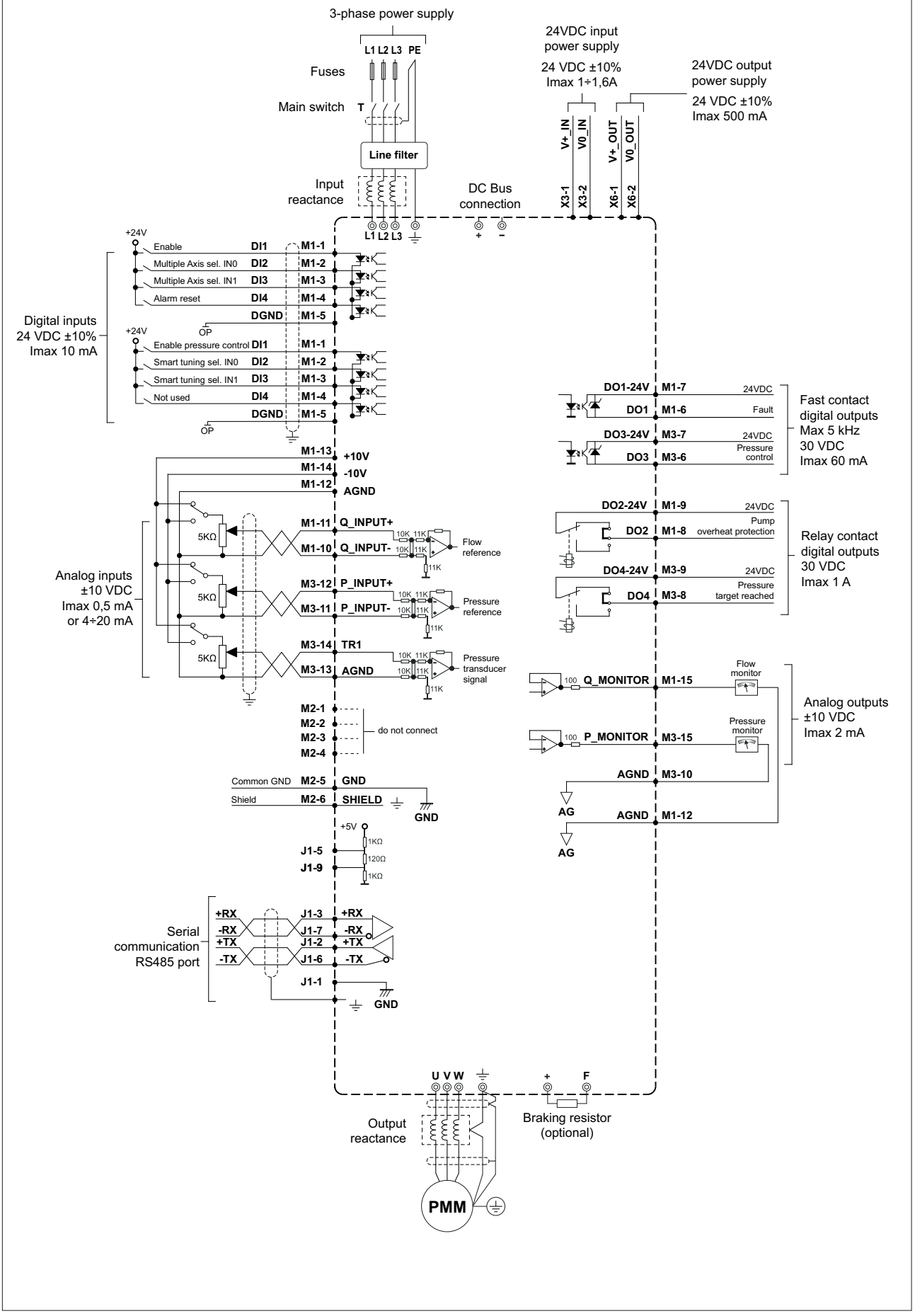
Assembly position	Wall mounting
Ambient temperature range	0 ÷ 40°C; up to 45°C with current derated to 88%
Storage temperature range	-10 ÷ 60°C
Altitude	Up to 1000 m; current derating for higher altitudes
Humidity	<90% - condensation not permitted
Vibration	0,2g
Cooling	Fan
Compliance	CE according to Low Voltage Directive (LVD) 2014/35/EU and to EMC directive 2014/30/EU RoHS Directive 2011/65/EU as last update by 2015/863/EU

6 ELECTRICAL CHARACTERISTICS

Drive type		**022**	**032**	**046**	**060**	**090**	**100**	**140**	**165**	**210**
Rated current	[A]	22	32	46	57.5	87	100	140	165	210
Overload current **(1)**	[A]	44	64	92	115	174	200	280	330	420
Rated power	[kW]	11	15	22	30	45	55	75	90	110
Rated IN voltage	[V]	200 V -10% ÷ 460 V +10% @ 45 ÷ 65 Hz				380 V -15% ÷ 460 V +10% @ 45 ÷ 65 Hz				
DC Bus voltage	[V]	280 V -10% ÷ 620 V +10%				530 V -15% ÷ 650 V +10%				
PWM frequency **(2)**	[kHz]	3 ÷ 14								
24VDC input power supply		24 VDC ±10% @ max 1,0 A for drives type 022, 032, 090, 100, 140, 165, 210 24 VDC ±10% @ max 1,6 A for drives type 046, 060								
24VDC output power supply		24 VDC ±10% @ max 500 mA - only for drives type 090, 100, 140, 165, 210								
Digital inputs		24 VDC ±10% @ max 10 mA								
Digital outputs - fast contact		30 VDC @ max 60 mA (max 5 kHz)								
Digital outputs - relay contact		30 VDC @ max 1 A								
Analog inputs		±10 V @ max 0,5 mA or 4 ÷ 20 mA (settable with specific dip-switch - see user manual)								
Analog outputs		±10 V @ max 2 mA								
Pressure transducer power supply		+24 VDC @ max 100 mA (E-ATR-8 see tech table **GS465**)								
Protection degree to DIN EN60529		IP20 for drives type 022, 032, 046, 060, 090, 100 IP00 for drives type 140, 165, 210								
Analog reference resolution		16 bit								
Speed control mode		Field-Oriented Control								
Braking resistance		External (see tech table **AS810**)								
Filter		External (see tech table **AS810**)								
Reactance		External - recommended for high power (> 45kW); see section 14								
Communication interface		Serial Atos ASCII coding	CANopen EN50325-4 + DS408			PROFIBUS DP EN50170-2/IEC61158		EtherCAT, PROFINET IO RT / IRT EC 61158		
Communication physical layer		insulated RS485	optical insulated CAN ISO11898			optical insulated RS485		Fast Ethernet, insulated 100 Base TX		
Recommended wiring cable for logic and 24VDC power supply		LiYCY shielded cables: 0,5 mm² max 30 m for logic - 1,5 mm² max 30 m for 24VDC power supply Max conductor size: 1,5 mm² Notes: for pressure transducer wiring cable please consult the transducer datasheet								
Recommended wiring cable for drive and servomotor power supply		see section 13								

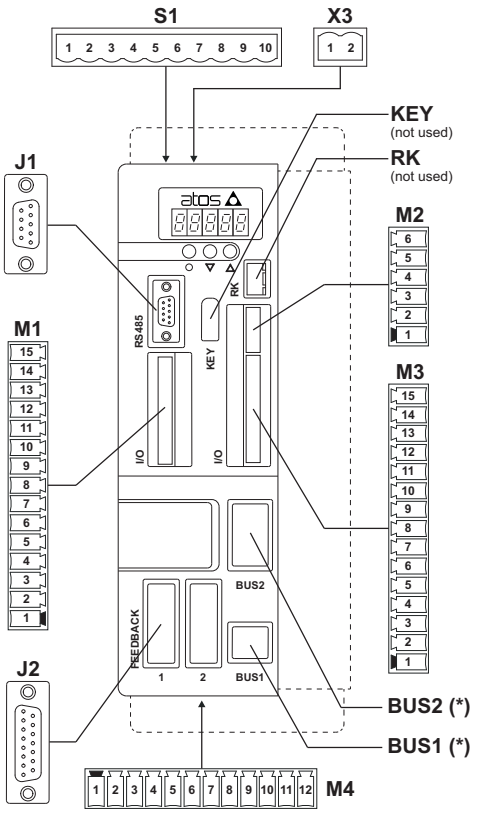
(1) 200% overload for maximum 3s and 155% for 30s
(2) Default is 5 kHz; only for drive type 140 default is 4 kHz

7 WIRING BLOCK DIAGRAM

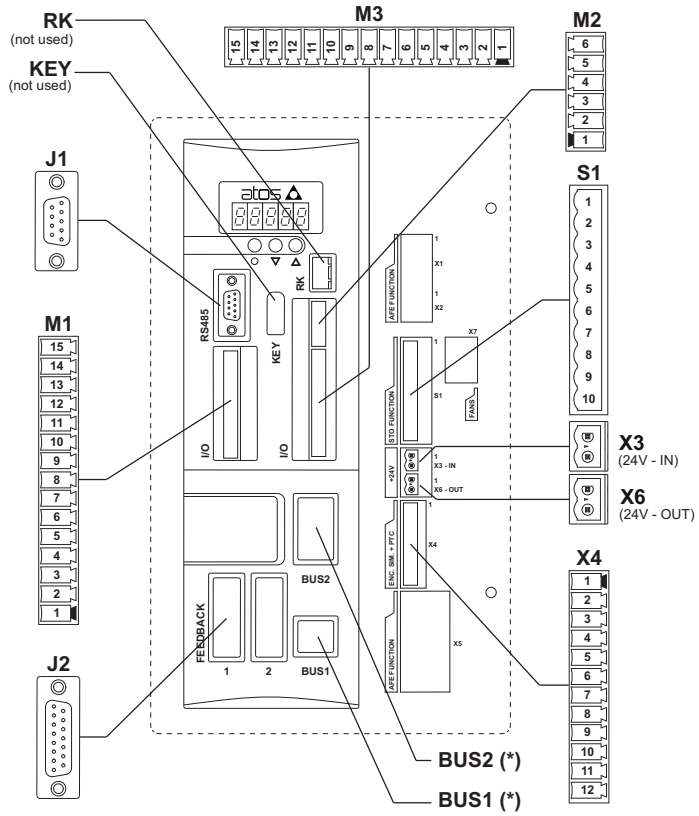


8 ELECTRONIC CONNECTIONS

D-MP-*- **022 032 046 060**



D-MP-*- **090 100 140 165 210**



(*) type of BUS1 and BUS2 connectors change according to the fieldbus interface (BUS1 connector available only for CANopen)

CANopen (BC) — **BUS2** (main)

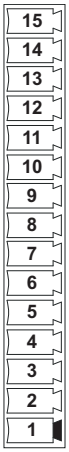
CANopen (BC) — **BUS1**

PROFIBUS DP (BP) — **BUS2**

Ethernet (EH, EP) — **BUS2**

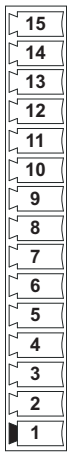
Connectors	Description	See
M1	IN/OUT analog and digital signals	8.1
M3	IN/OUT analog and digital signals - P/Q control	8.2
M2	Not used - available only for gnd and shield connections	8.3
X3	24VDC input power supply	8.4
X6	24VDC output power supply - only for 090, 100, 140, 165, 210	8.5
S1	Safe Torque Off (STO) - only for /K option	8.6
J2	Servomotor resolver	8.7
M4	Servomotor thermal sensor - for 022, 032, 046, 060	8.8
X4	Servomotor thermal sensor - for 090, 100, 140, 165, 210	
J1	Serial RS485 communication port	8.9
BUS1	Fieldbus optional boards - only for BC, BP, EH, EP	8.10 8.11 8.12
BUS2		
KEY	Not used	-
RK		

8.1 M1 connector - IN/OUT digital and analog signals

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
M1 	1	**DI1**	Enable (24 VDC) or disable (0 VDC) the servomotor control, referred to DGND	Input - on/off signal
	2	**DI2**	Multiple axis selection IN0, referred to DGND	Input - on/off signal
	3	**DI3**	Multiple axis selection IN1, referred to DGND	Input - on/off signal
	4	**DI4**	Alarm reset	Input - on/off signal
	5	**DGND**	Common gnd for digital input	Common gnd
	6	**DO1** (1)	Fault (0 VDC) or normal working (24 VDC), referred to DO1-24V	Output - on/off signal **Software selectable**
	7	**DO1-24V**	DO1 power supply 24 VDC	Input - power supply
	8	**DO2** (2)	Pump overheat protection active (24 VDC) or not active (0 VDC), referred to DO2-24V	Output - on/off signal **Software selectable**
	9	**DO2-24V**	DO2 power supply 24 VDC	Input - power supply
	10	**Q_INPUT-**	Negative flow reference input signal for Q_INPUT+	Input - analog signal
	11	**Q_INPUT+**	Flow reference input signal: ±10 VDC / 4 ÷ 20 mA maximum range Default is 0 ÷ 10 VDC	Input - analog signal **Dip-switch selectable**
	12	**AGND**	Common gnd for Q_MONITOR and stabilized power supply	Common gnd
	13	**+10V**	Stabilized power supply +10V - Current: max 10 mA	Output power supply
	14	**-10V**	Stabilized power supply -10V - Current: max 10 mA	Output power supply
	15	**Q_MONITOR**	Flow monitor output signal: ±10 VDC maximum range, referred to AGND	Output - analog signal **Software selectable**

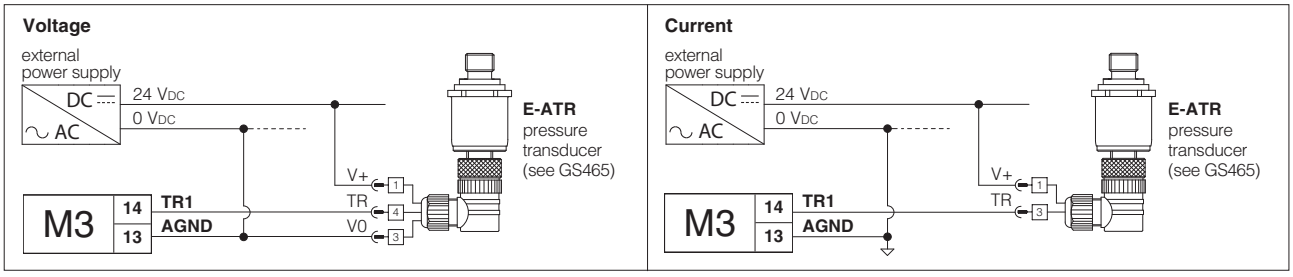
(1) Digital output with fast contact **(2)** Digital output with relay contact

8.2 M3 connector - IN/OUT digital and analog signals - **P/Q** control connections

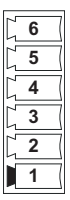
CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
M3 	1	**DI5**	Enable (24 VDC) or disable (0 VDC) the P/Q control, referred to DGND	Input - on/off signal
	2	**DI6**	Smart tuning setting selection IN0, referred to DGND	Input - on/off signal
	3	**DI7**	Smart tuning setting selection IN1, referred to DGND	Input - on/off signal
	4	**DI8**	(not used)	-
	5	**DGND**	Common gnd for digital input	Common gnd
	6	**DO3** (1)	Pressure control active (24 VDC) or not active (0 VDC), referred to DO3-24V	Output - on/off signal **Software selectable**
	7	**DO3-24V**	DO3 power supply 24 VDC	Input - power supply
	8	**DO4** (2)	Pressure target reached (24 VDC) or not reached (0 VDC), referred to DO4-24V	Output - on/off signal **Software selectable**
	9	**DO4-24V**	DO4 power supply 24 VDC	Input - power supply
	10	**AGND**	Common gnd for P_MONITOR	Common gnd
	11	**P_INPUT-**	Negative pressure reference input signal for P_INPUT+	Input - analog signal
	12	**P_INPUT+**	Pressure reference input signal: ±10 VDC / 4 ÷ 20 mA maximum range Default is 0 ÷ 10 VDC	Input - analog signal **Dip-switch selectable**
	13	**AGND**	Common gnd for transducer signal	Common gnd
	14	**TR1**	Signal pressure transducer: ±10 VDC / 4 ÷ 20 mA maximum range Default is 0 ÷ 10 VDC	Input - analog signal **Dip-switch selectable**
	15	**P_MONITOR**	Pressure monitor output signal: ±10 VDC maximum range, referred to AGND	Output - analog signal **Software selectable**

(1) Digital output with fast contact **(2)** Digital output with relay contact

Remote pressure transducer connections - examples



8.3 M2 connector - not used - available only for common GND and SHIELD connection

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
M2 	1	**NC**	-	Do not connect
	2	**NC**	-	Do not connect
	3	**NC**	-	Do not connect
	4	**NC**	-	Do not connect
	5	**GND**	Common gnd	
	6	**SHIELD**	Shield	

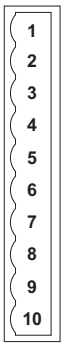
8.4 X3 connector - 24VDC input power supply

CONNECTORS		PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
X3  drives type **022 ÷ 060**	**X3**  drives type **090 ÷ 210**	1	**V+_IN**	Power supply 24 VDC	Input - power supply
		2	**V0_IN**	Power supply 0 VDC	Gnd - power supply

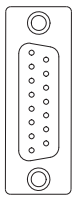
8.5 X6 connector - 24VDC output power supply - only for drives type **090 ÷ 210**

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
X6 	1	**V+_OUT**	Power supply 24 VDC	Output - power supply
	2	**V0_OUT**	Power supply 0 VDC	Gnd - power supply

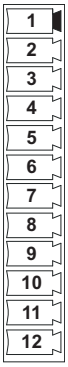
8.6 S1 connector - Safe Torque Off (STO) - only for **/K** option

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
S1 	1	**STO2_A**	Monitor for STO2 - second safety system channel When the terminal board is powered, the contact is open Voltage: max 60 VDC - Current: max 0,5 A	Output - on/off signal
	2	**STO2_B**		Output - on/off signal
	3	**NC**	-	Do not connect
	4	**+24V_STO2**	Power supply for STO2 - second safety system channel Voltage: +24 VDC ±10 % - Current: min 200 mA	Input - power supply
	5	**0V_STO2**		Gnd - power supply
	6	**NC**	-	Do not connect
	7	**STO1_A**	Monitor for STO1 - first safety system channel When the terminal board is powered, the contact is open Voltage: max 60 VDC - Current: max 0,5 A	Output - on/off signal
	8	**STO1_B**		Output - on/off signal
	9	**+24V_STO1**	Power supply for STO1 - first safety system channel Voltage: +24 VDC ±10 % - Current: min 200 mA	Input - power supply
	10	**0V_STO1**		Gnd - power supply

8.7 J2 connector - Servomotor resolver - DB15 - 15 pin

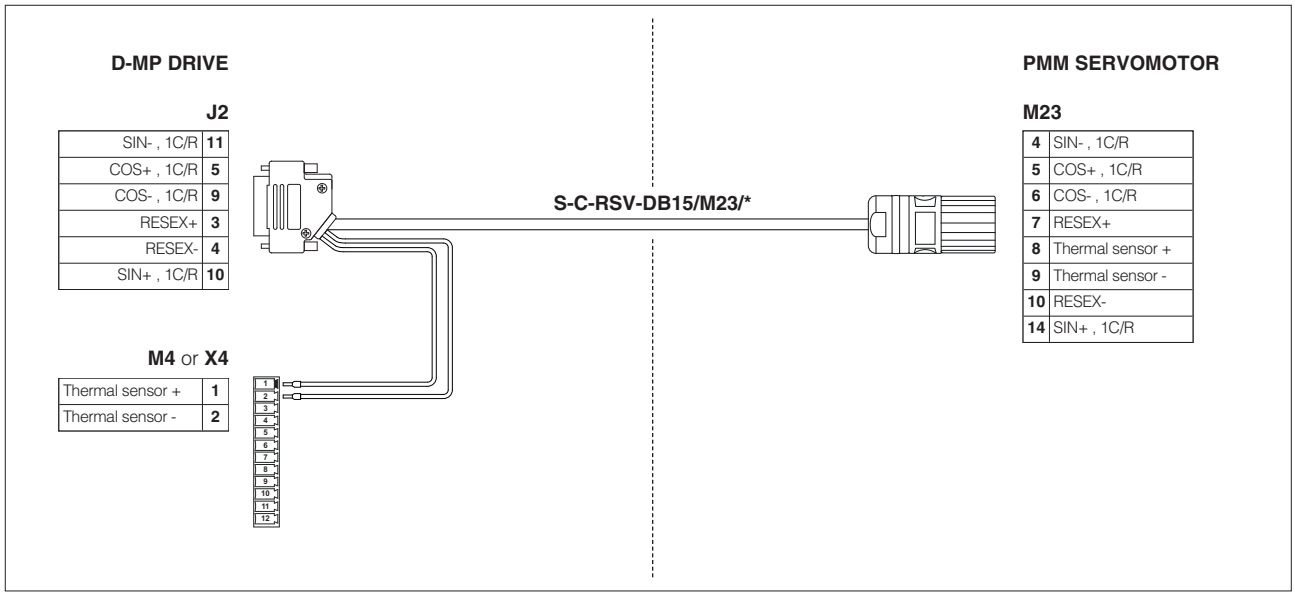
CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
J2  female (drive view)	1	**NC**	-	Do not connect
	2	**NC**	-	Do not connect
	3	**RESEX+**	Red	
	4	**RESEX-**	Blue	
	5	**COS+** , **1C/R**	Grey	
	6	**NC**	-	Do not connect
	7	**NC**	-	Do not connect
	8	**NC**	-	Do not connect
	9	**COS-** , **1C/R**	Pink	
	10	**SIN+** , **1C/R**	Yellow	
	11	**SIN-** , **1C/R**	Green	
	12	**NC**	-	Do not connect
	13	**NC**	-	Do not connect
	14	**NC**	-	Do not connect
	15	**NC**	-	Do not connect

8.8 M4 - X4 connector - Servomotor thermal sensor (1)

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
M4 - X4 	1	**Thermal sensor +**	Servomotor thermal sensor - positive input (KTY or PT)	Input - analog signal
	2	**Thermal sensor -**	Servomotor thermal sensor - negative input (KTY or PT)	Input - analog signal
	3	**GND**	Shield connection for PT or KTY cables	Common gnd
	4	**NC**	-	Do not connect
	5	**NC**	-	Do not connect
	6	**NC**	-	Do not connect
	7	**NC**	-	Do not connect
	8	**NC**	-	Do not connect
	9	**NC**	-	Do not connect
	10	**NC**	-	Do not connect
	11	**NC**	-	Do not connect
	12	**NC**	-	Do not connect

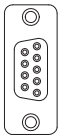
(1) M4 is for drives type 022 ÷ 060; X4 is for drives type 090 ÷ 210

Servomotor resolver cable connection - example - see tech table **AS810**



Note: for more information about PMM servomotor, please refer tech table **AS400**

8.9 J1 connector - Serial RS485 communication port - DB9 - 9 pin

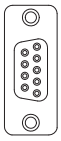
CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
J1  female (drive view)	1	**NC**	-	Do not connect
	2	**TX+**	Transmitter	
	3	**RX+**	Receiver	
	4	**NC**	-	Do not connect
	5	**NC**	-	Do not connect
	6	**TX-**	Transmitter	
	7	**RX-**	Receiver	
	8	**NC**	-	Do not connect
	9	**NC**	-	Do not connect

8.10 BUS2 and BUS1 connectors - CANopen (BC)

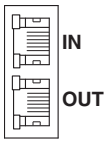
CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
BUS2  main	1	**CAN_H**	Bus line (high)	
	2	**CAN_L**	Bus line (low)	
	3	**CAN_GND**	Signal zero data line	
BUS1 	1	**CAN_H**	Bus line (high)	
	2	**CAN_L**	Bus line (low)	
	3	**CAN_GND**	Signal zero data line	

Note: on the board are present two dip-switch; one allows to terminate the fieldbus network while the other allows the simultaneous use of both connectors as input and output. For more information about setting dip-switch, please refer user manual.

8.11 BUS2 connector - PROFIBUS DP (BP)

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
BUS2 	1	**SHIELD**	Shield	
	2	**NC**	-	Do not connect
	3	**LINE_B**	Bus line (B)	
	4	**DE**	Control's signal for repeater	
	5	**DGND**	Data line and termination signal zero	
	6	**+5V**	Termination supply signal	
	7	**NC**	-	Do not connect
	8	**LINE_A**	Bus line (A)	
	9	**NC**	-	Do not connect

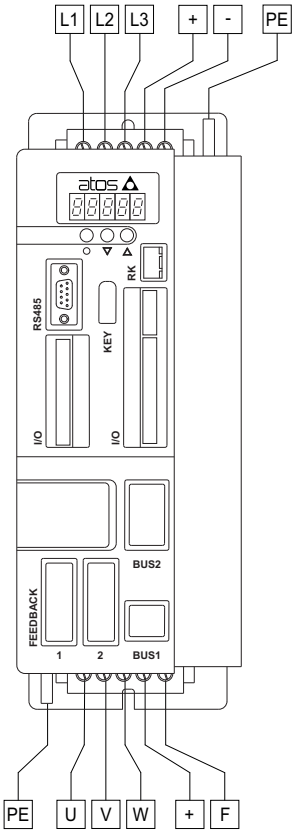
8.12 BUS2 connectors IN/OUT - Ethernet (EH, EP)

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
BUS2  **IN** **OUT**	1	**TX+**	Transmitter (white/orange)	
	2	**RX+**	Receiver (orange)	
	3	**TX-**	Transmitter (white/green)	
	4	**NC**	-	Do not connect
	5	**NC**	-	Do not connect
	6	**RX-**	Receiver (green)	
	7	**NC**	-	Do not connect
	8	**NC**	-	Do not connect

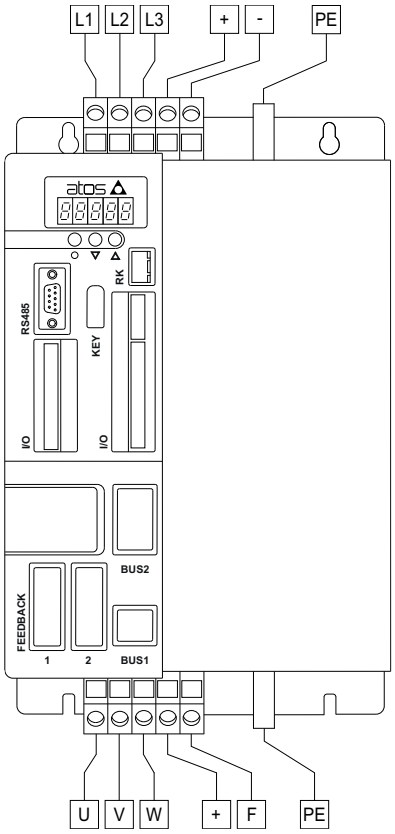
Note: perform the cables connection following the IN and OUT indications

9 DRIVE AND SERVOMOTOR POWER CONNECTIONS

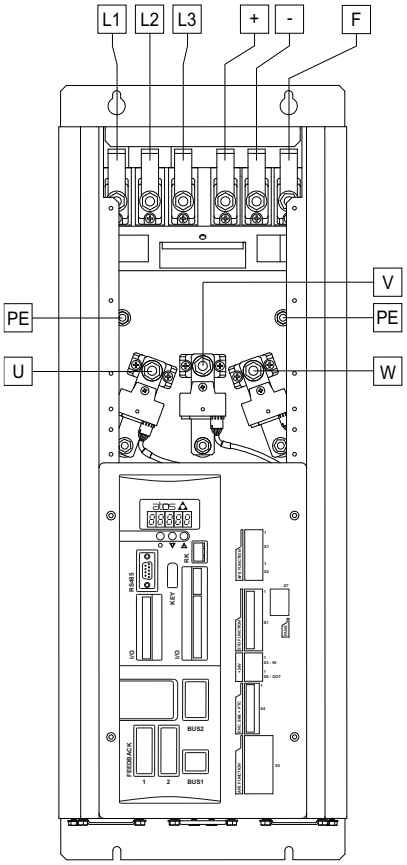
D-MP-*- **022**



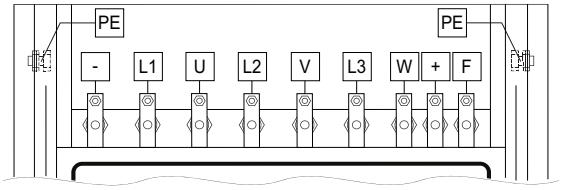
D-MP-*- **032**
D-MP-*- **046**
D-MP-*- **060**



D-MP-*- **090**
D-MP-*- **100**
D-MP-*- **140**



D-MP-*- **165**
D-MP-*- **210**

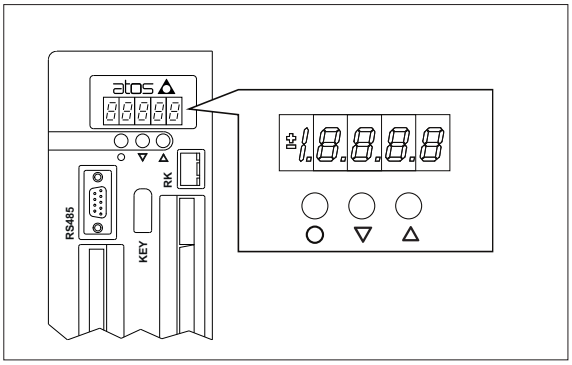


L1 **L2** **L3**	Drive power supply - input
U **V** **W**	Servomotor power supply - output (pass the cables through the toroid inside present, without the shield and ground)
+ **-**	DC Bus connection
+ **F**	Brake resistor connection
PE	Connection PE and shield

10 DISPLAY

On the drive front panel is available a numeric display to view the drive status: run or stop.

Note: the 3 keys, ● (S selection), ▼ (- decrease), ▲ (+ increase) are not used



11 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Atos digital drives are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **AS050** and in the user manuals included in the S-SW-SETUP programming software.
Generic electrical output signals of the drive (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

11.1 Drive power supply (L1, L2, L3)

The drive must be connected to the main power supply trought terminals L1, L2, L3 and with the ground cable connected to the PE stud (see section 9).
When connecting drives type 022 ÷ 60A to 3-phase supply mains we recommend using a 3-phase reactance (see tech table **AS810**).
For drives type 060 ÷ 210 the 3-phase input reactance is **mandatory**. The 3-phase reactance is used to reduce the current peaks on the diode bridge DB and the effective value of the current through the capacitors. It is also used to reduce interference from the supply line to the drive and from the drive to the line.
The drive must be wired steadily through appropriately sized cables (see section 13).

Notes: drives type 022 ÷ 060 feature a soft-start function built in the drive;
the reactance can be omitted only for particular cases (in this case contact Atos technical office)

⚠ A correct installation to the main power supply is required according to IEC 61800-5-1

⚠ Ultra-fast fuses must be installed between the main power supply and the drive (see section 14)

11.2 Servomotor power supply (U, V, W)

The servomotor must be connected to terminals U, V, W and with the ground cable connected to the PE stud (see section 9).
For drives type 090 ÷ 140 pass the servomotor 3-phase through the present toroid inside, without shield and ground. Connect the servomotor by means of shielded or armored cables only and ground the shield on the converter side as well as on servomotor side. If shielded cables cannot be used, the servomotor cables should be placed in a metallic raceway connected to ground.
Atos recommends to use a 3-phase reactance between the drive and the servomotor (see tech table **AS810**).
With cables longer than 50 meters, the reactance is obligatory.
Any short circuit between U, V, W will cause the drive to shut down. If the interruption between the servomotor and the drive is obtained by means of electromagnetic switches (such as contactors, thermal relays and the like) ensure that the drive is disabled before cutting off the connection between the servomotor and the drive (in order not to damage the contactors).
The servomotor must be wired steadily through appropriately sized cables (see section 13).

11.3 24VDC input power supply (V+_IN and V0_IN)

Through the pins 1 and 2 of the X3 connector (see 8.4) is possible to power the drive logic and servomotor sensor (mandatory for drives type 022 ÷ 060 no self powered).
The drives type 090 ÷ 210 generates internally an 24 VDC auxiliary supply through the main power supply; the drive logic can be supply through X3 connector with an external 24 VDC without produce conflict between the internally generated voltage and the auxiliary power supplied externally (is used the source with higher voltage level). This feature allows to configure the drive without main power supply and keep the drive logic switched on even in the absence of the drive main power supply.

11.4 24VDC output power supply (V+_OUT and V0_OUT)

Only for drives type 090 ÷ 210 the 24VDC output power supply is available on pins 1 and 2 of the X6 connector (see 8.5).
This voltage can be used only to provide an auxiliary supply for digital I/O to the drive and for /K option provides an auxiliary supply for STO channels function (the auxiliary supply must be interrupted by suitable safety contacts). The output current is internally limited to a 500mA; protection against external over-current and short-circuit.

11.5 Flow reference input signals (Q_INPUT+)

The drive is designed to receive an analog reference input signal (pin 11 on M1) for the servomotor rotation speed.
Flow reference input signal is factory preset, default is 0 ÷ 10 VDC. Input signal can be reconfigured between voltage and current within a maximum range of ±10 VDC or 4 ÷ 20 mA, using specific dip-switch present on the drive (see user manual).
Drive with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference).

11.6 Pressure reference input signal (P_INPUT+)

The drive is designed to receive an analog reference input signal (pin 12 on M3) for the system pressure.
Pressure reference input signal is factory preset, default is 0 ÷ 10 VDC. Input signal can be reconfigured between voltage and current within a maximum range of ±10 VDC or 4 ÷ 20 mA, using specific dip-switch present on the drive (see user manual).
Drive with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference).

11.7 Flow monitor output signal (Q_MONITOR)

The drive generates an analog output signal (pin 15 on M1) for servomotor actual rotation speed.
The monitor output signal can be software set to show other signals available in the drive (see user manual).

11.8 Pressure monitor output signal (P_MONITOR)

The drive generates an analog output signal (pin 15 on M3) to the system actual pressure.
The monitor output signal can be software set to show other signals available in the drive (see user manual).

11.9 Enable input signal (DI1)

To enable the servomotor control, supply a 24 VDC on pin 1 of the M1: Enable input signal allows to enable/disable servomotor control, without removing the electrical power supply to the drive; it is used to keep active the communication and the other driver functions when the drive must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.
Input is optoisolated from the internal regulation (24 VDC ±10% @ Imax 10 mA).

11.10 Multiple axis selection input signal (DI2 and DI3)

Two on-off input signals are available on pin 2 and pin 3 of the M1 connector to select one of the four axis parameters setting, stored into the drive.
Switching the active setting of axis during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.).
Supply a 24 VDC or a 0 VDC on pin 2 and/or pin 3 of the M1, to select one of the PID settings as indicated by binary code table at side.
Input is optoisolated from the internal regulation (24 VDC ±10% @ Imax 10 mA).

	AXIS SELECTION			
PIN	SET 1	SET 2	SET 3	SET 4
M1-2	0	24 VDC	0	24 VDC
M1-3	0	0	24 VDC	24 VDC

11.11 Alarm reset input signal (DI4)

Alarm reset input signal allows to clear all alarms present into the drive: to reset the drive alarms, supply 24 VDC on pin 4 of the M1.
Input is optoisolated from the internal regulation (24 VDC ±10% @ Imax 10 mA).

11.12 Fault output signal (DO1)

Fault output signal (pin 6 on M1) indicates fault conditions of the drive (reference or transducer signal cable broken, maximum error exceeded, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the status of the Enable input signal.
This output signal can be used as digital output by software selection.
Note: digital output with fast contact (max 5 kHz)

11.13 Pump overheat protection output signal (DO2)

This output signal (pin 8 on M1) indicates the working conditions to which the internal gear pump (PGI*) is subject to rapid overheating.
In case of /D option (see **AS100**) this digital output condition can be used to manage (using an external relay) the JO-DL cartridge installed on the manifold block.
Pump overheat protection presence of the pump corresponds to 24 VDC, normal working corresponds to 0 VDC.
Pump overheat protection logical output signal is not intended as a fault condition.
This output signal can be used as digital output by software selection.
Note: digital output with relay contact

11.14 Enable pressure input signal (DI5)

By default, the P/Q control is always active.
Through S-SW-SETUP software, it's possible to modify the configuration of the drive so that the P/Q control can be enabled/disabled via this digital input:
- when digital input is set to 0VDC, P/Q control is disabled and the drive performs just flow control
- when digital input is set to 24VDC, P/Q control is enabled and the drive performs flow and pressure control

Input is optoisolated from the internal regulation (24 VDC ±10% @ Imax 10 mA).

11.15 Smart tuning selection input signals (DI6 and DI7)

Smart tuning setting can be switched from Dynamic (default) to Balanced or Smooth via software, fieldbus or using DI6 and DI7 digital inputs (pin 2 and 3 on M3), as shown at side; if requested, performances can be further customized directly tuning each single PID control parameter.

	SMART TUNING SELECTION		
PIN	**DYNAMIC**	**BALANCED**	**SMOOTH**
M3-2	0	24 VDC	0
M3-3	0	0	24 VDC

11.16 Pressure control active output signal (DO3)

Pressure control active output signal (pin 6 on M3) indicates the P/Q control status.
The pressure control active corresponds to 24 VDC, while not active corresponds to 0 VDC.
Pressure control status is not affected by the status of the Enable pressure input signal.
Pressure control output signal can be used as digital output by software selection.
Note: digital output with fast contact (max 5 kHz)

11.17 Pressure target reached output signal (DO4)

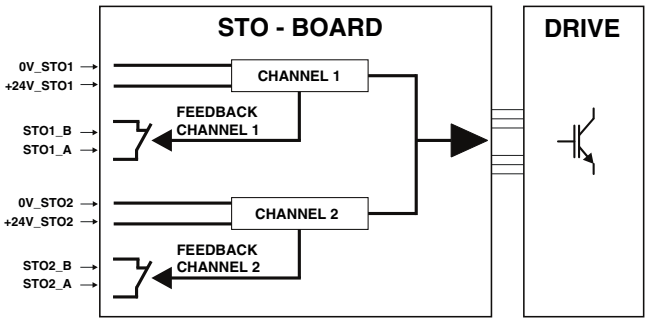
This output signal (pin 8 on M3) indicates if the pressure target has been reached.
The pressure target reached corresponds to 24 VDC, while not reached corresponds to 0 VDC.
Pressure target reached output signal can be used as digital output by software selection.
Note: digital output with relay contact

11.18 Remote pressure transducer input signals (TR1)

Analog remote pressure transducers can be directly connected to the drive.
Analog input signal (pin 14 on M3) is factory preset, default is 0 ÷ 10 VDC. Input signal can be reconfigured between voltage and current within a maximum range of ±10 VDC or 4 ÷ 20 mA, using specific dip-switch present on the drive (see user manual).
Refer to pressure transducer characteristics to select the transducer type according to specific application requirements.

12 OPTIONS

K = The drive implements the Safe Torque Off (STO) function as a prevention of unexpected starts according to 2006/42/EC Machinery Directive (MD) - standard EN 61800-5-2.
This function prevents the generation of a rotating magnetic field removing the power semiconductor control voltage allowing short-term operations (such as cleaning and / or maintenance work on parts of non-electrical devices of the machine) without disconnecting drive power supply or the connection between the drive and the servomotor.
The STO function is implemented using two redundant channels each having its own signal feedback accessible from the outside, available on the S1 connector (see 8.6).
For detailed descriptions, please refer to the user manual.



The following table resumes the STO enabling/disabling conditions according to the drives size:

	drive size 022 ÷ 140					drive size 165 ÷ 210				
	+24V_STO1	**STO1**	**+24V_STO2**	**STO2**	**STO Active**	**+24V_STO1**	**STO1**	**+24V_STO2**	**STO2**	**STO Active**
STO OFF	+24V	OPEN	+24V	OPEN	OFF	+24V	OPEN	+24V	OPEN	OFF
STO ON	+24V	OPEN	+24V	CLOSE	(*)	0V	CLOSE	0V	CLOSE	ON
	0V	CLOSE	0V	OPEN	ON					
	0V	CLOSE	0V	CLOSE	ON					

13 POWER AND PROTECTION CABLES SIZE

Drive type	Servomotor type (1)	Power Cables (mm^2)		Protection Cables (mm^2)		Max length [m]
		drive **L1 - L2 - L3**	servomotor **U - V - W**	drive **PE**	servomotor **PE**	drive and servomotor
D-MP-*-022	PMM-*009	6	6	6	6	20
D-MP-*-032	PMM-*015	10	10	10	10	
D-MP-*-046	PMM-*024	16	25	16	25	
D-MP-*-060	PMM-*032	25	25	25	25	
D-MP-*-090	PMM-*042	35	35	25	25	
D-MP-*-100	PMM-*055	50	70	35	35	
D-MP-*-140		70	70	50	35	
D-MP-*-165	PMM-*080	120	120	70	70	
D-MP-*-210	PMM-*100					

(1) For more information about PMM servomotor, please refer tech table **AS400**

14 FUSES

Drive type	Fuses - Min and Max value **(2)** [A]	Voltage [AC]	I2 T Maximum (A2s) for AC input
D-MP-*-022	25 - 40 (40 - 63)	480	1200
D-MP-*-032	40 - 63 (63 - 80)	480	1200
D-MP-*-046	50 - 80 (100 - 200)	480	3900
D-MP-*-060	80 - 100 (125 - 315)	480	3900
D-MP-*-090 **(1)**	100 - 140 (160 - 450)	480	9000
D-MP-*-100 **(1)**	125 - 160 (200 - 630)	480	40000
D-MP-*-140 **(1)**	160 - 200 (315 - 700)	480	62500
D-MP-*-165 **(1)**	200 - 250 (350 - 1000)	480	62500
D-MP-*-210 **(1)**	250 - 315 (400 - 1250)	480	160000

WARNING: the minimum values of the fuses are calculated for the drive that delivers the rated power

Notes:
- all fuses must be ultra-fast type
- the fuses are calculated for a minimum short-circuit current of 10 times the rated current; the maximum short-circuit current must not be greater than 20 times the rated current

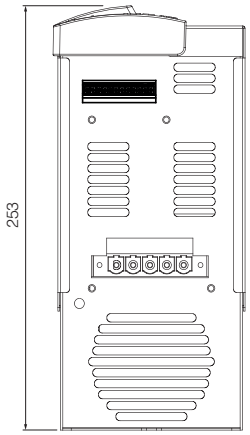
(1) The fuse rated current must be greater than the rated input current
(2) In brackets input fuses with DC Bus connection

15 OVERALL DIMENSIONS [mm]

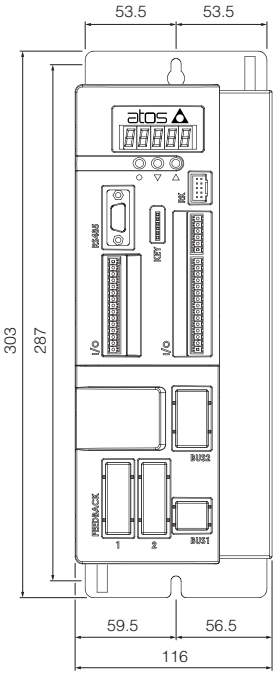
Mass [kg]	
D-MP-*-022	5.5
D-MP-*-032	6.4

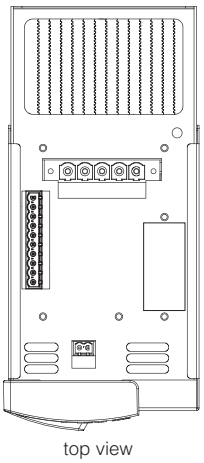
D-MP-*-022

Fixing screws = M4



bottom view

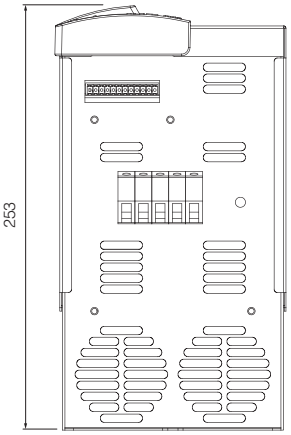




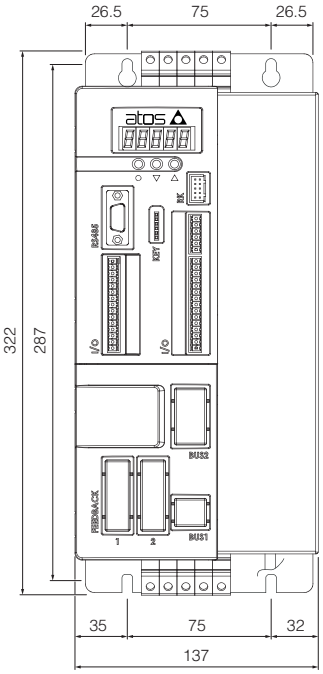
top view

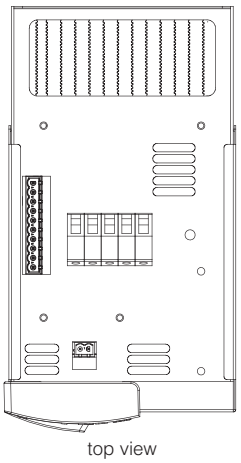
D-MP-*-032

Fixing screws = M4



bottom view



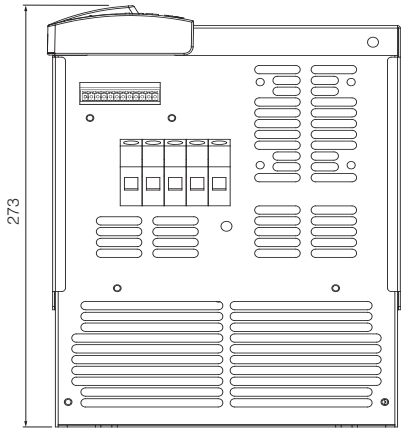


top view

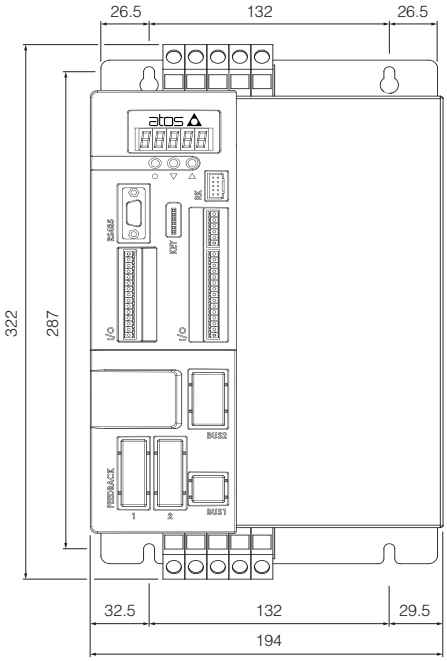
D-MP-*-046
D-MP-*-060

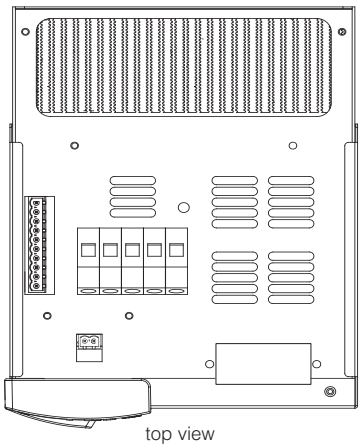
Fixing screws = M4

Mass [kg]	
D-MP-*-046	9.3
D-MP-*-060	10



bottom view



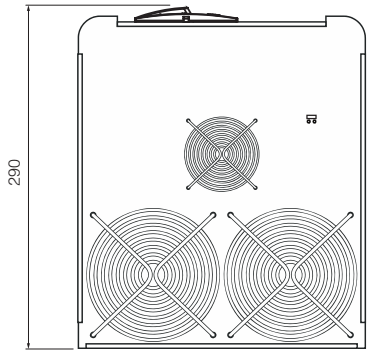


top view

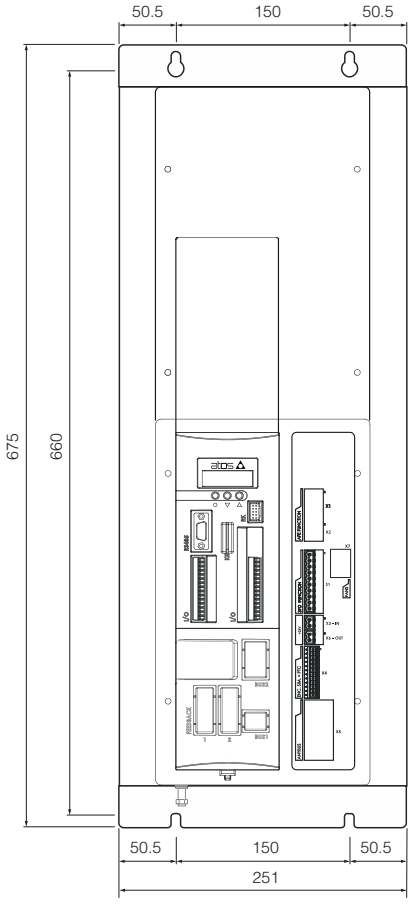
D-MP-*-090
D-MP-*-100
D-MP-*-140

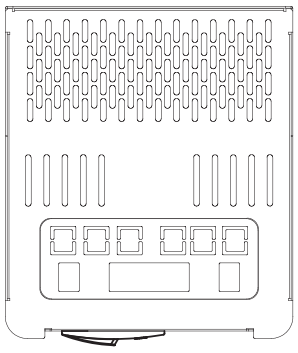
Fixing screws = M6

Mass [kg]	
D-MP-*-090	22
D-MP-*-100	
D-MP-*-140	



bottom view



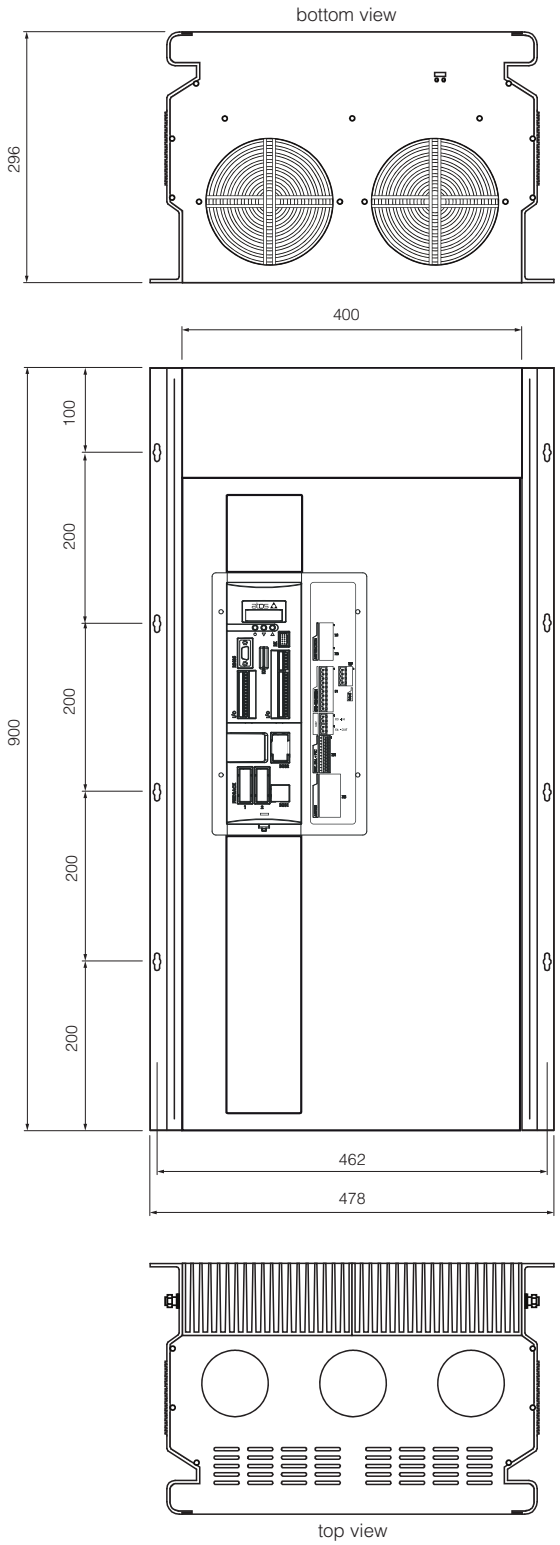


top view

D-MP-*-165
D-MP-*-210

Fixing screws = M4

Mass [kg]	
D-MP-*-165	65
D-MP-*-210	

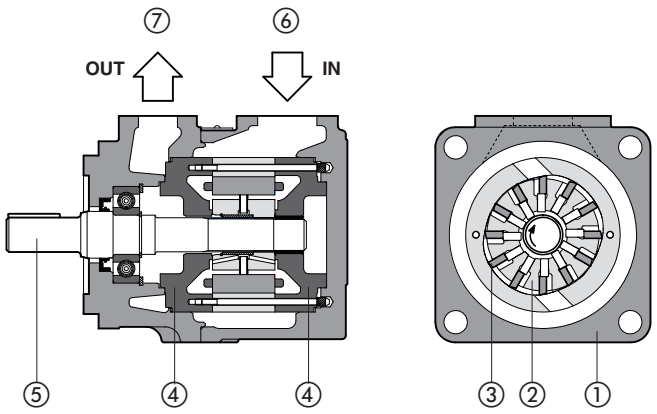


16 RELATED DOCUMENTATION

AS050	Basics for Smart Servopumps - SSP
AS100	SSP Smart Servopumps
AS200	Sizing criteria for servopumps
AS300	PGI cast iron internal gear pumps, high pressure
AS350	PGIL aluminium internal gear pumps
AS400	PMM high performance synchronous servomotors
AS510	Fieldbus
AS800	Programming tools for pumps & servopumps
AS810	Accessories for servopumps
AS910	Operating and maintenance information for servopumps
S-MAN-HW	Servopumps installation manual
S-MAN-SW	Servopumps programming software manual
S-MAN-STO	Servopumps Safe Torque Off manual

Vane pumps type PFE-31, PFE-41, PFE-51

fixed displacement - cartridge design



PFE-41

① Pump body
②③ Rotor with vanes
④ Balanced plates
⑤ Shaft
⑥ IN port - SAE 3000 flange
⑦ OUT port - SAE 3000 flange

PFE-*1 are fixed displacement vane pumps, ② ③ cartridge design with integral hydraulic balancing ④ for high volumetric efficency, long service life and low noise level.

They are available in three different body sizes with max displacements up to 44, 85 and 150 cm³/rev and single, multiple or with through-shaft configurations.

Mounting flange according to SAE J744 standard.

Inlet and outlet ports can be oriented in four different positions to match any installation requirement.

Simplified maintenance as the pumping cartridge can be easily replaced.

Max displacement: **up to 150 cm³/rev**
Max pressure: **210 bar**

1 MODEL CODE OF SINGLE PUMPS

PFE	XA	- 31	036 / 1	D	T	* /	*

PFE
Fixed displacement vane pump

XA — **Option for pumps with through shaft**, see section 3:
XA, XA7, XB, XB7, XC = for coupling with other pumps type PFE
XO = with through shaft, without rear flange

31 — **Size,** see section 2:
31, 41, 51

036 — **Displacement (cm³/rev),** see section 2

1 — **Drive shaft,** see section 8 and 9:
cylindrical, keyed
1 = standard
2 = long version - only for PFE-41 and PFE-51
3 = for high torque applications
splined:
5 = for single and multiple pumps (any position)
6 = for single and multiple pumps (only first position) } only for PFE-31 and PFE-41
7 = for second and third position in multiple pumps

D — **Direction of rotation,** viewed from the shaft end:
D = clockwise (supplied standard if not otherwise specified)
S = counterclockwise

T — **Port orientation,** see section 6:
T = standard
U, V, W = on request

***** — Series number

***** — **Seals material**:
- = NBR
PE = FKM

Note: for multiple pumps factory assembled, see tech. table A190

2 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Size code		31						41						51			
Displacement code		**010**	**016**	**022**	**028**	**036**	**044**	**029**	**037**	**045**	**056**	**070**	**085**	**090**	**110**	**129**	**150**
Displacement	(cm³/rev)	10.5	16.5	21.6	28.1	35.6	43.7	29.3	36.6	45.0	55.8	69.9	85.3	90.0	109.6	129.2	150.2
Max working pressure (1)	(bar)	160	210														
Recommended pressure on inlet port		from -0,15 to 1,5 bar for speed up to 1800 rpm; from 0 to +1,5 bar for speed over 1800 rpm															
Min speed	(rpm)	800															
Max speed (2)	(rpm)	2400	2800	2800	2800	2800	2500	2500	2500	2500	2500	2500	2000	2200	2200	2200	1800
Volumetric efficiency (3)		80	83	87	90	90	92	90	92	93	93	93	94	93	93	93	94
Noise level (3)	(dBA)	62	62	63	63	63	64	67	67	68	68	69	69	72	72	73	74

(1) Max pressure is 160 bar for HFDU, HFDR and HFC fluids
(2) Max speed is 1800 rpm for /PE versions; 1500 rpm for HFDU, HFDR and HFC fluids
(3) Measuring data with: n = 1450 rpm; P = 140 bar;

3 OPTION FOR PUMPS WITH THROUGH SHAFT

Pump size	**PFE-31**	**PFE-41**				**PFE-51**				
Through shaft option type	**XA**	**XA**	**XB**	**XA7**	**XB7**	**XA**	**XB**	**XC**	**XA7**	**XB7**
Splined coupling characteristics	SAE 16/32-9T	SAE 16/32-9T	SAE 16/32-13T	SAE 16/32-13T	SAE 12/24-14T	SAE 16/32-14T	SAE 13/32-13T	SAE 12/24-14T	SAE 16/32-13T	SAE 12/24-14T
2nd pump	PFE-3* shaft type 5	PFE-3* shaft type 5	PFE-4* shaft type 5	PFE-3* shaft type 7	PFE-4* shaft type 7	PFE-3* shaft type 5	PFE-4* shaft type 5	PFE-5* shaft type 5	PFE-3* shaft type 7	PFE-4* shaft type 7

4 GENERAL CHARACTERISTICS

Assembly position	Any position.
Loads on the shaft	Axial and radial loads are not allowed on the shaft. The coupling should be sized to absorb the power peak.
Ambient temperature range	-20°C ÷ +80°C
Compliance	REACH Regulation (EC) n°1907/2006 RoHS Directive 2011/65/EU as last update by 2015/863/EU

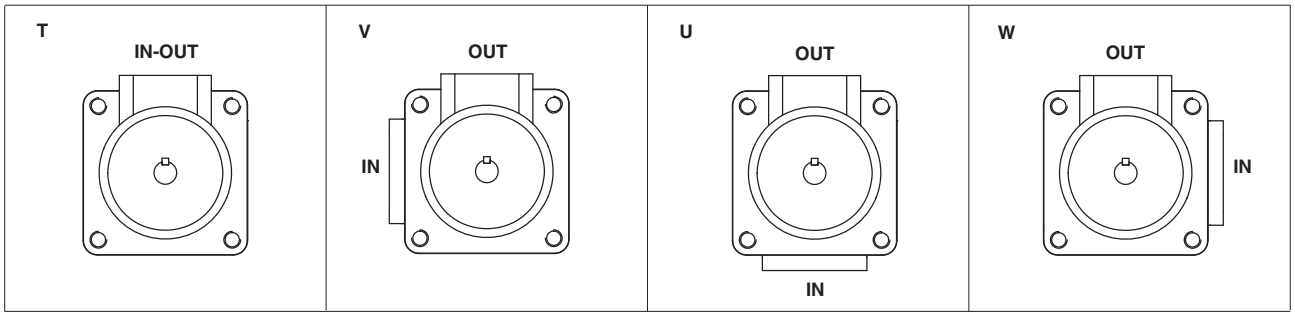
5 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -25°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C		
Recommended viscosity		10÷100 mm²/s - max at cold start 800 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 21/19/16 NAS1638 class 10		see also filter section at or KTF catalog
	longer life	ISO4406 class 18/16/13 NAS1638 class 8		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR **(1)**	ISO 12922
Flame resistant with water		NBR	HFC **(1)**	

(1) See performance restrictions at section 2

6 PORT ORIENTATION

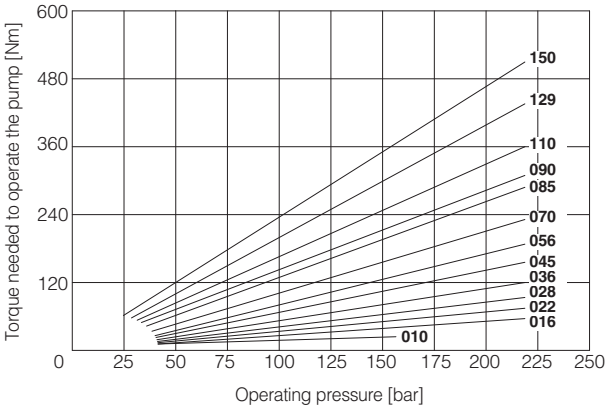
Single pumps can be supplied with oil ports oriented in different configuration in relation to the drive shaft, as follows (wiewed from the shaft end);
Ports orientation can be easily changed by rotating the pump body that carries inlet port.



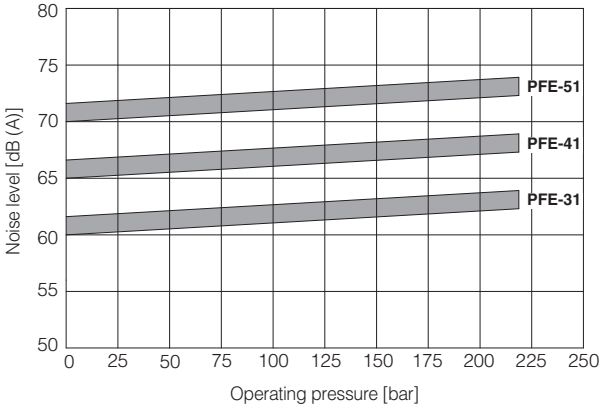
OUT = outlet port; **IN** = inlet port

7 DIAGRAMS (based on mineral oil ISO VG 46 at 50°C)

Torque versus pressure diagram

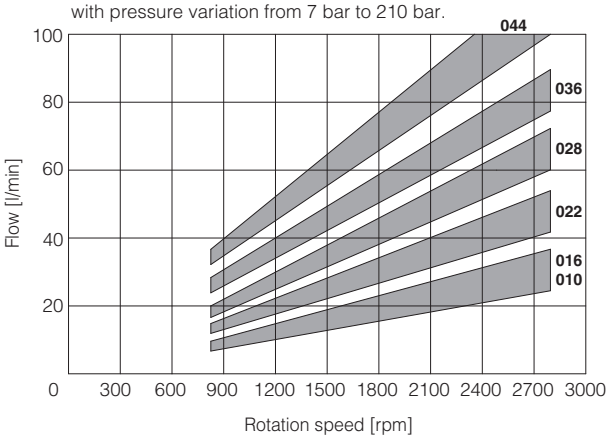


Noise levels

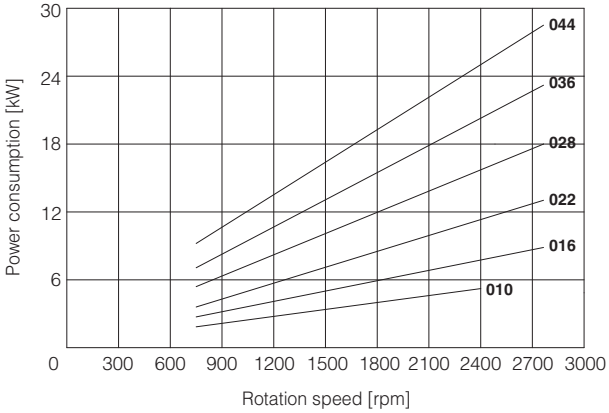


PFE-31:

Flow versus speed diagram
with pressure variation from 7 bar to 210 bar.

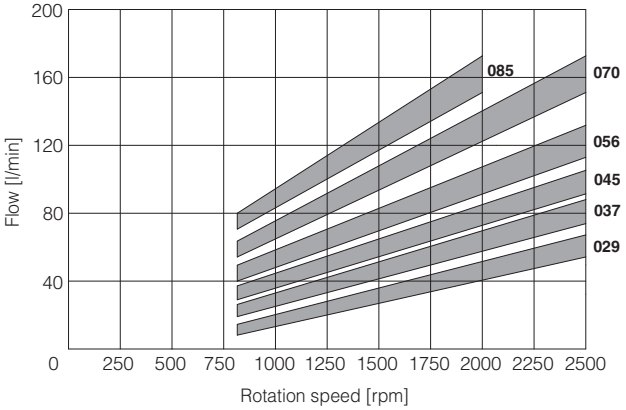


Power consumption versus speed diagram at 140 bar.
Power consumption is proportional to operating pressure.

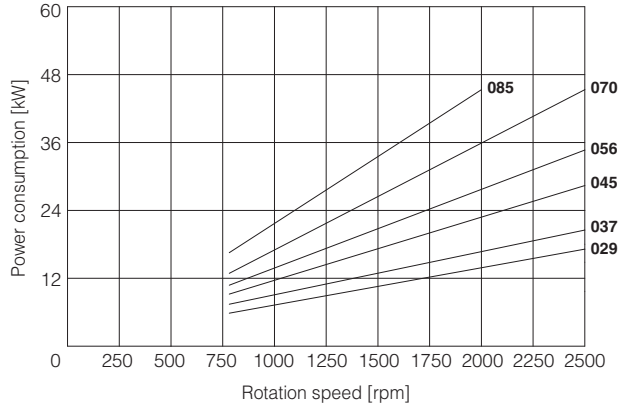


PFE-41:

Flow versus speed diagram
with pressure variation from 7 bar to 210 bar.

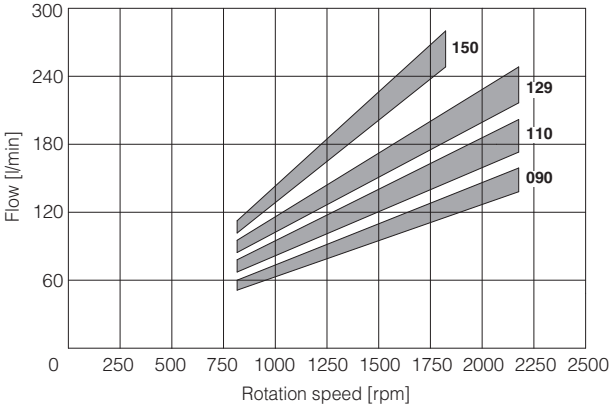


Power consumption versus speed diagram at 140 bar.
Power consumption is proportional to operating pressure.

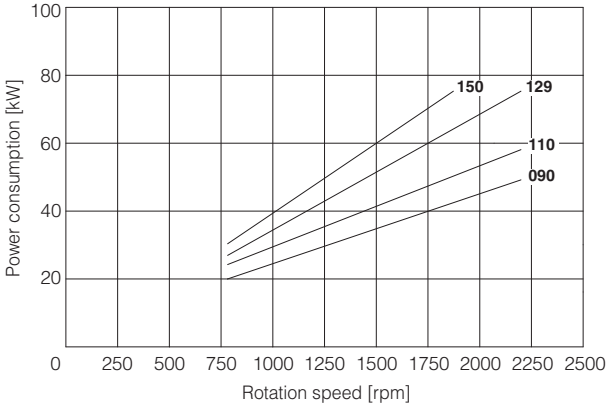


PFE-51:

Flow versus speed diagram
with pressure variation from 7 bar to 210 bar.



Power consumption versus speed diagram at 140 bar.
Power consumption is proportional to operating pressure.



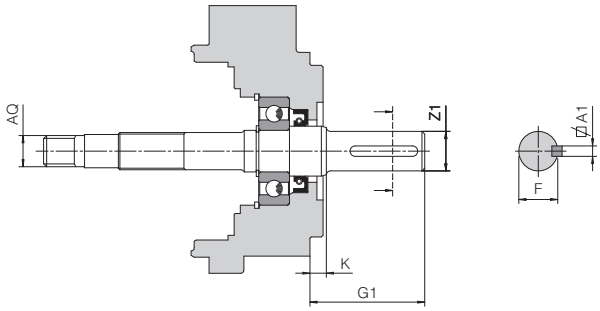
8 DRIVE SHAFT

CYLINDRICAL SHAFT KEYED

1 = for single and multiple pumps (only first position)

2 = for single and multiple pumps (only first position) long version (only for PFE-41 and PFE-51)

3 = for single and multiple pumps (only first position) for high torque applications



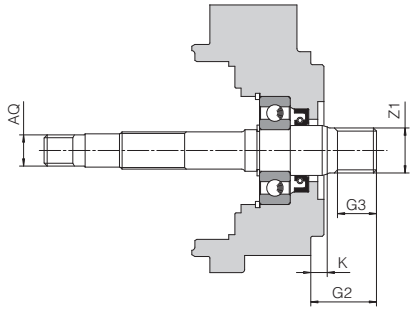
Pump size	Keyed shaft type 1 (standard)						Keyed shaft type 2						Keyed shaft type 3					
	A1	F	G1	K	ØZ1	Only for through shaft execution Ø AQ	A1	F	G1	K	ØZ1	Only for through shaft execution Ø AQ	A1	F	G1	K	ØZ1	Only for through shaft execution Ø AQ
PFE-31	4,78	21,11	56,00	8,00	19,05	SAE 16/32-9T	–	–	–	–	–	–	4,78	24,54	56,00	8,00	22,22	SAE 16/32-9T
	4,75	20,94			19,00								4,75	24,41			22,20	
PFE-41	4,78	24,54	59,00	11,40	22,22	SAE 32/64-24T	6,36	25,03	71,00	8,00	22,22	SAE 32/64-24T	6,38	28,30	78,00	11,40	25,38	SAE 32/64-24T
	4,75	24,41			22,20		6,35	24,77			22,20		6,35	28,10			25,36	
PFE-51	7,97	35,33	73,00	14	31,75	SAE 16/32-13T	7,95	35,33	84,00	8,10	31,75	SAE 16/32-13T	7,97	38,58	84,00	14	34,90	SAE 16/32-13T
	7,94	35,07			31,70		7,94	35,07			31,70		7,94	38,46			34,88	

SPLINED SHAFT

5 = for single and multiple pumps (any position)
for PFE-31 according to SAE A 16/32 DP, 9 teeth;
for PFE-41 according to SAE B 16/32 DP, 13 teeth;
for PFE-51 according to SAE C 12/24 DP, 14 teeth;

6 = for single and multiple pumps (only first position)
for PFE-31 and PFEX*-31 according to SAE B 16/32 DP, 13 teeth;
for PFE-41 and PFEX*-41 according to SAE C 12/24 DP, 14 teeth;

7 = for second and third position pump in multiple configuration:
for PFEX*-31 according to SAE B 16/32 DP, 13 teeth;
for PFEX*-41 according to SAE C 12/24 DP, 14 teeth;



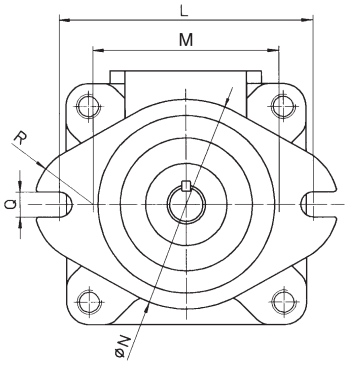
Pump size	Splined shaft type 5					Splined shaft type 6					Splined shaft type 7				
	G2	G3	K	Z1	Only for through shaft execution Ø AQ	G2	G3	K	Z1	Only for through shaft execution Ø AQ	G2	G3	K	Z1	Only for through shaft execution Ø AQ
PFE-31	32,00	19,50	6,50	SAE 16/32-9T	SAE 16/32-9T	41,00	28	8,00	SAE 16/32-13T	SAE 16/32-9T	32,00	19	8,00	SAE 16/32-13T	SAE 16/32-9T
PFE-41	41,25	28	8,00	SAE 16/32-13T	SAE 32/64-24T	55,60	42	8,00	SAE 12/24-14T	SAE 32/64-24T	41,60	28	8,00	SAE 12/24-14T	SAE 32/64-24T
PFE-51	56,00	42	8,10	SAE 12/24-14T	SAE 16/32-13T	–	–	–	–	–	–	–	–	–	–

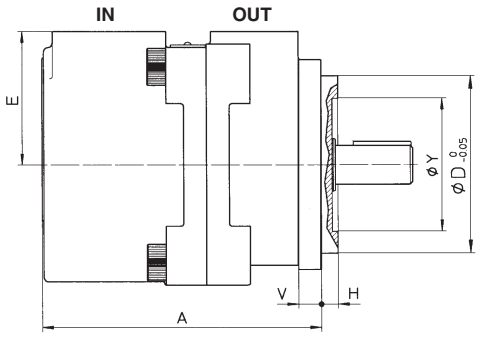
9 LIMITS OF SHAFT TORQUE

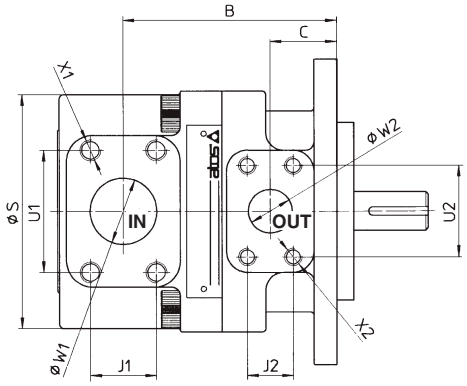
Pump size	Maximum driving torque [Nm]						Maximum torque available at the end of the through shaft [Nm]
	Shaft type 1	Shaft type 2	Shaft type 3	Shaft type 5	Shaft type 6	Shaft type 7	Any type of shaft
PFE-31	160	–	240	110	240	240	130
PFE-41	250	250	400	200	400	400	250
PFE-51	500	500	850	450	–	–	400

The values of torque required to operate the pumps are shown for each type on the “torque versus pressure” diagram at section 6.
In multiple pumps the total torque applied to the shaft of the first element (drive shaft) is the sum of the single torque needed for operating each single pump and it is necessary to verify that this total torque applied to the drive shaft is not higher than the values indicated in the table.

10 DIMENSIONS OF SINGLE PUMPS [mm]







PORTS DIMENSION (SAE 3000)

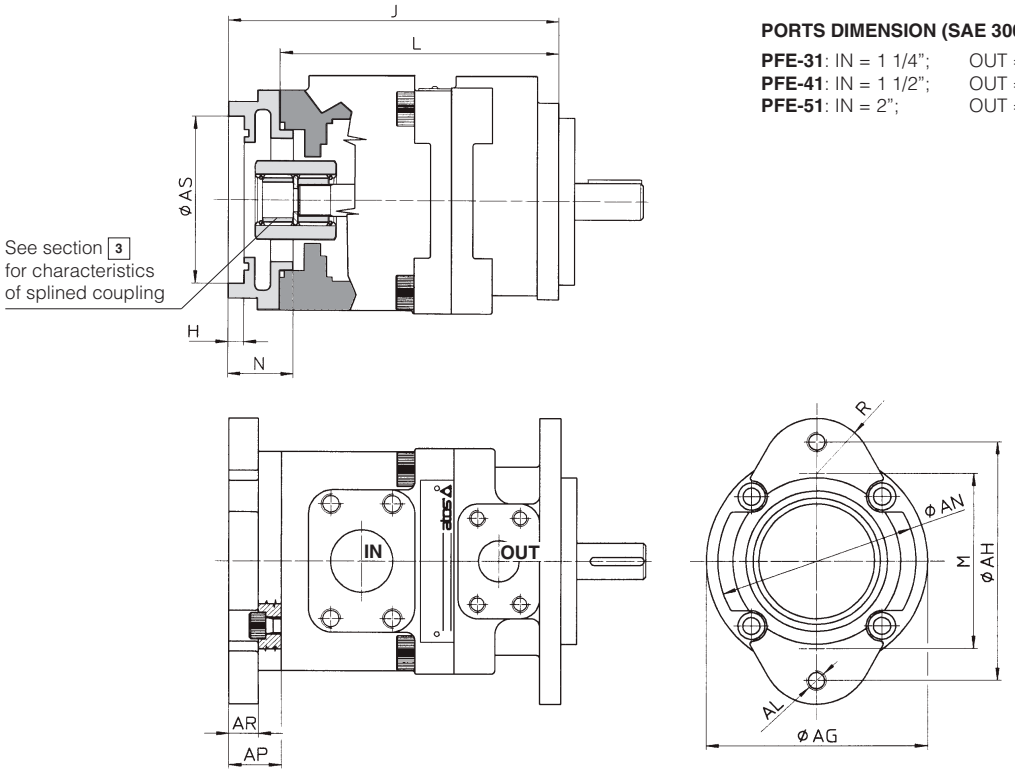
PFE-31: IN = 1 1/4"; OUT = 3/4"
PFE-41: IN = 1 1/2"; OUT = 1"
PFE-51: IN = 2"; OUT = 1 1/4"

Mass:

PFE-31 = 9 kg
PFE-41 = 14 kg
PFE-51 = 25,5 kg

Pump size	A	B	C	ØD	E	H	L	M	ØN	Q	R
PFE-31	136	100	28	82,55	70	6,4	106	73	95	11,1	28,5
PFE-41	160	120	38	101,6	76,2	9,7	146	107	120	14,3	34
PFE-51	186,5	125	38	127	82,6	12,7	181	143,5	148	17,5	35
Pump size	**ØS**	**U1**	**U2**	**V**	**ØW1**	**ØW2**	**J1**	**J2**	**X1**	**X2**	**ØY**
PFE-31	114	58,7	47,6	10	32	19	30,2	22,2	M10X20	M10X17	47
PFE-41	134	70	52,4	13	38	25	35,7	26,2	M12X20	M10X17	76
PFE-51	160	77,8	58,7	15	51	32	42,9	30,2	M12X20	M10X20	76

11 DIMENSIONS OF PUMPS WITH THROUGH-SHAFT (XA*, XB*, XC options) [mm]



PORTS DIMENSION (SAE 3000)

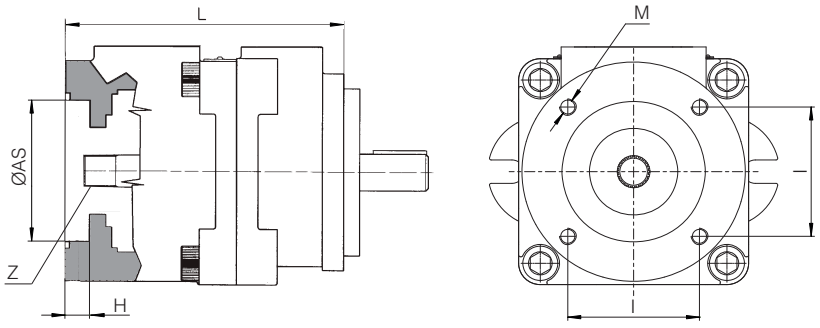
PFE-31: IN = 1 1/4"; OUT = 3/4"
PFE-41: IN = 1 1/2"; OUT = 1"
PFE-51: IN = 2"; OUT = 1 1/4"

For other dimensions, see section 10

Pump size	Ø AG	Ø AH	AL	Tightening torque (Nm) (1)	Ø AN	AP	AR	Ø AS	H	J	L	M	N	R
PFEXA-31	114	106	M10X17	70	95	33	25	82,57 82,63	6,42 6,47	165,5	132,5	79	32	28,5
PFEXA-41	134	106	M10X17	70	95	23	11	82,57 82,63	6,42 6,47	194	171	73	32	28,5
PFEXB-41	134	146	M12	125	120	32	18	101,62 101,68	9,73 9,78	203	171	107	41	34
PFEXA-51	134	106	M10X17	70	95	22,7	11	82,57 82,63	6,42 6,47	206,2	183,5	73	32	28,5
PFEXB-51	134	146	M12	125	120	32	18	101,62 101,68	9,73 9,78	215,5	183,5	107	41	34
PFEXC-51	134	181	M16	300	148	46,5	30,7	127,02 127,02	12,73 12,78	230	183,5	143,5	56	35

(1) Tightening torque for screw class 12.9

12 DIMENSIONS OF PUMPS WITH THROUGH SHAFT, WITHOUT REAR FLANGE (XO option) [mm]



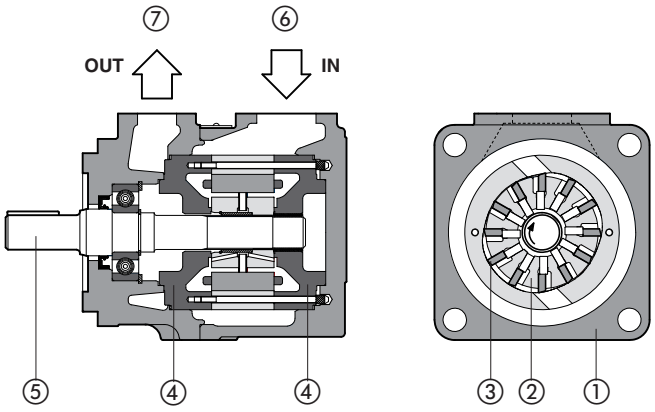
Pump size	L	Ø AS	H	M	I	Z
PFEXO-31	132.5	$60\ ^{+0.03}_{0}$	6.5	n°4 M6x13(max)	70	SAE 16/32-9T x15mm
PFEXO-41	171	$86\ ^{+0.035}_{0}$	15	n°4 M10x17(max)	79	SAE 32/64-24T x20mm
PFEXO-51	183.5	$86\ ^{+0.035}_{0}$	15	n°4 M10x17(max)	79	SAE 16/32-13T x20mm

13 RELATED DOCUMENTATION

A900	Operating and maintenance information for pumps

Vane pumps type PFE-32, PFE-42, PFE-52

fixed displacement - cartridge design - high pressure



PFE-42

① Pump body
②③ Rotor with vanes
④ Balanced plates
⑤ Shaft
⑥ IN port - SAE 3000 flange
⑦ OUT port - SAE 3000 flange

PFE-*2 are high pressure fixed displacement vane pumps, ② ③ cartridge design with integral hydraulic balancing ④ for high volumetric efficency, long service life and low noise level.

They are available in three different body sizes with max displacements up to 44, 85 and 150 cm³/rev and single, multiple or with through-shaft configurations.

Mounting flange according to SAE J744 standard.

Inlet and outlet ports can be oriented in four different positions to match any installation requirement.

Simplified maintenance as the pumping cartridge can be easily replaced.

Max displacement: **up to 150 cm³/rev**
Max pressure: **300 bar**

1 MODEL CODE OF SINGLE PUMPS

PFE	XA	- 32	036	/ 1	D	T	*	/ *

PFE: Fixed displacement vane pump

Option for pumps with through shaft, see section 3:
XA, XA7, XB, XB7, XC = for coupling with other pumps type PFE
XO = with through shaft, without rear flange

Size, see section 2:
32, 42, 52

Displacement (cm³/rev), see section 2

Drive shaft, see section 8 and 9:
cylindrical, keyed
3 = for high torque applications
splined:
5 = for single and multiple pumps (any position)
6 = for single and multiple pumps (only first position) } only for PFE-32 and PFE-42
7 = for second and third position in multiple pumps

Direction of rotation, viewed from the shaft end:
D = clockwise (supplied standard if not otherwise specified)
S = counterclockwise

Port orientation, see section 6:
T = standard
U, V, W = on request

Series number

Seals material:
- = NBR
PE = FKM

Note: for multiple pumps factory assembled, see tech. table A190

2 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Size code		32				42				52			
Displacement code		**016**	**022**	**028**	**036**	**045**	**056**	**070**	**085**	**090**	**110**	**129**	**150**
Displacement	(cm³/rev)	16.5	21.6	28.1	35.6	45.0	55.8	69.9	85.3	90.0	109.6	129.2	150.2
Max working pressure (1)	(bar)	210	300			280		250	210	250			210
Recommended pressure on inlet port		from -0,15 to 1,5 bar for speed up to 1800 rpm; from 0 to +1,5 bar for speed over 1800 rpm											
Min speed	(rpm)	1000	1200			1000			800	1000			800
Max speed (2)	(rpm)	2500	2500			2200			2000	2000			1800
Volumetric efficiency (3)		86	87	90	90	93	93	93	94	93	93	93	94
Noise level (3)	(dBA)	62	63	63	63	66	66	67	67	71	71	72	72

(1) Max pressure is 160 bar for HFDU, HFDR and HFC fluids
(2) Max speed is 1800 rpm for /PE versions; 1500 rpm for HFDU, HFDR and HFC fluids
(3) Measuring data with: n = 1450 rpm; P = 140 bar;

3 OPTION FOR PUMPS WITH THROUGH SHAFT

Pump size	**PFE-32**	**PFE-42**				**PFE-52**				
Through shaft option type	**XA**	**XA**	**XB**	**XA7**	**XB7**	**XA**	**XB**	**XC**	**XA7**	**XB7**
Splined coupling characteristics	SAE 16/32-9T	SAE 16/32-9T	SAE 16/32-13T	SAE 16/32-13T	SAE 12/24-14T	SAE 16/32-14T	SAE 13/32-13T	SAE 12/24-14T	SAE 16/32-13T	SAE 12/24-14T
2nd pump	PFE-3* shaft type 5	PFE-3* shaft type 5	PFE-4* shaft type 5	PFE-3* shaft type 7	PFE-4* shaft type 7	PFE-3* shaft type 5	PFE-4* shaft type 5	PFE-5* shaft type 5	PFE-3* shaft type 7	PFE-4* shaft type 7

4 GENERAL CHARACTERISTICS

Assembly position	Any position.
Loads on the shaft	Axial and radial loads are not allowed on the shaft. The coupling should be sized to absorb the power peak.
Ambient temperature range	-20°C ÷ +80°C
Compliance	REACH Regulation (EC) n°1907/2006 RoHS Directive 2011/65/EU as last update by 2015/863/EU

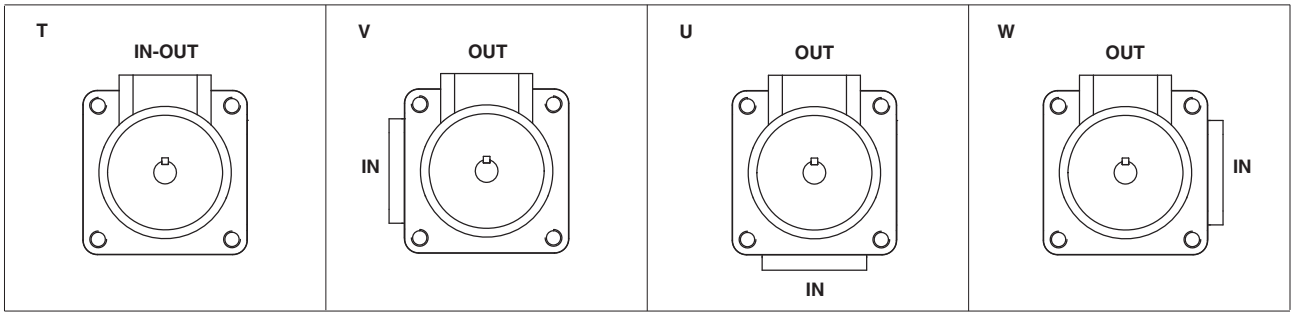
5 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -25°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C		
Recommended viscosity		10÷100 mm²/s - max at cold start 800 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 21/19/16 NAS1638 class 10		see also filter section at or KTF catalog
	longer life	ISO4406 class 18/16/13 NAS1638 class 8		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR **(1)**	ISO 12922
Flame resistant with water		NBR	HFC **(1)**	

(1) See performance restrictions at section 2

6 PORT ORIENTATION

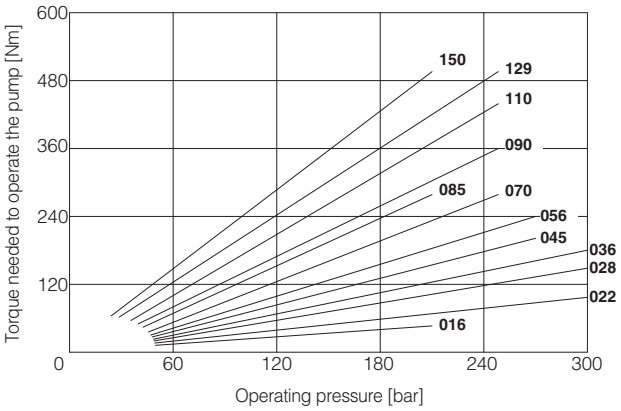
Single pumps can be supplied with oil ports oriented in different configuration in relation to the drive shaft, as follows (wiewed from the shaft end);
Ports orientation can be easily changed by rotating the pump body that carries inlet port.



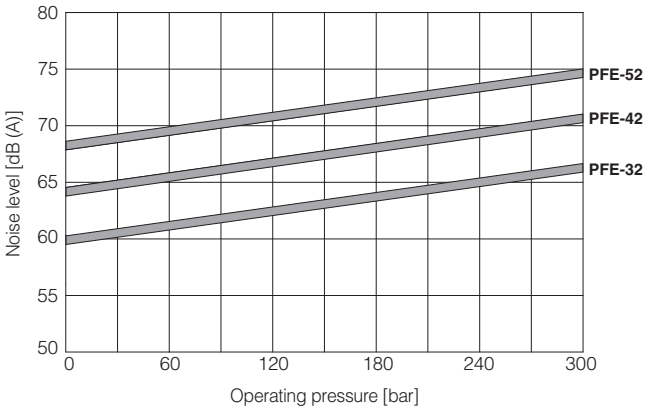
OUT = outlet port; **IN** = inlet port

7 DIAGRAMS (based on mineral oil ISO VG 46 at 50°C)

Torque versus pressure diagram

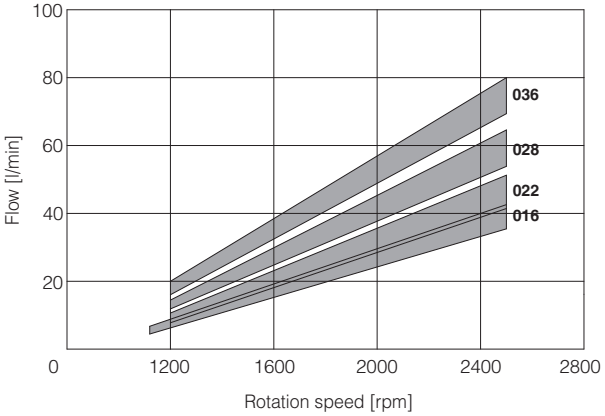


Noise levels

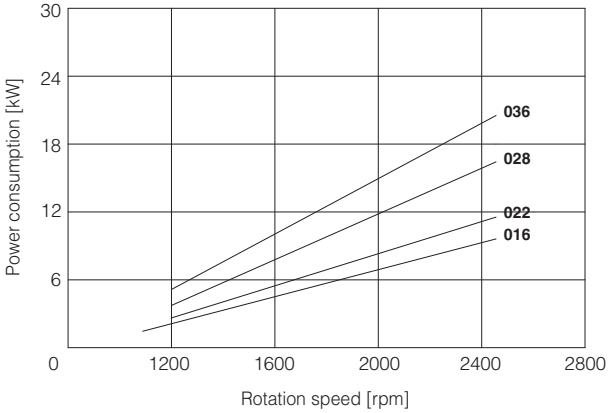


PFE-32:

Flow versus speed diagram
with pressure variation from 7 bar to 210 bar.

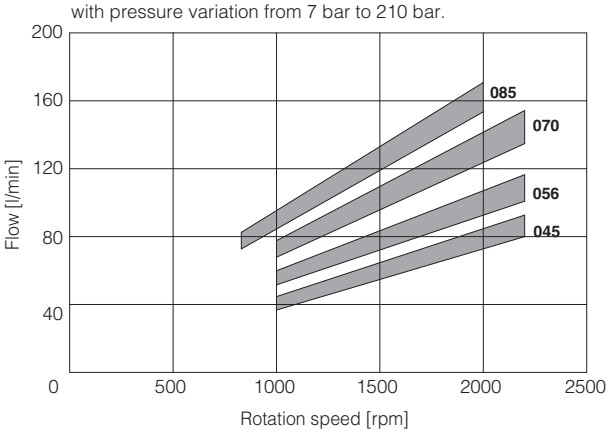


Power consumption versus speed diagram at 140 bar.
Power consumption is proportional to operating pressure.

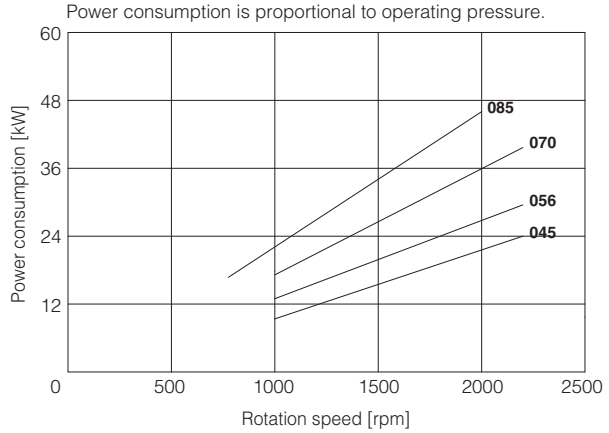


PFE-42:

Flow versus speed diagram
with pressure variation from 7 bar to 210 bar.

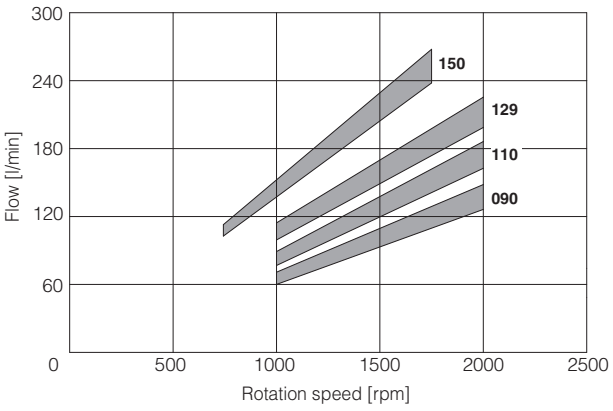


Power consumption versus speed diagram at 140 bar.
Power consumption is proportional to operating pressure.

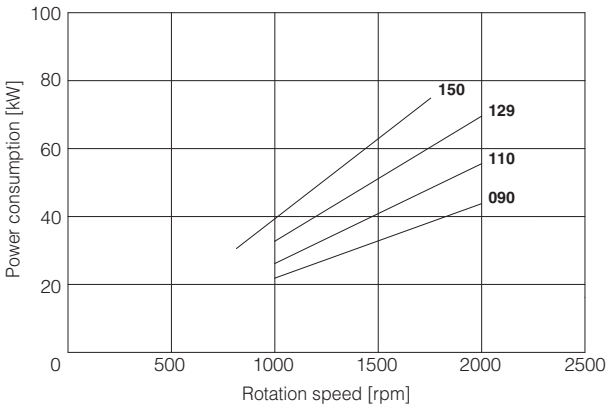


PFE-52:

Flow versus speed diagram
with pressure variation from 7 bar to 210 bar.



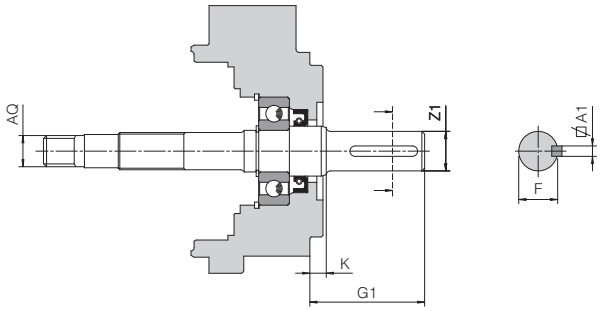
Power consumption versus speed diagram at 140 bar.
Power consumption is proportional to operating pressure.



8 DRIVE SHAFT

CYLINDRICAL SHAFT KEYED

3 = for single and multiple pumps (only first position)
for high torque applications



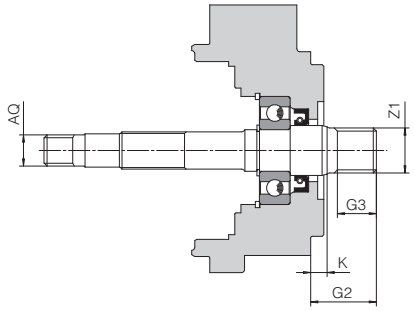
Pump size	Keyed shaft type 3					
	A1	F	G1	K	ØZ1	Only for through shaft execution Ø AQ
PFE-32	4,78	24,54	56,00	8,00	22,22	SAE 16/32-9T
	4,75	24,41			22,20	
PFE-42	6,38	28,30	78,00	11,40	25,38	SAE 32/64-24T
	6,35	28,10			25,36	
PFE-52	7,97	38,58	84,00	14	34,90	SAE 16/32-13T
	7,94	38,46			34,88	

SPLINED SHAFT

5 = for single and multiple pumps (any position)
for PFE-32 according to SAE A 16/32 DP, 9 teeth;
for PFE-42 according to SAE B 16/32 DP, 13 teeth;
for PFE-52 according to SAE C 12/24 DP, 14 teeth;

6 = for single and multiple pumps (only first position)
for PFE-32 and PFEX*-32 according to SAE B 16/32 DP, 13 teeth;
for PFE-42 and PFEX*-42 according to SAE C 12/24 DP, 14 teeth;

7 = for second and third position pump in multiple configuration:
for PFEX*-32 according to SAE B 16/32 DP, 13 teeth;
for PFEX*-42 according to SAE C 12/24 DP, 14 teeth;



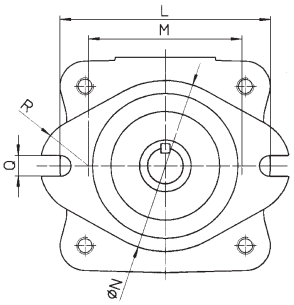
Pump size	Splined shaft type 5					Splined shaft type 6					Splined shaft type 7				
	G2	G3	K	Z1	Only for through shaft execution Ø AQ	G2	G3	K	Z1	Only for through shaft execution Ø AQ	G2	G3	K	Z1	Only for through shaft execution Ø AQ
PFE-32	32,00	19,50	6,50	SAE 16/32-9T	SAE 16/32-9T	41,00	28	8,00	SAE 16/32-13T	SAE 16/32-9T	32,00	19	8,00	SAE 16/32-13T	SAE 16/32-9T
PFE-42	41,25	28	8,00	SAE 16/32-13T	SAE 32/64-24T	55,60	42	8,00	SAE 12/24-14T	SAE 32/64-24T	41,60	28	8,00	SAE 12/24-14T	SAE 32/64-24T
PFE-52	56,00	42	8,10	SAE 12/24-14T	SAE 16/32-13T	–	–	–	–	–	–	–	–	–	–

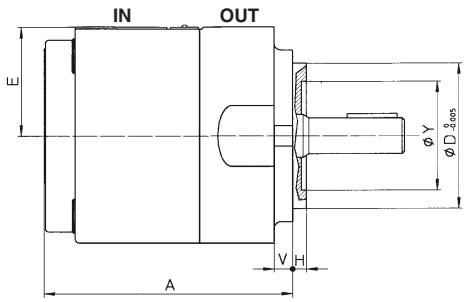
9 LIMITS OF SHAFT TORQUE

Pump size	Maximum driving torque [Nm]				Maximum torque available at the end of the through shaft [Nm]
	Shaft type 3	Shaft type 5	Shaft type 6	Shaft type 7	Any type of shaft
PFE-32	240	110	240	240	130
PFE-42	400	200	400	400	250
PFE-52	850	450	–	–	400

The values of torque required to operate the pumps are shown for each type on the “torque versus pressure” diagram at section 6.
In multiple pumps the total torque applied to the shaft of the first element (drive shaft) is the sum of the single torque needed for operating each single pump and it is necessary to verify that this total torque applied to the drive shaft is not higher than the values indicated in the table.

10 DIMENSIONS OF SINGLE PUMPS [mm]



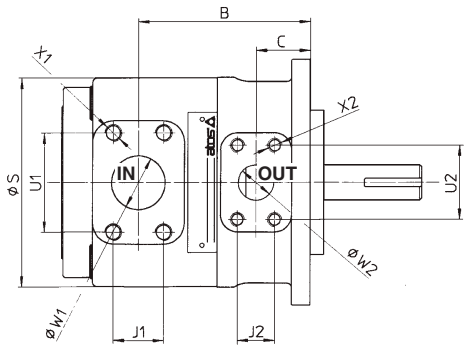


PORTS DIMENSION (SAE 3000)

PFE-32: IN = 1 1/4"; OUT = 3/4"
PFE-42: IN = 1 1/2"; OUT = 1"
PFE-52: IN = 2"; OUT = 1 1/4**"**

Mass:

PFE-32 = 9 kg
PFE-42 = 20,5 kg
PFE-52 = 32,1 kg

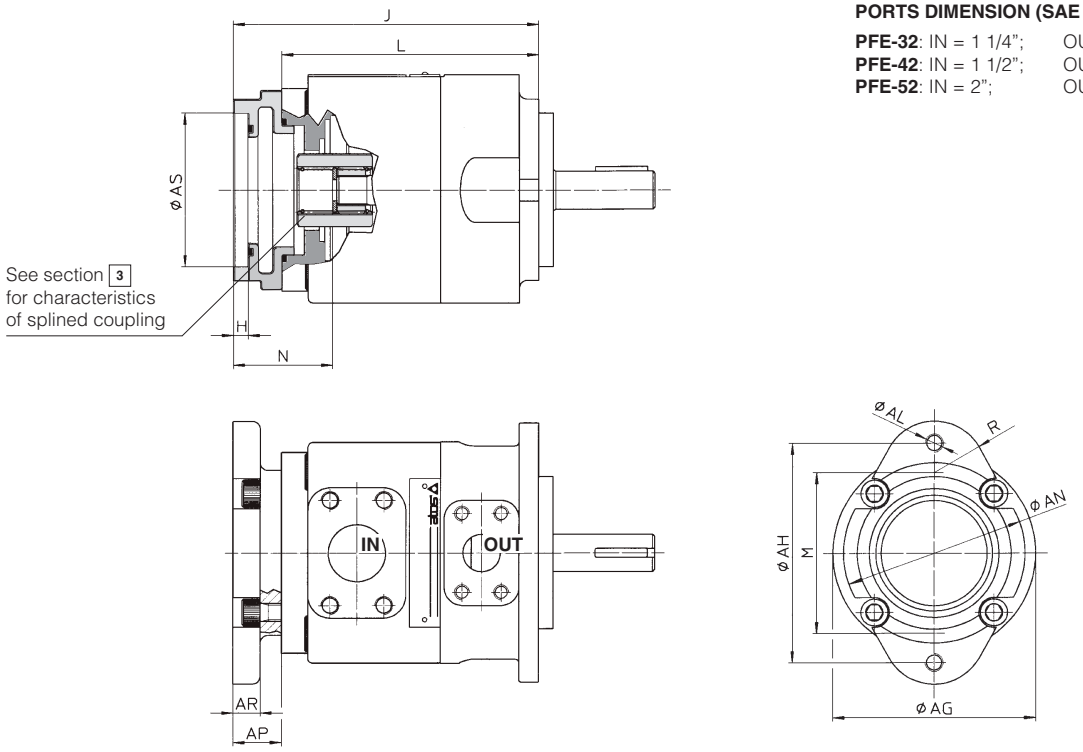


Pump size	A	B	C	ØD	E	H	L	M	ØN	Q	R
PFE-32	136	100	28	82,5	70	6,4	106	73	95	11	28,5
PFE-42	175,5	121	38	101,6	78	9,7	146	107	121	14,3	34
PFE-52	189	125	38	127	89	12,7	181	143,5	148	17,5	35
Pump size	**ØS**	**U1**	**U2**	**V**	**ØW1**	**ØW2**	**J1**	**J2**	**X1**	**X2**	**ØY**
PFE-32	114	58,7	47,6	10	32	19	30,2	22,2	M10X20	M10X17	47
PFE-42	148	70	52,4	13	38	25	35,7	26,2	M12X20	M10X17	76
PFE-52	174	77,8	58,7	16,3	50	50	42,9	30,2	M12X20	M10X20	76

11 DIMENSIONS OF PUMPS WITH THROUGH-SHAFT (XA*, XB*, XC* options) [mm]

PORTS DIMENSION (SAE 3000)

PFE-32: IN = 1 1/4"; OUT = 3/4"
PFE-42: IN = 1 1/2"; OUT = 1"
PFE-52: IN = 2"; OUT = 1 1/4"

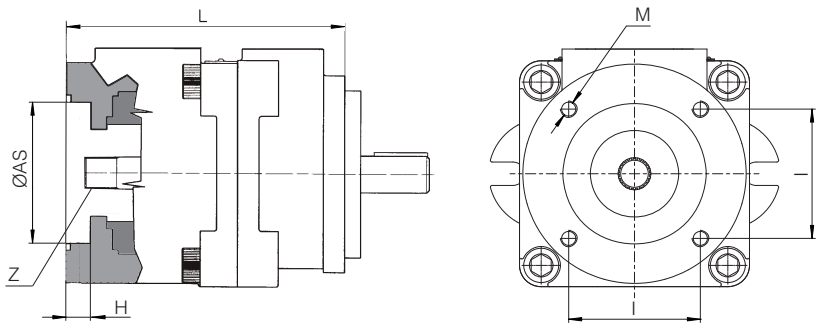


For other dimensions, see section 10

Pump size	Ø AG	Ø AH	AL	Tightening torque (Nm) (1)	Ø AN	AP	AR	Ø AS	H	J	L	M	N	R
PFEXA-32	114	106	M10X17	70	95	33	25	82,57 82,63	6,42 6,47	193,7	132,5	79	32	28,5
PFEXA-42	134	106	M10X17	70	95	22,7	11	82,57 82,63	6,42 6,47	194	171	73	34	28,5
PFEXB-42	134	146	M12	125	120	32	18	101,62 101,68	9,73 9,78	203	171	107	43	34
PFEXA-52	134	106	M10X17	70	95	22,7	11	82,57 82,63	6,42 6,47	206,2	183,5	73	34,5	28,5
PFEXB-52	134	146	M12	125	120	32	18	101,62 101,68	9,73 9,78	215,5	183,5	107	43,8	34
PFEXC-52	134	181	M16	300	148	46,7	30,7	127,02 127,02	12,73 12,78	230,2	183,5	143,5	58,5	35

(1) Tightening torque for screw class 12.9

12 DIMENSIONS OF PUMPS WITH THROUGH SHAFT, WITHOUT REAR FLANGE (XO option) [mm]



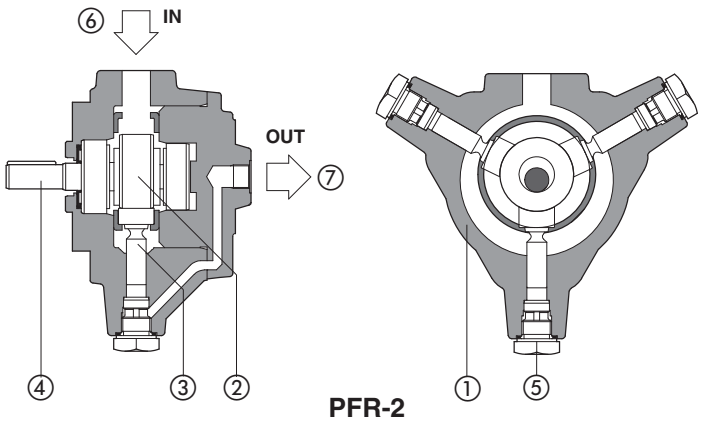
Pump size	L	Ø AS	H	M	I	Z
PFEXO-32	132.5	$60\ ^{+0.03}_{0}$	6.5	n°4 M6x13(max)	70	SAE 16/32-9T x15mm
PFEXO-42	171	$86\ ^{+0.035}_{0}$	15	n°4 M10x17(max)	79	SAE 32/64-24T x20mm
PFEXO-52	183.5	$86\ ^{+0.035}_{0}$	15	n°4 M10x17(max)	79	SAE 16/32-13T x20mm

13 RELATED DOCUMENTATION

A900	Operating and maintenance information for pumps

Radial piston pumps type PFR

fixed displacement



PFR-2

① body
② central bearing and return plates
③ radial pistons
④ shaft
⑤ seat of delivery valve
⑥ IN port
⑦ OUT port

PFR are fixed displacement radial piston pumps with positive drive construction of the pistons ③ (without return spring) for high performance and low noise level.

They are available in three different body size and single, multiple or with through-shaft configurations.

Max displacement **up to 25,4 cm³/rev.**

Max pressure **PFR-2 500 bar**
PFR-3, PFR-5 350 bar

1 MODEL CODE

PFR	XA	-	3	08	**	-	*
Fixed displacement radial piston pump	**Option for pumps with through shaft**, see section 3 Only for PFR-3: **XA, XA7, XB, XB7, XC** = for coupling with pumps type PFE		**Size,** see section 2: **2, 3, 5**	**Displacement [cm³/rev]**, see section 2 for PFR-2: **02, 03** for PFR-3: **08, 11, 15** for PFR-5: **18, 25**	Series number		**Seals material**: **-** = NBR **PE** = FKM

Note: for multiple pumps factory assembled, see tech. table A190

2 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Size code		**2**		**3**			**5**	
Displacement code		**02**	**03**	**08**	**11**	**15**	**18**	**25**
Displacement	(cm³/rev)	1,7	3,5	8,2	11,4	14,7	18,1	25,4
Max working pressure (1)	(bar)	500		350				
Recommended pressure on inlet port		from -0,10 to 1,5 bar for speed up to 1800 rpm						
Min speed	(rpm)	800						
Max speed (2)	(rpm)	1800						
Volumetric efficiency (3)		98	97	97	98	98	97	96
Noise level (3)	(dBA)	62	62	65	65	65	68	68

(1) Max pressure is 250 bar for HFDU, HFDR fluids - max pressure is 175 bar for HFC fluids
(2) Max speed is 1000 rpm for HFDU, HFDR and HFC fluids
(3) Measuring data with: n = 1450 rpm; P = 200 bar, see also diagram at section 6

3 OPTION FOR PUMPS WITH THROUGH SHAFT

Pump size	PFR-3				
Through shaft option type	**XA**	**XB**	**XA7**	**XB7**	**XC**
Splined coupling characteristics	SAE 16/32-9T	SAE 16/32-13T	SAE 16/32-13T	SAE 12/24-14T	SAE 12/24-14T
2nd pump PFE to be coupled	PFE-3* shaft type 5	PFE-4* shaft type 5	PFE-3* shaft type 7	PFE-4* shaft type 7	PFE-5* shaft type 5

4 MAIN CHARACTERISTICS

Installation position	Any position. It is advisable to install on the outlet pipe a proper valve for air bleeding. The installation under oil level is recommended. The installation above oil level should be avoided. The shaft of the pump has an eccentric cam which rotates with the shaft generating the stroke of the pistons and thus generating the flow rate. For best functioning a balanced coupling should be provided between the shaft of the motor and the shaft of the pump. See section 11
Commisioning	PFR pumps can be reversed without changing the flow direction. Therefore both directions of rotation are permitted. It is recommend to start the pump by short impulses, with pump case filled with working fluid and air bleed plugs unlocked. Pumps type PFR-3 and PFR-5 have 2 air bleeds ports, normally plugged, located near to the P ports. To help oil filling and air bleeding, it could be advisable to install a vertical pipe connected on the intake line, just before the IN port flange.
Loads on the shaft	Axial and radial loads are not allowed on the shaft. The coupling should be sized to absorb the power peak.
Compliance	EACH Regulation (EC) n°1907/2006 RoHS Directive 2011/65/EU as last update by 2015/863/EU

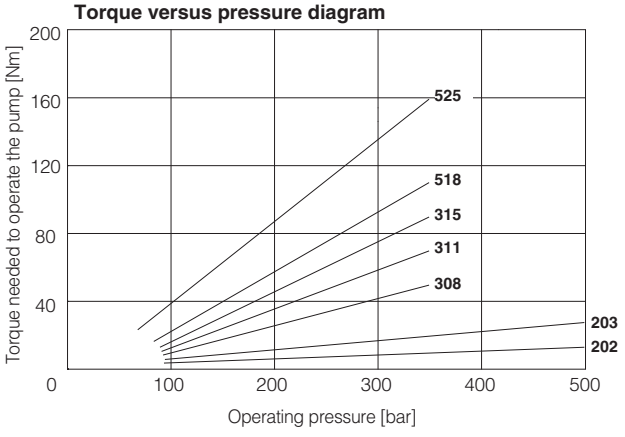
5 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -25°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C		
Recommended viscosity		10÷100 mm²/s - max at cold start 800 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 21/19/16 NAS1638 class 10		see also filter section at or KTF catalog
	longer life	ISO4406 class 18/16/13 NAS1638 class 8		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR **(1)**	ISO 12922
Flame resistant with water		NBR	HFC **(1)**	

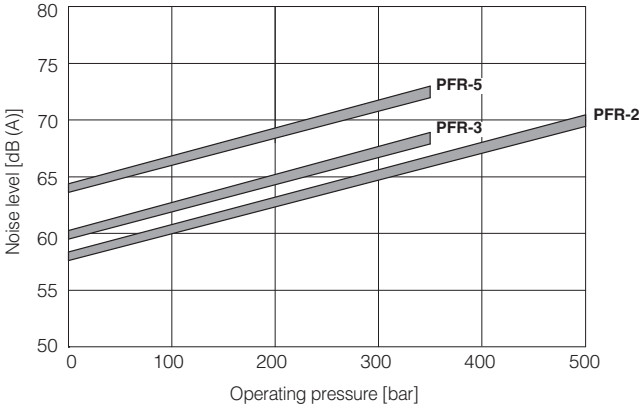
(1) See performance restrictions at section 2

6 DIAGRAMS (based on mineral oil ISO VG 46 at 50°C)

Torque versus pressure diagram



Noise levels



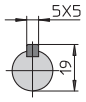
7 LIMIT OF SHAFT TORQUE

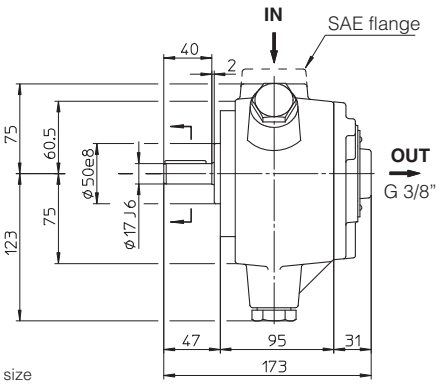
Pump size	Maximum driving torque [Nm]	Maximum torque available on the end of the through shaft [Nm]
PFR-2	200	=
PFR-3	600	320
PFR-5	800	320

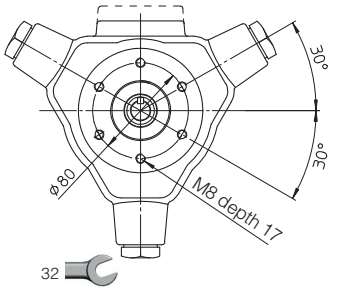
The values of torque needed to operate the pumps are shown on the "torque versus pressure diagram" at section 6.
In multiple pumps the total torque applied to the shaft of the first element (drive shaft) is the sum of the single torque needed for operating each single pump and it is necessary to verify that this total torque applied to the drive shaft is not higher than the values indicated in the table.

8 DIMENSIONS OF SINGLE PUMPS [mm]

PFR-2
Mass: 12 Kg

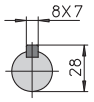


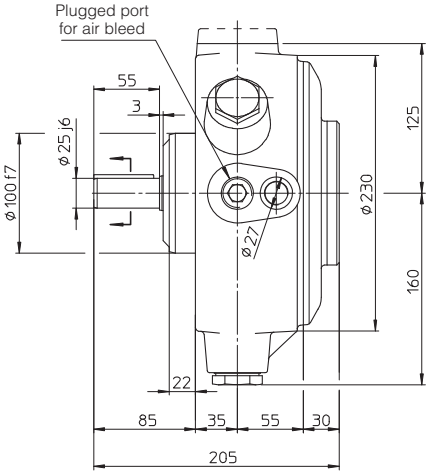


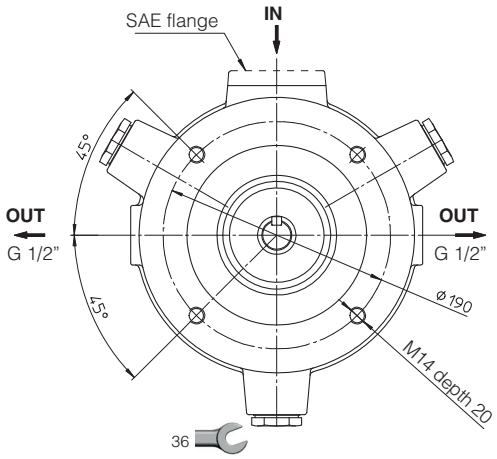


Note: PFR-206 have 5 pistons in the same size

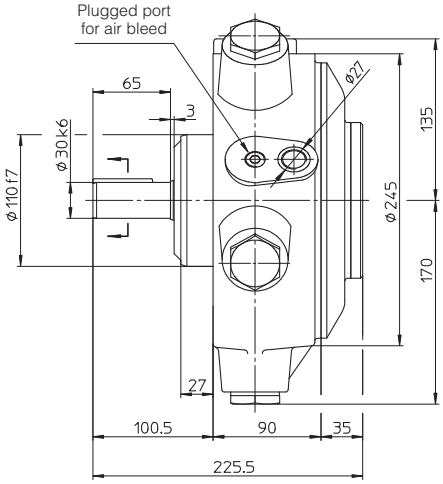
PFR-3
Mass: 31 Kg

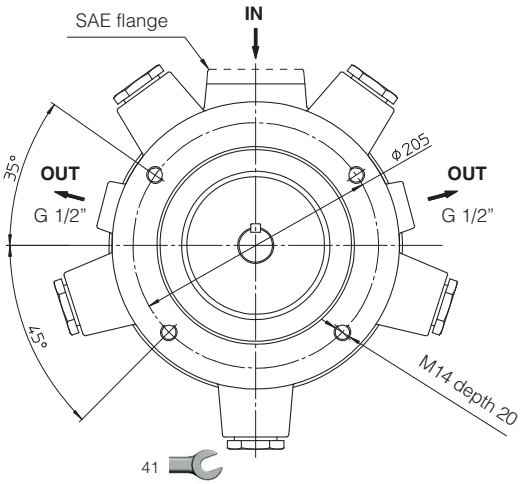






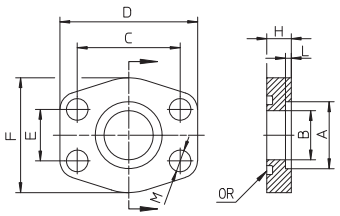
PFR-5
Mass: 38 Kg





SAE flanges are supplied with the pump

9 SAE-3000 FLANGES supplied with the pump [mm]

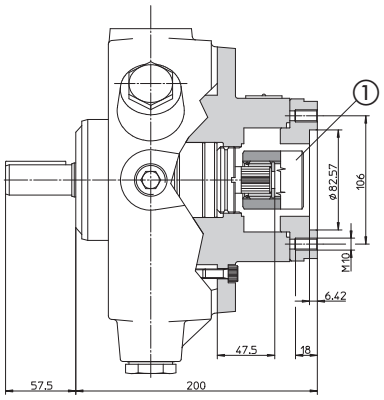


Flanges are supplied with seal and screws M10 class 12.9
Tightening torque = 70 Nm

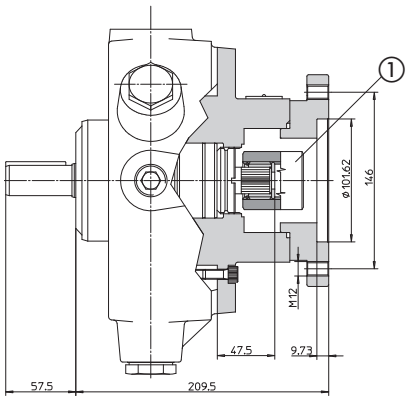
Pump model	Flange code	A	B	C	D	E	F	H	L	M	OR	Screws
PFR - 2	WFA-25	35,5	29	52,37	70	26,19	55	12	4	ø 11	4131	M10x30
PFR - 3 PFR - 5	WFA-32	42,5	34	58,72	79	30,18	68	12	4	ø 11,5	4150	M10x35

10 DIMENSIONS OF PUMPS WITH THROUGH-SHAFT (XA*, XB*, XC options) [mm]

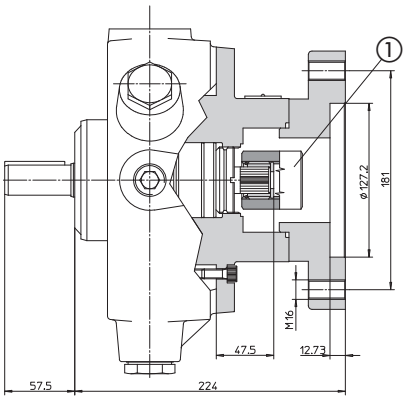
PFRXA-3



PFRXB-3



PFRXC-3



① See section 3 for characteristics of splined coupling

11 BALANCED COUPLING

The balanced couplings permit to minimize the vibrations caused by the unbalanced mass during the pump rotation.
The couplings listed in the table, supplied by Atos, must be used together with the relevant bell housing. The table lists the codes of the Atos balanced couplings and bell housing, available for the several pumps and for the standardized sizes of the electrical motors.

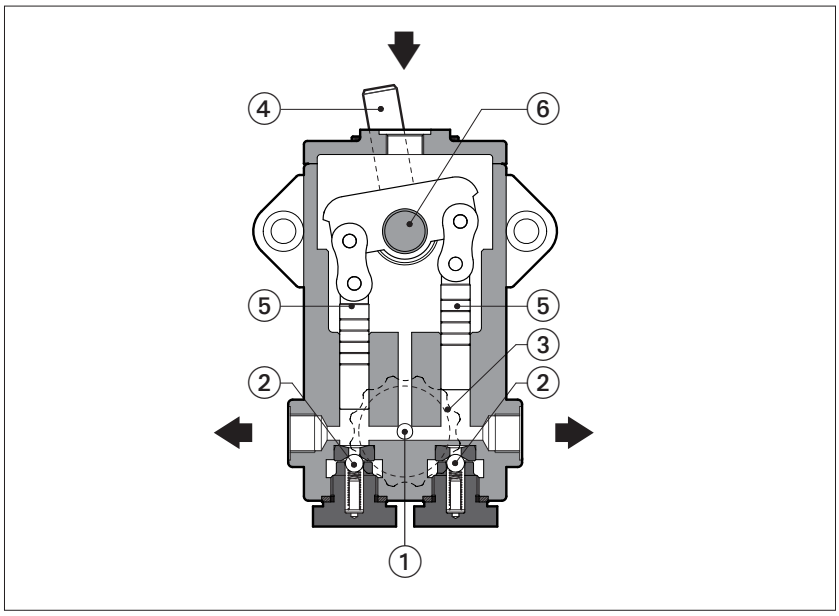
PUMP MODEL	ELECTRICAL MOTOR	BALANCED COUPLING	BELL HOUSING
PFR-202	UNEL-MEC 100-112	Y-GB-82/02	Y-LS4P2
	UNEL-MEC 132	Y-GB-122/02	Y-LS6P2
PFR-203	UNEL-MEC 100-112	Y-GB-82/03	Y-LS4P2
	UNEL-MEC 132	Y-GB-122/03	Y-LS6P2
PFR-308	UNEL-MEC 100-112	Y-GB-83/08	Y-LS4P3
	UNEL-MEC 132	Y-GB-123/08	Y-LS6P3
	UNEL-MEC 160	Y-GB-303/08	Y-LS7P3
PFR-311	UNEL-MEC 100-112	Y-GB-83/11	Y-LS4P3
	UNEL-MEC 132	Y-GB-123/11	Y-LS6P3
	UNEL-MEC 160	Y-GB-303/11	Y-LS7P3
PFR-315	UNEL-MEC 100-112	Y-GB-83/15	Y-LS4P3
	UNEL-MEC 132	Y-GB-123/15	Y-LS6P3
	UNEL-MEC 160	Y-GB-303/15	Y-LS7P3
PFR-518	UNEL-MEC 132	Y-GB-125/18	Y-LS6P5
	UNEL-MEC 160	Y-GB-305/18	Y-LS7P5
	UNEL-MEC 180	Y-GB-605/18	
PFR-525	UNEL-MEC 132	Y-GB-125/25	Y-LS6P5
	UNEL-MEC 160	Y-GB-305/25	Y-LS7P5
	UNEL-MEC 180	Y-GB-605/25	

12 RELATED DOCUMENTATION

A900	Operating and maintenance information for pumps

Hand pumps type PM

2-plunger



PM are double alternate-acting hand pumps with simple and rugged construction for minimum service and long operating life.
They are provided with one by-pass valve ① which connects directly the delivery ports with the inlet port through the delivery valves ②. The by-pass valve is operated by a handwheel ③.
Pumping operation is made by alternative movement of the lever ④ and consequently movement of plungers ⑤, after having locked the by-pass valve by means of the handwheel.
The splined shaft attachment ⑥ permits to turn the lever shaft in the best position.
On the pump body are available two outlet ports (one supplied plugged).

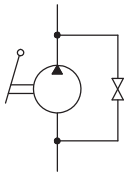
Displacements **from 12 to 20 cm³** for double stroke.

Max pressure **250 bar**

1 MODEL CODE

PM	-	112	*	/	*
2-plunger hand pump		Displacement, see section 2 **112**= 12 cm³/double stroke **120**= 20 cm³/double stroke	Series number		Seals material: omit for NBR (mineral oil & water glycol) **PE** = FPM

2 OPERATING CHARACTERISTICS with hydraulic fluid having a viscosity of 24 mm²/s and 40°C

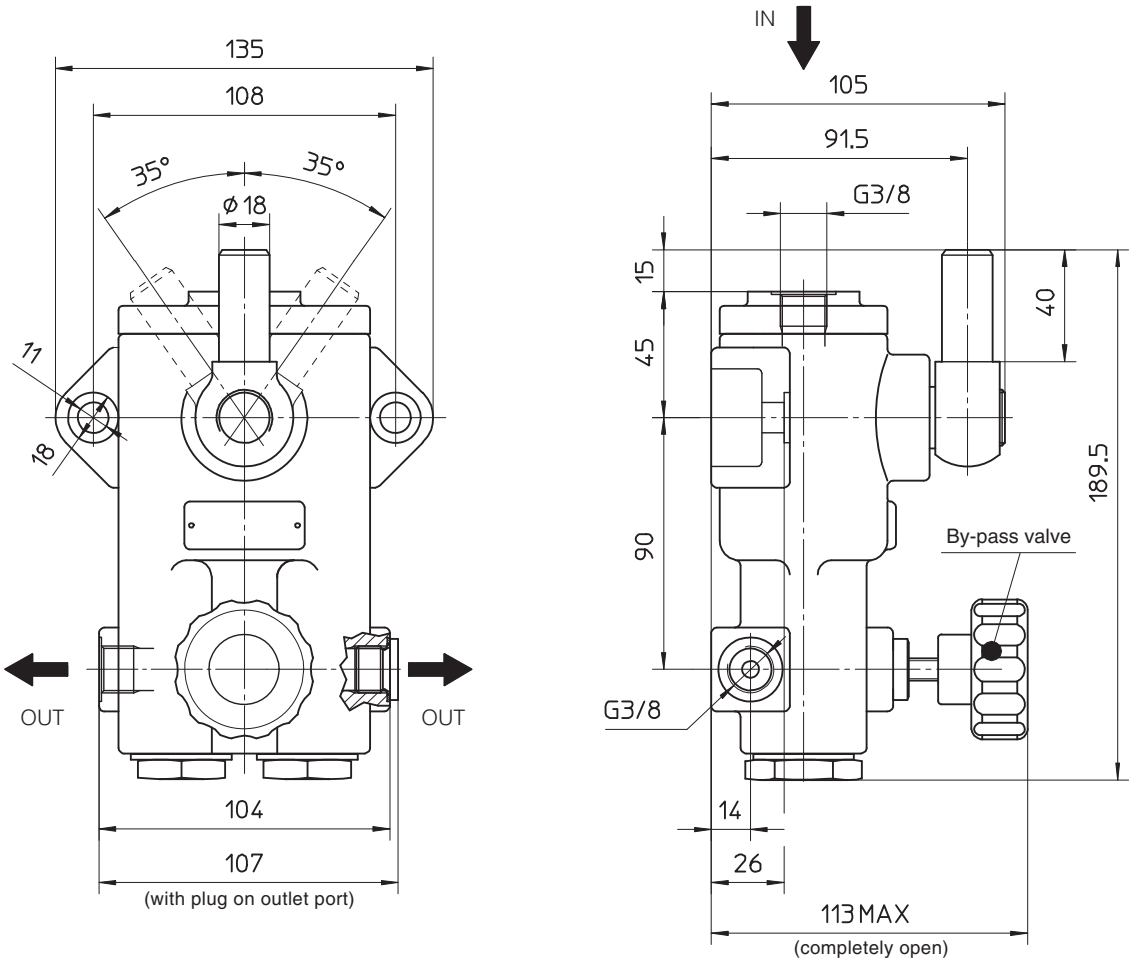


Model	Displacement for double stroke [cm³]	Max pressure [bar]	Shaft rotation angle [degree]	Maximum torque required [Nm]
PM-112	12	250	± 35°	133
PM-120	20	120	± 35°	116

3 MAIN CHARACTERISTICS OF HAND PUMP TYPE PM

Installation position		Vertical position, with inlet port facing upward to ensure complete case filling	
Commissioning		Pumping operation is made by alternative movement of the lever after closing by-pass valve. **Note:** the by-pass valve connects the delivery ports with inlet port and when locked it could allow some leakage from outlet ports. Two opposite outlet ports are available for pump delivery: one of these is supplied plugged. The pumps are supplied without lever harm that could made by a simple tube with Ø 18 mm inside diameter. Usually a lenght of 500 to 600 mm is appropriate. Lever position can be selected by proper assembling of lever on splined shaft.	
Ambient temperature		**Standard** = -25°C ÷ +80°C **/PE** option -15°C ÷ +80°C	
Fluid		Hydraulic oil as per DIN 51524...535; for other fluids see section 1	
Recommended viscosity		10 ÷ 100 mm²/sec at 40°C (ISO VG 15 - 100)	
Max fluid contamination level	normal operation	ISO4406 class 21/19/16 NAS1638 class 10	see also filter section at or KTF catalog
	longer life	ISO4406 class 18/16/13 NAS1638 class 8	
Fluid temperature		-20°C +60°C -20°C +50°C (water glycol) -20°C +80°C (/PE seals)	
Compliance		RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006	

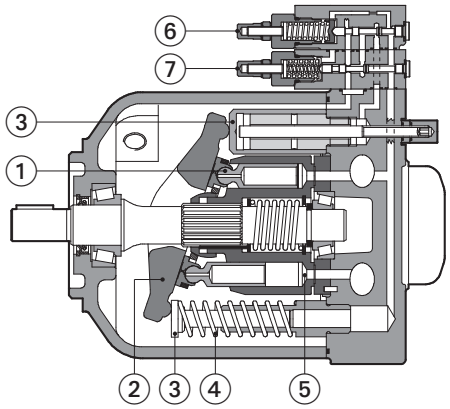
4 DIMENSIONS [mm]



Mass: 4,6 Kg

Axial piston pumps

variable displacement, mechanical controls



① Pistons
② Swash plate
③ Servo piston
④ Spring
⑤ Rotating barrel
⑥ Max pressure compensator
⑦ Load sensing compensator
⑧ Remote pressure transducer

PVPC-L-4046

PVPC

Variable displacement axial piston pumps with swash plate design suited for high pressure open circuits.

They are characterized by low noise emission, short response time and flexible operation thanks to the wilde range of mechanical controls, see section 12 and 13 .

For PVPC pumps with electrohydraulic proportional controls, see tech table AS170.

SAE J744 mounting flange and shaft.

Max displacement (cm³/rev)	**Max pressure working** (bar)	**Max pressure peak** (bar)
29, 46, 73, 140	280	350
88	250	315

1 MODEL CODE

PVPC	X2E	-	C	-	4046	/	1	D	-	X	24DC	*	/	*

Variable displacement axial piston pump

Option for pumps with through shaft (1):
XA = intermediate flange SAE A
XB = intermediate flange SAE B
XC = intermediate flange SAE C (only for size 5073 and 5090)

Additional suffix for double pumps:
X2E = with a fixed displacement pump type PFE (see tech table A005)

Type of control, see sections 12 and 13 :
C = manual pressure compensator
CH = manual pressure compensator, with venting
R = remote pressure compensator **(1)**
L = load sensing (pressure & flow)
LW = constant power (combined pressure & flow) **(2)**

For electrohydraulic proportional controls, see tech table AS170

Size and max displacement (3):
3029 = size 3 - displacement 029 cm³/rev
4046 = size 4 - displacement 046 cm³/rev
5073 = size 5 - displacement 073 cm³/rev
5090 = size 5 - displacement 088 cm³/rev
6140 = size 6 - displacement 140 cm³/rev

Shaft, SAE Standard **(4)**:
1 = keyed
5 = splined

Direction of rotation, viewed at the shaft end:
D = clockwise
S = counterclockwise

X = without connector (only for CH version)
See section 4 for available connectors, to be ordered separately

Coil voltage, see section 4
(only for CH version)

Series number

Seals material, see section 5 :
- = NBR
PE = FKM

(1) Not available for PVPC-*-6140
(2) Please specify the requested value of torque setting or power and speed in the PVPC-LW pump order, e.g. 70 Nm or 10 kW at 1450 RPM
(3) Optional intermediate displacements 35 and 53 cm³/rev are available on request
(4) Pumps with ISO 3019/2 mounting flange and shaft (option /M) are available on request

2 GENERAL CHARACTERISTICS

Assembly position - see section 7	Any position. The drain port must be on the top of the pump. Drain line must be separated and unrestricted to the reservoir and extended below the oil level as far from the inlet as possible. Suggested maximum line lenght is 3 m.
Ambient temperature range	**Standard** = -25°C ÷ +80°C **/PE** option -15°C ÷ +80°C
Storage temperature	**Standard** = -40°C ÷ +70°C **/PE** option -20°C ÷ +70°C
Surface protection (pump body)	Black painting RAL9005
Compliance	RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006

3 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

PVPC size		**3029**		**4046**		**5073**		**5090**		**6140**	
Max displacement	(cm^3/rev)	29		46		73		88		140	
Theoretical max flow at 1450 rpm	(l/min)	42		66,7		105,8		127,6		203	
Max pressure working / peak	(bar)	280 / 350		280 / 350		280 / 350		250 / 315		280 / 350 **(1)**	
Min/Max inlet pressure	(bar abs.)	0,8 / 25		0,8 / 25		0,8 / 25		0,8 / 25		0,8 / 25	
Max pressure on drain port	(bar abs.)	1,5		1,5		1,5		1,5		1,5	
Power consumption at 1450 rpm and at max pressure and displacement	(Kw)	19,9		31,6		50,1		54,1		122	
Max torque on the shaft	(shaft type)	Type 1	Type 5	Type 1	Type 5	Type 1	Type 5	Type 1	Type 5	Type 1	Type 5
	(Nm)	210	270	350	440	670	810	670	810	1300	1660
Max torque at max working pressure	(Nm)	128		203		328		350		780	
Speed rating	(rpm)	500 ÷ 3000		500 ÷ 2600		500 ÷ 2600		500 ÷ 2200		500 ÷ 2200	
Body volume	(l)	0,7		0,9		1,5		1,5		2,8	

(1) The maximum pressure can be increased to 350 bar (working) and 420 bar (peak) after detailed analysis of the application and of the pump working cycle

4 ELECTRICAL CHARACTERISTICS - for PVPC-CH

Insulation class	H
Connector protection degree	IP 65
Relative duty factor	100%
Supply voltage tolerance	± 10%

4.1 COIL VOLTAGE - only for CH version

Average values based ambient/coil temperature of 20°C.

External supply nominal voltage ±10%		**Voltage code**	Power consumption	Nominal courrent	Coil characteristics
DIRECT CURRENT	12 DC 24 DC	**12DC** **24DC**	19,2 W	1,61 A 0,80 A	Insulation Class: **H** Protection degree: **IP65**

4.2 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 - to be ordered separately

Code of connector	Function
SP-666	Connector IP-65
SP-667	Connector IP-65 but with built-in signal led

5 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -25°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C		
Recommended viscosity		15÷35 mm²/s - max allowed range: min 10 cSt (at 80°C) - max 1500 cSt at cold startup (-25°C)		
Max fluid contamination level	normal operation	ISO4406 class 20/18/13 NAS1638 class 9		see also filter section at or KTF catalog
	longer life	ISO4406 class 18/16/11 NAS1638 class 7		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR **(1)**	ISO 12922
Flame resistant with water		NBR	HFC **(1)**	

(1) See section 6

6 PERFORMACE RESTRICTIONS WITH FLAME RESISTANT FLUIDS

6.1 HFDU and HFDR - Phosphate ester

PVPC size		**3029**	**4046**	**5073**	**5090**	**6140**
Max pressure working / peak	(bar)	200 / 240				**(2)**
Max speed **(1)** (rpm @ VMAX)		2050	1850	1700	1550	
Ambient temperature range	(°C)	-10 ÷ +80				
Bearing life (% of bearing life with mineral oil)	(%)	90				

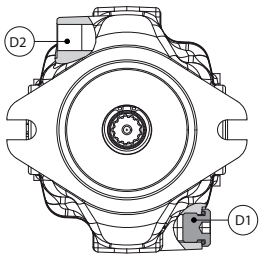
(1) With an inlet pressure of 1 bar abs
(2) For information about size 6140, contact Atos technical office

6.2 HFC - Water-glycol (35 ÷ 55 % of water)

PVPC size		**3029**	**4046**	**5073**	**5090**	**6140**
Max pressure working / peak	(bar)	180 / 210				**(2)**
Max speed **(1)** (rpm @ VMAX)		2050	1850	1700	1550	
Ambient temperature range	(°C)	-10 ÷ +60				
Bearing life (% of bearing life with mineral oil)	(%)	40				

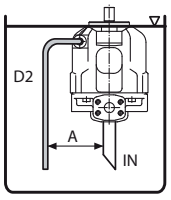
(1) With an inlet pressure of 1 bar abs
(2) For information about size 6140, contact Atos technical office

7 INSTALLATION POSITION

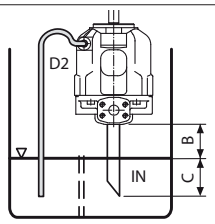


The pump is supplied with drain D2 open, and D1 plugged. Before installation fill the pump with hydraulic oil for at least 3/4 of its volume, keeping it in horizontal position. With exception of pump mounted below the oil level, we recomend to interpose a baffle plate between inlet and drain line.

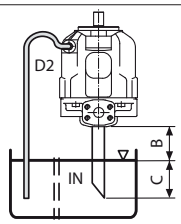
VERTICAL INSTALLATION



INSIDE THE TANK
Minimum oil level equal or above the pump mounting surface.
A ≥ 200mm

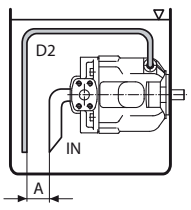


INSIDE THE TANK
Minimum oil level below the pump mounting surface.
Minimum inlet pressure = 0,8 bar absolute
B ≤ 800mm, C= 200mm

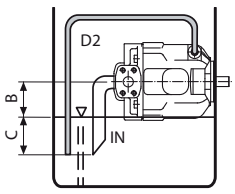


OUTSIDE THE TANK, above oil level
Minimum inlet pressure = 0,8 bar absolute
B ≤ 800mm, C= 200mm

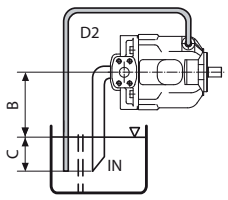
HORIZONTAL INSTALLATION



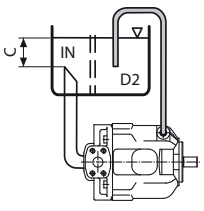
INSIDE THE TANK
Minimum oil level equal or above the pump mounting surface.
A ≥ 200mm



INSIDE THE TANK
Minimum oil level below the pump mounting surface.
Minimum inlet pressure = 0,8 bar (absolute)
B ≤ 800mm, C= 200mm



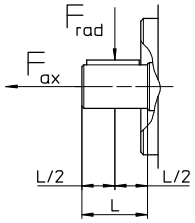
OUTSIDE THE TANK, above oil level
Minimum inlet pressure = 0,8 bar (absolute)
B ≤ 800mm, C= 200mm



OUTSIDE THE TANK, below oil level
C= 200mm

IN: inlet line - **D2:** drain line - **A:** minimum distance between inlet and drain line - **B+C:** permissible suction height - **C:** inlet line immersion dept

8 MAX PERMESSIBLE LOAD ON DRIVE SHAFT

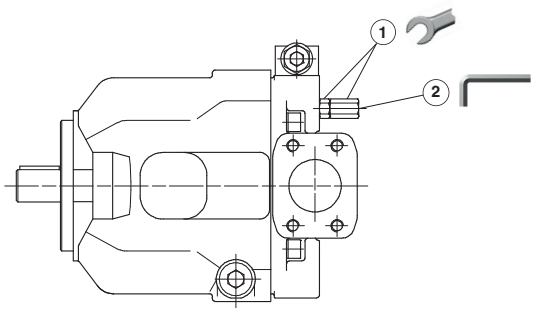
PVPC size			**3029**	**4046**	**5073**	**5090**	**6140**
F_{ax} = axial load		N	1000	1500	2000	2000	2000
F_{rad} = radial load		N	1500	1500	3000	3000	3000

9 VARIATION OF MAX SPEED VS INLET PRESSURE

Inlet pressure	**Displacement %**					
bar abs.	65	70	80	90	100	
0,8	120	115	105	97	90	**% variation of the max. speed**
0,9	120	120	110	103	95	
1,0	120	120	115	107	100	
1,2	120	120	120	113	106	
1,4	120	120	120	120	112	
1,6	120	120	120	120	117	
2,0	120	120	120	120	120	

Example
Displacement: 80% - Inlet pressure: 1,0 bar - Speed: 115%

10 MAX DISPLACEMENT SETTING



1 Locking displacement limiter screw

2 Displacement setting

PVPC size		**3029**	**4046**	**5073**	**5090**	**6140**
Max displacement setting range	from ÷ to	20,1 ÷ 28,7	31,8 ÷ 45,4	36,8 ÷ 73,6	44,0 ÷ 87,9	70 ÷ 140
One turn of screw changes pump displacement by approximately	cm^3/rev	1,5	2,2	3,2	3,2	6,0
For locking displacement limiter screw 	mm	14	14	17	17	19
For displacement setting 	mm	4	4	5	5	6
Tightening torque	Nm	15 ± 1	15 ± 1	15 ± 1	15 ± 1	20 ± 1

11 DIAGRAMS at 1450 rpm (based on mineral oil ISO VG 46 at 50°C)

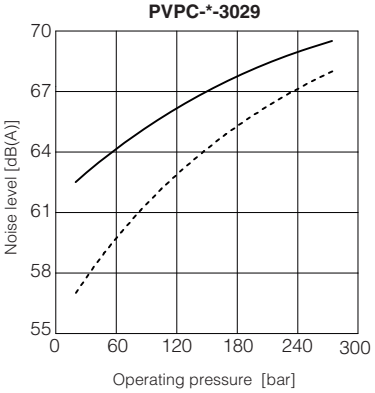
11.1 Noise level curves

Ambient noise levels measured in compliance with ISO 4412-1 oleohydraulics - Test procedure to define the ambient noise level - Pumps Shaft speed: 1450 rpm.

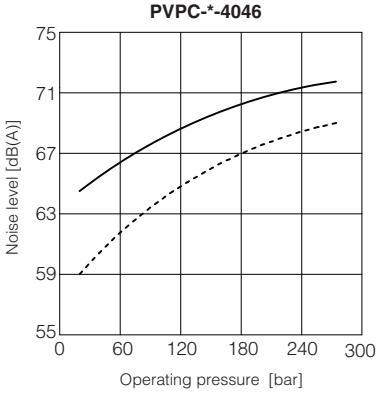
—— = Qmax

- - - - = Qmin

PVPC-*-3029



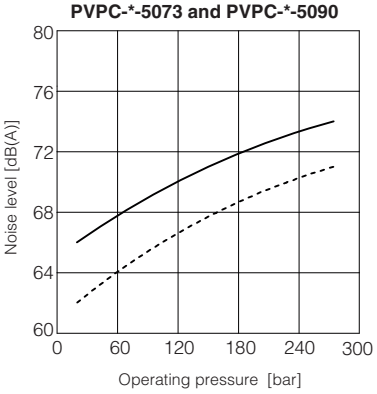
PVPC-*-4046



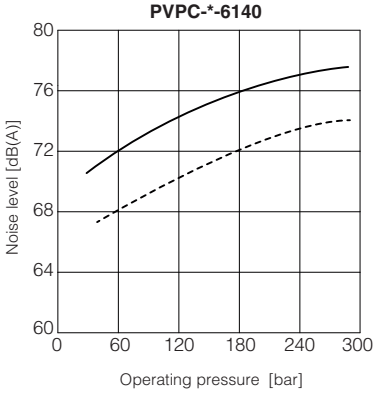
—— = Qmax

- - - - = Qmin

PVPC-*-5073 and PVPC-*-5090



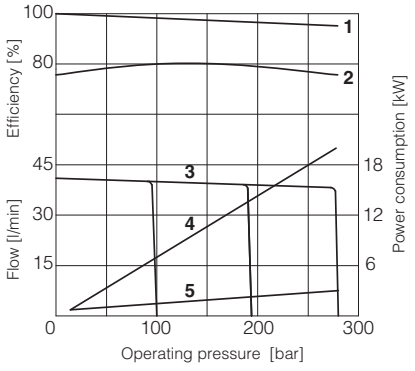
PVPC-*-6140



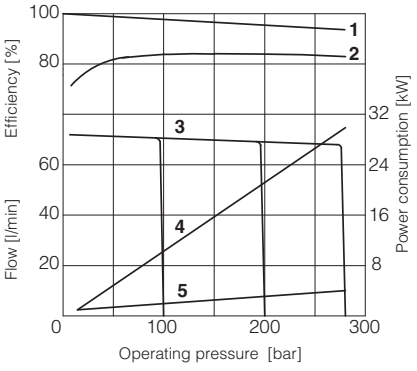
11.2 Operating limits

1 = Volumetric efficiency
2 = Overall efficiency
3 = Flow versus pressure curve
4 = Power consumption with full flow
5 = Power consumption at null flow

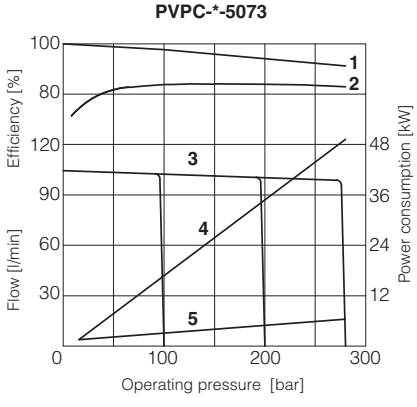
PVPC-*-3029



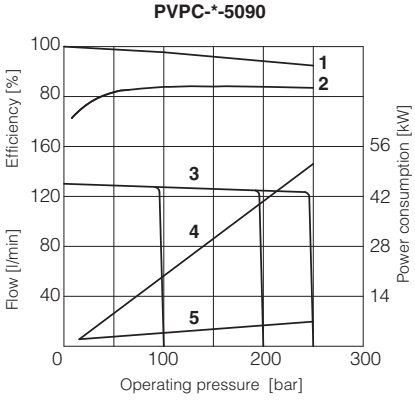
PVPC-*-4046



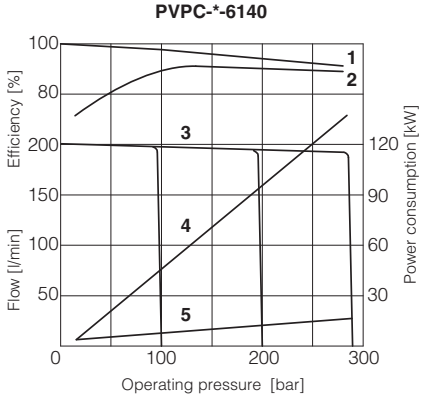
PVPC-*-5073



PVPC-*-5090



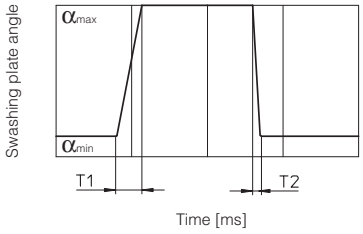
PVPC-*-6140



11.3 Response times

Response times and pressure peack due to variation 0% to 100% and 100% to 0% of the pump displacement, obtained with an istantaneously opening and shut-off of the delivery line.

Pump type	**T1** (ms)	**T2** (ms)
PVPC-*-3029	140	36
PVPC-*-4046	140	42
PVPC-*-5073	160	44
PVPC-*-5090	160	44
PVPC-*-6140	220	150



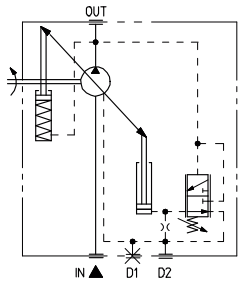
11.4 **Minimum power/torque setting for PVPC-LW (constant power regulator)**

For the pump correct operation, the power / torque factory setting hast to be higher than the values reported in the below table
In case of lower power/torque setting values, the regulator limits the maximum working pressure to a value lower than the standard setting.

Note: please specify the requested value of torque setting or power and speed in the PVPC-LW pump order, e.g. 70 Nm or 10 kW at 1450 RPM

Pump type	**Minimum torque** (Nm)	**Minimum power** (Kw)
PVPC-LW-3029	43	6,7
PVPC-LW-4046	68	10,7
PVPC-LW-5073	113	17,8
PVPC-LW-5090	132	20,7
PVPC-LW-6140	197	30

12 HYDRAULIC AND ELECTROHYDRAULIC CONTROLS for PVPC-3029 to PVPC-5090



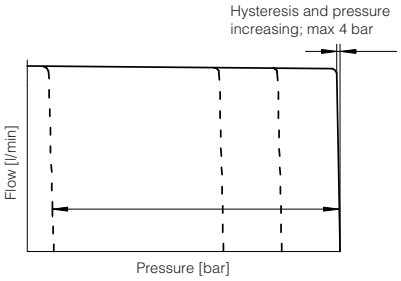
C

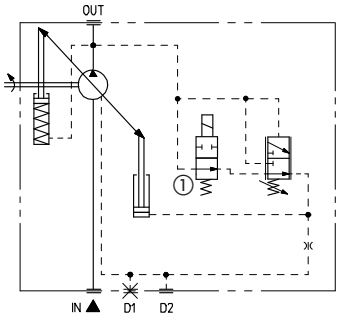
Manual pressure compensator

The pump displacement is zeroed when the line pressure approaches the setting pressure of the compensator.

Compensator setting range:
20 ÷ 280 bar for 3029, 4046, 5073
20 ÷ 250 bar for 5090

Compensator standard setting:
280 bar for 3029, 4046, 5073
250 bar for 5090





CH

① solenoid venting valve

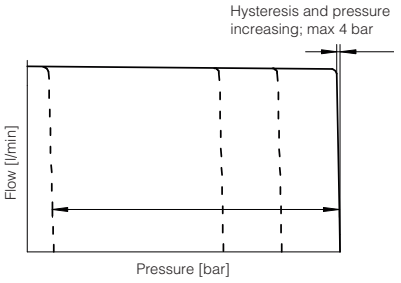
Manual pressure compensator with venting

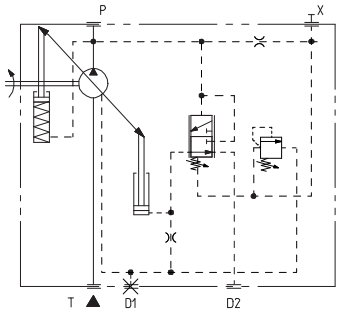
As C plus venting function, when a long unloading time is required and heat generation and noise have to be kept at lowest level.

Venting valve solenoid voltage, see section 4
Venting valve OFF = null displacement
Venting valve ON = max displacement

Compensator setting range:
20 ÷ 280 bar for 3029, 4046, 5073
20 ÷ 250 bar for 5090, 6140

Compensator standard setting:
280 bar for 3029, 4046, 5073
250 bar for 5090, 6140





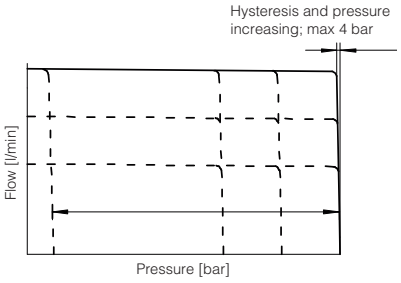
R

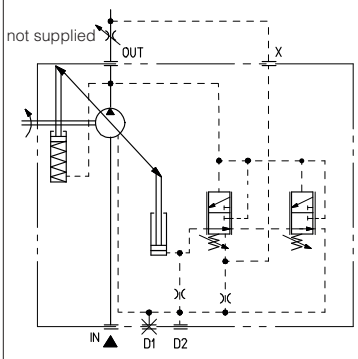
Remote pressure compensator

As C, but predisposed with X piloting port for connection of a remote pilot relief valve.

Compensator setting range:
20 ÷ 280 bar for 3029, 4046, 5073
20 ÷ 250 bar for 5090

Compensator standard setting:
280 bar for 3029, 4046, 5073
250 bar for 5090





L

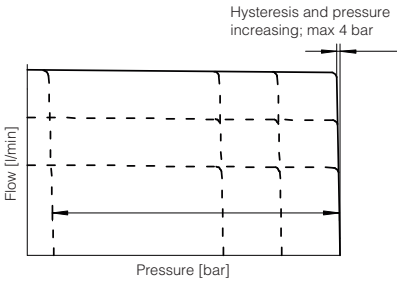
Load sensing

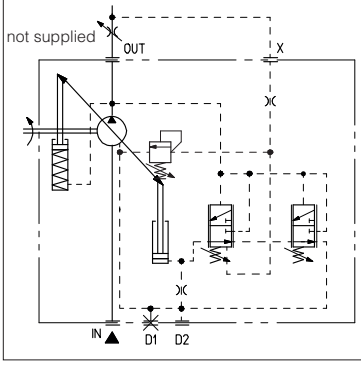
The pump displacement is automatically adjusted to maintain a constant (load indipendent) pressure drop across an external throttle. Changing the throttle regulation, the pump flow is consequently adjusted.
Load sensing control always incorporates an hydraulic compensator to limit the maximum pressure.

Compensator setting range:
20 ÷ 280 bar for 3029, 4046, 5073
20 ÷ 250 bar for 5090

Compensator standard setting:
280 bar for 3029, 4046, 5073
250 bar for 5090

Differential pressure setting range: 10 ÷ 40 bar
Differential pressure standard setting: 14 bar

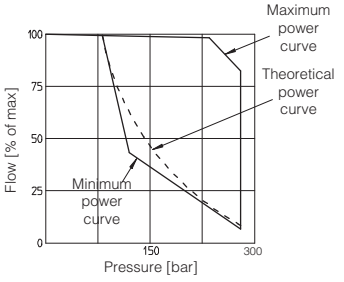


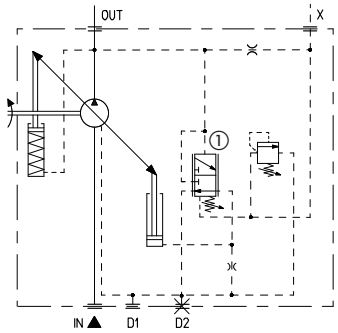


LW

Constant power

In order to achieve a constant drive torque with varying operating pressure. The swashing angle and therefore the outlet flow is varied so that the product of flow and pressure remains constant.
See section 11.4 for min power/torque setting





C

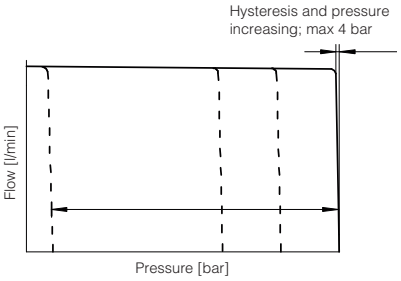
Manual pressure compensator

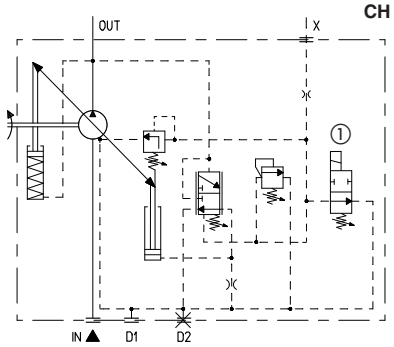
The pump displacement is zeroed when the line pressure approaches the setting pressure of the compensator.

Compensator setting range: 20 ÷ 280 bar

Compensator standard setting: 280 bar

Note: do not modify the setting of differential pressure compensator ①





CH

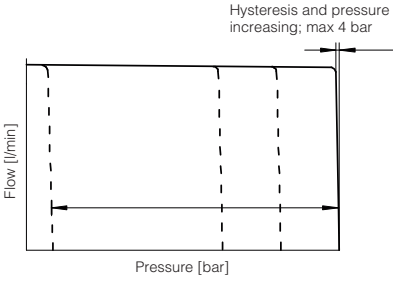
Manual pressure compensator with venting

As C plus venting function, when a long unloading time is required and heat generation and noise have to be kept at lowest level.

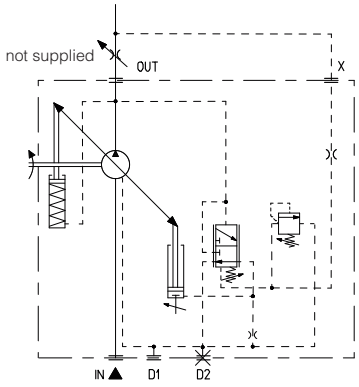
Venting valve solenoid voltage, see section 4
Venting valve OFF = null displacement
Venting valve ON = max displacement

Compensator setting range: 20 ÷ 280 bar

Compensator standard setting: 280 bar



① solenoid venting valve



L

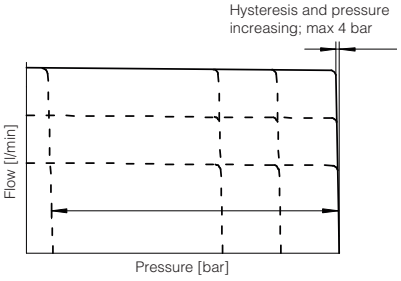
Load sensing

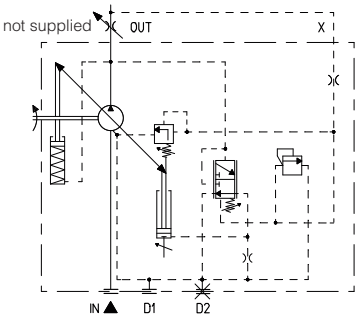
The pump displacement is automatically adjusted to maintain a constant (load indipendent) pressure drop across an external throttle. Changing the throttle regulation, the pump flow is consequently adjusted.
Load sensing control always incorporates an hydraulic compensator to limit the maximum pressure.

Compensator setting range: 20 ÷ 280 bar

Compensator standard setting: 280 bar

Differential pressure setting range: 10 ÷ 40 bar
Differential pressure standard setting: 14 bar

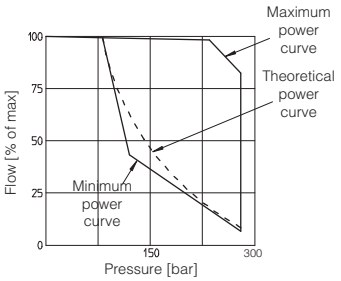




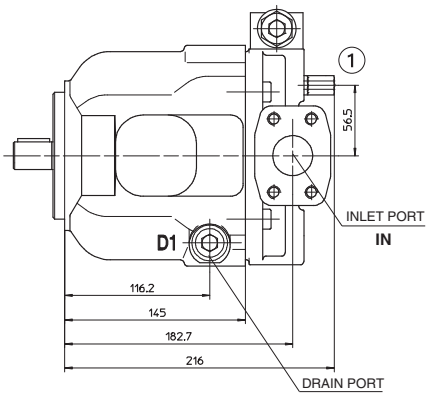
LW

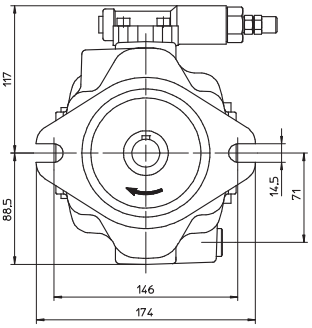
Constant power

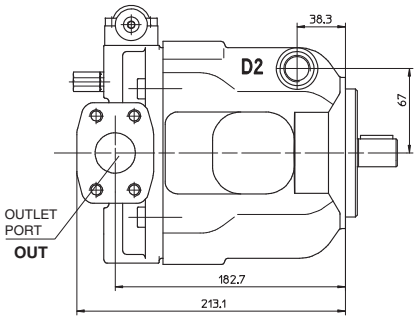
In order to achieve a constant drive torque with varying operating pressure. The swashing angle and therefore the outlet flow is varied so that the product of flow and pressure remains constant.
See section 11.4 for min power/torque setting



14 INSTALLATION DIMENSIONS OF PVPC-*-3029: BASIC VERSION “C” CONTROL







PORTS DIMENSION

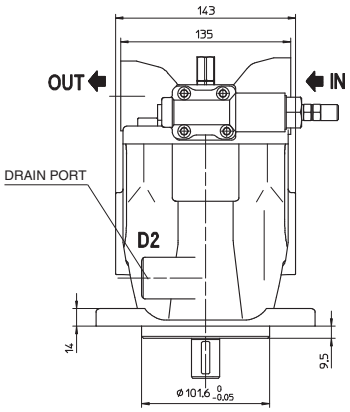
IN = Flange SAE 3000 1 1/4”

OUT = Flange SAE 6000 3/4”

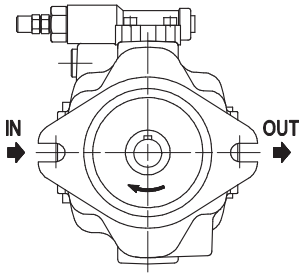
D1, D2 = 1/2” BSPP

① = Screw for max displacement setting.
In case of double pumps, the screw is not available for version XB

Mass [kg]	
PVPC-*-3029	18

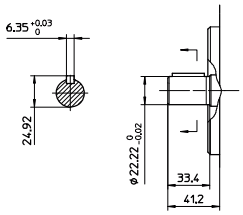


version S
counterclockwise rotation
viewed at the shaft end

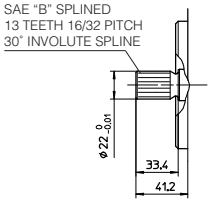


Pumps with counterclockwise rotation (**S**) have the IN and OUT inverted and consequently the position *of the compensators*

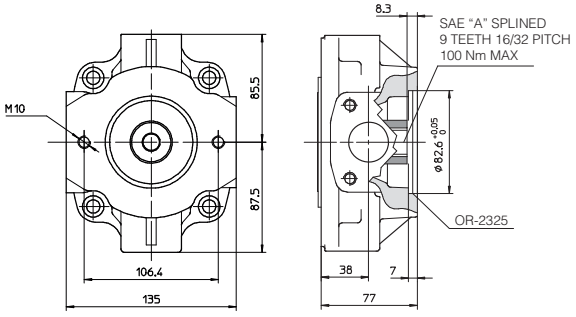
SHAFT TYPE “1”



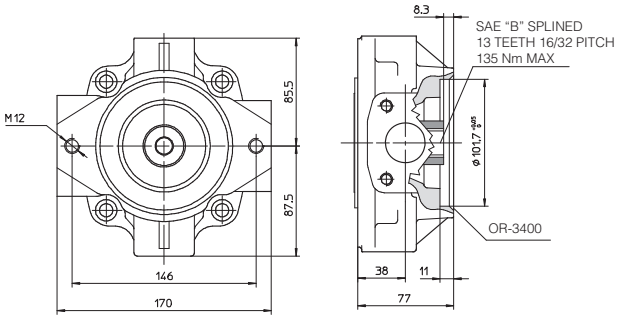
SHAFT TYPE “5”



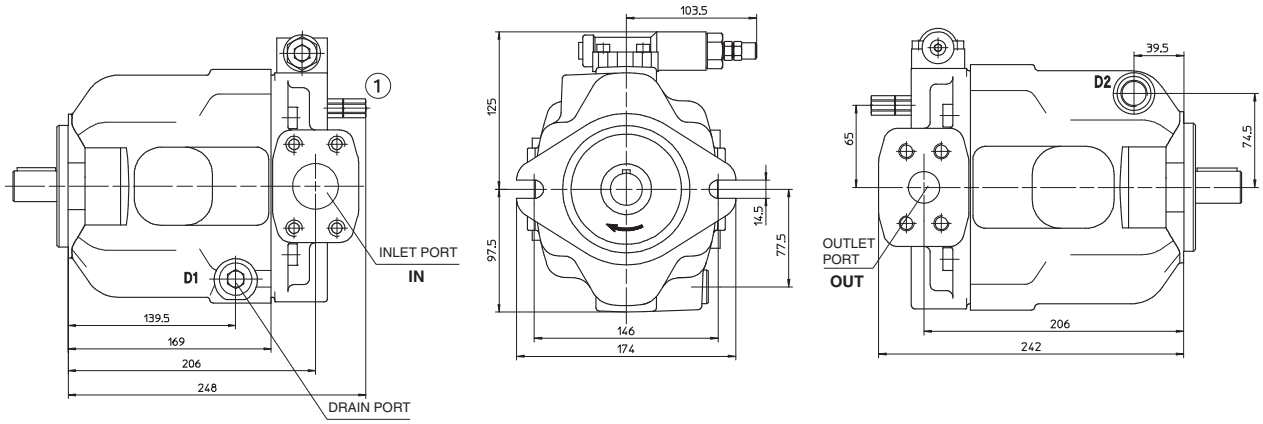
CODE XA - INTERMEDIATE FLANGE SAE “A” FOR PFE-31

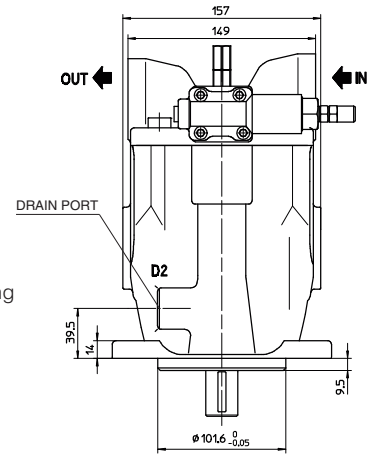


CODE XB - INTERMEDIATE FLANGE SAE “B” FOR PFE-41
screw for max displacement setting not available

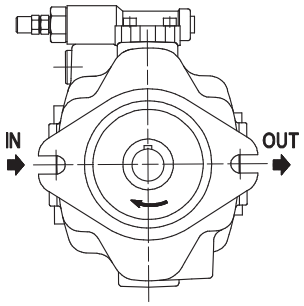


15 INSTALLATION DIMENSIONS OF PVPC-*-4046: BASIC VERSION “C” CONTROL





version S
counterclockwise rotation
viewed at the shaft end



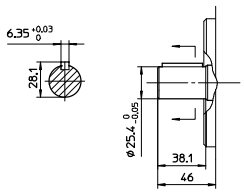
Pumps with counterclockwise rotation (**S**) have the IN and OUT inverted and consequently the position *of the compensators*

PORTS DIMENSION

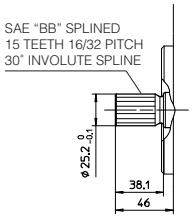
IN = Flange SAE 3000 1 1/2”
OUT = Flange SAE 6000 1”
D1, D2 = 1/2” BSPP
① = Screw for max displacement setting

Mass [kg]	
PVPC-*-4046	24

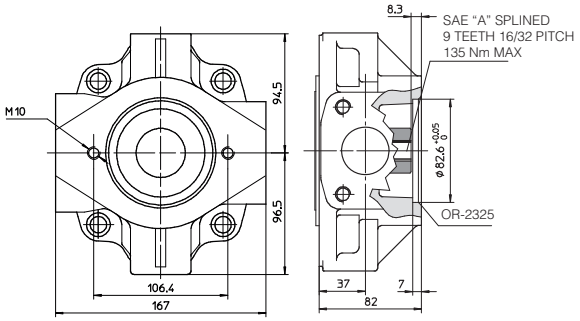
SHAFT TYPE “1”



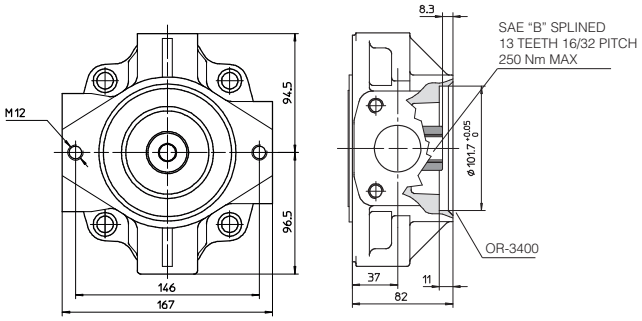
SHAFT TYPE “5”



CODE XA - INTERMEDIATE FLANGE SAE “A” FOR PFE-31

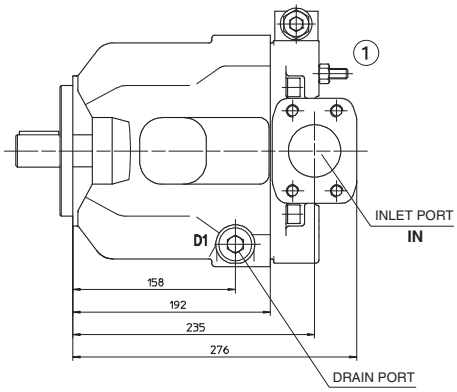


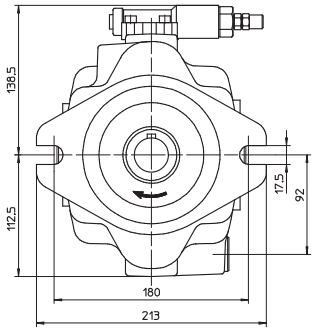
CODE XB - INTERMEDIATE FLANGE SAE “B” FOR PFE-41

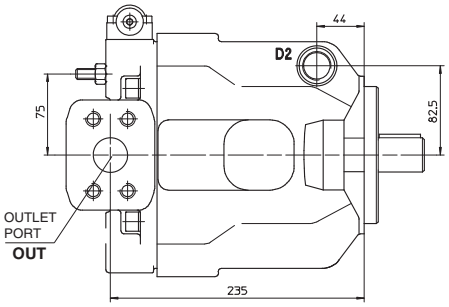


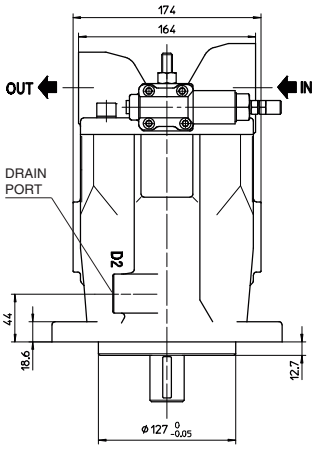
Drawing shows pumps with clockwise rotation (option D): pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted

16 INSTALLATION DIMENSIONS OF PVPC-*-5073 and PVPC-*-5090: BASIC VERSION "C" CONTROL

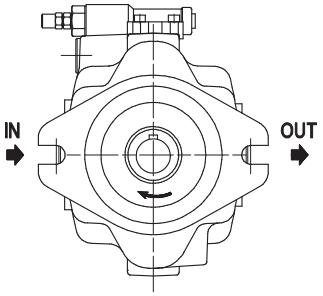








version S
counterclockwise rotation
viewed at the shaft end



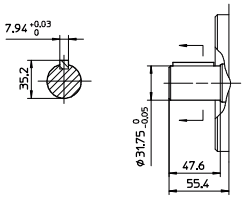
Pumps with counterclockwise rotation (**S**) have the IN and OUT inverted and consequently the position *of the compensators*

PORTS DIMENSION

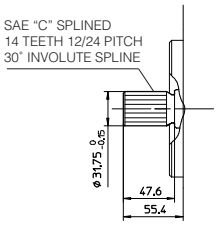
IN = Flange SAE 3000 2"
OUT = Flange SAE 6000 1 1/4"
D1, D2 = 3/4" BSPP
① = Screw for max displacement setting.
In case of double pump the screw is not available for version XC

Mass [kg]	
PVPC-*-5073	33
PVPC-*-5090	

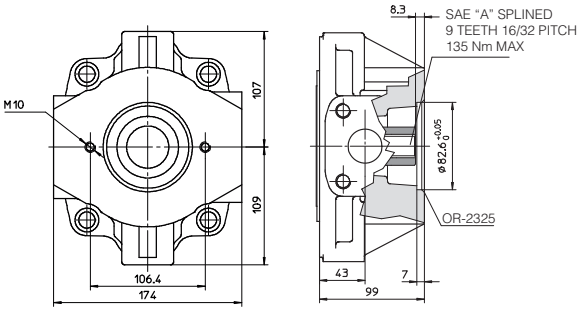
SHAFT TYPE "1"



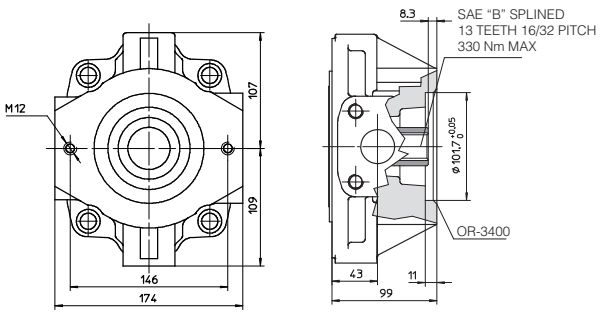
SHAFT TYPE "5"



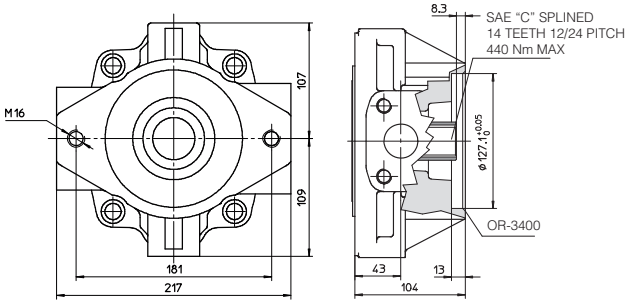
CODE XA - INTERMEDIATE FLANGE SAE "A" FOR PFE-31



CODE XB - INTERMEDIATE FLANGE SAE "B" FOR PFE-41

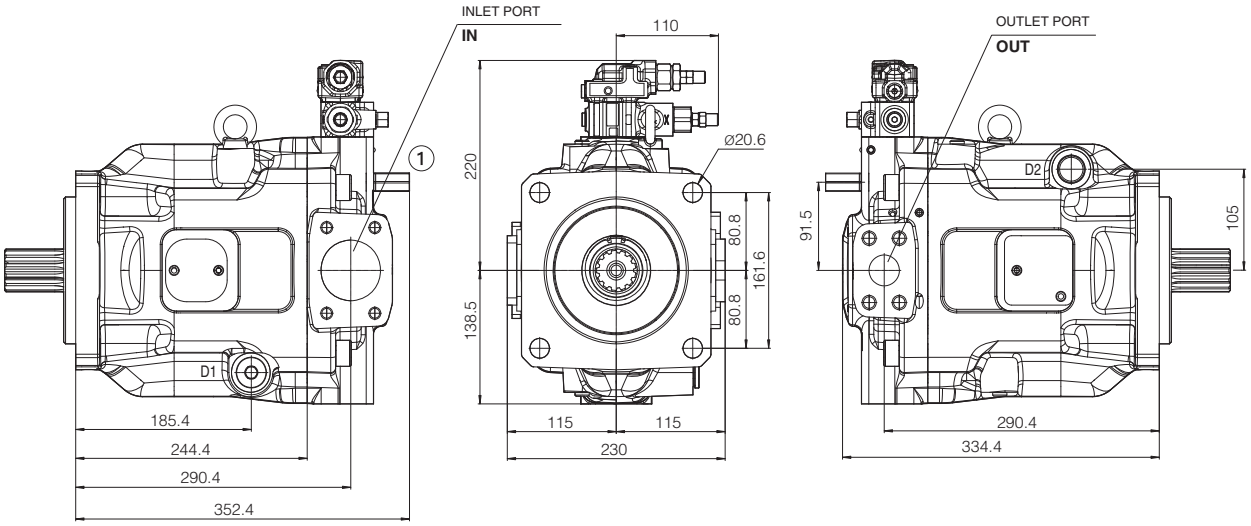


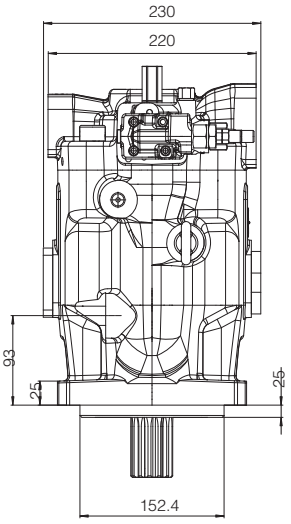
CODE XC - INTERMEDIATE FLANGE SAE "C" FOR PFE-51



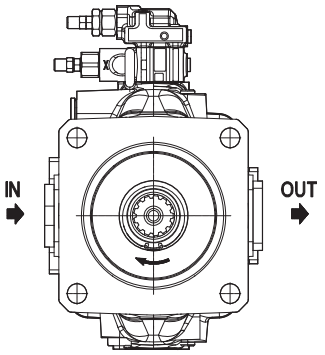
Drawing show pumps with clockwise rotation (option D): pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted

17 INSTALLATION DIMENSIONS OF PVPC-*-6140: BASIC VERSION “C” CONTROL





version S
counterclockwise rotation
viewed at the shaft end



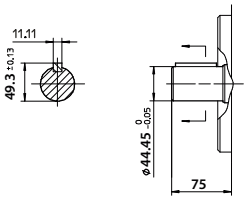
Pumps with counterclockwise rotation (**S**) have the IN and OUT inverted and consequently the position *of the compensators*

PORTS DIMENSION

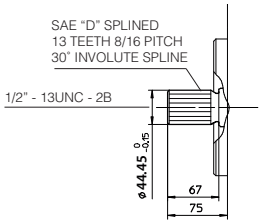
IN = Flange SAE 3000 2 1/2”
OUT = Flange SAE 6000 1 1/4”
D1, D2 = 1 1/16”-12UNF
① = Regulation screw for max displacement setting.

Mass [kg]	
PVPC-*-6140	69

SHAFT TYPE “1”



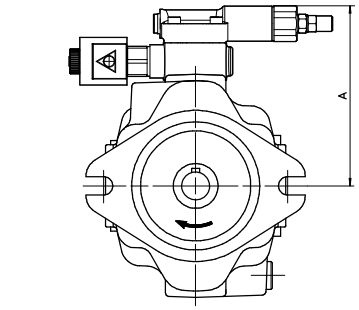
SHAFT TYPE “5”



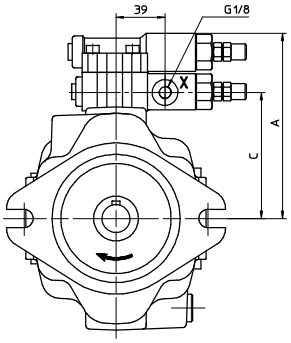
18 INSTALLATION DIMENSIONS OF OTHER CONTROLS

18.1 PVPC size 3, 4 and 5

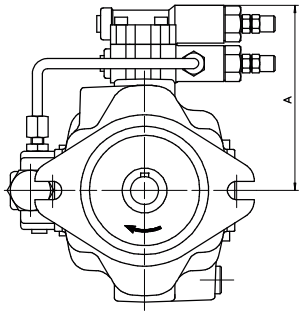
VERSION CH

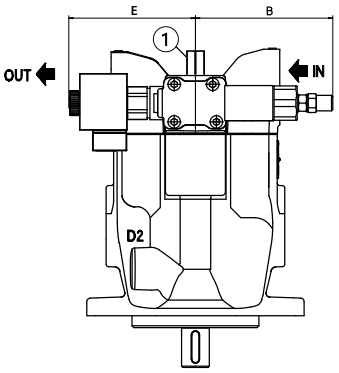


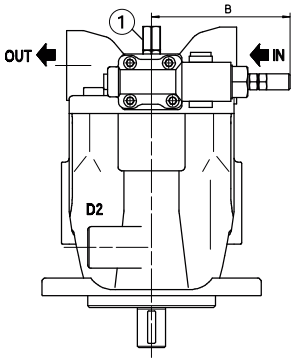
VERSIONS L, R

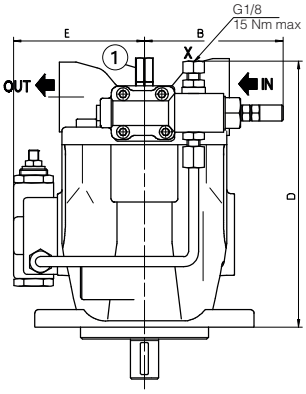


VERSION LW









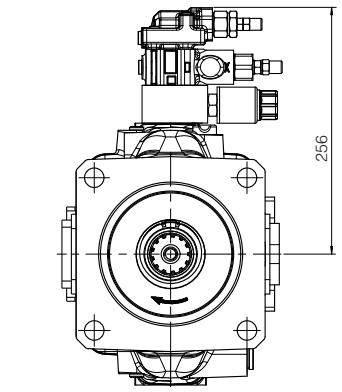
① = Regulation screw for max displacement. Adjustable range 50% to 100% of max displacement).
In case of double pump the regulation screw is not always available, please contact our technical office.

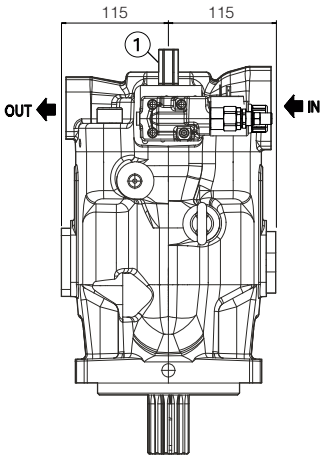
Drawing shows pumps with clockwise rotation (option D): pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted and also the consequently position of the control groups

Pump type	Version	A	B	C	D	E	Mass (kg)
PVPC-*-3029	**CH**	144	111	-	-	102	22
	L -R	144	111	100	-	-	19,2
	LW	144	111	-	211	104	20
PVPC-*-4046	**CH**	153	111	-	-	102	28
	L -R	153	111	109	-	-	25,2
	LW	153	111	-	235	111	26
PVPC-*-5073 PVPC-*-5090	**CH**	166	111	-	-	102	36,9
	L -R	166	111	122	-	-	34,2
	LW	166	111	-	258	120	35

18.2 PVPC size 6

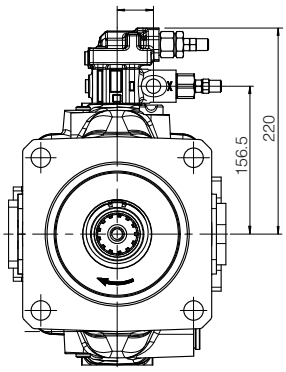
VERSION CH

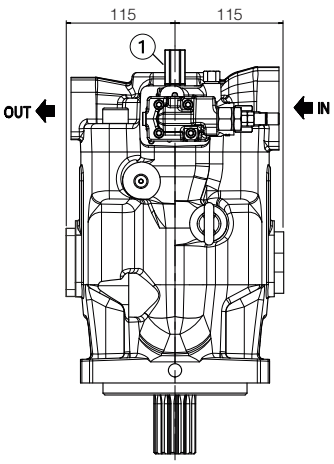




Mass [kg]	
PVPC-*-6140	74

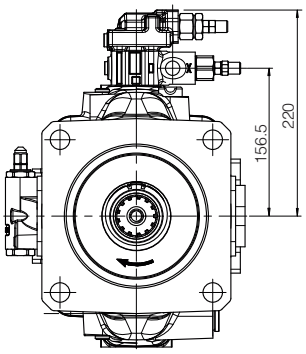
VERSION L

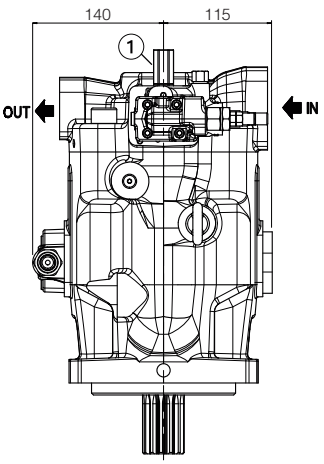




Mass [kg]	
PVPC-*-6140	70.2

VERSION LW





Mass [kg]	
PVPC-*-6140	71

① = Regulation screw for max displacement. Adjustable range 50% to 100% of max displacement).
In case of double pump the regulation screw is not always available, please contact our technical office.

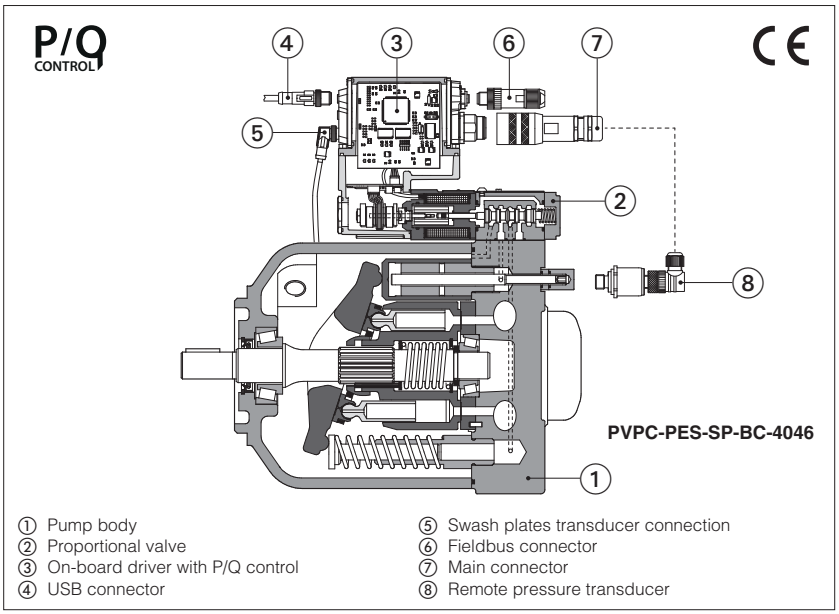
Drawing shows pumps with clockwise rotation (option D): pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted and also the consequently position of the control groups

19 RELATED DOCUMENTATION

A900	Operating and maintenance information for pumps
K800	Electric and electronic connectors

Proportional controls for axial piston pumps

pressure, flow or P/Q controls



① Pump body
② Proportional valve
③ On-board driver with P/Q control
④ USB connector
⑤ Swash plates transducer connection
⑥ Fieldbus connector
⑦ Main connector
⑧ Remote pressure transducer

PVPC

Variable displacement axial piston pumps with swash plate design suited for high pressure open circuits, they are provided with advanced electrohydraulic proportional controls:

- **CZ** open loop pressure control
- **LQZ** open loop flow control (load sensing)
- **PES** closed loop P/Q control

PES performs alternate closed loop controls of pressure, flow and max power limitation. It is also available with optional sequence module (PERS versions) that allows to reduce close to zero the pressure to the delivery line.

SAE J744 mounting flange and shaft.

Max displacement (cm^3/rev)	Max pressure working (bar)	Max pressure peak (bar)
29, 46, 73, 140	280	350
88	250	315

For technical characteristics and features, see tech table A160.

1 MODEL CODE

PVPC	X2E	-	PERS-SP	-	BC	-	4046	/	*	/	1	D	/	*	*	/	*

PVPC — Variable displacement axial piston pump

Option for pumps with through shaft (1):
XA = intermediate flange SAE A
XB = intermediate flange SAE B
XC = intermediate flange SAE C (only for size 5073 and 5090)

Additional suffix for double pumps:
X2E = with a fixed displacement pump type PFE (see tech table A005)

Type of control, see section 13 and 14:
CZ = proportional pressure control **(1)**
LQZ = proportional flow control (load sensing) **(1)**
PES-SP = closed loop integral digital P/Q driver
PERS-SP = as PES plus sequence module

Fieldbus interfaces, USB port always present **(2)**:
NP = Not present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EW = POWERLINK
EI = EtherNet/IP
EP = PROFINET RT/IRT

Size and max displacement (3):
3029 = size 3 - displacement 029 cm^3/rev
4046 = size 4 - displacement 046 cm^3/rev
5073 = size 5 - displacement 073 cm^3/rev
5090 = size 5 - displacement 090 cm^3/rev
6140 = size 6 - displacement 140 cm^3/rev

Pressure setting, only for PERS: **200** = 200 bar **250** = 250 bar **280** = 280 bar

Shaft, SAE Standard **(5)**:
1 = keyed **5** = splined

Direction of rotation, viewed at the shaft end: see section 23:
D = clockwise **S** = counterclockwise

Electronics options, for PES and PERS **(4):**
C = current feedback for pressure transducer 4÷20 mA (omit for std voltage ±10VDC)
I = current reference input and monitor 4÷20 mA (omit for std voltage ±10VDC)
X = on-board pressure transducer with pre-configured pressure settings (only for PERS)
S = with 2 on-off inputs for multiple pressure PID selection for NP execution or double power supply for fieldbus execution, plus dedicated connector for remote pressure transducer

Coil voltage, for CZ, LQZ - see section 18:
18 = optional coil for low current drivers

Series number

Seals material, see section 9 :
- = NBR
PE = FKM

(1) Not available for PVPC-*-6140
(2) Only for PES and PERS
(3) Optional intermediate displacements 35 and 53 cm^3/rev are available on request
(4) For possible combined options, see section 17
(5) Pumps with ISO 3019/2 mounting flange and shaft (option /M) are available on request

2 OFF-BOARD ELECTRONIC DRIVERS - only for **CZ**, **LQZ**

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Data sheet	G010		G020		G030		GS050

3 GENERAL NOTES

Atos digital proportionals pumps are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

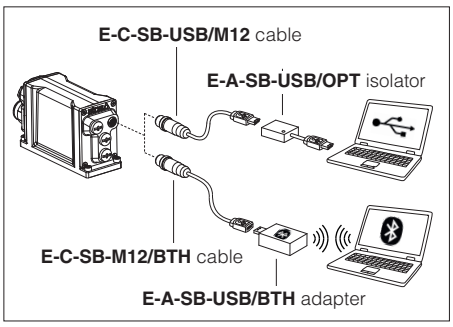
4 PUMP SETTINGS AND PROGRAMMING TOOLS

Pump's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver.
For fieldbus versions, the software permits pump's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **AS800**):

E-SW-BASIC/PQ	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS/PQ	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)

USB or Bluetooth connection



WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

WARNING: see tech table **AS800** for the list of countries where the Bluetooth adapter has been approved

5 FIELDBUS - see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

6 GENERAL CHARACTERISTICS

Assembly position	Any position. The drain port must be on the top of the pump. Drain line must be separated and unrestricted to the reservoir and extended below the oil level as far from the inlet as possible. Suggested maximum line lenght is 3 m.
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, for futher details see technical table P007
Ambient temperature range	**CZ,LQZ:** **Standard** = -25°C ÷ +60°C **/PE** option = -15°C ÷ +80°C **PES, PERS:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C
Storage temperature range	**CZ,LQZ:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **PES, PERS:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C
Surface protection (pump body)	Black painting RAL 9005
Surface protection (pilot valve)	Zinc coating with black passivation, galvanic treatment (driver housing)
Corrosion resistance (pilot valve)	Salt spray test (EN ISO 9227) > 200 h
Vibration resistance	See technical table G004
Compliance (proportional pilot valve)	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006)

7 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

PVPC size		**3029**		**4046**		**5073**		**5090**		**6140**	
Max displacement	(cm^3/rev)	29		46		73		88		140	
Theoretical max flow at 1450 rpm	(l/min)	42		66,7		105,8		127,6		203	
Max pressure working / peak	(bar)	280 / 350		280 / 350		280 / 350		250 / 315		280 / 350 **(1)**	
Min/Max inlet pressure	(bar abs.)	0,8 / 25		0,8 / 25		0,8 / 25		0,8 / 25		0,8 / 25	
Max pressure on drain port	(bar abs.)	1,5		1,5		1,5		1,5		1,5	
Power consumption at 1450 rpm and at max pressure and displacement	(Kw)	19,9		31,6		50,1		54,1		122	
Max torque on the first shaft	(Nm)	Type 1 210	Type 5 270	Type 1 350	Type 5 440	Type 1 670	Type 5 810	Type 1 670	Type 5 810	Type 1 1300	Type 5 1660
Max torque at max working pressure	(Nm)	128		203		328		350		780	
Speed rating	(rpm)	500 ÷ 3000		500 ÷ 2600		500 ÷ 2600		500 ÷ 2200		500 ÷ 2200	
Body volume	(l)	0,7		0,9		1,5		1,5		2,8	

(1) The maximum pressure can be increased to 350 bar (working) and 420 bar (peak) after detailed analysis of the application and of the pump working cycle

8 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	**CZ**, **LQZ** = 35 Watt; **PES**, **PERS** = 50 Watt			
Max. solenoid current	2,6 A for standard **12 VDC** coil; 1,5 A for standard **18 VDC** coil (only for CZ, LQZ)			
Coil resistance R at 20°C	**Size 3**: 3 ÷ 3,3 Ω for standard **12 VDC** coil; 13 ÷ 13,4 Ω for **18 VDC** coil (only for version CZ, LQZ)			
	Size 4, 5: 3,8 ÷ 4,1 Ω for standard **12 VDC** coil; 12 ÷ 12,5 Ω for **18 VDC** coil (only for version CZ, LQZ)			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer power supply	+24VDC @ max 100 mA (E-ATR-8 see tech table **GS465**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	**CZ, LQZ** = IP65; **PES, PERS** = IP66/67 with mating connector			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 22			

Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

9 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C		
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR **(1)**	ISO 12922
Flame resistant with water		NBR, HNBR	HFC **(1)**	

(1) See section 10

10 PERFORMACE RESTRICTIONS WITH FLAME RESISTANT FLUIDS

10.1 HFDU and HFDR - Phosphate ester

PVPC size		**3029**	**4046**	**5073**	**5090**	**6140**
Max pressure working / peak	(bar)	200 / 240				**(2)**
Max speed **(1)** (rpm @ VMAX)		2050	1850	1700	1550	
Ambient temperature range	(°C)	-10 ÷ +80				
Bearing life (% of bearing life with mineral oil)	(%)	90				

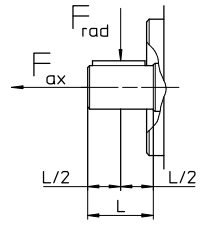
(1) With an inlet pressure of 1 bar abs
(2) For information about size 6140, contact Atos technical office

10.2 HFC - Water-glycol (35 ÷ 55 % of water)

PVPC size		**3029**	**4046**	**5073**	**5090**	**6140**
Max pressure working / peak	(bar)	180 / 210				**(2)**
Max speed **(1)** (rpm @ VMAX)		2050	1850	1700	1550	
Ambient temperature range	(°C)	-10 ÷ +60				
Bearing life (% of bearing life with mineral oil)	(%)	40				

(1) With an inlet pressure of 1 bar abs
(2) For information about size 6140, contact Atos technical office

11 MAX PERMESSIBLE LOAD ON DRIVE SHAFT

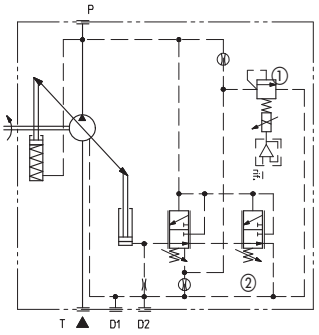
PVPC size			**3029**	**4046**	**5073**	**5090**	**6140**
Fax = axial load		N	1000	1500	2000	2000	2000
Frad = radial load		N	1500	1500	3000	3000	3000

12 VARIATION OF MAX SPEED VS INLET PRESSURE

Inlet pressure	**Displacement %**					
bar abs.	65	70	80	90	100	
0,8	120	115	105	97	90	**% variation of the max. speed**
0,9	120	120	110	103	95	
1,0	120	120	115	107	100	
1,2	120	120	120	113	106	
1,4	120	120	120	120	112	
1,6	120	120	120	120	117	
2,0	120	120	120	120	120	

Example
Displacement: 80% - Inlet pressure: 1,0 bar - Speed: 115%

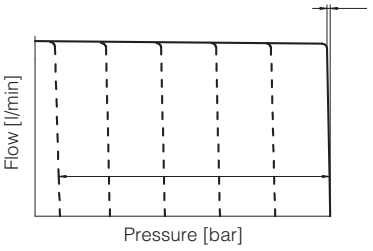
CZ



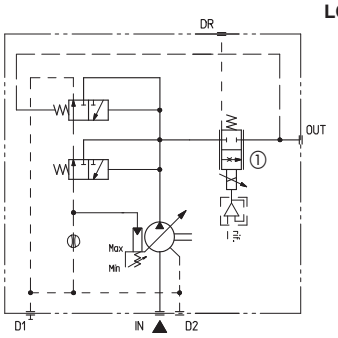
Proportional pressure control

Open loop control of the pump max pressure
The pumps displacement, and thus the flow, remains constant as far the pressure in the circuit reaches the value set on the proportional pilot valve ①, then the flow is reduced to maintain the circuit pressure to the value set by the electronic reference signal to the proportional valve. In this conditions the pressure in the circuit can be continuosly modulated by means of the reference signal.
Proportional pressure setting range: see below pressure control diagram.
Compensator setting range ②: 20÷350 bar (315 bar for 090)
Compensator factory setting ②: 280 bar (250 bar for 090)

Hysteresis and pressure increase: max 4 bar

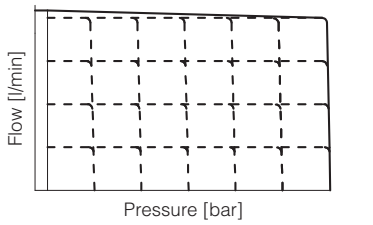


LQZ



Proportional flow (load-sensing)

Open loop control of the pump flow independent to the cyrcuit load. The pump displacement is self adjusted to maintain a costant pressure drop across the proportional flow control valve ①.
The pump flow can be continuosly regulated by modulating the proportional valve ①.

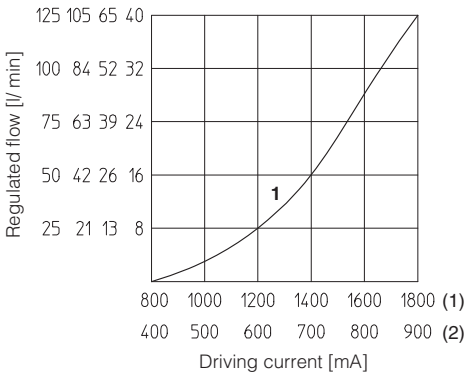


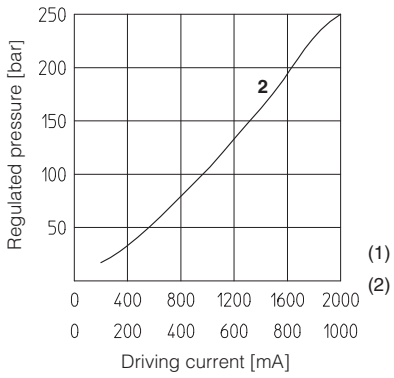
Diagrams for CZ, LQZ

Regulation diagrams
1 = Flow control
2 = Pressure control

(1) for standard 12 VDC coil
(2) for 18 VDC coil

Pump size
88 73 46 29 cm³/rev

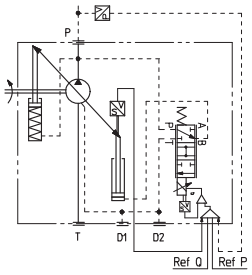




14 P/Q CONTROL

Pressure transducer not included

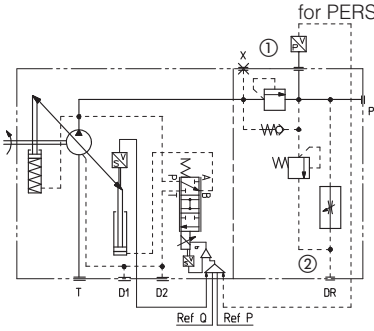
PES



Pressure transducer included only for PERS/X

PERS

PERS/X



P/Q control integrates the alternate pressure and flow regulation with the electronic max power limitation.
A remote pressure transducer must be installed on the system and its feedback has to be interfaced to the pump on-board digital driver.
Flow control is active when the actual system pressure is lower than the pressure reference input signal: the pump flow is regulated according to the flow reference input.
Pressure control is activated when the actual pressure grows up to the pressure reference input signal: the pump flow is then reduced in order to regulate and limit the max system pressure (if the pressure tends to decrease under its command value, the flow control returns active). This option allows to realize accurate dynamic pressure profiles.

Following fieldbus interfaces are available:

- BC - CANopen interface
- BP - PROFIBUS DP interface
- EH - EtherCAT interface
- EW - POWRELINK interface
- EI - EtherNet/IP interface
- EP - PROFINET RT/IRT interface

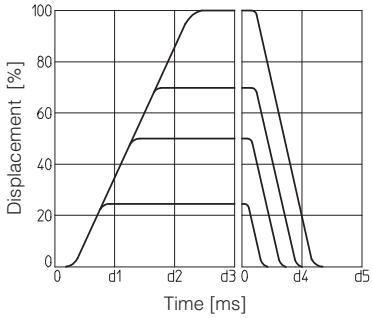
The pumps with BC, BP, EH, EW, EI and EP interfaces can be integrated into a fieldbus communication network and thus digitally operated by the machine control unit.
The digital control ensures high performances as flow and pressure linearity (see diagram 1), better flow knee (see diagram 2), internal leakage compensation (controlled flow independent to the load variations).

PVPC-PES basic version, without sequence module and without pressure transducer, which has to be installed on the main line and wired to the 12 poles connector of the pump on-board digital driver.

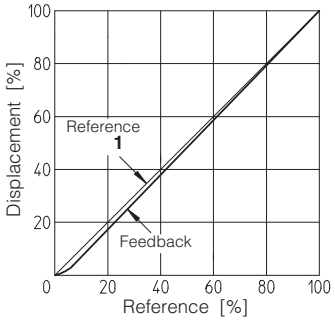
PVPC-PERS version with sequence module RESC ② which grant a minimum piloting pressure (18 bar) when the actual pressure falls below that value. Without pressure transducer.

PVPC-PERS/X as PERS version plus integral pressure transducer, with output signal 4÷20 mA, factory wired to the pump on-board digital driver through a cable gland.

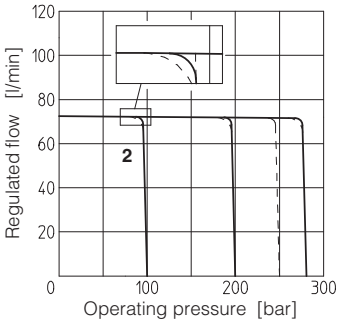
Response time



Regulated flow



P/Q control



Type pump	d1	d2	d3	d4	d5
	[ms]				
PVPC-PE(R)S-3029	30	60	90	30	60
PVPC-PE(R)S-4046	40	80	120	40	80
PVPC-PE(R)S-5073	50	100	150	50	100
PVPC-PE(R)S-5090	60	120	170	60	120
PVPC-PE(R)S-6140	90	180	200	90	180

Response time of displacement variation for a step change of the electronic reference signal.

15 PRESSURE TRANSDUCER SELECTION

The pressure transducer type E-ATR-8 must be ordered separately (see tech table **GS465**)
For /X option the pressure transducer with output signal 4 ÷ 20 mA is on-board to the pump.

Pump code:	Pressure transducer code:
PVPC-PE(R)S-*/200	E-ATR-8/250
PVPC-PE(R)S-*/250	E-ATR-8/400
PVPC-PE(R)S-*/280	E-ATR-8/400
PVPC-PE(R)S-*/200/*/C	E-ATR-8/250/I
PVPC-PE(R)S-*/250/*/C	E-ATR-8/400/I
PVPC-PE(R)S-*/280/*/C	E-ATR-8/400/I

16 ELECTRONICS OPTIONS - only for **PES** and **PERS**

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

C = This option is available to connect pressure transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

X = This option providing the presence of the pressure transducer, with output signal 4÷20 mA, integral to the pump and factory wired to the PES electronics through a cable gland (see 19.10).

S = Two on-off input signals are available on the main connector to select one of the four pressure PID parameters setting, stored into the driver (see 19.11).

17 POSSIBLE COMBINED OPTIONS

for **PES**:	for **PERS**:
/CI, /CS, /IS, /CIS	/CI, /CS, /IS, /IX, /SX, /CIS, /ISX

18 COIL VOLTAGE OPTION - only for **CZ** and **LQZ**

18 = Optional coil to be used with electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A.

19 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **PES** and **PERS**

Generic electrical output signals of the pump (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

19.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 19.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

19.2 Power supply for driver's logic and communication (VL+ and VL0) - only for **/S** and **/SX** options for fieldbus executions

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

19.3 Flow reference input signal (Q_INPUT+)

Functionality of Q_INPUT+ signal, is used as reference for the pump's flow.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

19.4 Pressure reference input signal (P_INPUT+)

Functionality of P_INPUT+ signal, is used as reference for the driver pressure closed loop.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

19.5 Flow monitor output signal (Q_MONITOR)

The driver generates an analog output signal proportional to the actual pump swashplate position; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).
Monitor output signal is factory preset according to selected pump code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

19.6 Pressure monitor output signal (P_MONITOR)

The driver generates an analog output signal proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference).
Monitor output signal is factory preset according to selected pump code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

19.7 Enable input signal (ENABLE) - only for **/S** and **/SX** options

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

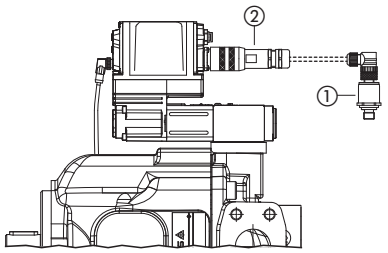
19.8 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

19.9 Pressure transducer input signal

Analog pressure transducers can be directly connected to the driver.
Analog input signal is factory preset according to selected pump code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Refer to the pump technical table to transducer characteristics to select the transducer's maximum pressure.
Standard:
Remote pressure transducer can be directly connected to the main connector on the driver (see 20.1)
/S option
Remote pressure transducer can be directly connected to a dedicated M12 connector (see 20.4)
/X and /SX options
Integral-to-pump transducer is directly connected with a dedicated M12 connector and no remote transducer is required;
current input signal (4 ÷ 20 mA) of the integral transducer allows cable break detection functionality

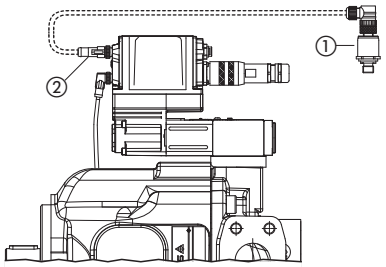
Standard



① = **remote transducer**
② = **main connector**

Note: ① and ② to be ordered separately

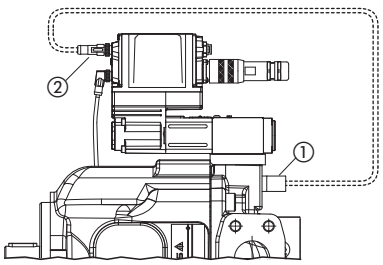
/S option



① = **remote transducer**
② = **M12 connector**

Note: ① and ② to be ordered separately

/X and /SX options



① = **integral transducer**
② = **M12 connector**

Note: ① and ② included

19.10 Logic Input Signal (D_IN) - only for **standard** and **standard** with **/X** option

D_IN on-off input signal can be software set to perform one of the following functions:
- enable and disable the driver functioning; apply 0 VDC to disable and 24 VDC to enable the driver - see 19.7
- switch between two pressure PID settings; apply 0 VDC to select SET1 pressure PID and 24 VDC to select SET2 - see 19.11
- enable and disable the power limitation function; default setting, apply 0V to disable and 24VDC to enable the power limitation - see 19.13

19.11 Multiple PID selection (D_IN0 and D_IN1) - only for **/S** and **/SX** options in **NP** execution

Two on-off input signals are available on the main connector to select one of the four pressure PID parameters setting, stored into the driver.
Switching the active setting of pressure PID during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.).
Supply a 24 VDC or a 0 VDC on pin 9 and/or pin 10, to select one of the PID settings as indicated by binary code table at side. Gray code can be selected by software.

	PID SET SELECTION			
PIN	**SET 1**	**SET 2**	**SET 3**	**SET 4**
9	0	24 VDC	0	24 VDC
10	0	0	24 VDC	24 VDC

19.12 Multiple pressure PID (1)

Four sets for pressure PID parameters are stored into the driver: switching in real-time the active pressure PID parameters during machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.).
The available commands to switch these PID pressure sets depend on the driver execution:

Fieldbus	Driver	Commands
NP	Standard and Standard with /X option	1 on-off input on main connector allow to switch the 2 PID parameters (SET1 and SET2, see 4.10)
	/S and /SX options	2 on-off inputs allow to switch the 4 PID parameters set (SET1.. SET4 - see 4.11)
BC, BP, EH, EW, EI, EP	All versions	real-time fieldbus communication can switch between the 4 PID parameters set (SET1 - SET4 - see driver manuals)

19.13 Hydraulic Power Limitation (1)

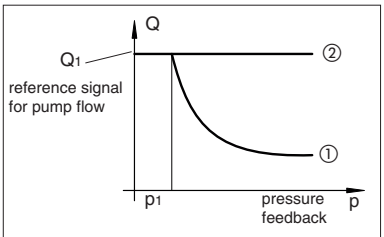
A limit to the maximum pump's hydraulic power can be software set into the driver thus limiting the electric power consumption of the motor coupled to the pump: when the actual requested hydraulic power **p**x**Q** (pressure transducer feeback x flow reference value) reaches the max power limit (p1xQ1), the driver automatically reduces the flow pump regulation.

The higher is the pressure feedback the lower is the pumps's regulated flow:

$$\text{Flow regulation} = \text{Min}\left(\frac{\text{Power Limit [kW]}}{\text{Pressure Feedback [bar]}} \text{ X } \frac{1}{\text{Flow Full Scale [l/min]}} \text{ ; Flow Reference}\right)$$

The hydraulic power limitation, disabled as default, can be enabled using the Atos pc software or the fieldbus communication (fieldbus executions).
Standard and standard with /X option allow also to enable and disable this function during the machine cycle, using the D_IN on-off input available on the main connector (see 19.11).

19.13 - Hydraulic Power Limitation



regulation curve ① with and ② without power limitation.
p1 x Q1 = max power limit

(1) The sections 19.12 and 19.13 are a brief description of the settings and features of digital drivers with alternated P/Q control. For a detailed descriptions of available settings, wirings and installation procedures, please refer to the user manual included in the E-SW programming software:
E-MAN-RI-PES - user manual for **PES-S** digital drivers

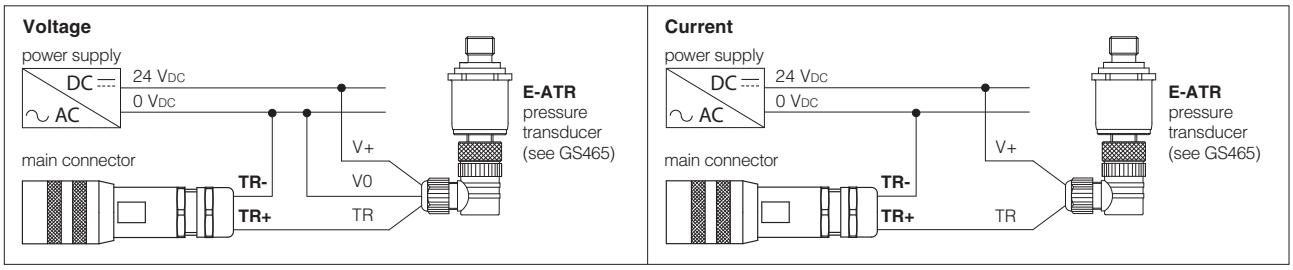
20 ELECTRONIC CONNECTIONS

20.1 Main connector signals - 12 pin (A) **Standard** and **Standard** with **/X** option - for **PES** and **PERS**

PIN	Standard	/X	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**		Power supply 24 VDC	Input - power supply
2	**V0**		Power supply 0 VDC	Gnd - power supply
3	**FAULT**		Fault (0 VDC) or normal working (24 VDC), referred to V0	Output - on/off signal
4	**INPUT-**		Negative reference input signal for Q_INPUT+ and P_INPUT+	Gnd - analog signal
5	**Q_INPUT+**		Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0÷+10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
6	**Q_MONITOR**		Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are 0÷+10 VDC for standard and 4 ÷ 20 mA for /I option. Referred to V0	Output - analog signal **Software selectable**
7	**P_INPUT+**		Pressure reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0÷+10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
8	**P_MONITOR**		Pressure monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are 0÷+10 VDC for standard and 4 ÷ 20 mA for /I option. Referred to V0	Output - analog signal **Software selectable**
9	**D_IN**		Function software selectable between: power limitation enable (default), multiple pressure PID selection or pump enable (24 VDC) / disable (0 VDC). Referred to V0	Input - on/off signal
10	**TR+**		Remote pressure transducer input signal: ±10 VDC / ±20 mA maximum range Defaults are 0÷+10 VDC for standard and 4 ÷ 20 mA for /C option	Input - analog signal **Software selectable**
		NC	Do not connect	
11	**TR-**		Negative pressure transducer input signal for TR+	Input - analog signal
		NC	Do not connect	
PE	**EARTH**		Internally connected to driver housing	

Note: these connections are the same of Rexroth A10VSO axial piston pumps, model SYDFEE and SYDFEC

Remote pressure transducer connections - only for **Standard**



20.2 Main connector signals - 12 pin (A) **/S** and **/SX** option - for **PES** and **PERS**

PIN	/S and /SX		TECHNICAL SPECIFICATIONS	NOTES
	NP	Fieldbus		
1	**V+**		Power supply 24 VDC	Input - power supply
2	**V0**		Power supply 0 VDC	Gnd - power supply
3	**ENABLE** referred to: V0	VL0	Enable (24 VDC) or disable (0 VDC) the pump	Input - on/off signal
4	**Q_INPUT+**		Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0÷+10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**		Negative reference input signal for Q_INPUT+ and P_INPUT+	Input - analog signal
6	**Q_MONITOR** referred to: V0	VL0	Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are 0÷+10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
7	**P_INPUT+**		Pressure reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0÷+10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
8	**P_MONITOR** referred to: V0	VL0	Pressure monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are 0÷+10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
9	**D_IN0**		Function software selectable between: multiple pressure PID 0 selection (default) or power limitation enable. Referred to V0	Input - on/off signal
		VL+	Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**D_IN1**		Function software selectable between: multiple pressure PID 1 selection (default) or power limitation enable. Referred to V0	Input - on/off supply
		VL0	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT** referred to: V0	VL0	Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
PE	**EARTH**		Internally connected to driver housing	

Notes: these connections are the same of Moog radial piston pumps, model RKP-D;
do not disconnect VL0 before VL+ when the driver is connected to PC USB port

20.3 Communications connectors - for **PES** and **PERS** (B) - (C)

(B) **USB connector - M12 - 5 pin** always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) (C2) **BP fieldbus execution, connector - M12 - 5 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(1) Shield connection on connector's housing is recommended

(C1) (C2) **BC fieldbus execution, connector - M12 - 5 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**CAN_SHLD**	Shield
2	**not used**	(C1) - (C2) pass-through connection (2)
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

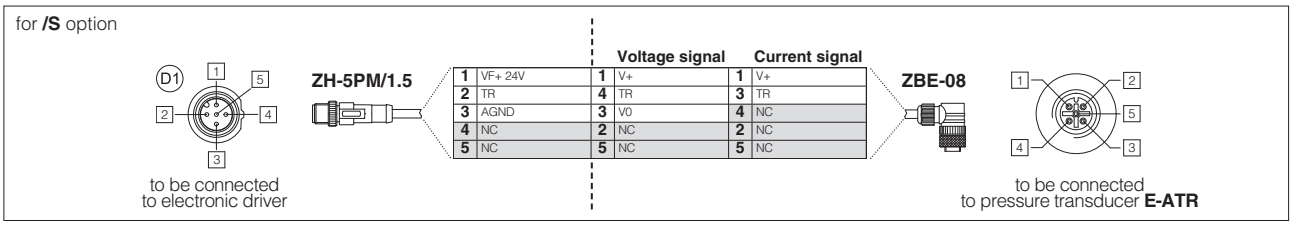
(C1) (C2) **EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

(2) Pin 2 can be fed with external +5V supply of CAN interface

20.4 Remote pressure/force transducer connector - M12 - 5 pin - for **PES** and **PERS** with for **/S, /X, /SX** options (D1) - (D2)

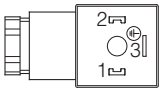
PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	Voltage	Current
1	**VF +24V**	Power supply +24VDC	Output - power supply	Connect	Connect
2	**TR1**	Signal transducer: ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect
3	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/
4	**NC**	Not connect		/	/
5	**NC**	Not connect		/	/

Remote pressure transducer connection - example



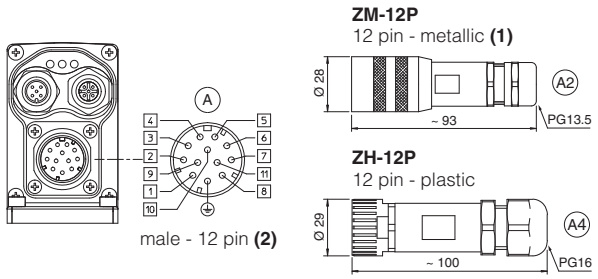
Note: connectors front view

20.5 Solenoid connection - for **CZ** and **LQZ**

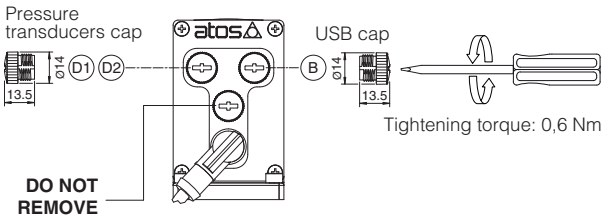
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

20.6 PES and PERS connections layout

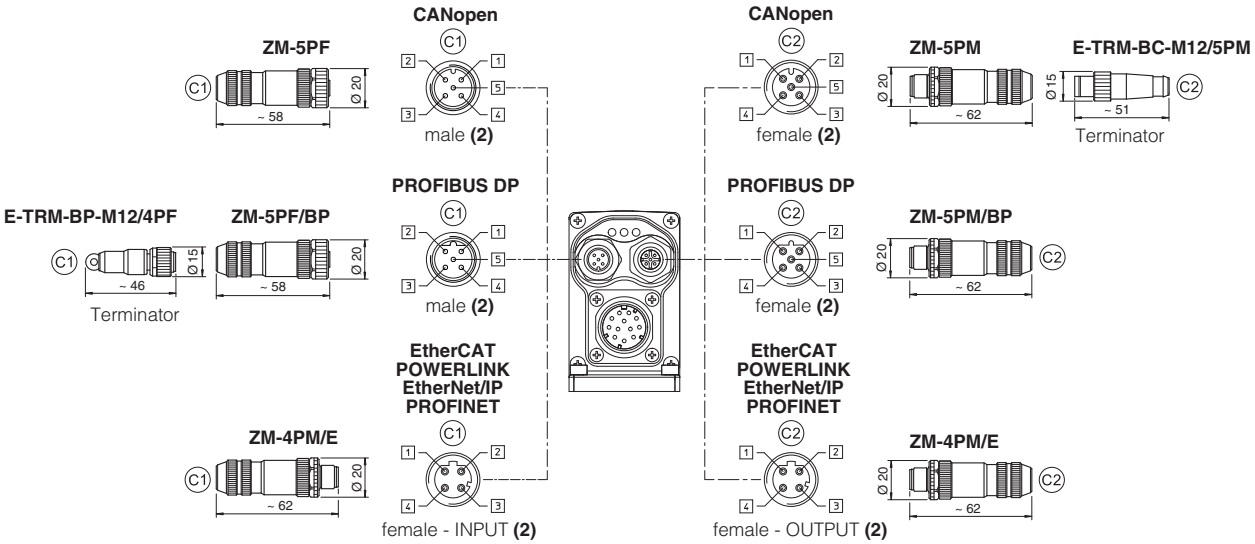
MAIN CONNECTORS



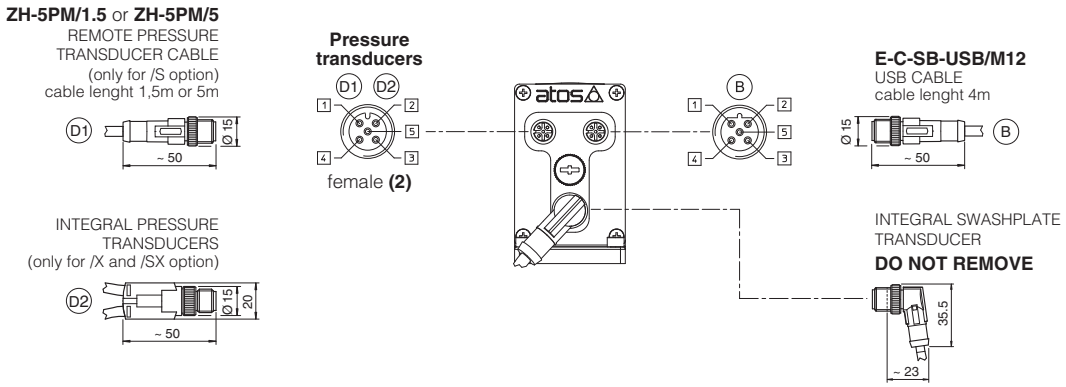
PLASTIC PROTECTION CAPS - supplied with the valves



FIELDBUS CONNECTORS



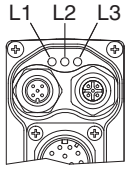
TRANSDUCERS AND USB CONNECTORS



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

20.7 Diagnostic LEDs (L)

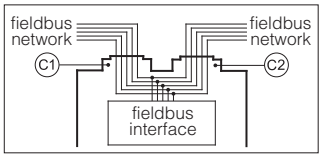
Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS / LEDS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	L1 L2 L3
L1	VALVE STATUS			LINK/ACT				
L2	NETWORK STATUS			NETWORK STATUS				
L3	SOLENOID STATUS			LINK/ACT				

21 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital driver executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.
For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **AS800**).
For EH, EW, EI and EP execution the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



22 CONNECTORS CHARACTERISTICS - to be ordered separately

22.1 Main connectors

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	A1 ZM-12P	A2 ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm² to 1,5 mm² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

22.2 Fieldbus communication connectors

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET (2)
CODE	C1 ZM-5PF	C2 ZM-5PM	C1 ZM-5PF/BP	C2 ZM-5PM/BP	C1 C2 ZM-4PM/E
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

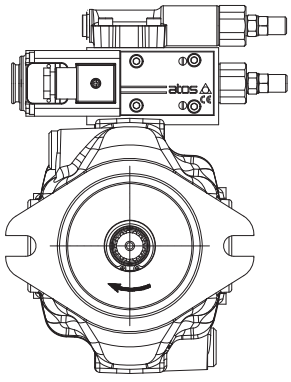
(1) E-TRM-** terminators can be ordered separately, see tech table **AS800** **(2)** Internally terminated

22.3 Remote pressure transducer connectors

CONNECTOR TYPE	PRESSURE TRANSDUCER		SF - Double transducers
CODE	D1 D2 ZH-5PM/1.5	D1 D2 ZH-5PM/5	D2 ZH-5PM-2/2
Type	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding A – IEC 61076-2-101
Material	Plastic		Plastic
Cable gland	Connector moulded on cables 1,5 m lenght	5 m lenght	Connector moulded on cables 2 m lenght
Cable	5 x 0,25 mm²		3 x 0,25 mm² (both cables)
Connection type	molded cable		splitting cable
Protection (EN 60529)	IP 67		IP 67

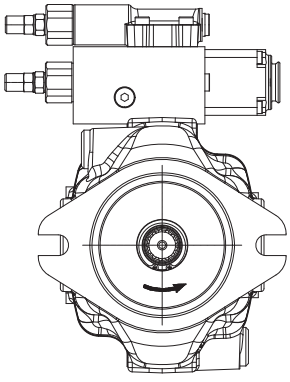
23 DIRECTION OF ROTATION

version D
clockwise rotation
viewed at the shaft end



Pumps with clockwise rotation (**D**)
have the IN and OUT as shown
in all representation of catalogue

version S
counterclockwise rotation
viewed at the shaft end

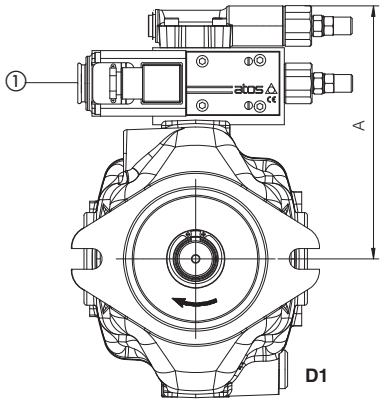


Pumps with counterclockwise rotation (**S**)
have the IN and OUT inverted and
consequently the position of the
electrohydraulic proportional controls

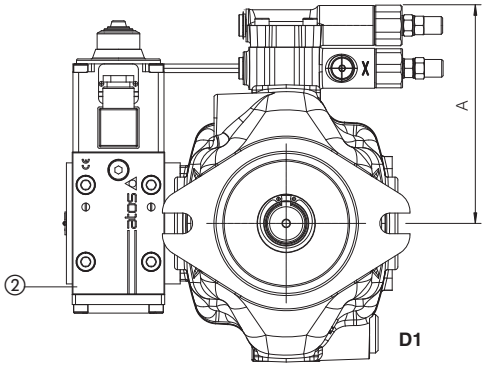
24 INSTALLATION DIMENSION [mm]

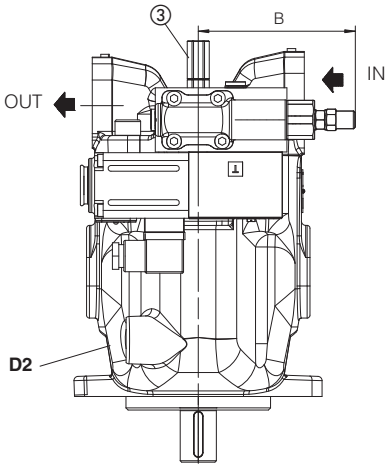
DIMENSIONS OF PVPC size 3, 4 and 5

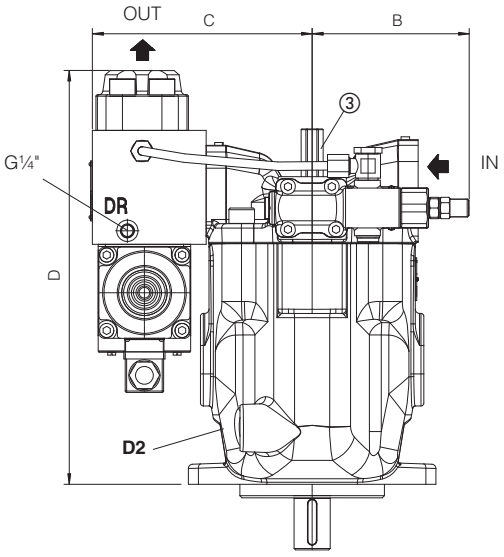
PVPC-CZ



PVPC-LQZ







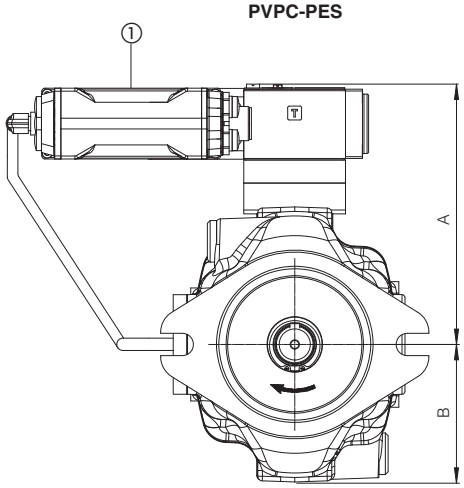
① = Proportional pressure control valve
② = Proportional flow control valve
③ = Regulation screw for max displacement. Adjustable range 50% to 100% of max displacement (not available for versions PES, PERS and PERS/X).
In case of double pump the regulation screw is not always available, please contact our technical office.

Drawing shows pumps with clockwise rotation (option D): pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted and consequently also the position of the control devices.

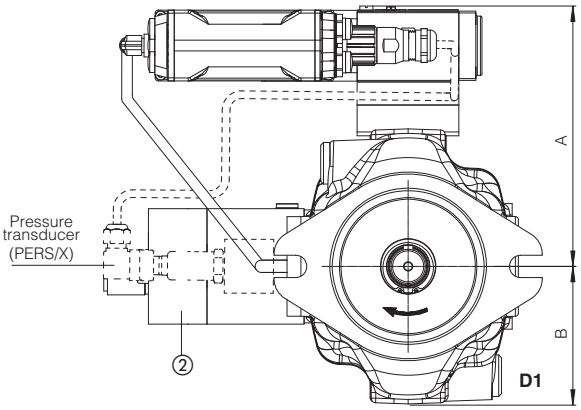
Pump type	Version	A	B	C	D	IN	OUT	D1, D2	Mass (kg)
PVPC-*-3029	**CZ**	168	111	-	-	Flange SAE 3000 1 1/4”	Flange SAE 6000 3/4”	1/2” BSPP	22
	LQZ	144	111	132	257				24
PVPC-*-4046	**CZ**	177	111	-	-	Flange SAE 3000 1 1/2”	Flange SAE 6000 1”	1/2” BSPP	28
	LQZ	153	111	156	293				33,6
PVPC-*-5073 PVPC-*-5090	**CZ**	190	111	-	-	Flange SAE 3000 2”	Flange SAE 6000 1 1/4”	3/4” BSPP	36,9
	LQZ	166	111	163	328				44

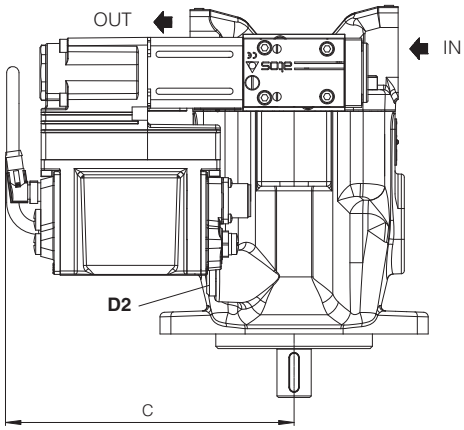
DIMENSIONS OF PVPC size 3, 4 and 5

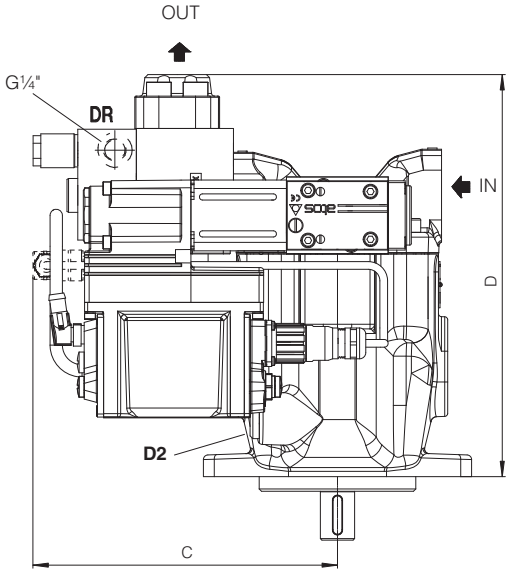
PVPC-PES



PVPC-PERS
PVPC-PERS/X (dotted line)







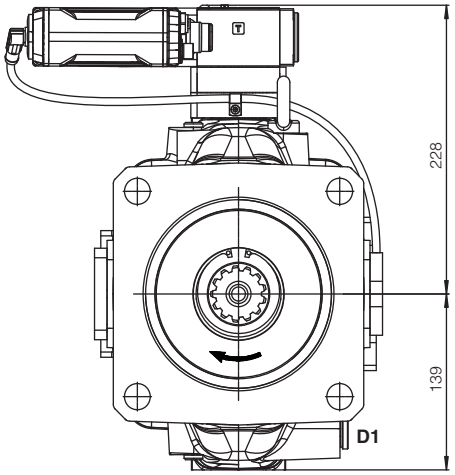
① = Proportional valve with on-board driver with P/Q control
② = Sequence module

Drawing shows pumps with clockwise rotation (option D): pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted and consequently also the position of the control devices.

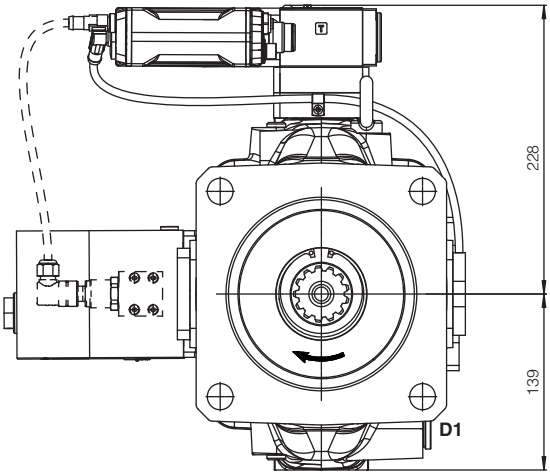
Pump type	Version	A	B	C	D	IN	OUT	D1, D2	Mass (kg)
PVPC-*-3029	**PES**	170	103,5	190	-	Flange SAE 3000 1 1/4”	Flange SAE 6000 3/4”	1/2” BSPP	21,6
	PERS	170	103,5	200	262,5				26
	PERS/X	190	103,5	200	262,5				26,4
PVPC-*-4046	**PES**	178	103,5	190	-	Flange SAE 3000 1 1/2”	Flange SAE 6000 1”	1/2” BSPP	27,6
	PERS	178	103,5	220	299				33,7
	PERS/X	178	103,5	220	299				34,1
PVPC-*-5073 PVPC-*-5090	**PES**	190	103,5	190	-	Flange SAE 3000 2”	Flange SAE 6000 1 1/4”	3/4” BSPP	36,6
	PERS	190	103,5	230	337				46,7
	PERS/X	190	103,5	230	337				47,1

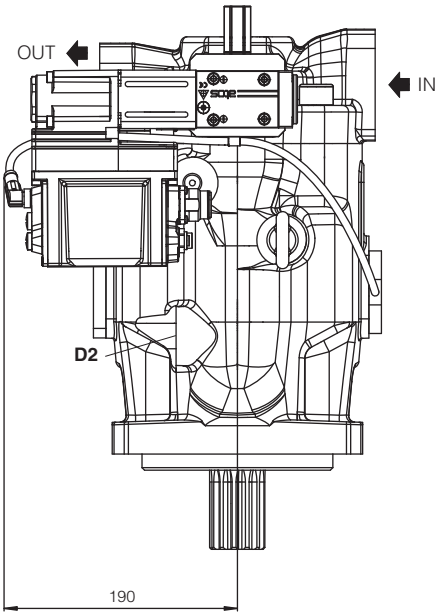
DIMENSIONS OF PVPC size 6

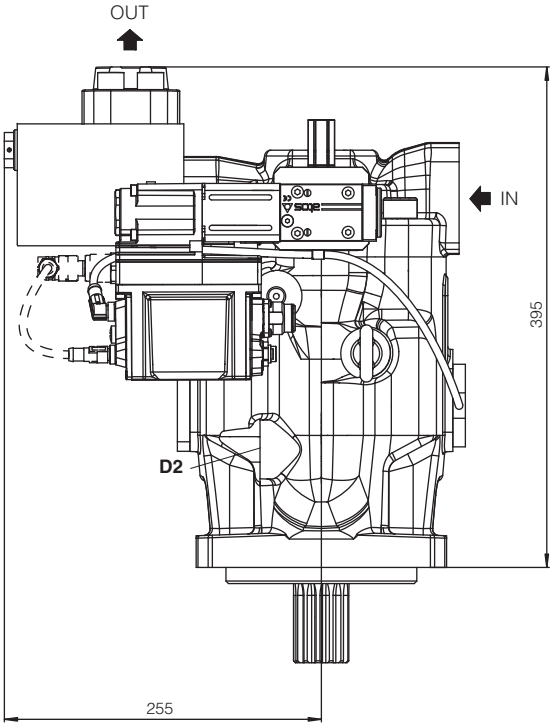
PVPC-PES



PVPC-PERS
PVPC-PERS/X (dotted line)







① = Proportional valve with on-board driver with P/Q control
② = Sequence module

Drawing shows pumps with clockwise rotation (option D): pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted and consequently also the position of the control devices.

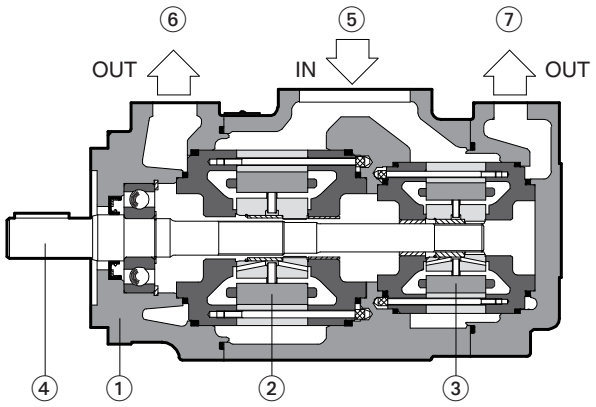
Pump type	Version	IN	OUT	D1, D2	Mass (kg)
PVPC-*-6140	**PES**	Flange SAE 3000 2 1/2”	Flange SAE 6000 1 1/4”	1 1/16”-12UNF	72,7
	PERS				82,8
	PERS/X				83,2

25 RELATED DOCUMENTATION

A900 Operating and maintenance information for pumps
FS001 Basics for digital electrohydraulics
FS500 Digital proportional valves with P/Q control
FS900 Operating and maintenance information for proportional valves
G010 E-MI-AC analog driver
G020 E-MI-AS-IR digital driver
G030 E-BM-AS digital driver
GS050 E-BM-AES digital driver
AS800 Programming tools
GS510 Fieldbus
K800 Electric and electronic connectors
P005 Mounting surfaces for electrohydraulic valves
E-MAN-RI-PES PES user manual

Double vane pumps type PFED

fixed displacement



① Pump body
② First cartridge
③ Second cartridge
④ Shaft
⑤ IN port - SAE 3000 flange
⑥ First OUT port
⑦ Second OUT port

PFED-43

PFED are fixed displacement double vane pumps composed by two cartridges ②③ assembled into a main body having one IN port ⑤ and two indipendent OUT ports ⑥⑦.

Pumps are available with 2 body sizes:

PFED-43: SAE B mounting flange
fist element from 29 to 85 cc/rev
second element from 16 to 44 cc/rev

FPED-54: SAE C mounting flange
fist element from 90 to 150 cc/rev
second element from 29 to 85 cc/rev.

They can be assembled, with fixed vane pump type PFEX-4 and PFEX-5 to obtain triple pumps PFEXD, see table A190.

Easy installation as inlet and outlet ports can be assembled in any of four relative positions.

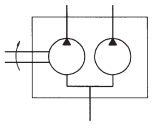
Simplified maintenance as pumping cartridge can be easily replaced.

Displacements: **from 29+16 up to 150+85 cm³/rev.**
Max pressure **up to 210 bar.**

1 MODEL CODE

PFED	-	43	045	/	022	/	1	D	TA	*	/	*
Fixed displacement double vane pump		**Size**: **43** = displacement from 29+16 to 85+45 cm³/rev **54** = displacement from 90+29 to 150+85 cm³/rev	**Displacement of first element** [cm³/rev], see sec. 3		**Displacement of second element** [cm³/rev], see sec. 3		Drive shaft, see section 7 and 8: cylindrical, keyed **1** = standard **2** = according to ISO/DIN 3019 **3** = for high torque applications splined **5** = for PFED-43: SAE B 13T 16/32 DP (13 teeth) for PFED-54: SAE C 14T 12/24 DP (14 teeth) **6** = for PFED-43: SAE C 14T 12/24 DP (14 teeth) **7** = for PFED-43: SAE C 14T 12/24 DP (14 teeth) assembled in multiple pumps PFEXD and PFRXDE - see tech. table A190	Direction of rotation (as viewed at the shaft end): **D** = clockwise (supplied standard if not otherwise specified) **S** = counterclockwise Note: PFED are not reversible	Ports orientation, see section 5	Series number		Seals material: see section 4 **-** = NBR **PE** = FPM

1.1 HYDRAULIC SYMBOL



2 GENERAL CHARACTERISTICS

Assembly position	Any position.
Loads on the shaft	Axial and radial loads are not allowed on the shaft. The coupling should be sized to absorb the power peak.
Ambient temperature range	-20°C ÷ +80°C
Compliance	REACH Regulation (EC) n°1907/2006 RoHS Directive 2011/65/EU as last update by 2015/863/EU

3 HYDRAULIC CHARACTERISTICS

Size code	**PFED-43**																										
First element displacement code	**029**			**037**				**045**					**056**					**070**					**085**				
First element displacement [cm³/rev]	29.3			36.6				45.0					55.8					69.9					85.3				
Second element displacement code	**016**	**022**	**028**	**016**	**022**	**028**	**036**	**016**	**022**	**028**	**036**	**044**	**016**	**022**	**028**	**036**	**044**	**016**	**022**	**028**	**036**	**044**	**016**	**022**	**028**	**036**	**044**
Second element displacement [cm³/rev]	16.5	21.5	28.1	16.5	21.5	28.1	35.6	16.5	21.5	28.1	35.6	43.7	16.5	21.5	28.1	35.6	43.7	16.5	21.5	28.1	35.6	43.7	16.5	21.5	28.1	35.6	43.7
Max working pressure (1) [bar]	210																										
Recommended pressure on inlet port	from -0,15 to +1,5 bar for speed up to 1800 rpm; from 0 to +1,5 bar for speed over to 1800 rpm;																										
Min speed [rpm]	800																										
Max speed (2) [rpm]	2500																						2000				

Size code	**PFED-54**																										
First element displacement code	**090**						**110**						**129**						**150**								
First element displacement [cm³/rev]	90.0						109.6						129.2						150.2								
Second element displacement code	**029**	**037**	**045**	**056**	**070**	**085**	**029**	**037**	**045**	**056**	**070**	**085**	**029**	**037**	**045**	**056**	**070**	**085**	**029**	**037**	**045**	**056**	**070**	**085**			
Second element displacement [cm³/rev]	29.3	36.6	45.0	55.8	69.9	85.3	29.3	36.6	45.0	55.8	69.9	85.3	29.3	36.6	45.0	55.8	69.9	85.3	29.3	36.6	45.0	55.8	69.9	85.3			
Max working pressure (1) [bar]	210																										
Recommended pressure on inlet port	from -0,15 to +1,5 bar for speed up to 1800 rpm; from 0 to +1,5 bar for speed over to 1800 rpm;																										
Min speed [rpm]	800																										
Max speed (2) [rpm]	2000						2200					2000	2200					2000	1800								

(1) Max pressure is 160 bar for HFDU, HFDR and HFC fluids

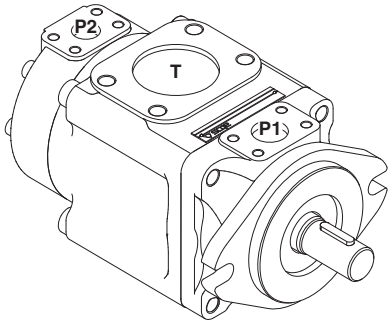
(2) Max speed is 1800 HFDU, HFDR fluids; 1500 rpm for HFC fluid

4 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -25°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C		
Recommended viscosity		10÷100 mm²/s - max at cold start 800 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 21/19/16 NAS1638 class 10		see also filter section at or KTF catalog
	longer life	ISO4406 class 18/16/13 NAS1638 class 8		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR **(1)**	ISO 12922
Flame resistant with water		NBR	HFC **(1)**	

(1) See performance restrictions at section 2

5 PORT ORIENTATION



Pumps can be supplied with the oil ports oriented in different configuration in relation to the drive shaft. Port orientation of the first elementis designated as follows (as wiewed at the shaft end);

T = inlet and outlet ports on the same axis (standard)
U = outlet orientated 180° with respect to the inlet
V = outlet oriented 90° with respect to the inlet
W = outlet oriented 270° with respect to the inlet

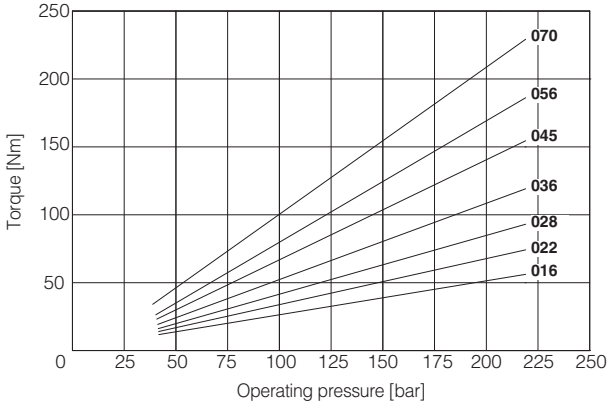
Outlet port of second element can be orientated, relative to the inlet port, in 8 positions at 45° **(O, A, B, C, D, E, F, G)**
Ports orientation can be easily changed by rotating the pump body that carries inlet port.

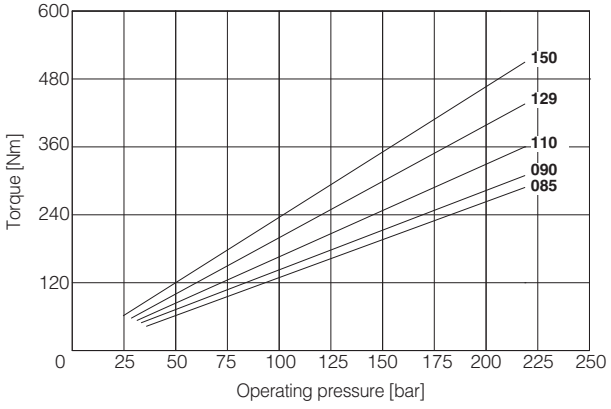
TO P1-T-P2	**TA** P1-T P2	**TB** P1-T P2	**TC** P1-T P2	**TD** P1-T P2	**TE** P1-T P2	**TF** P1-T P2	**TG** P1-T P2
WO P1-P2 T	**WA** P1 P2 T	**WB** P1 T P2	**WC** P1 T P2	**WD** P1 T P2	**WE** P1 T P2	**WF** P1 P2-T	**WG** P1 P2 T
UO P1-P2 T	**UA** P1 P2 T	**UB** P1 T P2	**UC** P1 T P2	**UD** P1 P2-T	**UE** P1 P2 T	**UF** P1 P2 T	**UG** P1 P2 T
VO P1-P2 T	**VA** P1 P2 T	**VB** P1 P2-T	**VC** P1 T P2	**VD** P1 T P2	**VE** P1 P2 T	**VF** P1 P2 T	**VG** P1 P2 T

P1 = outlet port of first element; **P2** = outlet port of second element; **T** = inlet port

6 DIAGRAMS (based on mineral oil ISO VG 46 at 50°C)

6.1 Torque versus pressure diagram

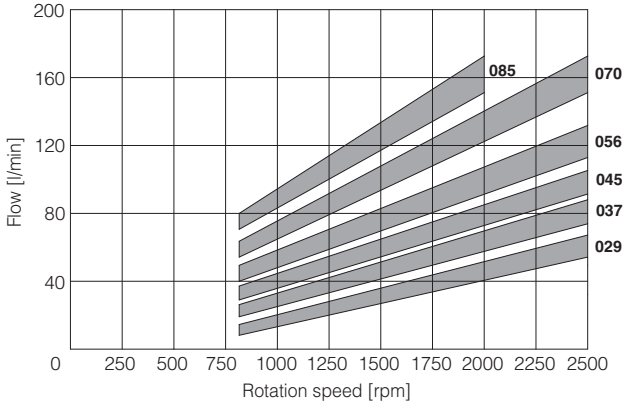




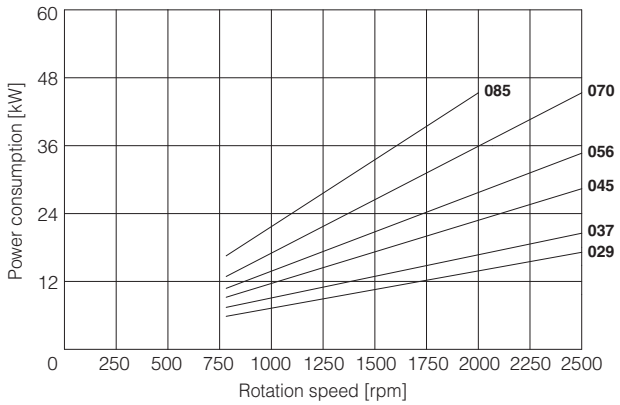
Note: values in above diagrams refer to the torque required to operate each single cartridge. The total torque applied to the pump shaft is given by the sum of the torque of each single cartridge (first element + second element)

6.2 PFED-43 FIRST ELEMENT

Flow versus speed diagram
with pressure variation from 7 bar to 210 bar.

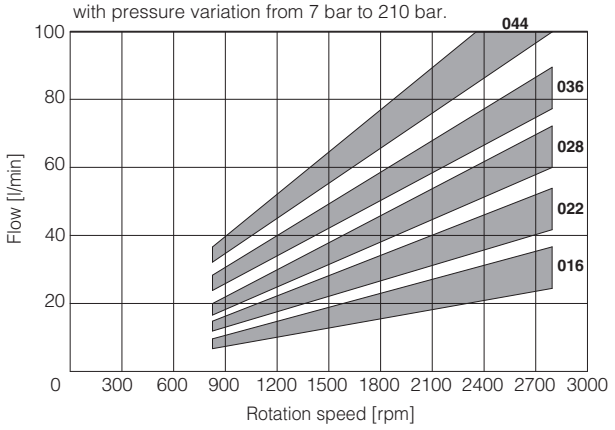


Power consumption versus speed diagram at 140 bar.
Power consumption is proportional to operating pressure.

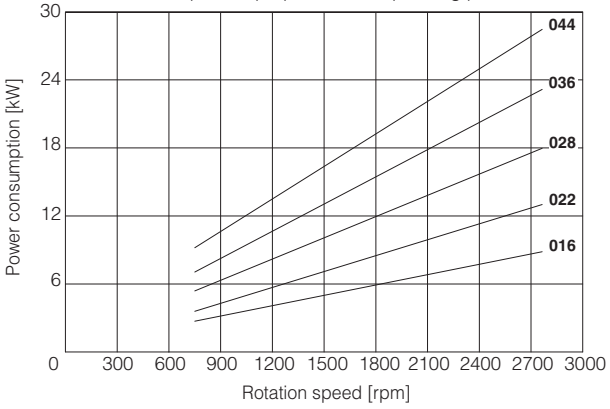


6.3 PFED-43 SECOND ELEMENT

Flow versus speed diagram
with pressure variation from 7 bar to 210 bar.

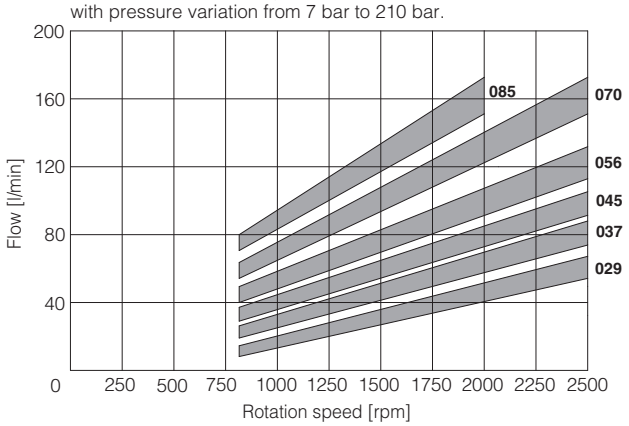


Power consumption versus speed diagram at 140 bar.
Power consumption is proportional to operating pressure.

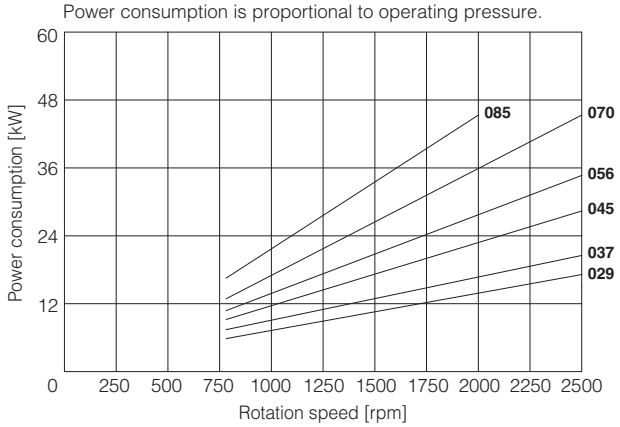


6.4 PFED-54 FIRST ELEMENT

Flow versus speed diagram
with pressure variation from 7 bar to 210 bar.

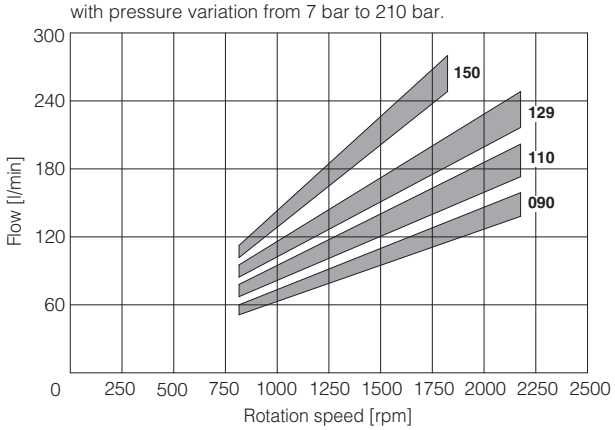


Power consumption versus speed diagram at 140 bar.
Power consumption is proportional to operating pressure.

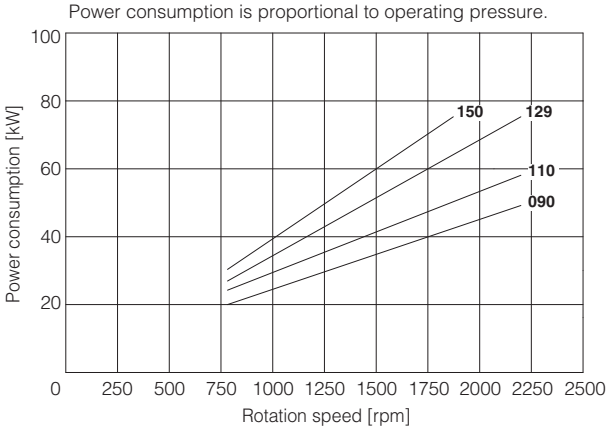


6.5 PFED-54 SECOND ELEMENT

Flow versus speed diagram
with pressure variation from 7 bar to 210 bar.



Power consumption versus speed diagram at 140 bar.
Power consumption is proportional to operating pressure.



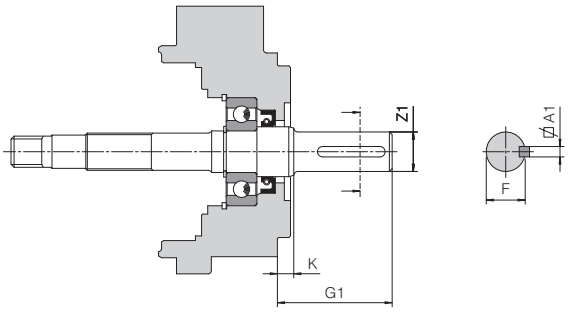
7 DRIVE SHAFT

CYLINDRICAL SHAFT KEYED

1 = supplied as standard if not specified in the model code

2 = according to ISO/DIN 3019 standards

3 = for high torque applications



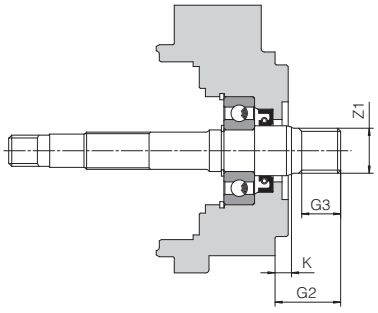
Model	Keyed shaft type 1 (standard)					Keyed shaft type 2					Keyed shaft type 3				
	A1	F	G1	K	ØZ1	A1	F	G1	K	ØZ1	A1	F	G1	K	ØZ1
PFED-43	4,78 4,75	24,54 24,41	59,00	11,40	22,22 22,20	6,38 6,35	25,03 24,77	71,00	8,00	22,22 22,20	6,38 6,35	28,30 28,10	78,00	11,40	25,38 25,35
PFED-54	7,97 7,94	35,33 35,07	74,25	14	31,75 31,70	7,97 7,94	35,33 35,07	84,25	8,1	31,75 31,70	7,97 7,94	38,58 38,46	84,25	14	34,90 34,88

SPLINED SHAFT

5 = for PFED-43 according to SAE B 16/32 DP, 13 teeth;
for PFED-54 according to SAE C 12/24 DP, 14 teeth;

6 = (only for PFED-43) according to SAE C 12/24 DP, 14 teeth;

7 = only for PFED-43 when used as the last element of a multiple pump: similar to shaft type 6.



Model	Splined shaft type 5				Splined shaft type 6				Splined shaft type 7			
	G2	G3	K	Z2	G2	G3	K	Z2	G2	G3	K	Z2
PFED-43	41,25	28	8,00	SAE 16/32-13T	55,60	42	8,00	SAE 12/24-14T	41,60	28	8,00	SAE 12/24-14T
PFED-54	55,7	42	8,1	SAE 12/24-14T	—	—	—	—	—	—	—	—

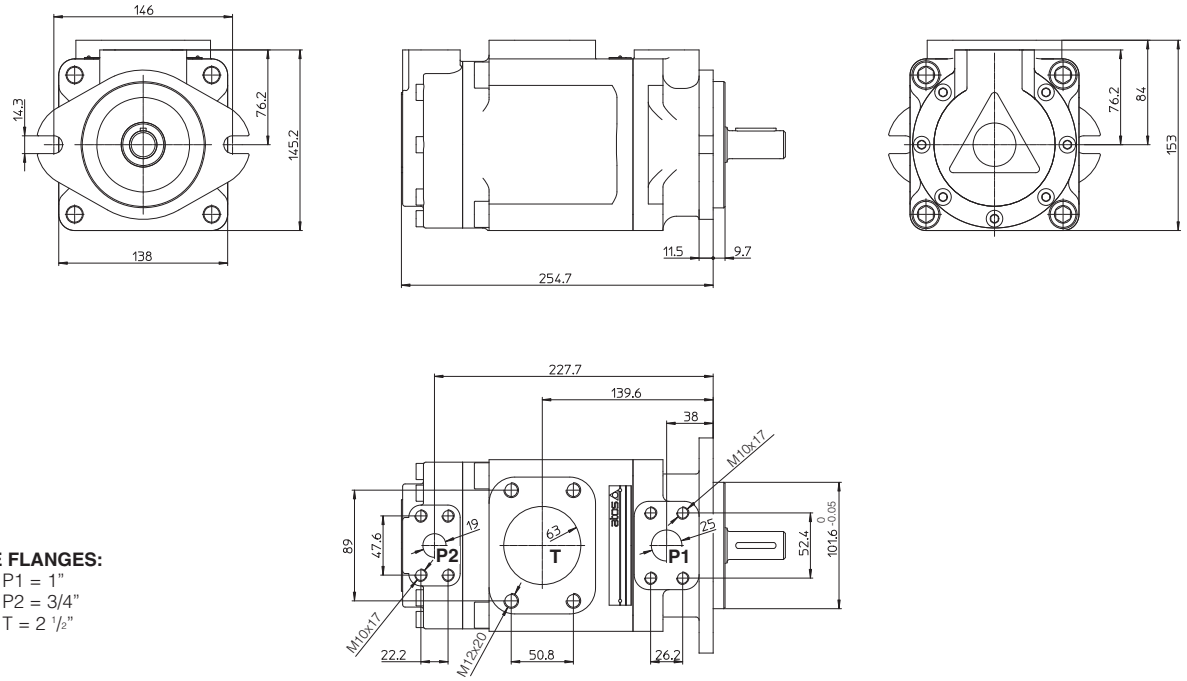
8 LIMITS OF SHAFT TORQUE

Pump size	Maximum driving torque [Nm]					
	Shaft type 1	Shaft type 2	Shaft type 3	Shaft type 5	Shaft type 6	Shaft type 7
PFED-43	250	250	400	200	400	400
PFED-54	500	500	850	450	–	–

The values of torque needed to operate each single cartridge are shown on the "torque versus pressure diagram" at section 6.
The total torque applied to the shaft of the pump is the sum of the single torque needed for operating each single cartridge and its valve must be lower than the vaues indicated in the table.

9 DIMENSIONS [mm]

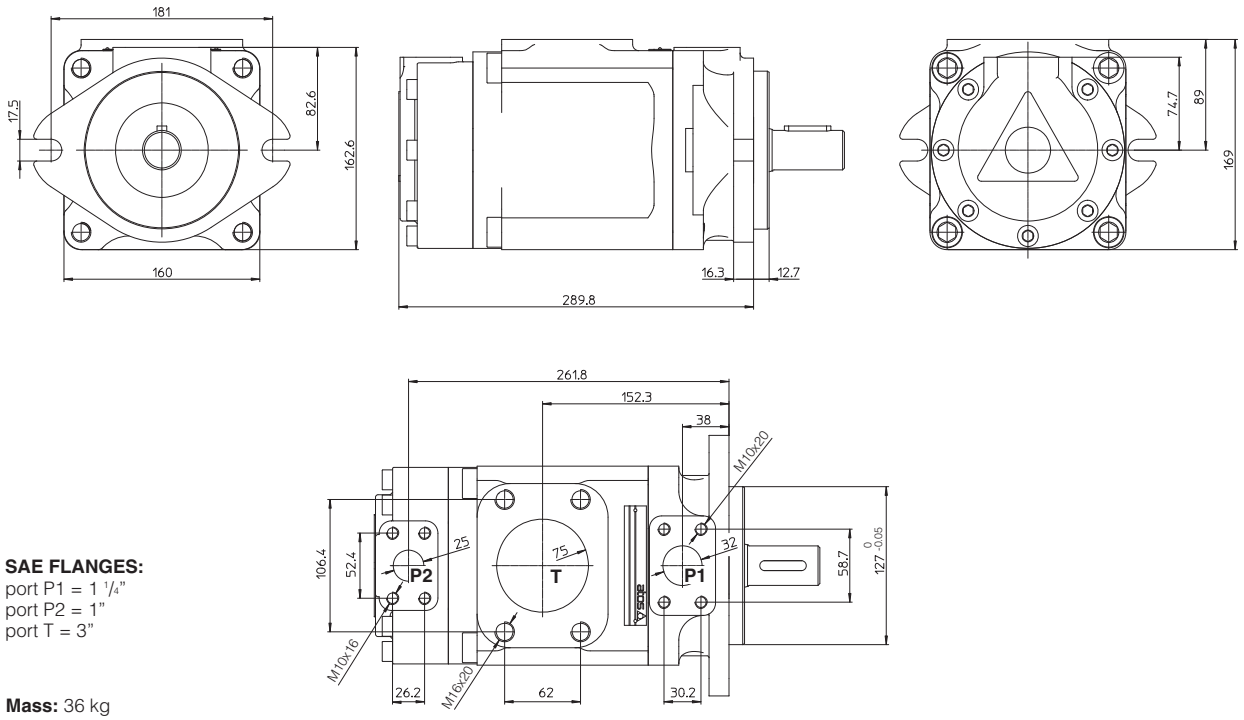
PFED-43



SAE FLANGES:
port P1 = 1”
port P2 = 3/4”
port T = 2 ½”

Mass: 24,5 kg

PFED-54



SAE FLANGES:
port P1 = 1 ¼”
port P2 = 1”
port T = 3”

Mass: 36 kg

10 RELATED DOCUMENTATION

A900	Operating and maintenance information for pumps

Multiple pumps type PFEX, PFRX, PVPCX2E

vane, piston, fixed or variable displacement

Multiple pumps are compact groups made by single pumps factory assembled in modular execution, designed to be driven by a single motor. They are suitable to perform control logics such as high / low flow circuits or for applications where each individual stage of the pump feeds a specific line of the hydraulic circuit.

Multiple pumps are available in execution with double or triple fixed displacement vane pumps, or single vane pumps coupled to fixed displacement radial piston pumps or variable displacement axial piston pumps.

Multiple vane pumps, fixed displacement - see section 1
PFEX2 double pump made by two vane pumps type **PFE**
PFEX3 triple pump made by three vane pumps type **PFE**
PFEXD triple pump made by one vane pump type **PFE** coupled with double vane pump type **PFED**

Multiple radial piston + vane pumps, fixed displacement - see section 2
PFRX2E double pump made by radial piston pumps type **PFR** coupled with one vane pumps type **PFE**
PFRX3E triple pump made by radial piston pumps type **PFR** coupled with two vane pumps type **PFE**
PFRXE triple pump made by one vane pane type **PFR** coupled with double vane pump type **PFED**

Multiple axial piston, variable displacement + vane pump, fixed displacement - see section 3
PVPCX2E double pump made by one axial piston pumps type **PVPC** coupled with one vane pump type **PFE**

Note: for tech. tables of single pumps see section 4

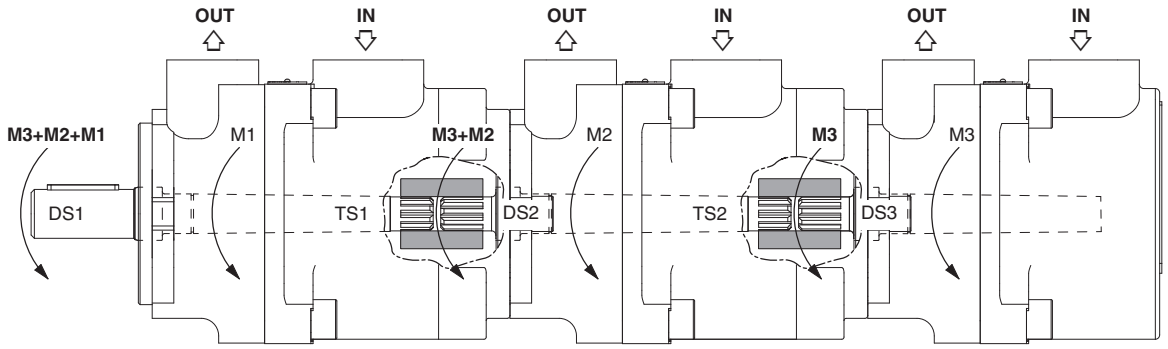


Fig.1

Sizing criteria

The total torque applied to the drive shaft of the first pumps is the sum of the single torque required to operate each single pump.

- It must be verified that the total torque applied to the drive shaft of the first pumps does not exceed the max allowed limit specified in the tech table of the specific pump
- It must be verified that the max torque applied on each single drive shaft and on each single through shaft are not higher than the max allowed limit specified in the tech table of each single pump

With reference to above Fig.1:
M1, M2, M3 = torque required to operate each single pump
DS1, DS2, DS3 = limits of torque for drive shafts
TS1, TS2 = limits of torque at the end of through shafts

The following conditions must be verified:
a) **M3** ≤ **TS2**
b) **M3** + **M2** ≤ **DS2**
c) **M3** + **M2** ≤ **TS1**
d) **M3** + **M2** + **M1** ≤ **DS1**

1 MODEL CODE OF PFEX*

1.1 MODEL CODE OF PFEX2, PFEX3

PFEX	2	-	42	045	/	31028	/	31016	/	3	D	T	*	/	*

Fixed displacement multiple vane pump

Execution
2 = double pump (two pumps type PFE)
3 = triple pump (three pumps type PFE)

Size of first pump:
31, **41**, **51**, **32**, **42**, **52**

Displacement of first pump
for PFE 31: **010, 016, 022, 028, 036, 044**
for PFE 41: **029, 037, 045, 056, 070,085**
for PFE 51: **090, 110, 129, 150**
for PFE 32: **016, 022, 028, 036**
for PFE 42: **045, 056, 070, 085**
for PFE 52: **090, 110, 129, 150**

Size and displacement of second pump - see first pump **(1)**

Size and displacement of third pump - see first pump **(1)**

Drive shaft
cylindrical keyed:
1 = (only for PFE-31, 41, 51) standard
2 = (only for PFE-41 and PFE-51) according to ISO/DIN 3019
3 = for high torque applications

splined
5 = standard
6 = for high torque applications
for PFEX*-3 according to SAE B 16/32 DP, 13 teeth;
for PFEX*-4 according to SAE C 12/24 DP, 14 teeth;

Direction of rotation viewed at the shaft end:
D = clockwise (supplied standard)
S = counterclockwise
Note: PFE are not reversible

Port orientation, see section 1.2

Series number

Seals material:
- = NBR (mineral oil & water glycol)
PE = FPM

(1) Second and third pumps must be selected with equal or smaller size than the first pump

1.2 MODEL CODE OF PFEXD

PFEX	D	-	42	045	/	43037	/	022	/	3	D	T	*	/	*

Fixed displacement multiple vane pump

Execution
D = triple pump (one pump type PFE and one pump type PFED)

Size of first pump:
41, **51**, **42**, **52**

Displacement of first pump
for PFE 41: 029, 037, 045, 056, 070,085
for PFE 51: 090, 110, 129, 150
for PFE 42: 045, 056, 070, 085
for PFE 52: 090, 110, 129, 150

Size and displacement of PFED first element
for PFED **43: 029, 037, 045, 056, 070, 085**
for PFED **54: 090, 110, 129, 150**

Displacement of PFED second element
for PFED 43: **016, 022, 028, 036, 044**
for PFED 54: **029, 037, 045, 056, 070, 085**

Drive shaft
cylindrical keyed:
1 = (only for PFE-31, 41, 51) standard
2 = (only for PFE-41 and PFE-51) according to ISO/DIN 3019
3 = for high torque applications

splined
5 = standard
6 = for high torque applications
for PFEX*-3 according to SAE B 16/32 DP, 13 teeth;
for PFEX*-4 according to SAE C 12/24 DP, 14 teeth;

Direction of rotation viewed at the shaft end:
D = clockwise (supplied standard)
S = counterclockwise
Note: PFE are not reversible

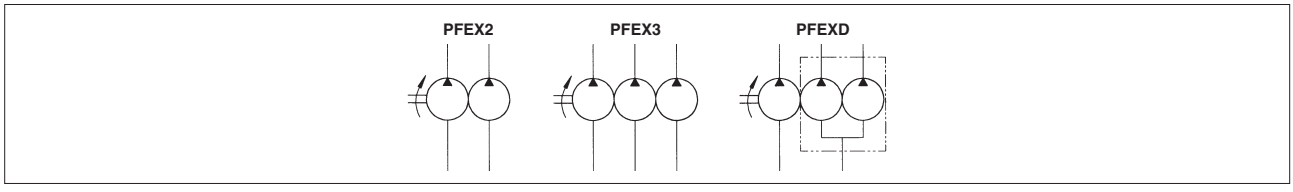
Port orientation, see section 1.2

Series number

Seals material:
- = NBR (mineral oil & water glycol)
PE = FPM

(1) PFEXD-41 and 42 can be coupled only with PFED-43

1.3 HYDRAULIC SYMBOL

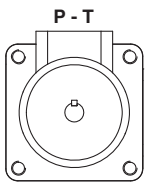
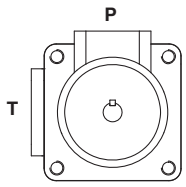
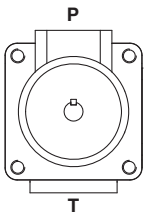
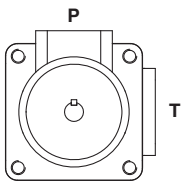


1.2 PORT ORIENTATION

-PFEX2, PFEX3

Pumps can be supplied with oil ports oriented in different configurations viewed from shaft end, as below indicated.
The port orientation is defined by code **T, U, V, W** and it is the same for first, second (third) pumps.
Ports orientation can be easily changed by rotating the pump body that carries inlet port.

Model code example: PFEX2-42045/41037/5D**T**

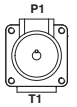
T 	**V** 	**U** 	**W** 
orientation of all pumps	orientation of all pumps	orientation of all pumps	orientation of all pumps

P = outlet port; **T** = inlet port

-PFEXD

Pumps can be supplied with oil ports oriented in different configurations viewed from shaft end, as below indicated..
In PFEXD, the ports orientation of second / third pump (PFED), can be selected according following table.
The ports orientation of first pump depends to the selected orientation of second / third pumps.

Model code example: PFEXD-42045/43037/016/5D**TO**

1st PUMP PFEX*	**2nd / 3th PUMP PFED***							
	**TO** 	**TA** 	**TB** 	**TC** 	**TD** 	**TE** 	**TF** 	**TG** 
	**WO** 	**WA** 	**WB** 	**WC** 	**WD** 	**WE** 	**WF** 	**WG** 
	**UO** 	**UA** 	**UB** 	**UC** 	**UD** 	**UE** 	**UF** 	**UG** 
	**VO** 	**VA** 	**VB** 	**VC** 	**VD** 	**VE** 	**VF** 	**VG** 

P1 outlet port of first element; **P2** outlet port of second element; **P3** outlet port of third element; **T1** inlet port of first element; **T2** inlet port of second element

1.3 OPERATING CHARACTERISTICS OF PFEX*

See technical table of single pumps:
A005 for PFE-31, 41, 51 **A007** for PFE-32, 42, 52

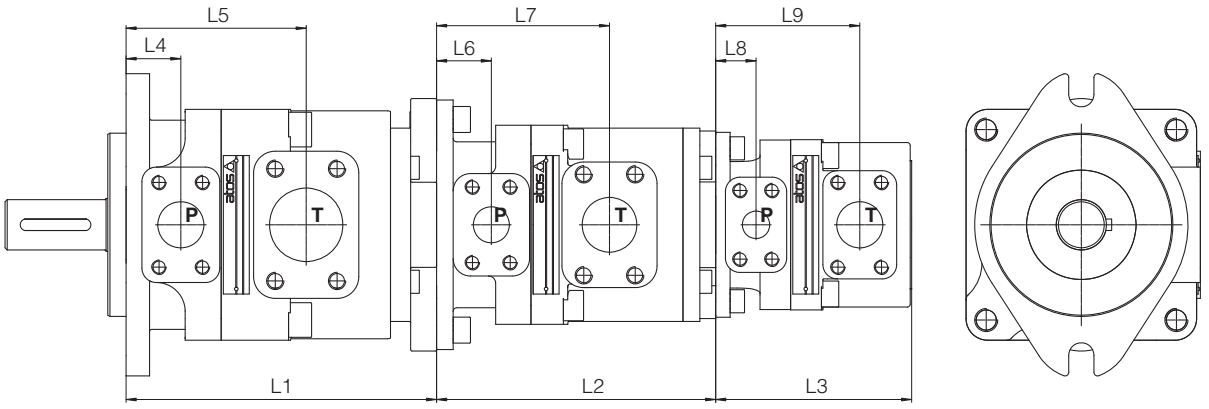
1.4 DIMENSIONS OF PFEX* [mm]

PFEX2

For missing details see tab. A005 and A007

Model code	First pump	Second pump	L1	L2	L3	L4	L5	L6
PFEX2-32***/31***/*	PFEXA-32***/*	PFE-31***/5	164	134,5	27,5	98,5	27,5	98,5
PFEX2-42***/31***/*	PFEXA7-42***/*	PFE-31***/7	194	134,5	38	120	27,5	98,5
PFEX2-42***/41***/*	PFEXB7-42***/*	PFE-41***/7	203	160	38	120	38	120
PFEX2-52***/31***/*	PFEXA7-52***/*	PFE-31***/7	206	134,5	38	125	27,5	98,5
PFEX2-52***/41***/*	PFEXB7-52***/*	PFE-41***/7	215,5	160	38	125	38	120
PFEX2-52***/51***/*	PFEXC-52***/*	PFE-51***/5	230	186,5	38	125	38	125

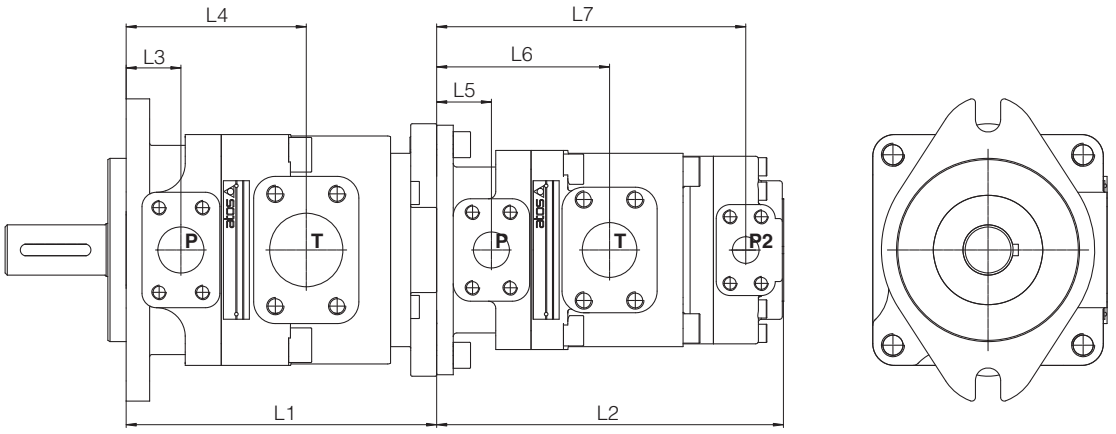
PFEX3



For missing details see tab. A005 and A007

Model code	First pump	Second pump	Third pump	L1	L2	L3	L4	L5	L6	L7	L8	L9
PFEX3-32***/31***/31***/*	PFEXA-32***/*	PFEXA-31***/5	PFE-31***/5	164	164	134,5	27,4	98,5	27,4	98,5	24,7	98,5
PFEX3-42***/31***/31***/*	PFEXA7-42***/*	PFEXA-31***/7	PFE-31***/5	203	164	134,5	38	120	27,4	98,5	24,7	98,5
PFEX3-42***/41***/31***/*	PFEXB7-42***/*	PFEXA7-41***/7	PFE-31***/7	203	194	134,5	38	120	38	120	24,7	98,5
PFEX3-42***/41***/41***/*	PFEXB7-42***/*	PFEXB7-41***/7	PFE-41***/7	203	203	160	38	120	38	120	38	120
PFEX3-52***/31***/31***/*	PFEXA7-52***/*	PFEXA-31***/7	PFE-31***/5	206	164	134,5	38	125	24,7	98,5	24,7	98,5
PFEX3-52***/41***/31***/*	PFEXB7-52***/*	PFEXA7-41***/7	PFE-31***/7	215,5	194	134,5	38	125	38	120	24,7	98,5
PFEX3-52***/41***/41***/*	PFEXB7-52***/*	PFEXB7-41***/7	PFE-41***/7	215,5	203	160	38	125	38	120	38	120
PFEX3-52***/51***/31***/*	PFEXC-52***/*	PFEXA7-51***/5	PFE-31***/7	230	206	134,5	38	125	38	125	24,7	98,5
PFEX3-52***/51***/41***/*	PFEXC-52***/*	PFEXB7-51***/5	PFE-41***/7	230	206	160	38	125	38	125	38	120
PFEX3-52***/51***/51***/*	PFEXC-52***/*	PFEXC-51***/5	PFE-51***/5	230	230	186,5	38	125	38	125	38	125

PFEXD



For missing details see tab. A005 and A007, A180

Model code	First pump	Second pump	L1	L2	L3	L4	L5	L6	L7
PFEXD-42***/43***/0**	PFEXB7-42***	PFED-43***/0**/7	203	256	38	120	38	139,6	227,7
PFEXD-52***/43***/0**	PFEXB7-52***	PFED-43***/0**/7	215,5	256	38	125	38	199,6	227,7
PFEXD-52***/54***/0**	PFEXC-52***	PFED-54***/0**/5	230	288	38	125	38	152,3	261,8

2 MODEL CODE OF PFRX*E

2.1 MODEL CODE OF PFRX2E, PFRX3E

PFRX	2E	-	3	08	/	31044	/	31028	/	D	*	*	/	*

Multiple fixed displacement radial piston/vane pump

Execution
2E = double: PFR + PFE
3E = triple: PFR + PFEX2

Size of first pump type PFR
3

Displacement of first pump type PFR [cm³/rev]
for PFR-3: **08**, **11**, **15**

Size and displacement of PFE second (and third) pump
for PFE 31: 010, 016, 022, 028, 036, 044
for PFE 41: 029, 037, 045, 056, 070,085
for PFE 51: 090, 110, 129
for PFE 32: 016, 022, 028, 036
for PFE 42: 045, 056, 070, 085
for PFE 52: 090, 110, 129

Size and displacement of PFE third pump
for PFE 31: 010, 016, 022, 028, 036, 044
for PFE 41: 029, 037, 045, 056, 070,085
for PFE 51: 090, 110, 129
for PFE 32: 016, 022, 028, 036
for PFE 42: 045, 056, 070, 085
for PFE 52: 090, 110, 129

Direction of rotation viewed at the shaft end:
D = clockwise (supplied standard if not otherwise specified)
S = counter clockwise
Note: PFRX*E are not reversible

Port orientation, see section 2.2

Series number

Seals material:
- = NBR (mineral oil & water glycol)
PE = FPM

2.2 MODEL CODE OF PFRXDE

PFRX	DE	-	3	08	/	43045	/	036	D	*	*	/	*

Multiple fixed displacement radial piston/vane pump

Execution
DE = triple: PFR + PFED

Size of first pump type PFR
3

Displacement of first pump type PFR [cm³/rev]
for PFR-3: **08**, **11**, **15**

Size and displacement of PFED first element [cm³/rev]
for PFED **43: 029, 037, 045, 056, 070, 085**
for PFED **54: 090, 110, 129**

Displacement of PFED second element [cm³/rev]
for PFED 43: **016, 022, 028, 036, 044**
for PFED 54: **029, 037, 045, 056, 070, 085**

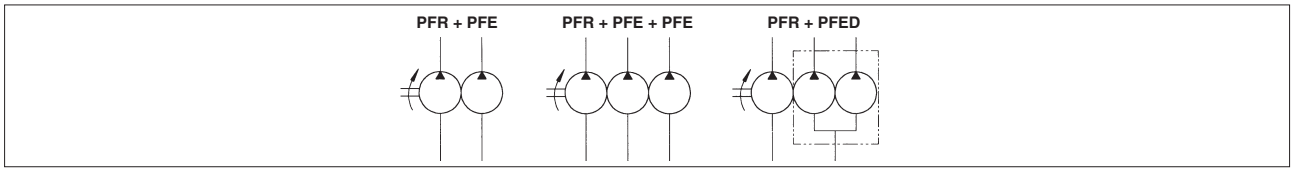
Direction of rotation viewed at the shaft end:
D = clockwise (supplied standard if not otherwise specified)
S = counter clockwise
Note: PFRX*E are not reversible

Port orientation, see section 2.2

Series number

Seals material:
- = NBR (mineral oil & water glycol)
PE = FPM

2.3 HYDRAULIC SYMBOL

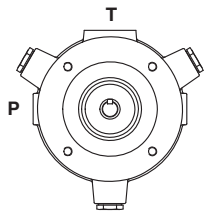
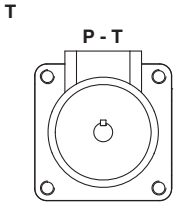
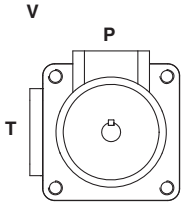
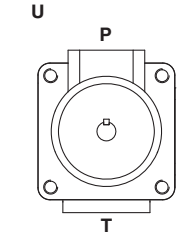
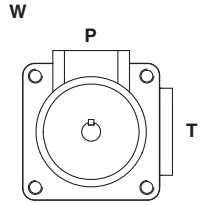


2.4 PORT ORIENTATION

-PFRX2E, PFRX3E

Pumps can be supplied with oil ports oriented in different configurations viewed from shaft end, as below indicated.
Referred to the first element (PFRX*), in second / third pumps the ports can be oriented as indicated in the picture. The third pump is always oriented as the second pump.

Model code example: PFRX2E-525/31044/D**T**

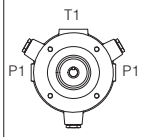
1st PUMP PFRX*	2nd / 3th PUMP PFE			
				

P = outlet port; **T** = inlet port

-PFRXDE

Pumps can be supplied with oil ports oriented in different configurations viewed from shaft end, as below indicated.
The port orientation of second and third pump (PFED) is defined by codes T*, W*, U*, V* as per below table

Model code example: PFRXDE-525/43045/022/D**TO**

1st PUMP PFRX*	2nd / 3th PUMP PFED*							
	**TO** P2-T2-P3	**TA** P2-T2 P3	**TB** P2-T2 P3	**TC** P2-T2 P3	**TD** P2-T2 P3	**TE** P2-T2 P3	**TF** P2-T2 P3	**TG** P2-T2 P3
	WO P2-P3 T2	**WA** P2 P3 T2	**WB** P2 P3 T2	**WC** P2 P3 T2	**WD** P2 P3 T2	**WE** P2 P3 T2	**WF** P2 P3-T2	**WG** P2 P3 T2
	UO P2-P3 T2	**UA** P2 P3 T2	**UB** P2 P3 T2	**UC** P2 P3 T2	**UD** P2 P3-T2	**UE** P2 P3 T2	**UF** P2 P3 T2	**UG** P2 P3 T2
	VO P2-P3 T2	**VA** P2 P3 T2	**VB** P2 P3-T2	**VC** P2 P3 T2	**VD** P2 P3 T2	**VE** P2 P3 T2	**VF** P2 P3 T2	**VG** P2 P3 T2

P1 outlet port of first element; **P2** outlet port of second element; **P3** outlet port of third element; **T1** inlet port of first element; **T2** inlet port of second element

2.5 OPERATING CHARACTERISTICS OF PFRX2E

(at 1450 rpm and based on mineral oil ISO VG46 at 50° C)

Model code (1)	Speed range [rpm] (2)	RADIAL PISTON PUMP			VANE PUMP			
		Displacement [cm³/rev]	Flow [l/min] (3)	Max pressure [bar] (4)	Displacement [cm³/rev]	Flow [l/min] (3)	Max pressure [bar] (5)	Total flow [l/min]
PFRX2E-308/31010	600-1800	8	12,6	350	10,5	15	160	27,6
PFRX2E-308/31016					16,5	23	210	35,6
PFRX2E-308/31022					21,6	30		42,6
PFRX2E-308/31028					28,1	40		52,6
PFRX2E-308/31036					36,5	51		63,6
PFRX2E-308/31044					43,7	63		75,6
PFRX2E-308/41029					29,3	41		53,6
PFRX2E-308/41037					36,6	52		64,6
PFRX2E-308/41045					45	64		76,6
PFRX2E-308/41056					55,8	80		92,6
PFRX2E-308/41070					69,9	101		113,6
PFRX2E-308/41085					85,3	124		136,6
PFRX2E-308/51090					90	128		140,6
PFRX2E-308/51110					109,6	157		169,6
PFRX2E-308/51129					129,2	186		198,6
PFRX2E-311/31044		11,4	16,5	350	43,7	63		79,5
PFRX2E-311/41070					69,9	101		117,5
PFRX2E-311/41085					85,3	124		140,5
PFRX2E-311/51110					109,6	157		173,5
PFRX2E-311/51129					129,2	186		202,5
PFRX2E-315/41056		14,7	21,5	350	55,8	80		101,5
PFRX2E-315/41070					69,9	101		122,5
PFRX2E-315/51110					109,6	157		178,5
PFRX2E-315/51129					129,2	186		207,5

(1) Further composition of PFR and PFE double pumps are available on request. Other composition of PFRX2E must subject to verification of max torque limits allowed by the drive shafts of PFR and PFE and by the through shaft of PFR (320 Nm).
(2) Max speed is 1800 rpm for HFDU, HFDR fluids; 1000 rpm for HFC fluids
(3) Flow rate and power consumption are proportional to revolution speed
(4) Max pressure is 250 bar for HFDU, HFDR fluids, 175 bar for HFC fluids
(5) Max pressure is 160 bar for HFDU, HFDR, HFC fluids

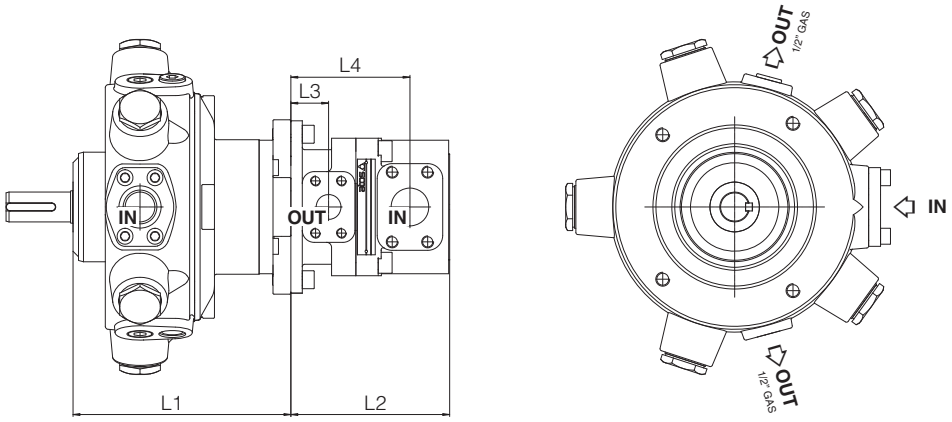
The shaft of the PFR pump has an eccentric cam which rotates with the shaft generating the stroke of the pistons and thus generating the flow rate.
For best functioning a balanced coupling should be provided between the shaft of the motor and the shaft of the pump.
See tab. A045

2.6 TRIPLE PUMPS TYPE PFRX3E AND PFRXDE

Many triple pump compositions PFRX3E = PFR + PFEX2 or PFRXDE = PFR + PFED can be realized but they must be subject to verification of max torque-limits allowed by drive shaft and through shaft of each individual basic pump according to description of first page.

2.7 DIMENSIONS OF PFRX* [mm]

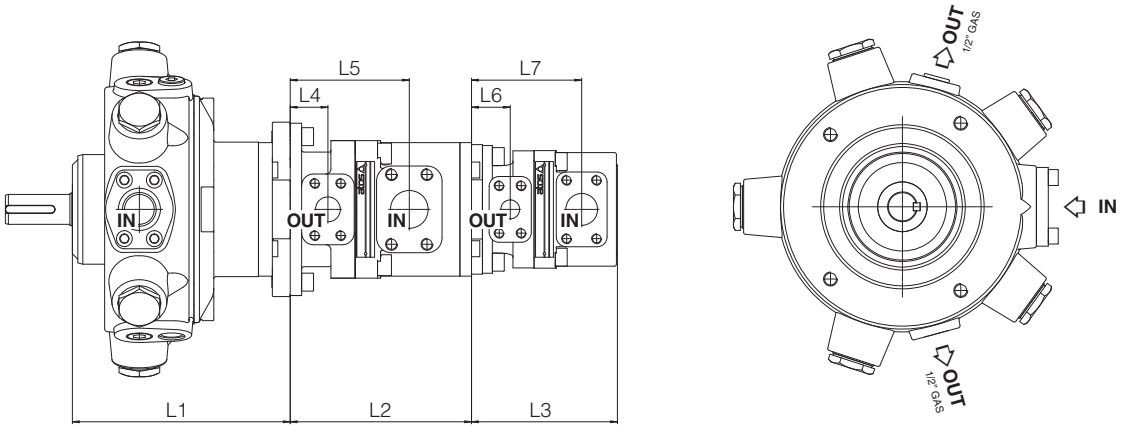
PFRX2E



For missing details see tab. A045, A005 and A007

Model code	First element - piston pump -	Second element - vane pump -	L1	L2	L3	L4
PFRX2E-3**/31***	PFRXA-3**	PFE-31***	200	134,5	27,5	98,5
PFRX2E-3**/41***	PFRXB-3**	PFE-41***	209	160	38	120
PFRX2E-3**/51***	PFRXC-3**	PFE-51***	224	186,5	38	125

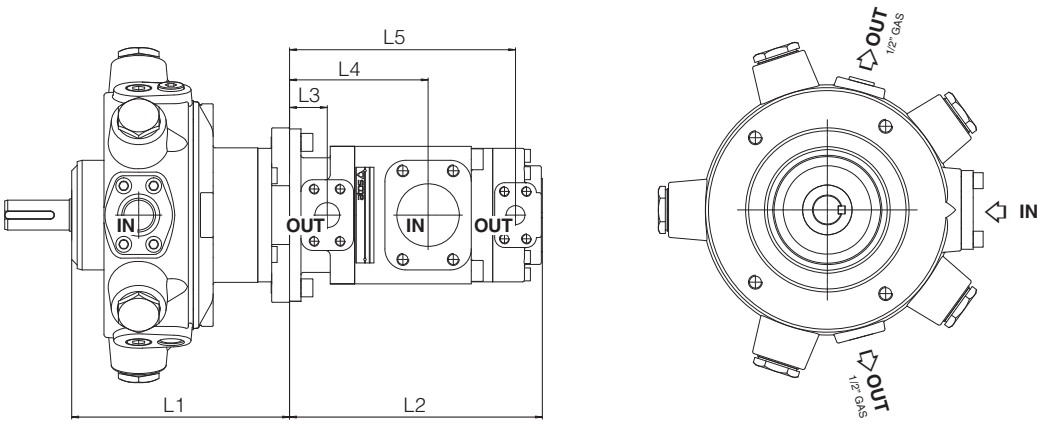
PFRX3E



For missing details see tab. A045, A005 and A007

Model code	First element - piston pump -	Second element - vane pump -	Third element - vane pump -	L1	L2	L3	L4	L5	L6	L7
PFRX3E-3**/31**/31***	PFRXA-3**	PFEXA-31***	PFE-31***	200	164	134,5	27,5	98,5	27,5	98,5
PFRX3E-3**/41***/31***	PFRXB-3**	PFEXA-41***	PFE-31***	209	194	134,5	38	120	27,5	98,5
PFRX3E-3**/41***/41***	PFRXB-3**	PFEXB-41***	PFE-41***	209	203	160	38	120	38	120
PFRX3E-3**/51***/31***	PFRXC-3**	PFEXA-51***	PFE-31***	224	206	134,5	38	125	27,5	98,5
PFRX3E-3**/51***/41***	PFRXC-3**	PFEXB-51***	PFE-41***	224	215,5	160	38	125	38	120
PFRX3E-3**/51***/51***	PFRXC-3**	PFEXC-51***	PFE-51***	224	230	186,5	38	125	38	125

PFRXDE



For missing details see tab. A045 and A180

Model code	First element - piston pump -	Second element - vane pump -	L1	L2	L3	L4	L5
PFRXDE-3**/43***/0**	PFRXB-3**	PFED-43***/0**	209	256,5	38	139,6	227,7
PFRXDE-3**/54***/0**	PFRXC-3**	PFED-54***/0**	224	288	38	152,3	261,8

PFRX*E pumps are supplied with WFA-32 inlet flange for PFR, and set of inlet, outlet flanges for PFE or PFED;

3 MODEL CODE OF PVPCX2E

3.1 MODEL CODE FOR PVPCX2E with mechanical controls

PVPC	X2E	-	C	-	4046	/	31044	/	1	D	X	24DC	*	/	*

Variable displacement axial piston pump

X2E = coupled with a fixed displacement pump type PFE (see tab. A005, A007)

Type of control:
C = manual pressure compensator
CH = manual pressure compensator, with venting
R = remote pressure compensator
L = load sensing (pressure & flow)
LW = constant power (combined pressure & flow)

Size and max displacement of axial piston pump:
3029 = 29 cm³/rev **5073** = 73 cm³/rev
4046 = 46 cm³/rev **5090** = 88 cm³/rev

Size and displacement of PFE second pump
for PFE 31: **010, 016, 022, 028, 036, 044** for PFE 32: **016, 022, 028, 036**
for PFE 41: **029, 037, 045, 056, 070, 085** for PFE 42: **045, 056, 070, 085**
for PFE 51: **090, 110, 129, 150** for PFE 52: **090, 110, 129, 150**

Shaft (SAE Standard):
1 = keyed (7/8" for 029 - 1" for 046 - 1 1/4" for 073 and 090)
5 = splined (13 teeth for 029 - 15 for 046 - 14 for 073 and 090)

Direction of rotation viewed at the shaft end:
D = clockwise
S = counterclockwise

X = without connector

Coil voltage - only CH version:
12DC 24/50AC
24DC 110/50AC
220/50AC

Series number

Seals material:
– = NBR
PE = FKM
See notes under sect. 2

3.2 MODEL CODE FOR PVPCX2E with electrohydraulic proportional controls

PVPC	X2E	-	PERS-SP	-	BC	-	4046	/	31044	/	*	/	1	D	/	18	*	/	*

Variable displacement axial piston pump

X2E = coupled with a fixed displacement pump type PFE (see tab. A005, A007)

Type of control
CZ = proportional pressure control
LQZ = proportional flow control (load sensing)
PES-SP = closed loop integral digital P/Q driver
PERS-SP = as PES plus sequence module

Fieldbus interfaces, USB port always present (Only for PES and PERS):
NP = Not present
BC = CANopen **EW** = POWERLINK
BP = PROFIBUS DP **EI** = EtherNet/IP
EH = EtherCAT **EP** = PROFINET RT/IRT

Size and max displacement of axial piston pump:
3029 = 29 cm³/rev **4046** = 46 cm³/rev
5073 = 73 cm³/rev **5090** = 88 cm³/rev

Size and displacement [cm³/rev] of PFE second pump
for PFE 31: **010, 016, 022, 028, 036, 044** for PFE 32: **016, 022, 028, 036**
for PFE 41: **029, 037, 045, 056, 070, 085** for PFE 42: **045, 056, 070, 085**
for PFE 51: **090, 110, 129, 150** for PFE 52: **090, 110, 129, 150**

Pressure setting, only for PERS: **200** = 200 bar **250** = 250 bar **280** = 280 bar

Direction of rotation viewed at the shaft end
D = clockwise **S** = counterclockwise

Coil voltage, for CZ, LQZ - see section 18:
18 = optional coil 18 VDC for low current drivers instead of standard 12 VDC

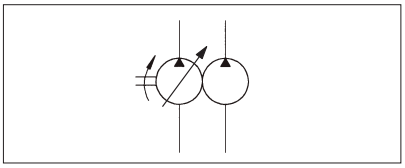
Electronics options, for PES and PERS **(4):**
C = current feedback for pressure transducer 4÷20 mA (omit for std voltage ±10VDC)
I = current reference input and monitor 4÷20 mA (omit for std voltage ±10VDC)
X = on-board pressure transducer with pre-configured pressure settings (only for PERS)
S = with 2 on-off inputs for multiple pressure PID selection for NP execution or double power supply for fieldbus execution, plus dedicated connector for remote pressure transducer

Shaft (SAE Standard):
1 = keyed (7/8" for 029 - 1" for 046 - 1 1/4" for 073 and 090)
5 = splined (13 teeth for 029 - 15 for 046 - 14 for 073 and 090)

Series number

Seals material:
– = NBR
PE = FKM
See notes under sect. 2

3.3 HYDRAULIC SYMBOL



PVPCX2E are double pumps composed by one variable displacement axial piston pump type PVPC and one vane pump type PFE.
They have two separated inlet ports and two separated outlet ports.

For technical characteristics of PVPC pumps, see tab. A160;
for technical characteristics of PFE pumps see tab. A005 and A007.

3.4 OPERATING CHARACTERISTICS OF DOUBLE PUMPS TYPE PVPCX2E (with PFE-31, 41 and 51)

(at 1450 rpm and based on mineral oil ISO VG46 at 40° C)

Model code	Speed range [rpm] (1)	AXIAL PISTON PUMP			VANE PUMP			
		Displacement [cm³/rev]	Flow [l/min] (2)	Max pressure [bar] (3)	Displacement [cm³/rev]	Flow [l/min] (2)	Max pressure [bar] (4)	Total flow [l/min]
PVPCX2E-*-3029/31010	800-2400	29	42	280/350	10,5	15	160	57
PVPCX2E-*-3029/31016	800-2800				16,5	23	210	65
PVPCX2E-*-3029/31022					21,6	30		72
PVPCX2E-*-3029/31028					28,1	40		82
PVPCX2E-*-3029/31036					35,6	51		93
PVPCX2E-*-3029/31044	800-2500				43,7	63		105
PVPCX2E-*-3029/41029					29,3	41		83
PVPCX2E-*-3029/41037					36,6	52		94
PVPCX2E-*-3029/41045					45,0	64		106
PVPCX2E-*-3029/41056					55,8	80		122
PVPCX2E-*-3029/41070					69,9	101		143
PVPCX2E-*-3029/41085	800-2000				85,3	124		166
PVPCX2E-*-4046/31010	800-2400	46	66,7	280/350	10,5	15	160	81,7
PVPCX2E-*-4046/31016	800-2600				16,5	23	210	89,7
PVPCX2E-*-4046/31022					21,6	30		92,7
PVPCX2E-*-4046/31028					28,1	40		102,7
PVPCX2E-*-4046/31036					35,6	51		113,7
PVPCX2E-*-4046/31044	800-2500				43,7	63		129,7
PVPCX2E-*-4046/41029					29,3	41		107,7
PVPCX2E-*-4046/41037					36,6	52		118,7
PVPCX2E-*-4046/41045					45,0	64		130,7
PVPCX2E-*-4046/41056					55,8	80		146.7
PVPCX2E-*-4046/41070					69.9	101		167,7
PVPCX2E-*-4046/41085	800-2000				85,3	124		190,7
PVPCX2E-*-5073/31010	800-2400	73	105,8	280/350	10,5	15	160	120,8
PVPCX2E-*-5073/31016	800-2200				16,5	23	210	128,8
PVPCX2E-*-5073/31022					21,6	30		135,8
PVPCX2E-*-5073/31028					28,1	40		145,8
PVPCX2E-*-5073/31036					35,6	51		156,8
PVPCX2E-*-5073/31044					43,7	63		168,8
PVPCX2E-*-5073/41029					29,3	41		146,8
PVPCX2E-*-5073/41037					36,6	52		157,8
PVPCX2E-*-5073/41045					45,0	64		169,8
PVPCX2E-*-5073/41056					55,8	80		185,8
PVPCX2E-*-5073/41070					69,9	101		206,8
PVPCX2E-*-5073/41085	800-2000				85,3	124		229,8
PVPCX2E-*-5073/51090	800-2200				90,0	128		233,8
PVPCX2E-*-5073/51110					109,6	157		262,8
PVPCX2E-*-5073/51129					129,2	186		291,8
PVPCX2E-*-5073/51150	800-1800				150,2	215		320,8
PVPCX2E-*-5090/31010	800-2400	88	127,6	250/315	10,5	15	160	142,6
PVPCX2E-*-5090/31016	800-2200				16,5	23	210	150,6
PVPCX2E-*-5090/31022					21,6	30		157,6
PVPCX2E-*-5090/31028					28,1	40		167,6
PVPCX2E-*-5090/31036					35,6	51		178,6
PVPCX2E-*-5090/31044					43,7	63		190,6
PVPCX2E-*-5090/41029					29,3	41		168,6
PVPCX2E-*-5090/41037					36,6	52		179,6
PVPCX2E-*-5090/41045					45,0	64		191,6
PVPCX2E-*-5090/41056					55,8	80		207,6
PVPCX2E-*-5090/41070					69,9	101		228,6
PVPCX2E-*-5090/41085	800-2000				85,3	124		251,6
PVPCX2E-*-5090/51090	800-2200				90,0	128		255,6
PVPCX2E-*-5090/51110					109,6	157		284,6
PVPCX2E-*-5090/51129					129,2	186		313,6
PVPCX2E-*-5090/51150	800-1800				150,2	215		342,6

(1) Max speed is 1800 rpm for HFDU, HFDR fluids; 1000 rpm for HFC fluids
(2) Flow rate and power consumption are proportional to revolution speed
(3) Max pressure is 190 bar for HFDU, HFDR fluids, 160 bar for HFC fluids
(4) Max pressure is 160 bar for HFDU, HFDR, HFC fluids

3.5 OPERATING CHARACTERISTICS OF STANDARD DOUBLE PUMPS TYPE PVPCX2E (with PFE-32, 42 and 52)

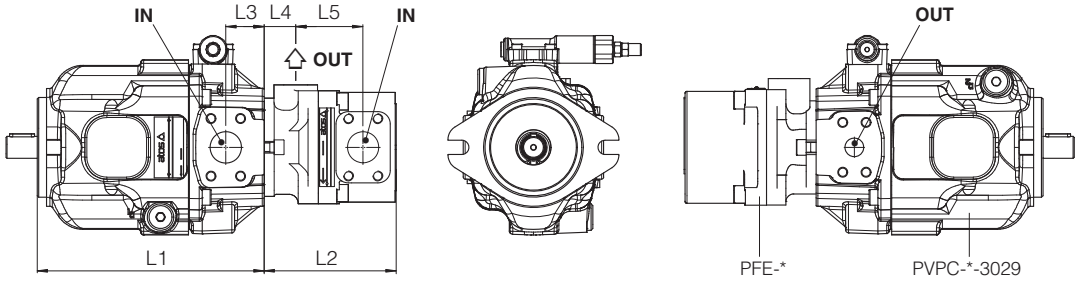
(at 1450 rpm and based on mineral oil ISO VG46 at 40° C)

Standard model	Speed range [rpm] (1)	AXIAL PISTON PUMP			VANE PUMP			
		Displacement [cm³/rev]	Flow [l/min] (2)	Max pressure [bar] (3)	Displacement [cm³/rev]	Flow [l/min] (2)	Max pressure [bar] (4)	Total flow [l/min]
PVPCX2E-*-3029/32016	1200-2500	29	42	280/350	16,5	23	210	65
PVPCX2E-*-3029/32022					21,6	30	300	72
PVPCX2E-*-3029/32028					28,1	40		82
PVPCX2E-*-3029/32036					35,6	51		93
PVPCX2E-*-3029/42045	1000-2200				45,0	64	280	106
PVPCX2E-*-3029/42056					55,8	80		122
PVPCX2E-*-3029/42070					69,9	101		143
PVPCX2E-*-3029/42085	800-2000				85,3	124		166
PVPCX2E-*-4046/32016	1200-2500	46	66,7	280/350	16,5	23	210	89,7
PVPCX2E-*-4046/32022					21,6	30	300	92,7
PVPCX2E-*-4046/32028					28,1	40		102,7
PVPCX2E-*-4046/32036					35,6	51		113,7
PVPCX2E-*-4046/42045	1000-2200				45,0	64	280	130,7
PVPCX2E-*-4046/42056					55,8	80		146,7
PVPCX2E-*-4046/42070					69,9	101		167,7
PVPCX2E-*-4046/42085	800-2000				85,3	124		190,7
PVPCX2E-*-5073/32016	1200-2500	73	105,8	280/350	16,5	23	210	128,8
PVPCX2E-*-5073/32022					21,6	30	300	135,8
PVPCX2E-*-5073/32028					28,1	40		145,8
PVPCX2E-*-5073/32036					35,6	51		156,8
PVPCX2E-*-5073/42045	1000-2200				45,0	64	280	169,8
PVPCX2E-*-5073/42056					55,8	80		185,8
PVPCX2E-*-5073/42070					69,9	101		206,8
PVPCX2E-*-5073/42085	800-2000				85,3	124		229,8
PVPCX2E-*-5073/52090	800-2000				90,0	128	250	233,8
PVPCX2E-*-5073/52110					109,6	157		262,8
PVPCX2E-*-5073/52129					129,2	186		291,8
PVPCX2E-*-5073/52150	800-1800				150,2	215	210	320,8
PVPCX2E-*-5090/32016	1200-1850	88	127,6	280/350	16,5	23	210	150,6
PVPCX2E-*-5090/32022					21,6	30	300	157,6
PVPCX2E-*-5090/32028					28,1	40		167,6
PVPCX2E-*-5090/32036					35,6	51		178,6
PVPCX2E-*-5090/42045	1000-1850				45,0	64	280	191,6
PVPCX2E-*-5090/42056					55,8	80		207,6
PVPCX2E-*-5090/42070					69,9	101		228,6
PVPCX2E-*-5090/42085	800-1850				85,3	124		251,6
PVPCX2E-*-5090/52090	1000-1850				90,0	128	250	255,6
PVPCX2E-*-5090/52110					109,6	157		284,6
PVPCX2E-*-5090/52129					129,2	186		313,6
PVPCX2E-*-5090/52150	800-1800				150,2	215	210	342,6

(1) Max speed is 1800 rpm for HFDU, HFDR versions; 1500 rpm for HFC fluids
(2) Flow rate and power consumption are proportional to revolution speed
(3) Max pressure is 190 bar for HFDU, HFDR fluids, 160 bar for HFC fluids
(4) Max pressure is 160 bar for HFDU, HFDR, HFC fluids

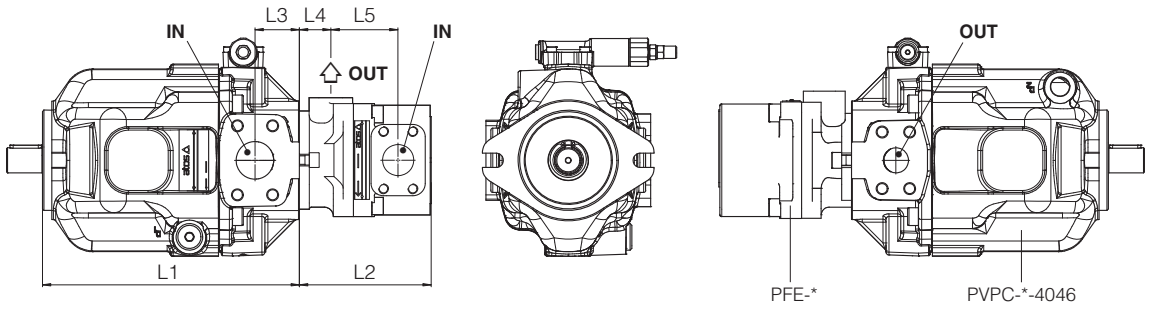
3.6 DIMENSIONS OF MULTIPLE PUMPS TYPE PVPCX2E [mm]

PVPCX2E-*-3029



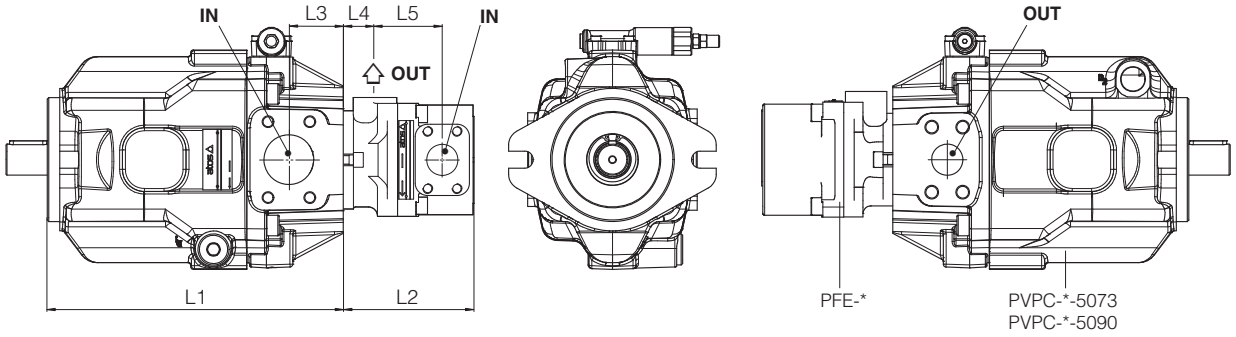
Model code	First element - piston pump -	Second element - vane pump -	L1	L2	L3	L4	L5
PVPCX2E-*-3029/3****	PVPCXA-*-3029	PFE-3****	231,2	134,5	39	27,5	71
PVPCX2E-*-3029/4****	PVPCXB-*-3029	PFE-4****	231,2	160	39	38	82

PVPCX2E-*-4046



Model code	First element - piston pump -	Second element - vane pump -	L1	L2	L3	L4	L5
PVPCX2E-*-4046/3****	PVPCXA-*-4046	PFE-3****	259	134,5	45	27,5	71
PVPCX2E-*-4046/4****	PVPCXB-*-4046	PFE-4****	259	160	45	38	82

PVPCX2E-*-5073
PVPCX2E-*-5090



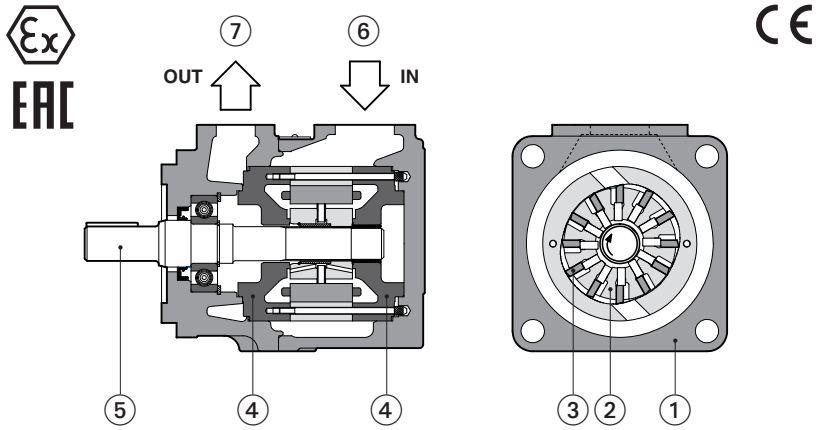
Model code	First element - piston pump -	Second element - vane pump -	L1	L2	L3	L4	L5
PVPCX2E-*-5073/3****	PVPCXA-*-5073	PFE-3****	303,6	134,5	55,7	27,5	71
PVPCX2E-*-5073/4****	PVPCXB-*-5073	PFE-4****	303,6	160	55,7	38	82
PVPCX2E-*-5073/5****	PVPCXC-*-5073	PFE-5****	303,6	186,5	55,7	38	87
PVPCX2E-*-5090/3****	PVPCXA-*-5090	PFE-3****	303,6	134,5	55,7	27,5	71
PVPCX2E-*-5090/4****	PVPCXB-*-5090	PFE-4****	303,6	160	55,7	38	82
PVPCX2E-*-5090/5****	PVPCXC-*-5090	PFE-5****	303,6	186,5	55,7	38	87

4 RELATED DOCUMENTATION

A005, A007	Vane pumps type PFE	**A160, AS170**	Axial piston pumps type PVPC
A180	Double vane pumps type PFED	**A900**	Operating and maintenance information for pumps
A045	Radial piston pumps type PFR		

Ex-proof vane pumps type PFEA

fixed displacement - for potentialy explosive atmospheres - **ATEX, EAC**



PFEA

① body
② and ③ rotor with vanes
④ balanced plates
⑤ shaft
⑥ inlet port
⑦ outlet port

PFEA are fixed displacement-twelve-vane pumps available in threebody sizes and two different executions.
They are certified for application in potentially explosive atmospheres according to ATEX, EAC, protection mode

Ex II 2/2G Ex h IIC T5, T4 Gb, and
Ex II 2/2D Ex h IIIC T100°C, T135°C Db (group II for surface plants with gas, vapours and dust environment, category 2, zone 1, 2, 21 and 22).

The external surface temperature of the pump is in accordance with the certified class, to avoid the self ignition of the explosive mixture present in the environment.

PFEA are available in two executions:

PFEA-*1 max pressure **210 bar**

PFEA-*2 max pressure **300 bar**

Displacements up to **150 cm³/rev**

1 **MODEL CODE**

PFEA	XA	-	31	036	/	1	D	T	/	7	*	/	*

Fixed displacement vane pump with ex-proof certification

Additional suffix for pumps with through shaft, for coupling with 2nd pump type PFEA:
XA = for coupling with PFEA-31
XB = for coupling with PFEA-41 (only for PFEA-41, 42 and PFEA-51, 52)
XC = for coupling with PFEA-51 (only for PFEA-51 and 52)
XO = with through shaft, without rear flange

Size:
31, 41, 51 (standard)
32, 42, 52 (high pressure and low noise)

Displacement of **PFEA-31, 41, 51** [cm³/rev]
for PFEA-31: **010, 016, 022, 028, 036, 044**
for PFEA-41: **029, 037, 045, 056, 070, 085**
for PFEA-51: **090, 110, 129, 150**

Displacement of **PFEA-32, 42, 52** [cm³/rev]
for PFEA-32: **016, 022, 028, 036**
for PFEA-42: **045, 056, 070, 085**
for PFEA-52: **090, 110, 129, 150**

Drive shaft:
cylindrical, keyed (not for PFEA rear pumps to be coupled with PFEAX*)
1 = standard (only for PFEA 31, 41, 51)
2 = long version (only for PFEA-41 and PFEA-51)
3 = for high torque applications

splined
5 = for singol and through-shaft pumps (1)
6 = for singol and through-shaft pumps (only first position)
7 = for singol and through-shaft pumps (only second and third position)
only PFEA-31,42 PFEA-32,42

Direction of rotation (viewed from the shaft end):
D = clockwise
S = counterclockwise
Note: PFEA* are not reversible

Port orientation, see section 8:
T = standard
U, V, W = on request

Option:
7 = for ambient temperature up to 70°C **(2)**

Series number

Seals material:
omit for NBR (mineral oil & water glycol)
PE = FKM **(2)**

(1) Shaft type 5 has to be selected for PFEA rear pumps to be coupled with PFEAX* first pumps

(2) Pumps with option **/7** are always equipped with seals FKM

2 GENERAL CHARACTERISTICS

Assembly position	Any position
Loads on the shaft	Axial and radial loads are not allowed on the shaft. The coupling should be sized to absorb the power peak.
Ambient temperature range	-20°C to +70°C
Recommended pressure on inlet port	from -0,15 to 1,5 bar for speed up to 1800 rpm; from 0 to +1,5 bar for speed over 1800 rpm
Compliance	Explosion proof protection "Ex h", see section 6 RoHs Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006

3 HYDRAULIC CHARACTERISTICS of PFEA - 31, 41, 51 based on mineral oil ISO VG 46 at 50 °C

Size code		**31**						**41**						**51**			
Displacement code		**010**	**016**	**022**	**028**	**036**	**044**	**029**	**037**	**045**	**056**	**070**	**085**	**090**	**110**	**129**	**150**
Displacement	(cm^3/rev)	10.5	16.5	21.6	28.1	35.6	43.7	29.3	36.6	45.0	55.8	69.9	85.3	90.0	109.6	129.2	150.2
Max working pressure (1)	(bar)	160	210														
Recommended pressure on inlet port		from -0,15 to 1,5 bar for speed up to 1800 rpm; from 0 to +1,5 bar for speed over 1800 rpm															
Min speed	(rpm)	800															
Max speed (2)	(rpm)	2400	2800	2800	2800	2800	2500	2500	2500	2500	2500	2500	2000	2200	2200	2200	1800
Volumetric efficiency (3)		80	83	87	90	90	92	90	92	93	93	93	94	93	93	93	94
Noise level (3)	(dBA)	62	62	63	63	63	64	67	67	68	68	69	69	72	72	73	74

(1) Max pressure is 160 bar for HFDU, HFDR and HFC fluids
(2) Max speed is 1800 rpm for /PE versions; 1500 rpm for HFDU, HFDR and HFC fluids
(3) Measuring data with: n = 1450 rpm; P = 140 bar;

4 HYDRAULIC CHARACTERISTICS of PFEA - 32, 42, 52 based on mineral oil ISO VG 46 at 50 °C

Size code		**32**				**42**				**52**			
Displacement code		**016**	**022**	**028**	**036**	**045**	**056**	**070**	**085**	**090**	**110**	**129**	**150**
Displacement	(cm^3/rev)	16.5	21.6	28.1	35.6	45.0	55.8	69.9	85.3	90.0	109.6	129.2	150.2
Max working pressure (1)	(bar)	210	300			280		250	210	250			210
Recommended pressure on inlet port		from -0,15 to 1,5 bar for speed up to 1800 rpm; from 0 to +1,5 bar for speed over 1800 rpm											
Min speed	(rpm)	1000	1200			1000			800	1000			800
Max speed (2)	(rpm)	2500	2500			2200			2000	2000			1800
Volumetric efficiency (3)		86	87	90	90	93	93	93	94	93	93	93	94
Noise level (3)	(dBA)	62	63	63	63	66	66	67	67	71	71	72	72

(1) Max pressure is 160 bar for HFDU, HFDR and HFC fluids
(2) Max speed is 1800 rpm for /PE versions; 1500 rpm for HFDU, HFDR and HFC fluids
(3) Measuring data with: n = 1450 rpm; P = 140 bar;

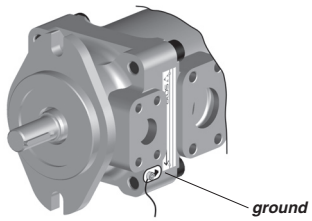
5 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C		
Recommended viscosity		15÷100 mm²/s - max start-up viscosity = 1000 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 21/19/16 NAS1638 class 10	see also filter section at or KTF catalog	
	longer life	ISO4406 class 19/17/14 NAS1638 class 8		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR	HFC	

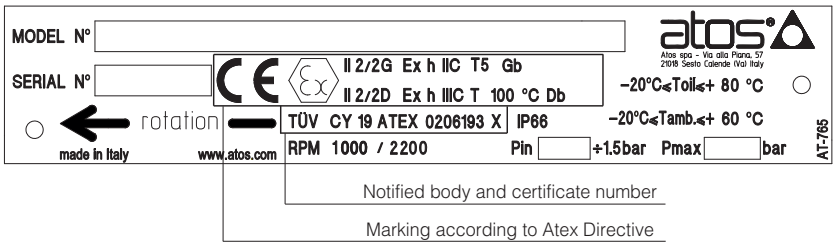
6 CERTIFICATION MAIN DATA

Certification	**ATEX, EAC**	
Protection mode	Ex II 2/2G Ex h IIC T5, T4 Gb, Ex II 2/2D Ex h IIIC T100°C, T135°C Db	
Type examination certificate	TUV CY 19 ATEX 026182X	
Pump version	(**std** and **/PE**)	**/7 /PE**
Temperature class	T6	T5
Surface temperature	≤ 85 °C	≤ 100 °C
Ambient temperature	-20 ÷ +60 °C	-20 ÷ +70 °C
Max inlet fluid temperature	+60 °C	+80 °C
Protection degree	IP 66	

PFEA



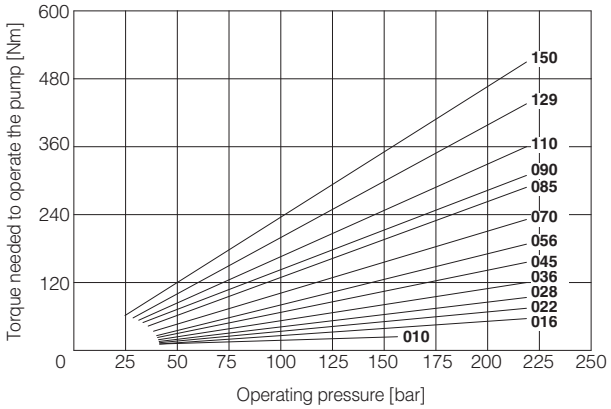
6.1 EXAMPLE OF PFEA NAMEPLATE MARKING



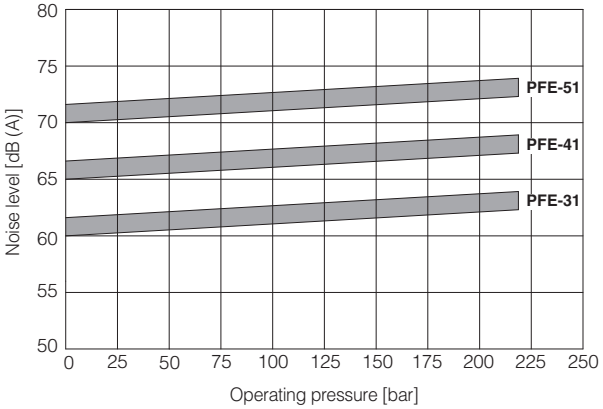
Ex = Equipment for explosive atmospheres
II = Group II for surfaces plants
2/2 = Pump category
G = For gas and vapours
D = For dust
h = Marking includes one on more of the following types of protection ("c", "b", "k")
IIC = Gas group (acetylene, hydrogen)
IIIC = Conduictive dust
T* = Temperature class (T6, T5)
T°C** = Max surface temperature (85, 100)
Zone 1 (gas) **and 21** (dust) = Possibility of explosive atmosphere during normal functioning
Zone 2 (gas) **and 22** (dust) = Low probability of explosive atmosphere

7 DIAGRAMS for PFEA -31, 41, 51 (based on mineral oil ISO VG 46 at 50°C)

Torque versus pressure diagram

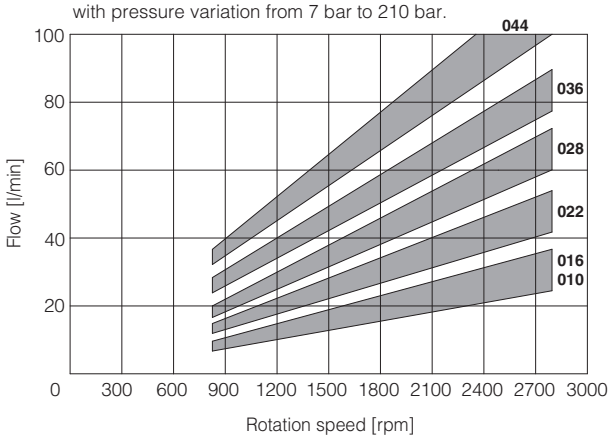


Noise levels

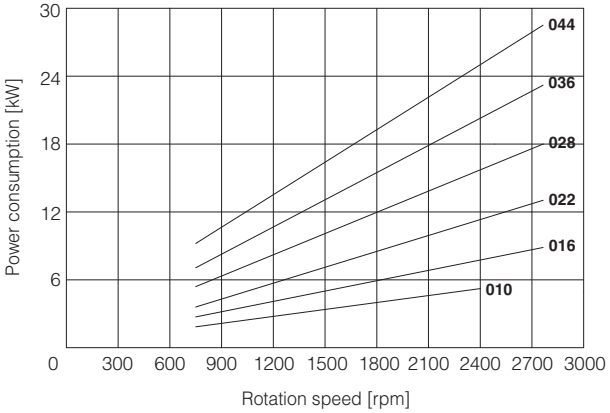


PFEA-31:

Flow versus speed diagram
with pressure variation from 7 bar to 210 bar.

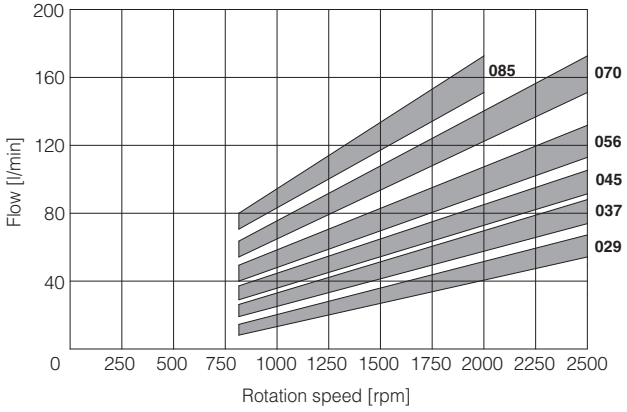


Power consumption versus speed diagram at 140 bar.
Power consumption is proportional to operating pressure.

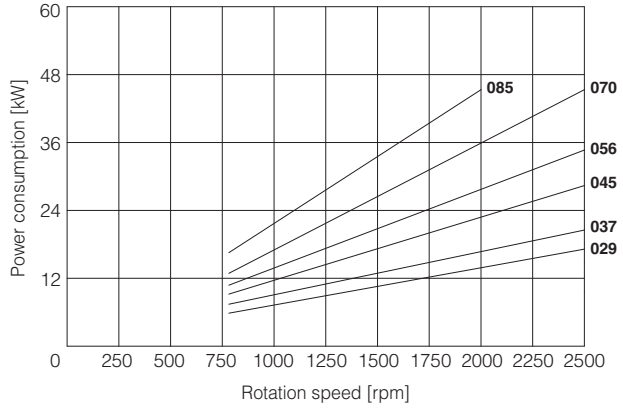


PFEA-41:

Flow versus speed diagram
with pressure variation from 7 bar to 210 bar.

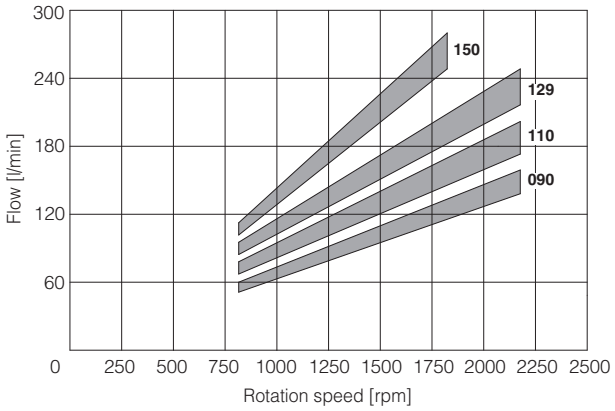


Power consumption versus speed diagram at 140 bar.
Power consumption is proportional to operating pressure.

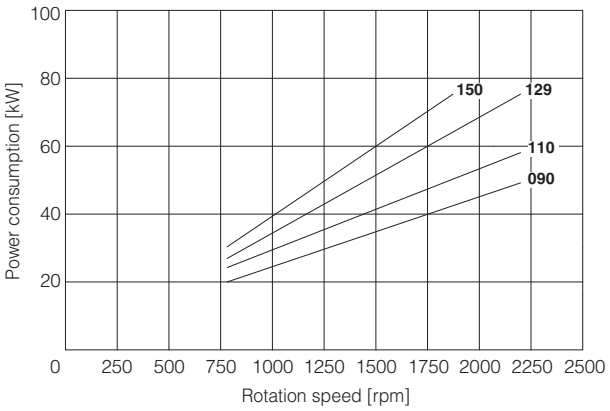


PFEA-51:

Flow versus speed diagram
with pressure variation from 7 bar to 210 bar.

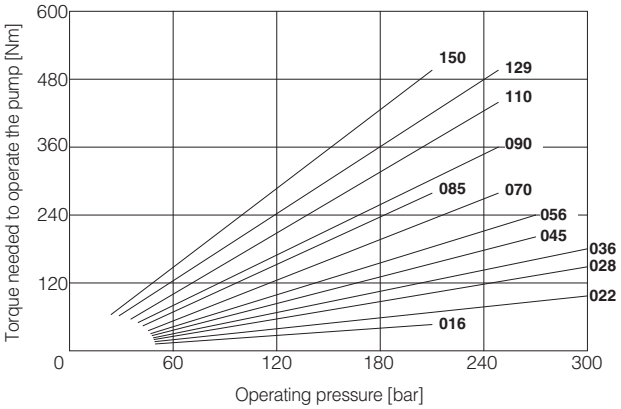


Power consumption versus speed diagram at 140 bar.
Power consumption is proportional to operating pressure.

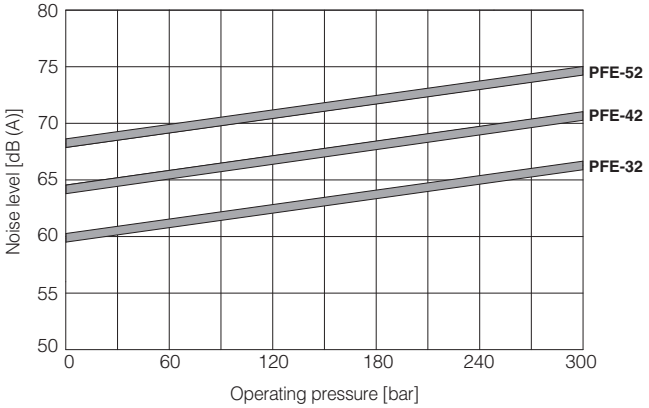


8 **DIAGRAMS** for PFEA -32, 42, 52 (based on mineral oil ISO VG 46 at 50°C)

Torque versus pressure diagram

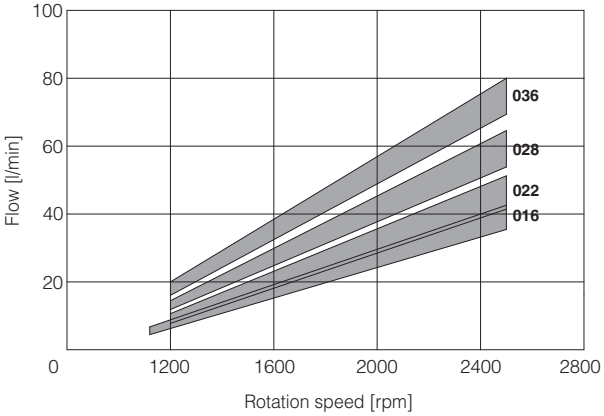


Noise levels

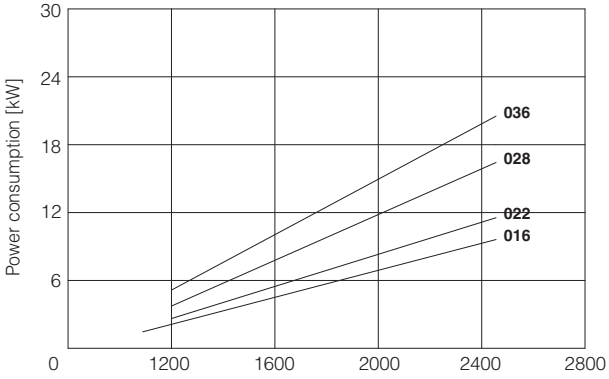


PFEA-32:

Flow versus speed diagram
with pressure variation from 7 bar to 210 bar.

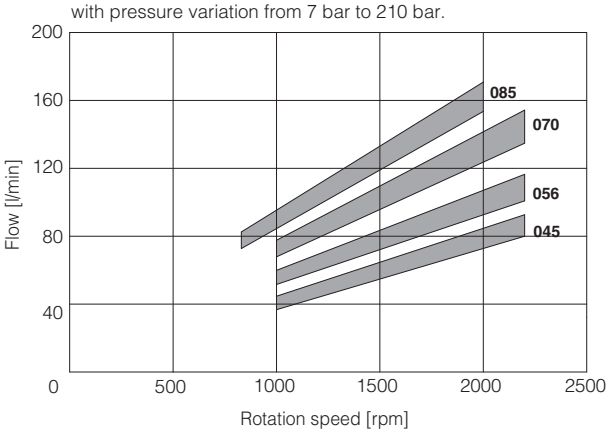


Power consumption versus speed diagram at 140 bar.
Power consumption is proportional to operating pressure.

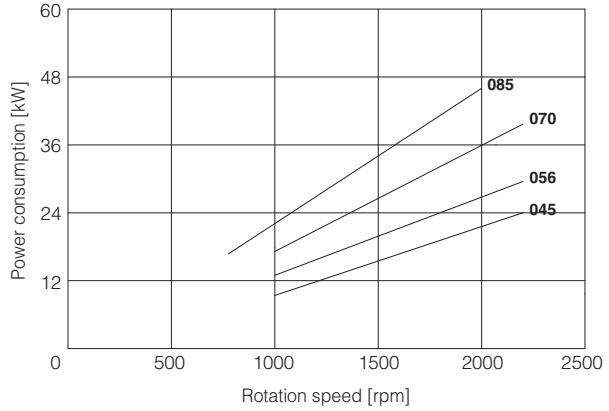


PFEA-42:

Flow versus speed diagram
with pressure variation from 7 bar to 210 bar.

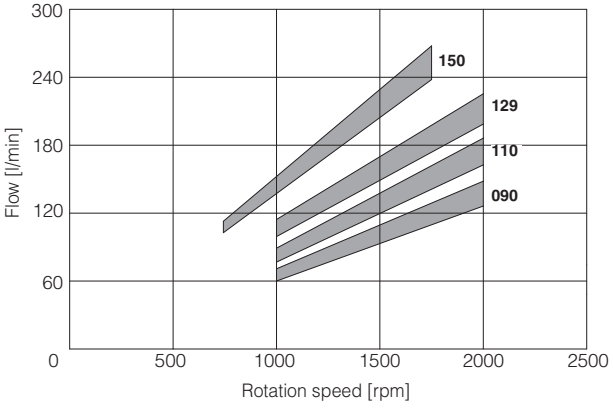


Power consumption versus speed diagram at 140 bar.
Power consumption is proportional to operating pressure.

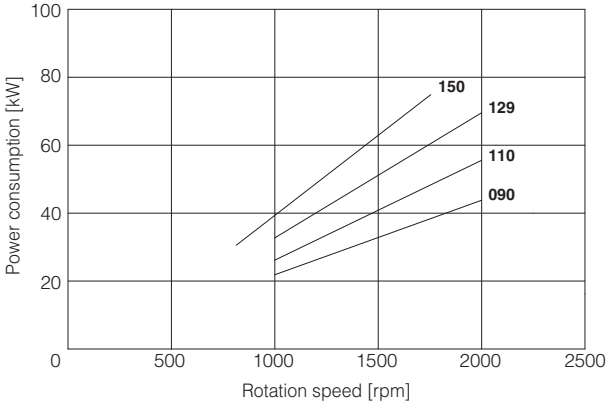


PFEA-52:

Flow versus speed diagram
with pressure variation from 7 bar to 210 bar.

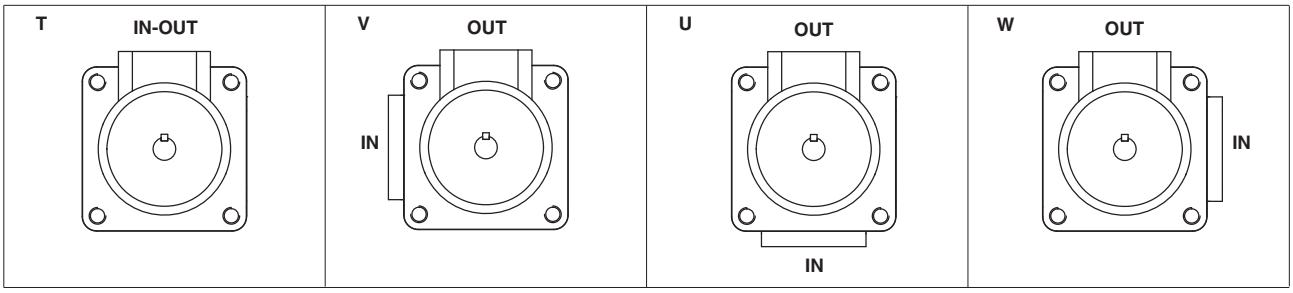


Power consumption versus speed diagram at 140 bar.
Power consumption is proportional to operating pressure.



9 PORT ORIENTATION

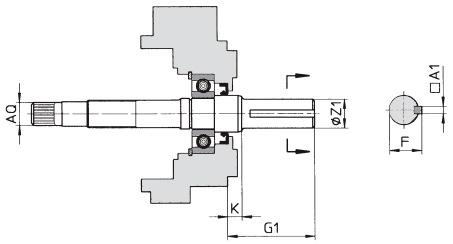
Single pumps can be supplied with oil ports oriented in different configuration in relation to the drive shaft, as follows (wiewed from the shaft end);
Ports orientation can be easily changed by rotating the pump body that carries inlet port.



OUT = outlet port; **IN** = inlet port

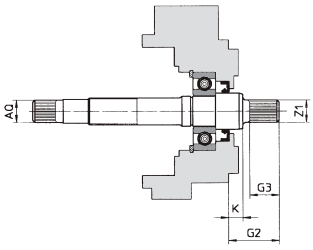
10 DRIVE SHAFT

CYLINDRICAL SHAFT KEYED



PFEA Model	PFEA - 31,41,51						PFEA - 41,51						ALL VERSIONS					
	Keyed shaft type 1 (only PFEA - 31,41,51)						Keyed shaft type 2 (only PFEA - 41,51)						Keyed shaft type 3					
	A1	F	G1	K	ØZ1	Ø AQ Only for through shaft execution	A1	F	G1	K	ØZ1	Ø AQ Only for through shaft execution	A1	F	G1	K	ØZ1	Ø AQ Only for through shaft execution
31,32	4,78 4,75	21,11 20,94	56,00	8,00	19,05 19,00	SAE 16/32-9T	–	–	–	–	–	–	4,78 4,75	24,54 24,41	56,00	8,00	22,22 22,20	SAE 16/32-9T
41,42	4,78 4,75	24,54 24,41	59,00	11,40	22,22 22,20	SAE 32/64-24T	6,36 6,35	25,03 24,77	71,00	8,00	22,22 22,20	SAE 32/64-24T	6,38 6,35	28,30 28,10	78,00	11,40	25,38 25,36	SAE 32/64-24T
51,52	7,97 7,94	35,33 35,07	73,00	14	31,75 31,70	SAE 16/32-13T	7,95 7,94	35,33 35,07	84,00	8,10	31,75 31,70	SAE 16/32-13T	7,97 7,94	38,58 38,46	84,00	14	34,90 34,88	SAE 16/32-13T

SPLINED SHAFT



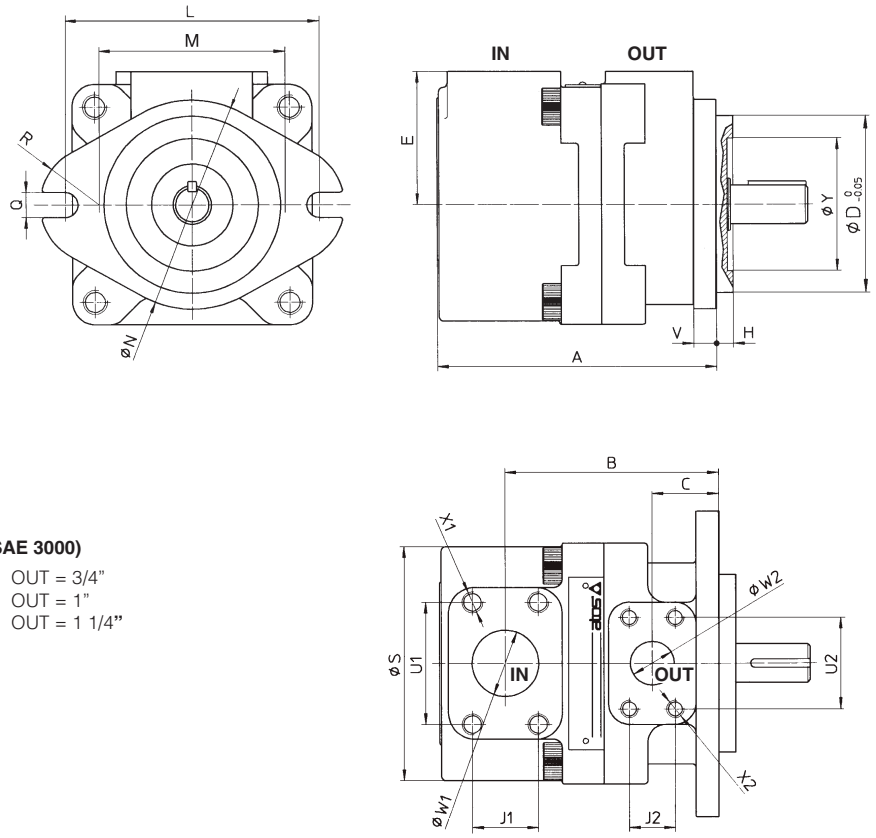
PFEA Model	Splined shaft type 5					Splined shaft type 6					Splined shaft type 7				
	G2	G3	K	Z1	Ø AQ Only for through shaft execution	G2	G3	K	Z1	Ø AQ Only for through shaft execution	G2	G3	K	Z1	Ø AQ Only for through shaft execution
31,32	32,00	19,50	6,50	SAE 16/32-9T	SAE 16/32-9T	41,00	28	8,00	SAE 16/32-13T	SAE 16/32-9T	32,00	19	8,00	SAE 16/32-13T	SAE 16/32-9T
41,42	41,25	28	8,00	SAE 16/32-13T	SAE 32/64-24T	55,60	42	8,00	SAE 12/24-14T	SAE 32/64-24T	41,60	28	8,00	SAE 12/24-14T	SAE 32/64-24T
51,52	56,00	42	8,10	SAE 12/24-14T	SAE 16/32-13T	–	–	–	–	–	–	–	–	–	–

11 LIMITS OF SHAFT TORQUE

PFEA Model	Maximum driving torque [Nm]						Maximum torque available at the end of the through shaft [Nm]
	Shaft type 1	Shaft type 2	Shaft type 3	Shaft type 5	Shaft type 6	Shaft type 7	Any type of shaft
31,32	160	–	240	110	240	240	130
41,42	250	250	400	200	400	400	250
-51,52	500	500	850	450	–	–	400

The values of torque required to operate the pumps are shown for each type on the “torque versus pressure” diagram at section 4.
In multiple pumps the total torque applied to the shaft of the first element (drive shaft) is the sum of the single torque needed for operating each single pump and it is necessary to verify that this total torque applied to the drive shaft is not higher than the values indicated in the table.

12 DIMENSIONS OF PFEA - 31, 41, 51 SINGLE PUMPS [mm]



PORTS DIMENSION (SAE 3000)

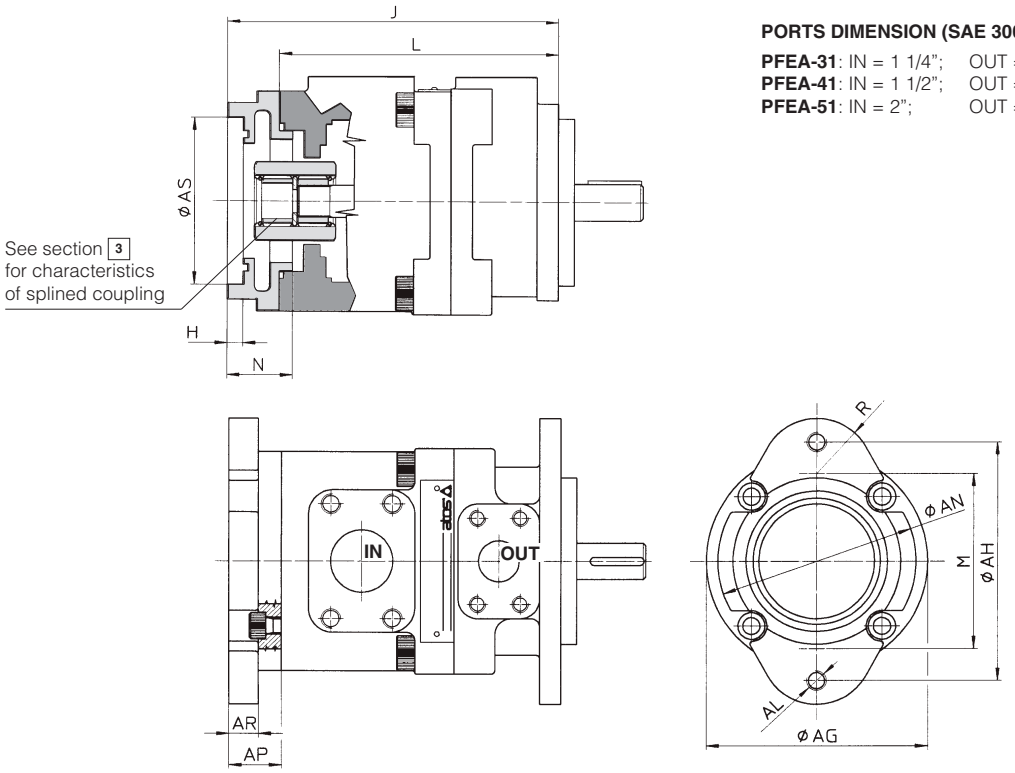
PFEA-31: IN = 1 1/4"; OUT = 3/4"
PFEA-41: IN = 1 1/2"; OUT = 1"
PFEA-51: IN = 2"; OUT = 1 1/4"

Mass:

PFEA-31 = 9 kg
PFEA-41 = 14 kg
PFEA-51 = 25,5 kg

Pump size	A	B	C	ØD	E	H	L	M	ØN	Q	R
PFEA-31	136	100	28	82,55	70	6,4	106	73	95	11,1	28,5
PFEA-41	160	120	38	101,6	76,2	9,7	146	107	120	14,3	34
PFEA-51	186,5	125	38	127	82,6	12,7	181	143,5	148	17,5	35
Pump size	**ØS**	**U1**	**U2**	**V**	**ØW1**	**ØW2**	**J1**	**J2**	**X1**	**X2**	**ØY**
PFEA-31	114	58,7	47,6	10	32	19	30,2	22,2	M10X20	M10X17	47
PFEA-41	134	70	52,4	13	38	25	35,7	26,2	M12X20	M10X17	76
PFEA-51	160	77,8	58,7	15	51	32	42,9	30,2	M12X20	M10X20	76

13 DIMENSIONS OF PFEA-31, 41, 51 WITH THROUGH-SHAFT (XA*, XB*, XC options) [mm]



PORTS DIMENSION (SAE 3000)

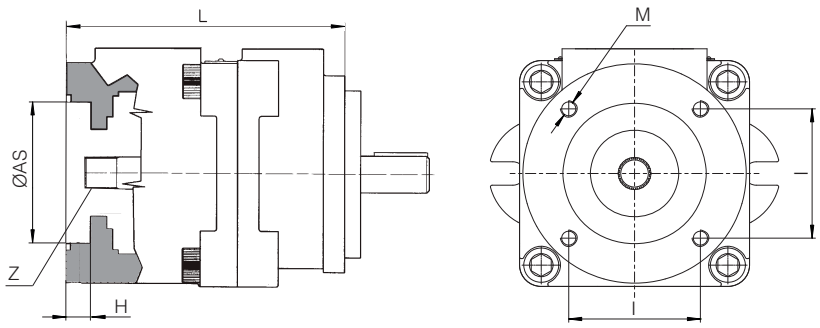
PFEA-31: IN = 1 1/4"; OUT = 3/4"
PFEA-41: IN = 1 1/2"; OUT = 1"
PFEA-51: IN = 2"; OUT = 1 1/4"

For other dimensions, see section 10

Pump size	Ø AG	Ø AH	AL	Tightening torque (Nm) (1)	Ø AN	AP	AR	Ø AS	H	J	L	M	N	R
PFEAXA-31	114	106	M10X17	70	95	33	25	82,57 82,63	6,42 6,47	165,5	132,5	79	32	28,5
PFEAXA-41	134	106	M10X17	70	95	23	11	82,57 82,63	6,42 6,47	194	171	73	32	28,5
PFEAXB-41	134	146	M12	125	120	32	18	101,62 101,68	9,73 9,78	203	171	107	41	34
PFEAXA-51	134	106	M10X17	70	95	22,7	11	82,57 82,63	6,42 6,47	206,2	183,5	73	32	28,5
PFEAXB-51	134	146	M12	125	120	32	18	101,62 101,68	9,73 9,78	215,5	183,5	107	41	34
PFEAXC-51	134	181	M16	300	148	46,5	30,7	127,02 127,02	12,73 12,78	230	183,5	143,5	56	35

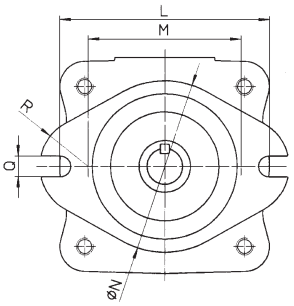
(1) Tightening torque for screw class 12.9

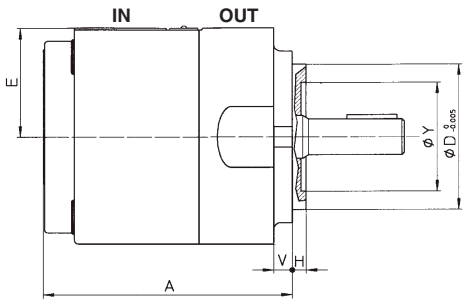
14 DIMENSIONS OF PFEA-31, 41, 51 WITH THROUGH SHAFT, WITHOUT REAR FLANGE (XO option) [mm]



Pump size	L	Ø AS	H	M	I	Z
PFEAXO-31	132.5	$60\ ^{+0.03}_{0}$	6.5	n°4 M6x13(max)	70	SAE 16/32-9T x15mm
PFEAXO-41	171	$86\ ^{+0.035}_{0}$	15	n°4 M10x17(max)	79	SAE 32/64-24T x20mm
PFEAXO-51	183.5	$86\ ^{+0.035}_{0}$	15	n°4 M10x17(max)	79	SAE 16/32-13T x20mm

15 DIMENSIONS OF PFEA - 32, 42, 52 SINGLE PUMPS [mm]



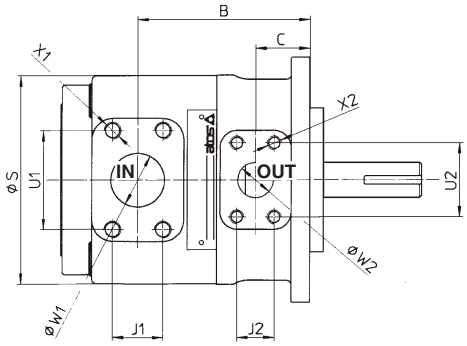


PORTS DIMENSION (SAE 3000)

PFEA-32: IN = 1 1/4"; OUT = 3/4"
PFEA-42: IN = 1 1/2"; OUT = 1"
PFEA-52: IN = 2"; OUT = 1 1/4**"**

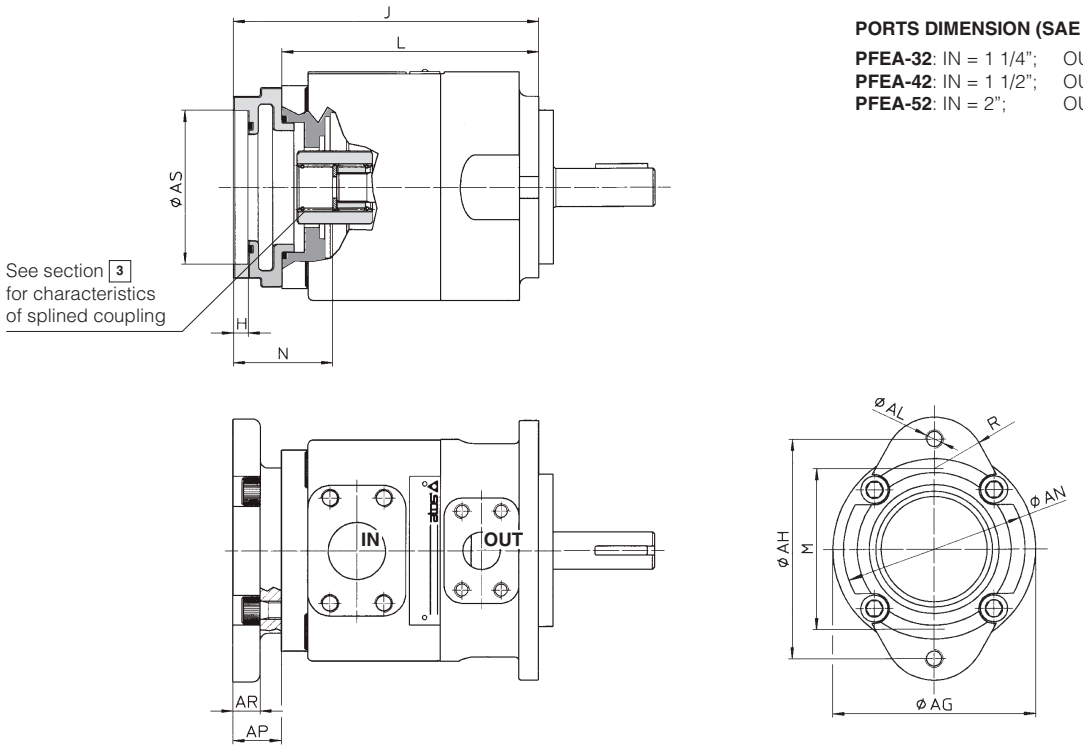
Mass:

PFEA-32 = 9 kg
PFEA-42 = 20,5 kg
PFEA-52 = 32,1 kg



Pump size	A	B	C	ØD	E	H	L	M	ØN	Q	R
PFEA-32	136	100	28	82,5	70	6,4	106	73	95	11	28,5
PFEA-42	175,5	121	38	101,6	78	9,7	146	107	121	14,3	34
PFEA-52	189	125	38	127	89	12,7	181	143,5	148	17,5	35
Pump size	**ØS**	**U1**	**U2**	**V**	**ØW1**	**ØW2**	**J1**	**J2**	**X1**	**X2**	**ØY**
PFEA-32	114	58,7	47,6	10	32	19	30,2	22,2	M10X20	M10X17	47
PFEA-42	148	70	52,4	13	38	25	35,7	26,2	M12X20	M10X17	76
PFEA-52	174	77,8	58,7	16,3	50	50	42,9	30,2	M12X20	M10X20	76

16 DIMENSIONS OF PFEA - 32, 42, 52 WITH THROUGH-SHAFT (XA*, XB*, XC* options) [mm]



PORTS DIMENSION (SAE 3000)

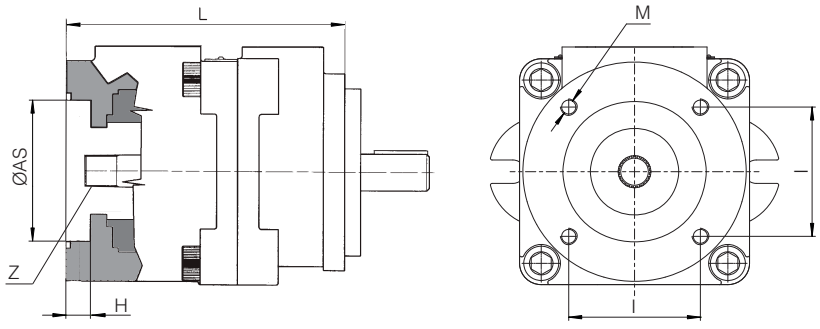
PFEA-32: IN = 1 1/4"; OUT = 3/4"
PFEA-42: IN = 1 1/2"; OUT = 1"
PFEA-52: IN = 2"; OUT = 1 1/4"

For other dimensions, see section 10

Pump size	Ø AG	Ø AH	AL	Tightening torque (Nm) (1)	Ø AN	AP	AR	Ø AS	H	J	L	M	N	R
PFEAXA-32	114	106	M10X17	70	95	33	25	82,57 82,63	6,42 6,47	193,7	132,5	79	32	28,5
PFEAXA-42	134	106	M10X17	70	95	22,7	11	82,57 82,63	6,42 6,47	194	171	73	34	28,5
PFEAXB-42	134	146	M12	125	120	32	18	101,62 101,68	9,73 9,78	203	171	107	43	34
PFEAXA-52	134	106	M10X17	70	95	22,7	11	82,57 82,63	6,42 6,47	206,2	183,5	73	34,5	28,5
PFEAXB-52	134	146	M12	125	120	32	18	101,62 101,68	9,73 9,78	215,5	183,5	107	43,8	34
PFEAXC-52	134	181	M16	300	148	46,7	30,7	127,02 127,02	12,73 12,78	230,2	183,5	143,5	58,5	35

(1) Tightening torque for screw class 12.9

17 DIMENSIONS OF PFEA - 32, 42, 52 WITH THROUGH SHAFT, WITHOUT REAR FLANGE (XO option) [mm]



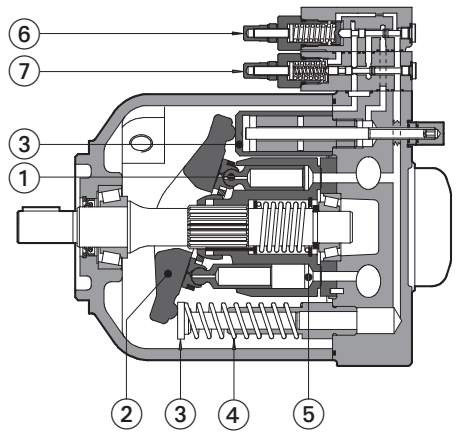
Pump size	L	Ø AS	H	M	I	Z
PFEAXO-32	132.5	$60\ ^{+0.03}_{0}$	6.5	n°4 M6x13(max)	70	SAE 16/32-9T x15mm
PFEAXO-42	171	$86\ ^{+0.035}_{0}$	15	n°4 M10x17(max)	79	SAE 32/64-24T x20mm
PFEAXO-52	183.5	$86\ ^{+0.035}_{0}$	15	n°4 M10x17(max)	79	SAE 16/32-13T x20mm

18 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO
AX900	Operating and maintenance information for ex-proof pumps

Ex-proof axial piston pumps type PVPCA

for potentially explosive atmospheres - **ATEX, EAC**



① pumping piston
② swashing plate
③ servo piston
④ spring
⑤ rotation barrel
⑥ pressure compensator
⑦ flow regulator

PVPCA-L-4046

PVPCA are variable displacement axial piston pumps for high pressure operation, and low noise level, available in a wide range of hydraulic and proportional controls.

They are certified for application in potentially explosive atmospheres according to ATEX, EAC protection mode Ex II 2/2G Ex h IIC T5, T4 Gb, and Ex II 2/2D Ex h IIIC T100°C, T135°C Db (group II for surface plants with gas, vapours and dust environment, category 2, zone 1, 2, 21 and 22).

The external surface temperature of the pump is in accordance with the certified class, to avoid the self ignition of the explosive mixture present in the environment.

Displacement: **29-46-73-88 cm³/rev.**
Pressure: **280 bar working**
350 bar peak

1 MODEL CODE

PVPCA	XA	-	C	-	4	046	/	31044	/	1	D	-	GK	/	7	24DC	*	/	*

Variable displacement vane pump with ex-proof certification

Additional suffix for pumps with through shaft, for coupling with 2nd pump type PFEA:
XA =for coupling with PFEA-3* (only for PVPCA*-3*)
XB =for coupling with PFEA-4* (only for PVPCA*-4*)
XC =for coupling with PFEA-5* (only for PVPCA*-5*)

Type of control **(1)**:
C = manual pressure compensator
CH= manual pressure compensator with venting
R = remote pressure compensator
L = load sensing (pressure & flow)
LW= constant power (combined pressure & flow)
For proportional controls see note (2)

Size:
3 = for displacement 029
4 = for displacement 046
5 = for displacement 073 and 090

Max displacement of axial piston pump:
029 = 29 cm³/rev
046 = 46 cm³/rev
073 = 73 cm³/rev
090 = 88 cm³/rev

Type of PVPCA (for double pumps), see tech table A160

Shaft (SAE Standard):
1 = keyed (7/8" for 029 - 1" for 046 - 1 1/4" for 073 and 090)
5 = splined (13 teeth for 029 - 15 for 046 - 14 for 073 and 090)

Direction of rotation (viewed at the shaft end):
D = clockwise
S = counterclockwise

Solenoid threaded connection (only for CH control):
GK = GK-1/2" ISO/UNI-6125 (tapered)
NPT= 1/2" NPT ANSI B2.1 (tapered)
M = M20x1,5 UNI-4535

Option:
7 = for ambient temperature up to 70°C **(3)**
Only for CH control:
O = horizontal cable entrance
WP = prolongued manual override protected by metallic cap

Voltage code, only for CH: see tech table EX010

Series number

Seals material: omit for NBR (mineral oil & water glycol)
PE = FKM **(3)**

(1) Pumps CH, CZ, LQZ, PES and PERS are supplied with two certificates, one for the pump, and one for control valve

(2) Pumps with proportional controls type: CZ, LQZ, PES and PERS are available on request.
For the technical characteristics of PVPCA pumps with proportional controls, see tech table AS170

(3) Pumps with option **/7** are always equipped with seals FKM

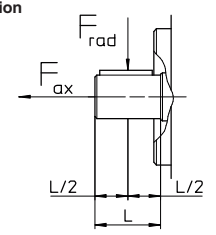
2 GENERAL CHARACTERISTICS

Assembly position	Any position. The drain port must be on the top of the pump. Drain line must be separated and unrestricted to the reservoir and extended below the oil level as far from the inlet as possible. Suggested maximum line lenght is 3 m.
Ambient temperature range	-20°C to +70°C
Compliance	Explosion proof protection "Ex h", see section 6 RoHs Directive 2011/65/EU as last update by 2015/65/EU (only PVPCA-CH) REACH Regulation (EC) n°1907/2006

3 OPERATING CHARACTERISTICS

Pump model		PVPCA*-3029	PVPCA*-4046	PVPCA*-5073	PVPCA*-5090
Displacement	[cm³/rev]	29	46	73	88
Theoretical max flow at 1450 rpm	[l/min]	42	66,7	105,8	127,6
Max working pressure / Peak pressure	[bar]	280/350	280/350	280/350	250/315
Min/Max inlet pressure	[bar abs.]	0,8 / 25	0,8 / 25	0,8 / 25	0,8 / 25
Max pressure on drain port	[bar abs.]	1,5	1,5	1,5	1,5
Power consumption at 1450 rpm and at maximum pressure and displacement	[kW]	19,9	31,6	50,1	54,1
Max torque on the first shaft	[Nm]	Type 1 210 / Type 5 270	Type 1 350 / Type 5 440	Type 1 670 / Type 5 810	Type 1 670 / Type 5 810
Max permissible load on drive shaft	[N] Fax	1000	1500	2000	2000
	Frad	1500	1500	3000	3000
Speed rating	[rpm]	500 ÷ 3000	500 ÷ 2600	500 ÷ 2600	500 ÷ 2200

External load position



Fax = axial load
Frad = radial load

Notes: For speeds over 1800 rpm the inlet port must be under oil level with adequate pipes.
Maximum pressure for all models with water glycol fluid is 160 bar, with option /PE is 190 bar.
Max speed with options /PE and for water glycol fluid is 2000/1900/1600/1500 rpm respectively for the four sizes.

4 ELECTRICAL CHARACTERISTICS FOR VERSION CH

Valve type		DHA
Voltage code **(1)**	VDC ±10%	**12DC, 24DC, 28DC, 48DC, 110DC, 125DC, 220DC**
	VAC 50/60 Hz ±10%	**12AC, 24AC, 110AC, 230AC**
Power consumption at 20°C		8W
Coil insulation		class H
Protection degree with relevant cable gland		IP66/67 to DIN EN60529
Duty factor		100%

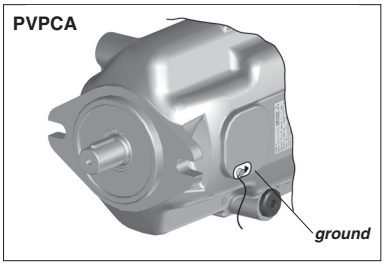
(1) For alternating current supply a rectifier bridge is provided built-in the solenoid
For power supply frequency 60 Hz, the nominal supply voltage of solenoids 110AC and 230AC must be 115/60 and 240/60 respectively

5 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

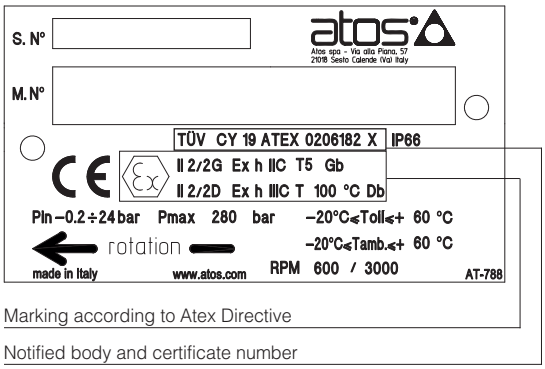
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C		
Recommended viscosity	15÷100 mm²/s - max start-up viscosity = 1000 mm²/s		
Max fluid contamination level — normal operation	ISO4406 class 20/18/15 NAS1638 class 9	see also filter section at or KTF catalog	
Max fluid contamination level — longer life	ISO4406 class 18/16/13 NAS1638 class 7		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR	HFC	

6 CERTIFICATION DATA

Certification	**ATEX, EAC**	
Protection mode	Ex II 2/2G Ex h IIC T5, T4 Gb, Ex II 2/2D Ex h IIIC T100°C, T135°C Db	
Type examination certificate	TUV CY 19 ATEX 026182X	
Pump version	(**std** and **/PE**)	**/7 /PE**
Temperature class	T5	T4
Surface temperature	≤ 100 °C	≤ 135 °C
Ambient temperature	-20 ÷ +60 °C	-20 ÷ +70 °C
Max inlet fluid temperature	+60 °C	+80 °C
Protection degree	IP 66	



6.1 EXAMPLE OF PVPCA NAMEPLATE MARKING

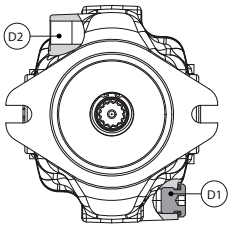


Marking according to Atex Directive

Notified body and certificate number

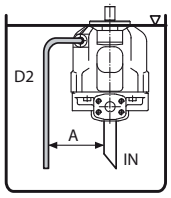
Ex = Equipment for explosive atmospheres
II = Group II for surfaces plants
2/2 = Pump category
G = For gas and vapours
D = For dust
h = Marking includes one on more of the following types of protection ("c", "b", "k")
IIC = Gas group (acetylene, hydrogen)
IIIC = Conduictive dust
T* = Temperature class (T6, T5, T4)
T°C** = Max surface temperature (85, 100, 135)
Zone 1 (gas) **and 21** (dust) = Possibility of explosive atmosphere during normal functioning
Zone 2 (gas) **and 22** (dust) = Low probability of explosive atmosphere

7 INSTALLATION POSITION

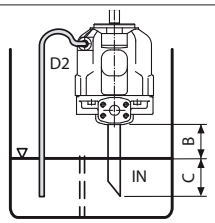


The pump is supplyed whit drain D2 open, and D1 plugged.
Before installation fill the pump with hydraulic oil for at least 3/4 of its volume, keeping it in horizontal position.
With exception of pump mounted below the oil level, we recomend to interpose a baffle plate between inlet and drain line.

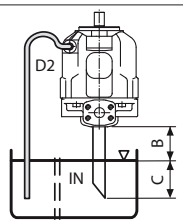
VERTICAL INSTALLATION



INSIDE THE TANK
Minimum oil level equal or above the pump mounting surface.
A ≥ 200mm

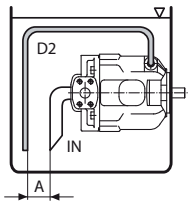


INSIDE THE TANK
Minimum oil level below the pump mounting surface.
Minimum inlet pressure = 0,8 bar absolute
B ≤ 800mm, C= 200mm

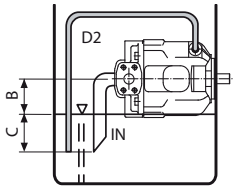


OUTSIDE THE TANK,
above oil level
Minimum inlet pressure = 0,8 bar absolute
B ≤ 800mm, C= 200mm

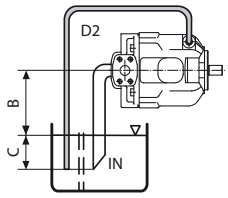
HORIZONTAL INSTALLATION



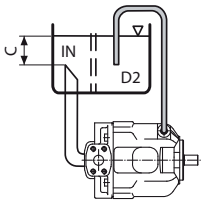
INSIDE THE TANK
Minimum oil level equal or above the pump mounting surface.
A ≥ 200mm



INSIDE THE TANK
Minimum oil level below the pump mounting surface.
Minimum inlet pressure = 0,8 bar (absolute)
B ≤ 800mm, C= 200mm



OUTSIDE THE TANK,
above oil level
Minimum inlet pressure = 0,8 bar (absolute)
B ≤ 800mm, C= 200mm



OUTSIDE THE TANK,
below oil level
C= 200mm

IN: inlet line - **D1:** drain line - **A:** minimum distance between inlet and drain line - **B+C:** permissible suction height - **C:** inlet line immersion dept

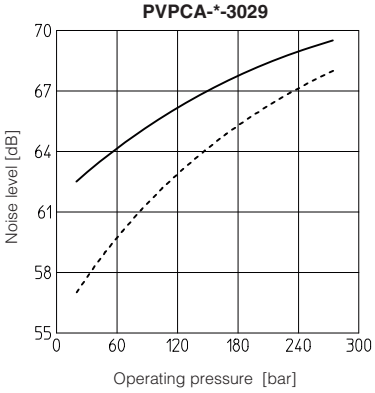
8 DIAGRAMS at 1450 rpm (based on mineral oil ISO VG 46 at 50°C)

8.1 Noise level curves

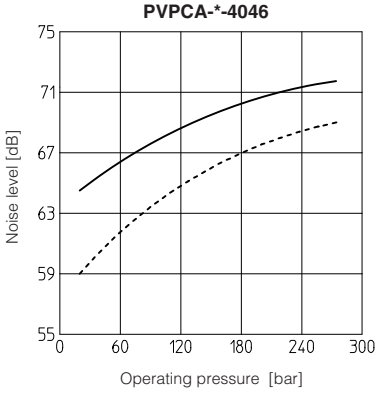
Ambient noise levels measured in compliance with ISO 4412-1 oleohydraulics -Test procedure to define the ambient noise level - Pumps
Shaft speed: 1450 rpm.

—— = Qmax ------ = Qmin

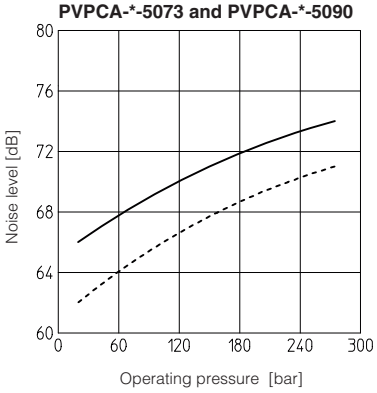
PVPCA-*-3029



PVPCA-*-4046



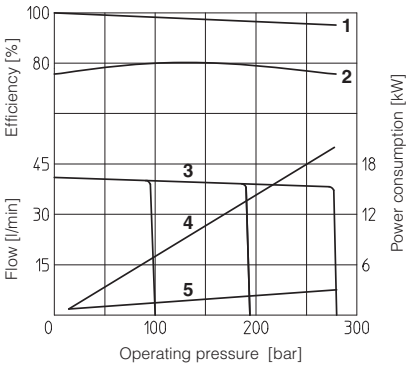
PVPCA-*-5073 and PVPCA-*-5090



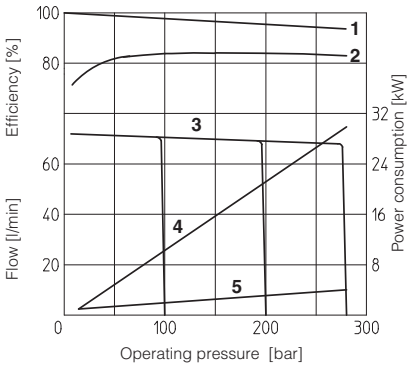
8.2 Operating limits

1 = Volumetric efficiency
2 = Overall efficiency
3 = Flow versus pressure curve
4 = Power consumption with full flow
5 = Power consumption at pressure compensation

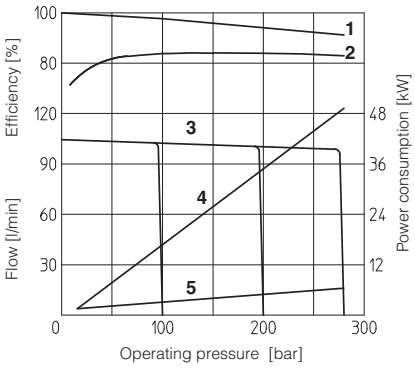
PVPCA-*-3029



PVPCA-*-4046



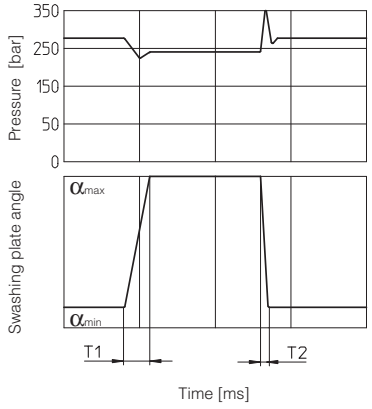
PVPCA-*-5073



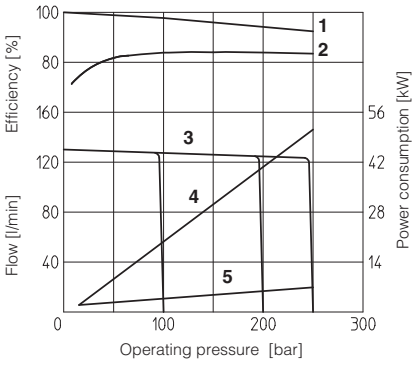
8.3 Response times

8.3.1 Response times and pressure peack due to variation 0% → 100% → 0% of the pump displacement, obtained with an istantaneously opening and shut-off of the delivery line.

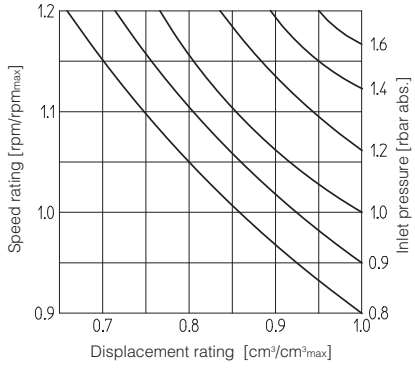
Pump type	**T1** (ms)	**T2** (ms)
PVPCA-*-3029	31	19
PVPCA-*-4046	44	20
PVPCA-*-5073	50	25
PVPCA-*-5090	53	28

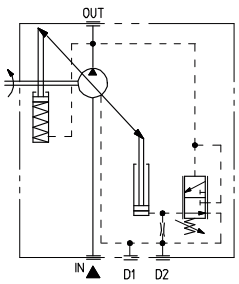


PVPCA-*-5090



8.3.2 Variation of inlet pressure and reduction of displacement with increasing speed rating

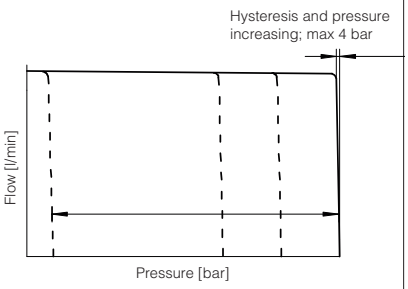


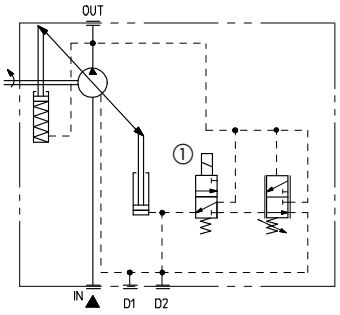


C

Manual pressure compensator

The pump displacement decreases when the line pressure approaches the setting pressure of the compensator. The pump supplies only the fluid required by the system. Pressure may be steplessly adjusted at the pilot valve.
Compensator setting range: 20 ÷ 350 bar (315 bar for 090)
Compensator standard setting: 280 bar (250 bar for 090)



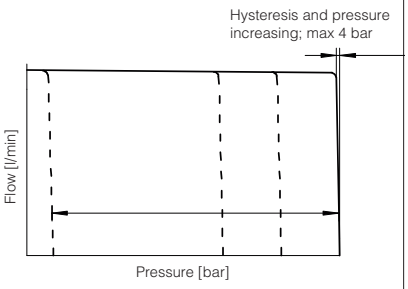


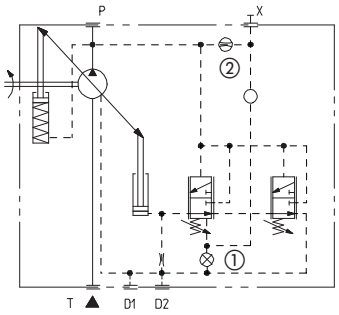
① solenoid venting valve

CH

Manual pressure compensator with venting

As C plus venting function, when a long unloading time is required and heat generation and noise have to be kept at lowest level.
Venting valve solenoid voltage, see section 5
Venting valve OFF = null displacement
Venting valve ON = max displacement
Compensator setting range: 20 ÷ 350 bar (315 bar for 090)
Compensator standard setting: 280 bar (250 bar for 090)

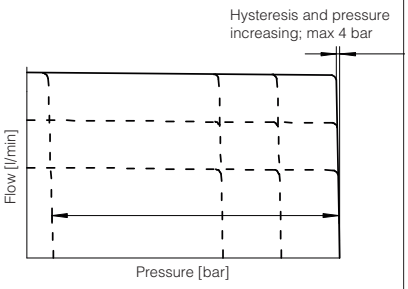


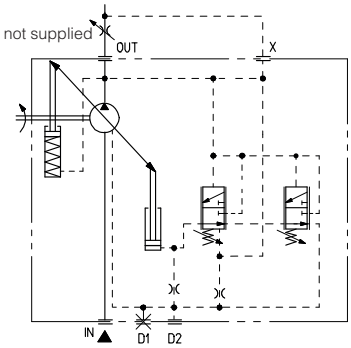


R

Remote pressure compensator

As C, but with remote setting of the compensator by means of a pressure relief valve on the piloting line X.
This version can be obtained from version L using a blind plug UNI 5923 M4x12 in pos. ① and a restrictor M4 drilled ø 0,75 mm in pos. ②.
Compensator setting range: 20 ÷ 350 bar (315 bar for 090)
Compensator standard setting: 280 bar (250 bar for 090)

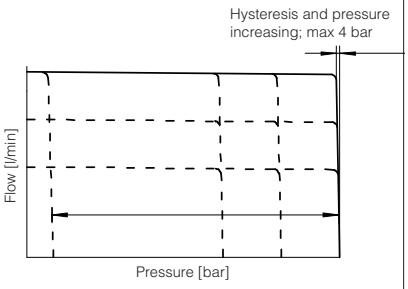


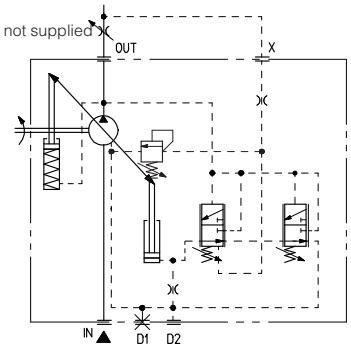


L

Load sensing

The pump displacement is automatically adjusted to maintain a constant (load indipendent) pressure drop across an external throttle. Changing the throttle regulation, the pump flow is consequently adjusted.
Load sensing control always incorporates an hydraulic compensator to limit the maximum pressure.
Compensator setting range: 20 ÷ 350 bar (315 bar for 090)
Compensator standard setting: 280 bar (250 bar for 090)
Differential pressure setting range: 10 ÷ 40 bar
Differential pressure standard setting: 14 bar

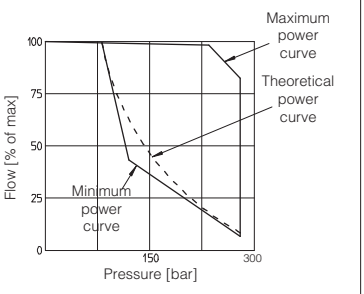




LW

Constant power

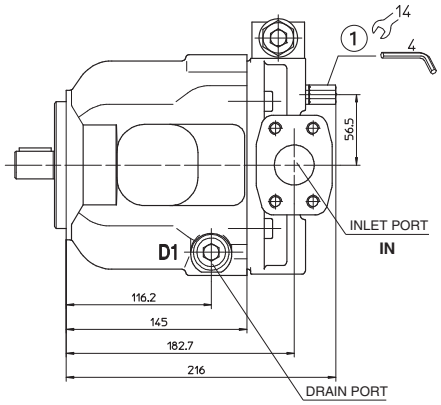
In order to achieve a constant drive torque with varying operating pressure. The swashing angle and therefore the outlet flow is varied so that the product of flow and pressure remains constant.
For the best regulation, minimum working pressure is 80 bar.
While selecting LW control, the required value of power must be communicated with the order (ex. 10 kW at 1450 rpm).

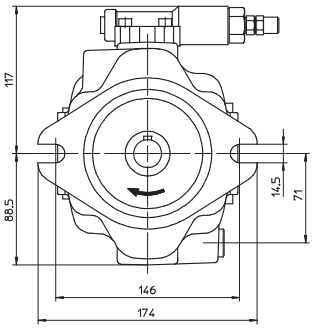


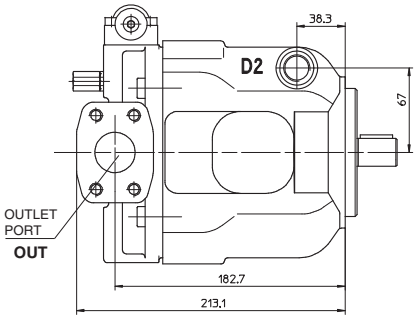
10 DIMENSIONS OF PVPCA-*-3029: BASIC VERSION “C” CONTROL

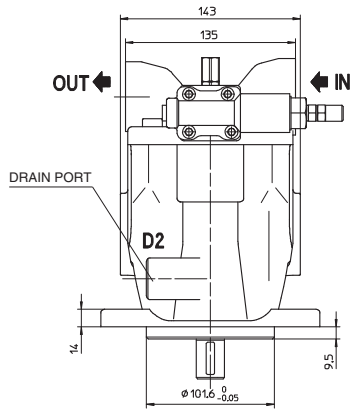
PORTS DIMENSION

IN = Flange SAE 3000 1 1/4”
OUT = Flange SAE 6000 3/4”
D1, D2 = 1/2” BSPP
① = Regulation screw for max displacement 1,5 cm³/rev per turn. Adjustable range 20 to 29 cm³/rev.
In case of double pump the regulation screw is not always available, please contact our technical office.



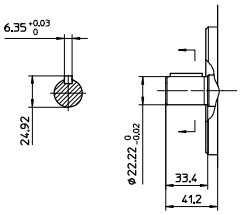




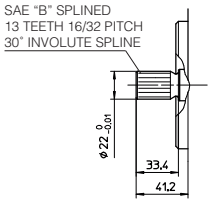


Mass: 18 kg

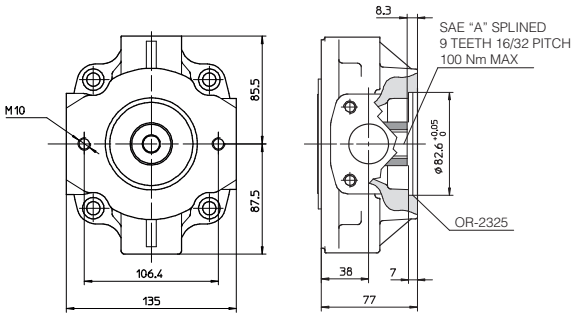
SHAFT TYPE “1”



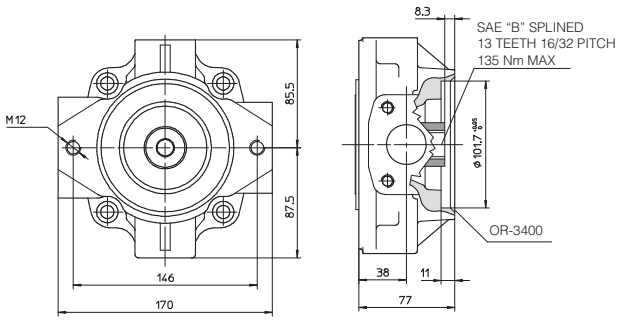
SHAFT TYPE “5”



INTERMEDIATE FLANGE SAE “A” FOR PFEA-31



INTERMEDIATE FLANGE SAE “B” FOR PFEA-41

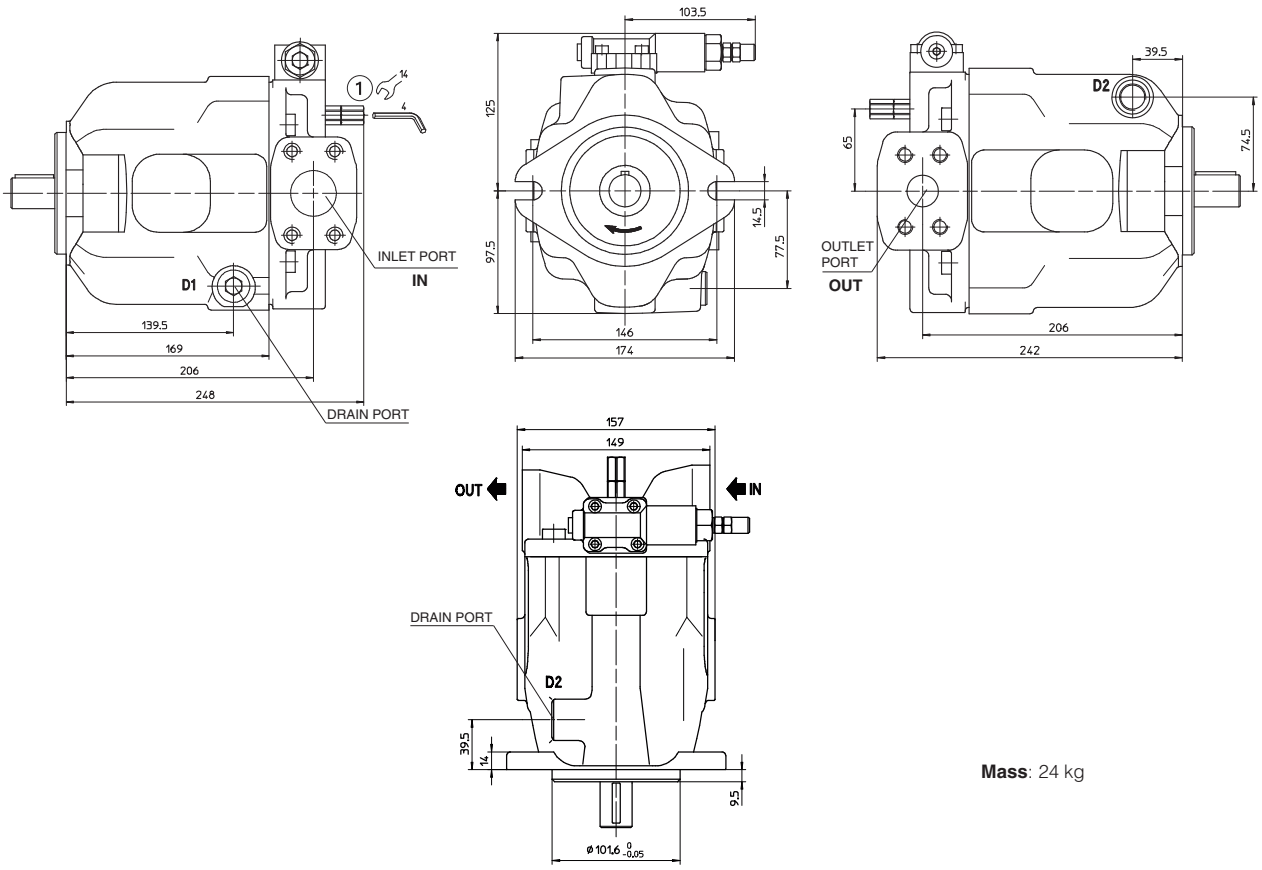


Drawing shows pumps with clockwise rotation (option D): pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted

11 DIMENSIONS OF PVPCA-*-4046: BASIC VERSION "C" CONTROL

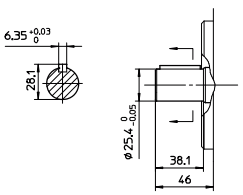
PORTS DIMENSION

IN = Flange SAE 3000 1 1/2"
OUT = Flange SAE 6000 1"
D1, D2 = 1/2" BSPP
① = Regulation screw for max displacement 2,2 cm³/rev per turn. Adjustable range 31,8 to 46 cm³/rev.
In case of double pump the regulation screw is not always available, please contact our technical office.

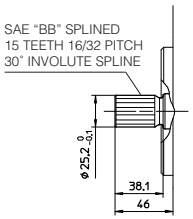


Mass: 24 kg

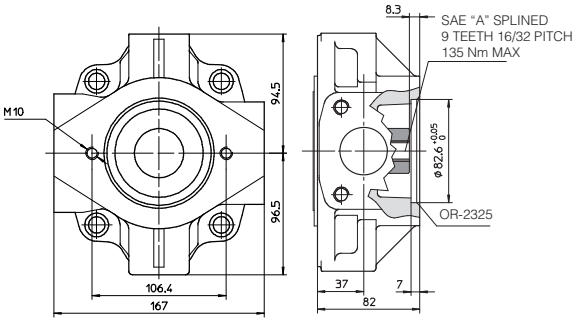
SHAFT TYPE "1"



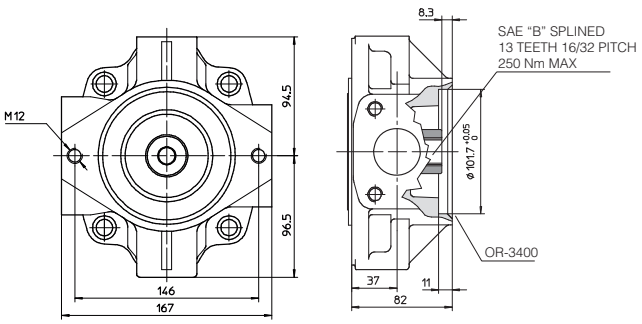
SHAFT TYPE "5"



INTERMEDIATE FLANGE SAE "A" FOR PFEA-31

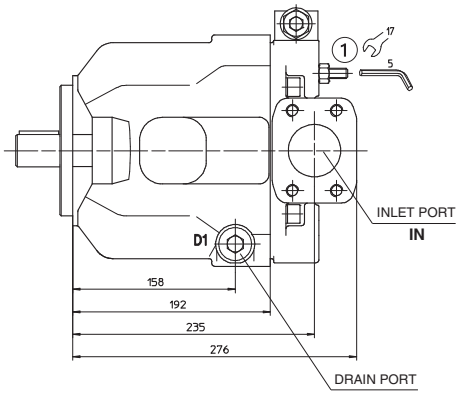


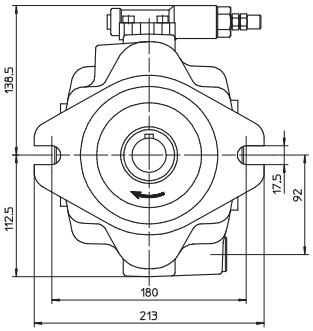
INTERMEDIATE FLANGE SAE "B" FOR PFEA-41

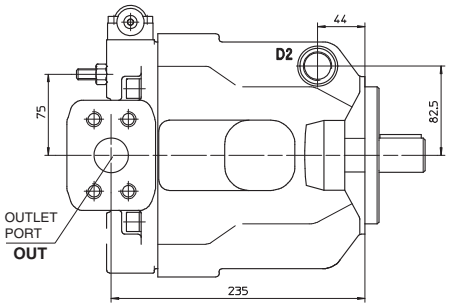


Drawing shows pumps with clockwise rotation (option D): pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted

12 DIMENSIONS OF PVPCA-*-5073 and PVPC-*-5090: BASIC VERSION "C" CONTROL

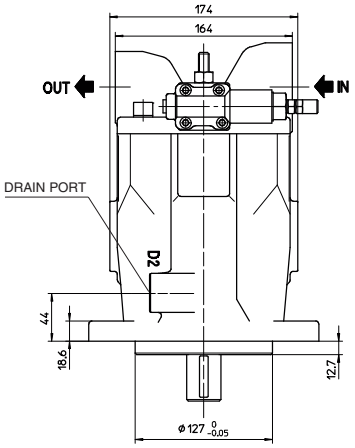






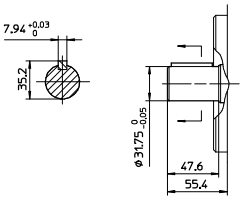
PORTS DIMENSION

IN = Flange SAE 3000 2"
OUT = Flange SAE 6000 1 1/4"
D1, D2 = 3/4" BSPP
① = Regulation screw for max displacement 3,2 cm^3/rev per turn.
Adjustable range :
PVPC-5073 = 36,8 to 46 cm^3/rev
PVPC-5073 = 44 to 88 cm^3/rev.
In case of double pump the regulation screw is not always available, please contact our technical office.

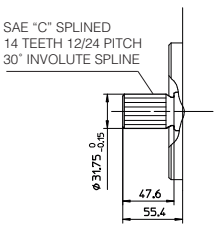


Mass: 33 kg

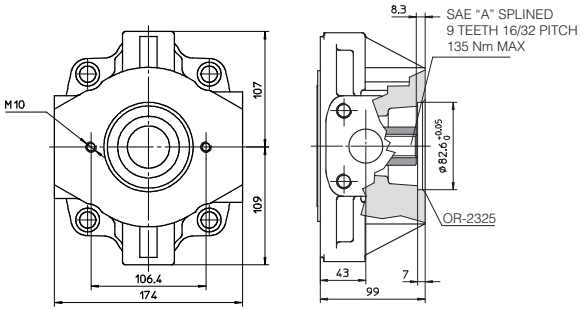
SHAFT TYPE "1"



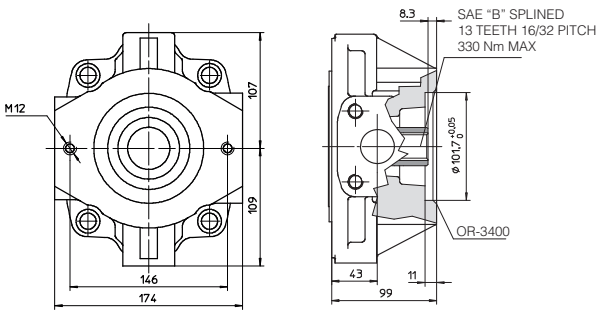
SHAFT TYPE "5"



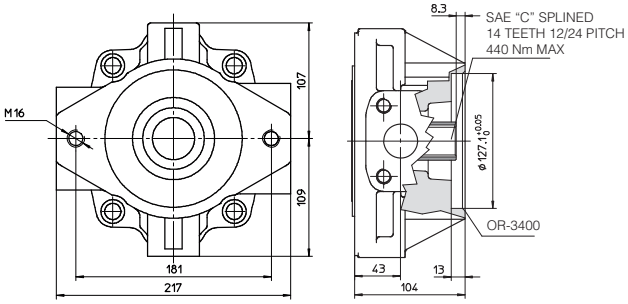
INTERMEDIATE FLANGE SAE "A" FOR PFEA-31



INTERMEDIATE FLANGE SAE "B" FOR PFEA-41



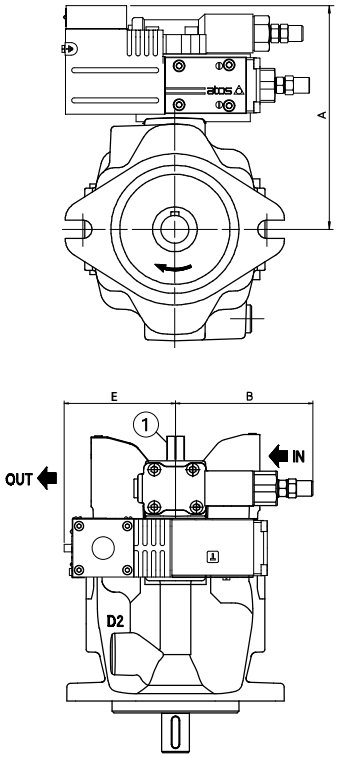
INTERMEDIATE FLANGE SAE "C" FOR PFEA-51



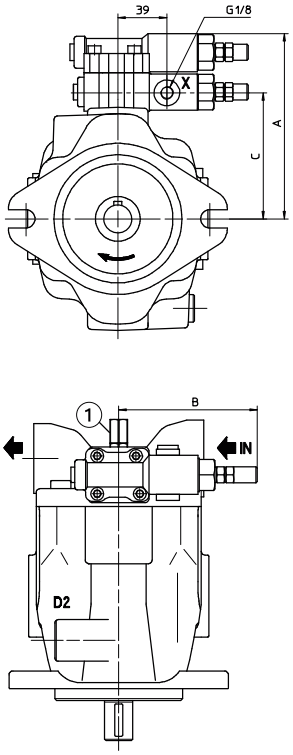
Drawing show pumps with clockwise rotation (option D): pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted

13 DIMENSIONS OF PVPCA: OTHER CONTROLS

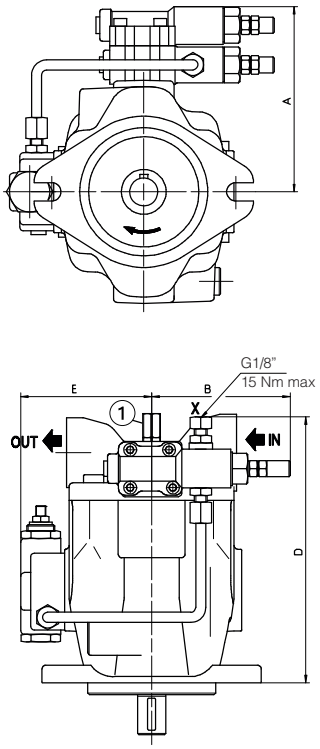
VERSION CH



VERSIONS L, R



VERSION LW



① = Regulation screw for max displacement. Adjustable range 50% to 100% of max displacement).
In case of double pump the regulation screw is not always available, please contact our technical office.

Drawing shows pumps with clockwise rotation (option D): pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted and also the consequently position of the control groups

Pump type	Version	A	B	C	D	E	Mass (kg)
PVPCA-*-3029	**CH**	144	111	-	-	92	22
	L -R	144	111	100	-	-	19,2
	LW	144	111	-	211	104	20
PVPCA-*-4046	**CH**	153	111	-	-	92	28
	L -R	153	111	109	-	-	25,2
	LW	153	111	-	235	111	26
PVPCA-*-5073 PVPCA-*-5090	**CH**	166	111	-	-	92	36,9
	L -R	166	111	122	-	-	34,2
	LW	166	111	-	258	120	35

14 RELATED DOCUMENTATION

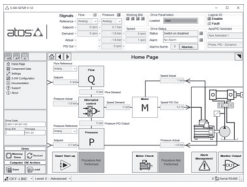
X010	Basics for electrohydraulics in hazardous environments
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO
AX900	Operating and maintenance information for ex-proof pumps

Accessories for SSP servopumps

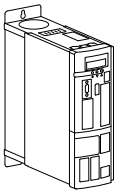
Software, cables, reactances, EMC filters and braking resistances

1 S-SW-SETUP PROGRAMMING SOFTWARE

SSP system can be easily configured connecting D-MP drive to the PC and using Atos S-SW-SETUP programming software. At the system first start-up, the software will invite the user to follow the Smart Start-Up wizard for setting all the parameters necessary for the correct start-up and operation of the system. All the main functions can in any case, be reached and modified thanks to a simple and intuitive graphic interface.
Direct access to the latest releases of programming software, manuals and fieldbus configuration files in MyAtos area at .
For more information about S-SW-SETUP software, see techical table **AS800**.



S-SW-SETUP
programming
software



D-MP drive:
J1 connector

S-A-PS-USB/DB9 adapter

Serial RS485 connection

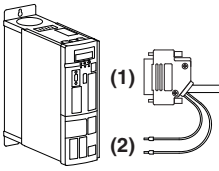
5 m

PC:
USB port

2 RESOLVER CABLE

This cable allows to connect motor resolver to D-MP drive.

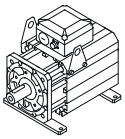
D-MP drive:
J2 connector **(1)**
M4 or **X4** terminal board **(2)**



(1)

(2)

S-C-RSV-DB15/M23/5 cable



PMM motor:
M23 connector

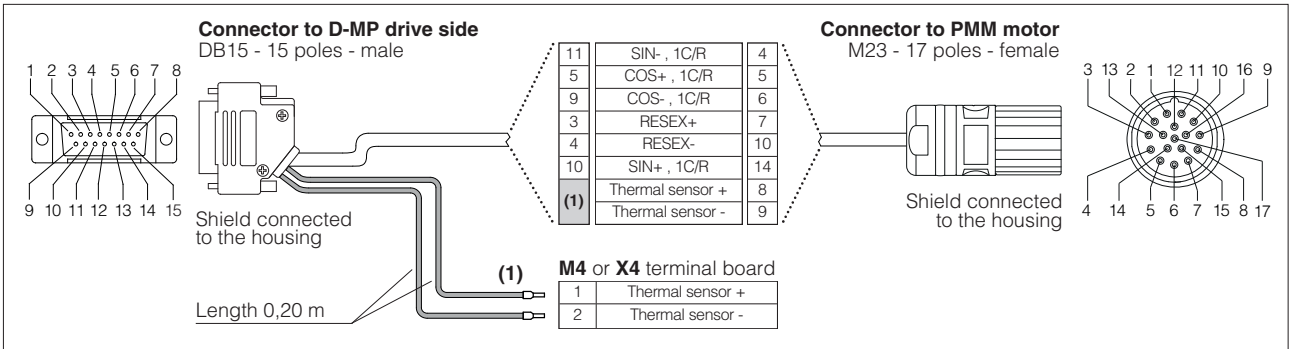
Model code

S-C-RSV	-	DB15	/	M23	/	5
Resolver cable						Length [m]: **5** , **10** , **15** , **20**
DB15 = from J2 DB15 connector, D-MP drive side				**M23** = to M23 connector, PMM motor side		

S-C-RSV-DB15/M23/* - technical specifications

- DB15 male 15 poles connector to D-MP drive
- M23 female 17 poles connector to motor
- two external wires for thermal sensor (KTY and PT)
- paired transmission cable with overall copper screen
- self extinguishing according to IEC 60332-1-2, EN 60332-1-2, UL CSA FT-1, FT-2
- oil resistant with outer green PUR stealth type TMPU
- halogen free according to DIN VDE 0472
- -40°C to +80°C installing temperature range
- 30 V max nominal voltage
- RoHS and CE compliant
- minimum bending radius: 5 x D (D = diameter)

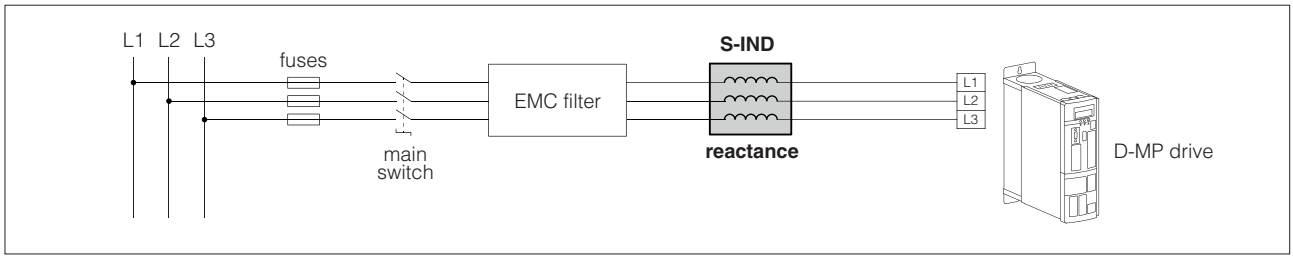
Resolver cable wiring diagram



(1) Thermal sensor external wires have to be connected to pin 1 and 2 of M4 or X4 D-MP drive terminal board (DB15 pass-through connection):
M4 available for D-MP drives size 022 ÷ 060 or **X4** available for D-MP drives size 090 ÷ 210

3 REACTANCES

The 3-phase reactance is used to reduce harmonics on the current drawn by D-MP drive.



Note: when connecting D-MP drives size 022 ÷ 060 to 3-phase power supply we recommend using a 3-phase reactance
For D-MP drives size 090 ÷ 210 the 3-phase input reactance is mandatory

Model code

S-IND	-	022
Reactance on the line side - 3-phase input		Size: **022** = for D-MP-*-022 **060** = for D-MP-*-060 **140** = for D-MP-*-140 **032** = for D-MP-*-032 **090** = for D-MP-*-090 **165** = for D-MP-*-165 **046** = for D-MP-*-046 **100** = for D-MP-*-100 **210** = for D-MP-*-210

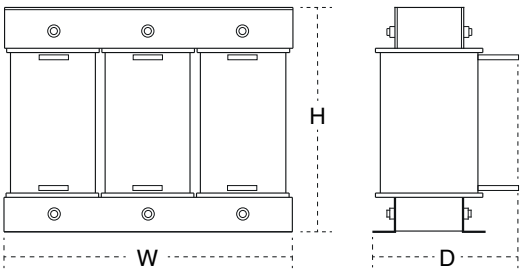
General characteristics

Reactance type	Reactance value [mH]	Nominal current [A]	Overload current [A]	Mass [kg]	D-MP drive type
S-IND-022	0.470	23.4	46.9	6	D-MP-*-022 **(1)**
S-IND-032	0.294	37.5	74.9	6	D-MP-*-032 **(1)**
S-IND-046	0.235	46.9	93.7	6.5	D-MP-*-046 **(1)**
S-IND-060	0.198	55.8	111.6	8	D-MP-*-060 **(1)**
S-IND-090	0.132	83.7	167.4	9	D-MP-*-090 **(2)**
S-IND-100	0.110	100.0	200.0	12	D-MP-*-100 **(2)**
S-IND-140	0.080	137.9	275.7	14	D-MP-*-140 **(2)**
S-IND-165	0.067	165.0	331.0	14	D-MP-*-165 **(2)**
S-IND-210	0.055	202.0	404.0	20	D-MP-*-210 **(2)**

(1) Reactance recommended
(2) Reactance mandatory

Note: voltage drop of 1,5% calculated for 3-phase power supply 400 Vrms, frequency 50 Hz and at nominal current

Installation dimension [mm]

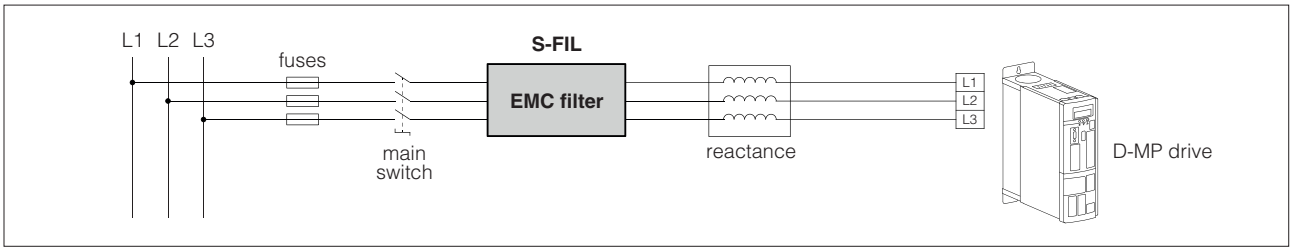


Reactance type	**W**	**D**	**H**
S-IND-022	180	115	200
S-IND-032	180	115	200
S-IND-046	180	120	200
S-IND-060	180	130	200
S-IND-090	180	160	165
S-IND-100	240	140	215
S-IND-140	240	150	215
S-IND-165	240	140	280
S-IND-210	240	170	280

Note: the image is intended for explanatory purposes only and may show differences in accordance to the type

4 EMC FILTERS

The EMC filters are used to improve the immunity and safety of electrical and electronic equipment from electromagnetic noise exchanged between D-MP drive and 3-phase power supply.



Note: when connecting D-MP drives to 3-phase power supply we recommend using a EMC filter

Model code

S-FIL	-	032
EMC filter - 3-phase		Size: **032** = for D-MP-*-022 and D-MP-*-032 **046** = for D-MP-*-046 **060** = for D-MP-*-060 **090** = for D-MP-*-090 **140** = for D-MP-*-100 and D-MP-*-140 **165** = for D-MP-*-165 **210** = for D-MP-*-210

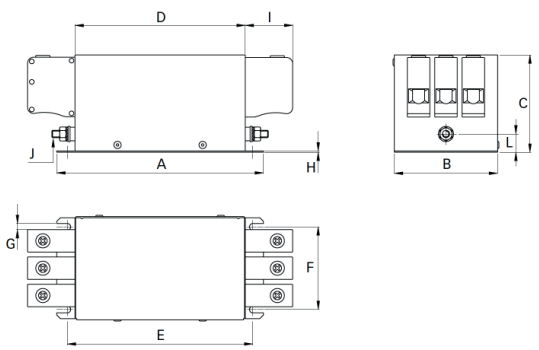
General characteristics

EMC filter type	Rated current @ 50°C (40°C) [A]	Typical drive power rating **(1)** [kW]	Leakage Current @ 480 VAC/50 Hz [mA]	Power loss @ 25°C/50 Hz [W]	Input-Output connections type		Mass [Kg]	D-MP drive type
S-FIL-032	35 (38)	22	29.4 **(2)**	6.8		-	0.7	D-MP-*-022 D-MP-*-032
S-FIL-046	50 (55)	30	29.4 **(2)**	12.8		-	1.2	D-MP-*-046
S-FIL-060	80 (88)	45	29.4 **(2)**	13.5		-	2.2	D-MP-*-060
S-FIL-090	100 (110)	55	29.4 **(2)**	17.1		-	2.6	D-MP-*-090
S-FIL-140	150 (164)	75	59.5 **(2)**	7.5	-		6.1	D-MP-*-100 D-MP-*-140
S-FIL-165	200 (219)	110	59.5 **(2)**	13.2	-		6.1	D-MP-*-165
S-FIL-210	250 (272)	130	10	80	-		9.0	D-MP-*-210

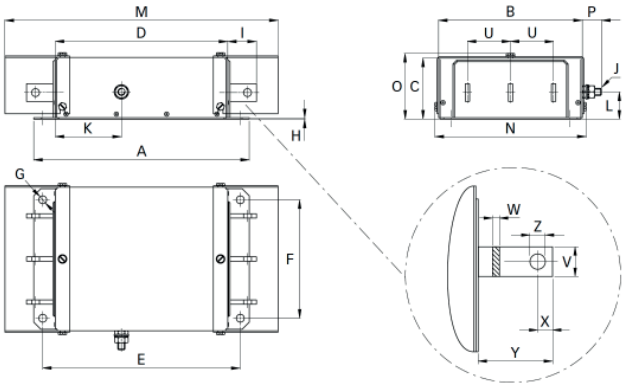
(1) Calculated at rated current, 480 VAC and cos phi = 0.8; the exact value depends upon the efficiency of the D-MP drive, motor and entire application
(2) Maximum leakage under normal operating conditions. Note: if two phases are interrupted, worst case leakage could reach 5.2 times higher levels

Installation dimensions [mm] - size 032 ÷ 165

size 032 ÷ 090

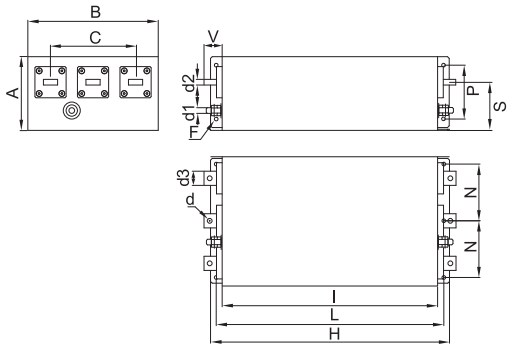


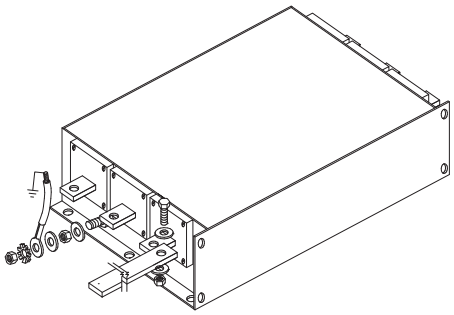
size 140 ÷ 165



EMC filter type	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	U	V	W	X	Y	Z
S-FIL-032	160	70	68	130	142.5	50	5.5	1	25	M5		20										
S-FIL-046	170	85	80	140	152.5	65	5.5	1	39	M6		15										
S-FIL-060	200	95	90	170	182.5	75	5.5	1.5	45	M8		16										
S-FIL-090	230	95	90	200	212.5	75	5.5	1.5	45	M8		16										
S-FIL-140	300	200	86	240	275	165	Ø 11	2	40	M10	92	37	380	211	93	26.5	60	20	3	10	37	Ø 9
S-FIL-165	300	200	86	240	275	165	Ø 11	2	40	M10	92	37	380	211	93	26.5	60	20	3	10	37	Ø 9

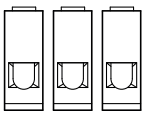
Installation dimension [mm] - size 210





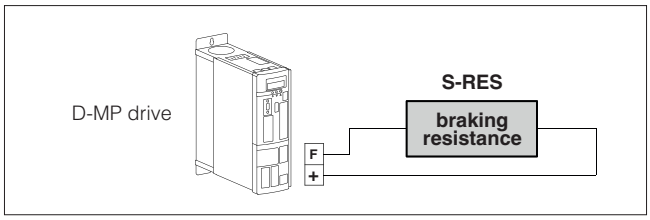
EMC filter type	**A**	**B**	**C**	**d**	**d1**	**d2**	**d3**	**V**	**F**	**H**	**I**	**L**	**N**	**P**	**S**
S-FIL-210	90	220	120	M8	M10	6	20	42	6.5	356	320	340	95	70	55

EMC filter input/output connector cross section - only for size 032 ÷ 090

EMC filter type	Solid wire [mm²]	Flex wire [mm²]	Recommended torque [Nm]	Connection type
S-FIL-032	16	10	1.5 - 1.8	
S-FIL-046	35	25	4.0 - 4.5	
S-FIL-060	50	50	7.0 - 8. 0	
S-FIL-090	50	50	7.0 - 8. 0	

5 BRAKING RESISTANCES

The braking resistances have the purpose of limiting the voltage of D-MP drive internal circuits (DC BUS) when the input stage of the line entrance is not able to recover the energy coming from the field into the network.
In these conditions, the energy supplied by D-MP drive internal circuits is transformed into heat dissipated on the external braking resistance.



Model code

S-RES	-	RFH-220	/	20R

Alluminium housing braking resistance

Nominal power:
RFH-220 = 400 W
HPR-2000 = 1900 W
KHPR2-1200 = 2100 W
KHPR2-2000 = 3500 W

Ohmic value:
20R = 20 Ω (for **RFH-220**)
28R = 28 Ω (for **RFH-220**)
5R = 5 Ω (for **HPR-2000** and **KHPR2-1200**)
2R5 = 2,5 Ω (for **KHPR2-2000**)

Note: all braking resistances are available with an external IP20 protection grid and IP21 cable box with cable gland. Following related ordering codes: S-RES-RFH**G**-220/20R , S-RES-RFH**G**-220/28R , S-RES-HPR**G**-2000/5R , S-RES-KHPR2**G**-1200/5R , S-RES-KHPR2**G**-2000/2R5

Power rating and thermal characteristics

Braking resistance type	Nominal power **(1)** [W]	Nominal temperature rise [°C]	Single adiabatic load **(2)** [kJ]	Ciclic load at Pn Ton<2'' **(2)** [kJ]	Thermal time constant [s]	Thermal resistance [°C/W]
S-RES-RFH-220/20R	400	350	12	15	400	0.875
S-RES-RFH-220/28R						
S-RES-HPR-2000/5R	1900	400	100	120	900	0.21
S-RES-KHPR2-1200/5R	2100	400	100	120	800	0.22
S-RES-KHPR2-2000/2R5	3500	400	150	160	900	0.12

(1) Nominal power is intended as continuous and refers to lab conditions with the resistance suspended in air
(2) Maximum values: actual energy depends on ohmic value, mean power, load time

Electric characteristics

Braking resistance type	Ohmic value range [Ω]	Tollerance class	Thermal derivative [ppm/°C]	Max. working voltage (Vcc) [V]	Max. working voltage (Vac) **(1)** [V]
S-RES-RFH-220/20R	20	J	150	1500	1000
S-RES-RFH-220/28R	28				
S-RES-HPR-2000/5R	5	J	< 100	1500	1000
S-RES-KHPR2-1200/5R	5				
S-RES-KHPR2-2000/2R5	2,5				

(1) Maximum working voltage depends of the electric solicitation harmonic content; electric load with an important high frequency component have to be verified

Drive/resistance associations

D-MP drive type	Braking resistance type	Overall resistance [Ω]	Overall average power [W]
D-MP-*-022	1 x S-RES-RFH-220/28R	28	400
D-MP-*-032	1 x S-RES-RFH-220/20R	20	400
D-MP-*-046	2 x S-RES-RFH-220/20R **(1)**	10	800
D-MP-*-060	2 x S-RES-RFH-220/20R **(1)**	10	800
D-MP-*-090	3 x S-RES-RFH-220/20R **(1)**	6.7	1200
D-MP-*-100	1 x S-RES-HPR-2000/5R	5	1900
D-MP-*-140	1 x S-RES-KHPR2-1200/5R	5	2100
D-MP-*-165	1 x S-RES-KHPR2-1200/5R	5	2100
D-MP-*-210	1 x S-RES-KHPR2-2000/2R5	2.5	3500

(1) The resistance have to be connected in parallel

Note: the drive/resistance associations could change according to the average power (P average) and maximum energy value (E peak) indica-

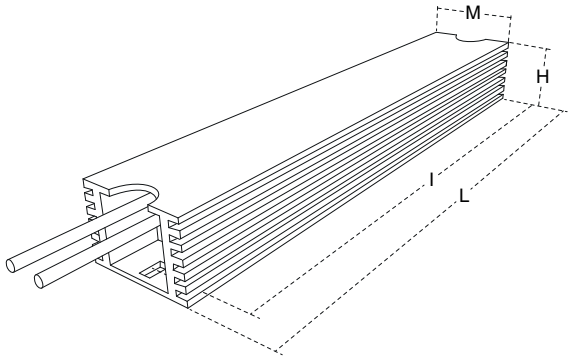
Standard

Standard		S-RES-RFH-*		S-RES-HPR-* S-RES-KHPR2-*	
		Limit	**Typical**	**Limit**	**Typical**
Dir. 2002/95/CE RoHS		compliant	compliant	compliant	compliant
IEC 60364	Component class	I	I	I	i
	Insulation resistance [MΩ] **(1)**	100	> 100	100	> 100
	Electric strength [mA] **(2)**	< 2	< 0.1	< 2	< 0.1
IEC 60529	Resistor body	IP64	IP64	IP55	IP55
	Terminals	IP00	IP00	IP00	IP00
IEC 60664	Overvoltage category	I	I	II	II
	Pollution degree	4	4	4	4

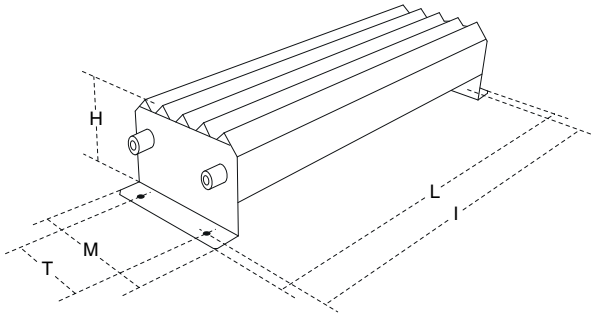
(1) Applied voltage 1000 Vcc
(2) Test voltage 3000 Vac 60''

Installation dimension [mm]

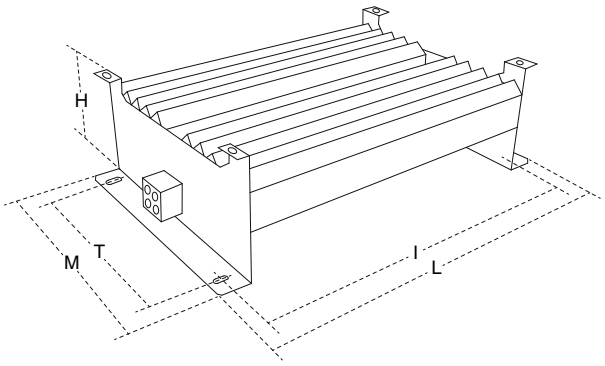
S-RES-RFH-*



S-RES-HPR-*



S-RES-KHPR2-*

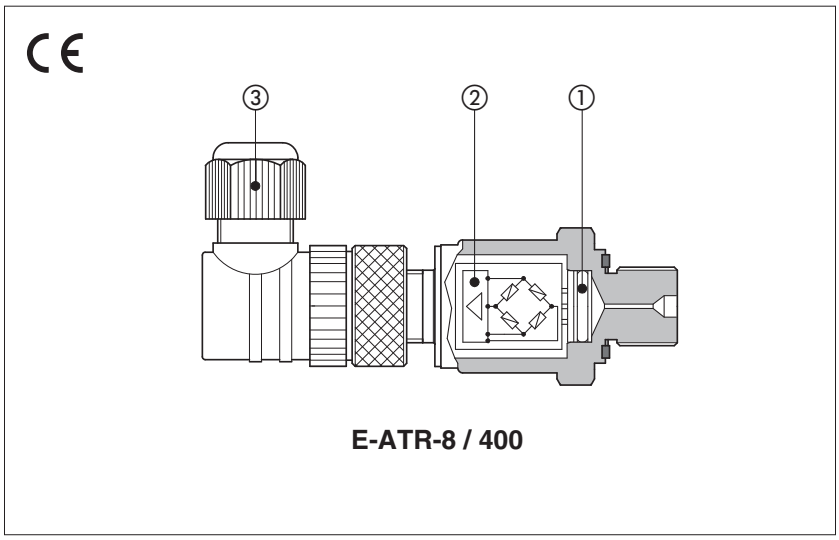


Braking resistance type	L	H	M	I	T	Cables length	Average mass [kg]
S-RES-RFH-220/20R	200	27	36	189	-	300	0,333
S-RES-RFH-220/28R	200	27	36	189	-	300	0,333
S-RES-HPR-2000/5R	365	73	105	350	70	450	4
S-RES-KHPR2-1200/5R	310	115	230	295	170	-	7
S-RES-KHPR2-2000/2R5	365	115	230	350	170	-	8

Note: tolerance of ± 2% on all nominal dimensions

Pressure transducers type E-ATR-8

analog, for open and closed loop systems



E-ATR-8 / 400

1 MODEL CODE

E-ATR-8	/	400	/	*	*
Pressure transducer		**Pressure measuring range:** **60** = 0 ÷ 60 bar **100** = 0 ÷ 100 bar **160** = 0 ÷ 160 bar **250** = 0 ÷ 250 bar **400** = 0 ÷ 400 bar		**Options:** **-** = voltage output signal 0 ÷ 10 V **I** = current output signal 4 ÷ 20 mA	Series number

E-ATR-8

This pressure transducers measure the static and dynamic pressure of the hydraulic fluid, supplying a voltage or current output signal.

The sensor is composed by a thin-film circuit ①, with high resistance to overloads and pressure peaks.

The integrated electronic circuit ② supplies an amplified voltage or current output signal, proportional to the hydraulic pressure, with thermal drift compensation.

E-ATR-8 equip pressure control digital proportional valves with integral transducer and electronics, REB/RES execution.

They are also used in association with other Atos digital proportionals to perform closed loop pressure controls:

- variable displacement axial piston pumps, PE(R)S execution
  (see tech table AS170)
- directional control valves with additional closed loop pressure control, SP and SF options on TES/LES execution
  (see tech table FS500)

Features:

- Factory preset and calibrated
- Standard 5 pin M12 main connector ③
- IP67 protection degree
- CE mark according to EMC directive

2 MAIN CHARACTERISTICS

Pressure measuring range	0 ÷ 60/100/160/250/400 bar; other values availables on request Note: negative pressure can damage the pressure transducer
Overload pressure	2 x FS without exceeding 600 bar
Burst pressure	5 x FS without exceeding 1700 bar
Response time	≤ 2 ms
Temperature range	Operating -40 ÷ +100 °C; Storage -40 ÷ +100 °C; Fluid: -40 ÷ +100 °C
Thermal drift	@ zero: ≤ ±0,025 % FS/°C max; @ FS: ≤ ±0,025 % FS/°C max
Accuracy	≤ ±1,2 % FS
Non-Linearity	≤ ±0,5 % of FS (BFSL) as per IEC 61298-2
Fluid Compatibility	Hydraulic oil as per DIN51524...535; for water-glycol, phosphate ester and skydrol® , please contact Atos technical department
Power supply	24 VDC nominal; 14 ÷ 30 VDC for standard (8 ÷ 30 VDC for /I option); Imax 25 mA
Output signal	Standard: voltage output signal 0 ÷ 10 V (3 pins); Min load > maximum output signal / 1 mA /I option: current output signal 4 ÷ 20 mA (2 pins); Max load ≤ (power supply - 8 V) / 0,02 mA
Wiring protections	Against reverse polarity on power supply and short-circuit on output signal
Materials	Wetted parts: stainless steel 316L (13-8 PH for sensor); seals: FPM/FKM
Mass	Approx. 57 g
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE EN 61326 emission (group 1, class B) and immunity (industrial application)
Service life	$1x10^6$ load cycles
MTTF	> 100 years
Compliance	RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Vibration resistance	20 g according to DIN EN 60068-2-6 from 20 to 2000 Hz
Shock resistance	40 g / 6 ms / half-sinusoid, according to DIN EN 60068-2-27
Protection class	IP67 with mating connector
Hydraulic connection	1/4" GAS - DIN 3852 (pressure port orifice Ø 0,6 mm)
Electrical connection	Type: plastic 5 pins M12 at 90° (DIN 43650-C) with cable gland type PG7 for cable max Ø 6 mm Protection: IP67 according to EN 60529; Insulation: according to VDE 0110-C

Notes: FS = Full Scale; **BFSL** = Best Fit Straight Line

3 INSTALLATION AND COMMISSIONING

3.1 Warning

E-ATR-8 transducers have to be installed as near as possible to the point where the pressure have to be measured, taking care that the oil flow is not turbulent.

3.2 Commissioning

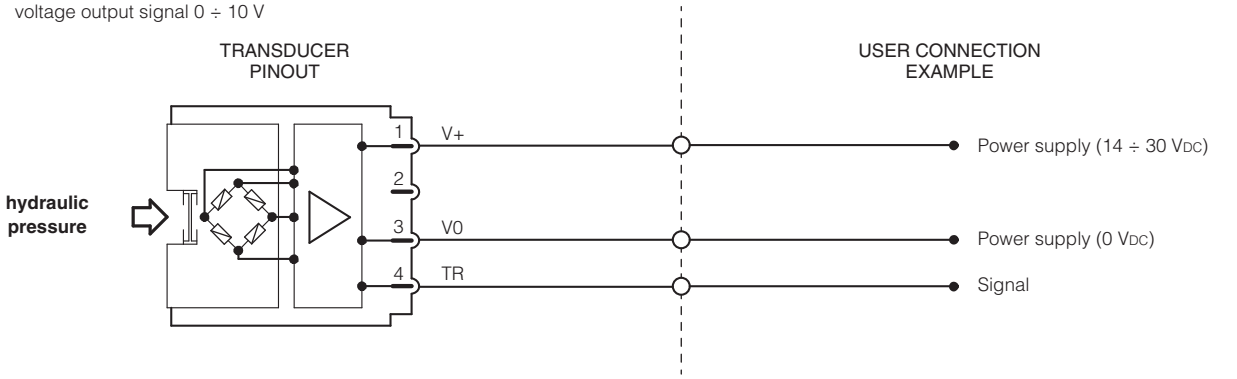
Install the transducer in the hydraulic circuit.

Switch-off the power supply before connecting and disconnecting the transducer connector as shown in scheme 4 .

4 ELECTRONIC CONNECTIONS

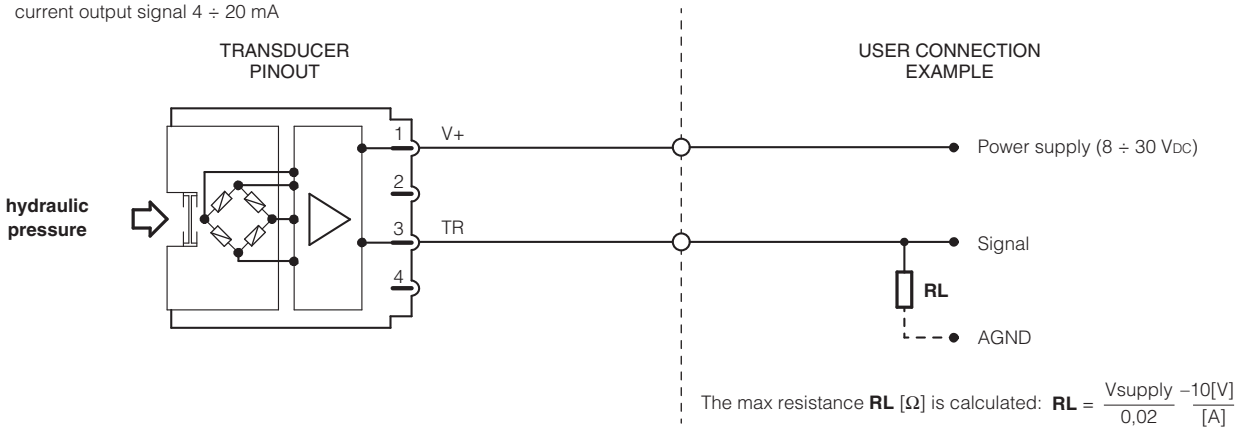
E-ATR-8 / *

voltage output signal 0 ÷ 10 V



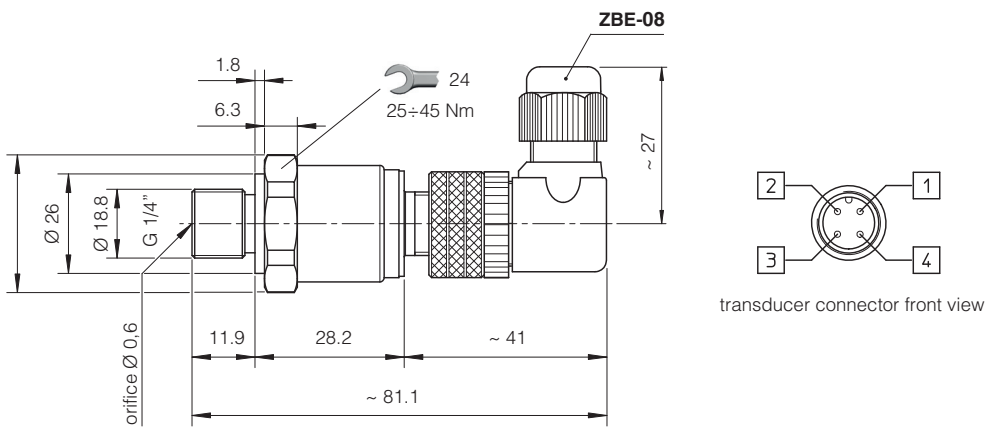
E-ATR-8 / * / I

current output signal 4 ÷ 20 mA



The max resistance **RL** [Ω] is calculated: $\mathbf{RL} = \frac{\text{Vsupply} - 10[\text{V}]}{0{,}02} \frac{}{[\text{A}]}$

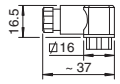
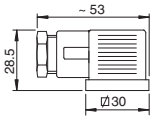
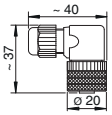
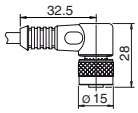
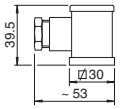
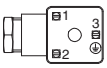
5 OVERALL DIMENSIONS [mm]



Electric and electronic connectors

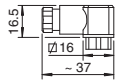
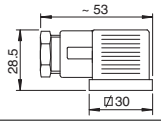
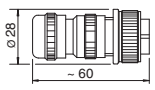
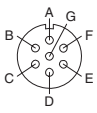
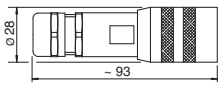
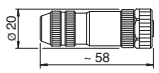
for transducers, on/off and proportional valves, pumps

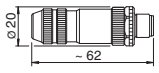
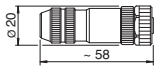
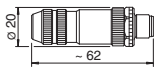
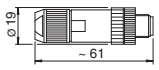
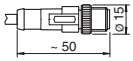
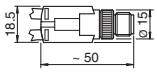
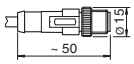
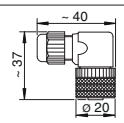
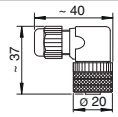
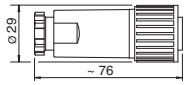
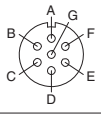
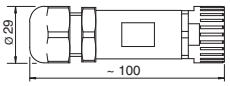
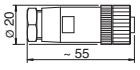
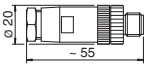
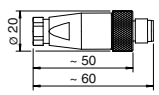
1 CONNECTORS FOR ON/OFF VALVES AND PUMPS

CODE AND DIMENSIONS	APPLICATION	INTERNAL VIEW PINOUT (1)	FRONT VIEW	CABLE GLAND Ø CABLE	REFERENCE RULES
345 	Female plastic connector - 4 pin: - inductive proximity sensor, /FI option for DHI, DHE			PG7 ø 4 ÷ 6 mm	DIN EN 61984 (VDE 0627) Protection degree IP 65 EN 60529
664 **666** (black) **666/A** (grey) **667-24** **667-110** **667-220** 	Female plastic connector - 4 pin: - pressure switch type MAP - inductive proximity sensor, /FI option for DKE-17* Female plastic connector - 3 pin: - standard coil connector for on/off valves - inductive proximity sensor, /FI option for DKE-16* Female plastic connector - 3 pin: - standard coil connector for on/off valves with built-in led	 **664**  **666** **667-***	 	PG11 ø 8 ÷ 10 mm	DIN 43650-A/ISO 4400 Protection degree IP 65 EN 60529
ZBE-06 	Female plastic connector - 4 pin: - inductive position switch, /FV option			PG7 ø 2,5 ÷ 6,5 mm	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529
BKS-B-20-4-03 	Female plastic connector - 4 pin (3 wire): - inductive proximity sensor for LIFI Cable length: 3 m			Moulded on cable	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529
669 (black) **669/A** (grey) 	Female plastic connector - 3 pin: - optional electronic connector for on/off valves with built-in rectifier bridge for supplying DC coils by AC current			PG11 ø 8 ÷ 10 mm	DIN 43650-A/ISO 4400 Protection degree IP 65 EN 60529

(1) the wiring of electrical terminals has to be made according to specific technical table

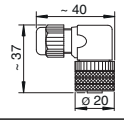
2 CONNECTORS FOR PROPORTIONAL VALVES AND PUMPS

CODE AND DIMENSIONS	APPLICATION	INTERNAL VIEW PINOUT (1)	FRONT VIEW	CABLE GLAND Ø CABLE	REFERENCE RULES
345 	Female plastic connector - 4 pin: - position transducer for ZO(R)-T and ZO-L valves			PG7 ø 4 ÷ 6 mm	Protection degree IP 65 EN 60529
666 (black) 	Female plastic connector - 3 pin: - standard coil connector for proportionals valves			PG11 ø 8 ÷ 10 mm	DIN 43650-A/ISO 4400 Protection degree IP 65 EN 60529
ZM-7P 	Female metallic connector - 7 pin: - main connector for integral electronic driver			PG11 ø 7 ÷ 9 mm	According to MIL-C-5015 Protection degree IP 67 EN 60529
ZM-12P 	Female metallic connector - 12 pin: - main connector for integral electronic driver			PG13,5 ø 8 ÷ 11 mm	DIN 43651 Protection degree IP 67 EN 60529
ZM-5PF 	Female metallic connector - 5 pin: - CANbus for integral electronic driver			Pressure nut ø 6 ÷ 8 mm	M12 - coding A IEC 60947-5-2 Protection degree IP 67 EN 60529

ZM-5PM		Male metallic connector - 5 pin: - CANbus for integral electronic driver			Pressure nut ø 6 ÷ 8 mm	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529
ZM-5PF/BP		Female metallic connector - 5 pin: - PROFIBUS DP for integral electronic driver			Pressure nut ø 6 ÷ 8 mm	M12 - coding B IEC 61076-2-101 Protection degree IP 67 EN 60529
ZM-5PM/BP		Male metallic connector - 5 pin: - PROFIBUS DP for integral electronic driver			Pressure nut ø 6 ÷ 8 mm	M12 - coding B IIEC 61076-2-101 Protection degree IP 67 EN 60529
ZM-4PM/E		Male metallic connector - 4 pin: - EtherCAT, POWERLINK, EtherNet/IP, PROFINET RT/IRT for integral electronic driver			Pressure nut ø 6 ÷ 8 mm	M12 - coding D IEC 61076-2-101 Protection degree IP 67 EN 60529
ZH-5PM/1.5 **ZH-5PM/5**		Male plastic connector - 5 pin - single pressure/force transducer - analog position transducer Cable length: 1.5 m or 5 m			Moulded on cable	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529
ZH-5PM-2/2		Male plastic connector - 4 pin: - double pressure/force transducers Splitting cable length: 2 m			Moulded on cable	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529
ZH-8PM/5 **ZH-8PM/10**		Male plastic connector - 8 pin: - digital position transducer Cable length: 5 m or 10 m			Moulded on cable	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529
ZBE-06		Female plastic connector - 4 pin: - position transducer (LIQZO-T* size 50) - integral pressure transducer (TERS)			PG7 ø 2,5 ÷ 6,5 mm	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529
ZBE-08		Female plastic connector - 5 pin: - position transducer E-THT-15 (LIQZP)			PG7 ø 2,5 ÷ 6,5 mm	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529
ZH-7P		Female plastic reinforced with fiber glass connector - 7 pin: - main connector for integral electronic driver			PG11 ø 8 ÷ 10 mm	According to MIL-C-5015 Protection degree IP 67 EN 60529
ZH-12P		Female plastic reinforced with fiber glass connector - 12 pin: - main connector for integral electronic driver			PG16 ø 6 mm x 2 cable	DIN 43651 Protection degree IP 67 EN 60529
ZH-5P		Female plastic connector - 5 pin: - RS232 Serial, CANbus - digital electronic driver E-MI-AS-IR, /M12 option			PG9 ø 6 ÷ 8 mm	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529
ZH-5P/BP		Male plastic connector - 5 pin: - PROFIBUS DP			PG9 ø 6 ÷ 8 mm	M12 - coding B IEC 61076-2-101 Protection degree IP 67 EN 60529
ZH-5PM		Male plastic connector - 5 pin: - pressure, force, position transducers (TEZ/LEZ series 10 or lower)			PG7 ø 4 ÷ 6 mm	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529

(1) the wiring of electrical terminals has to be realized according to specific technical table

3 CONNECTOR FOR PRESSURE TRANSDUCERS AND PRESSURE SWITCHES

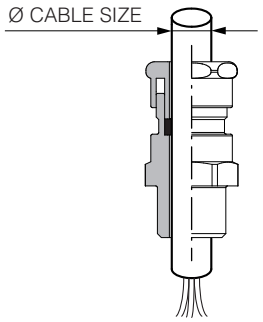
CODE AND DIMENSIONS	APPLICATION	INTERNAL VIEW PINOUT (1)	FRONT VIEW	CABLE GLAND Ø CABLE	REFERENCE RULES
ZBE-08 	Female plastic connector - 5 pin: - pressure transducer E-ATR8 - electronic pressure switch type E-DAP-2			PG7 ø 2,5 ÷ 6,5 mm	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529

(1) the wiring of electrical terminals has to be made according to specific technical table

Cable glands and plugs for ex-proof valves and pumps

Multicertified ATEX, IECEx, EAC

1 MULTICERTIFIED CABLE GLAND FOR NON-ARMOURED CABLES - Group II (surface plants)

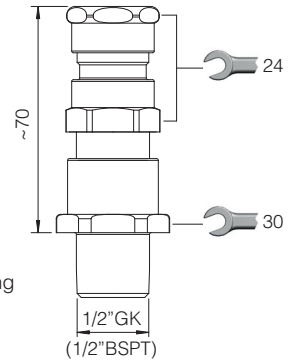
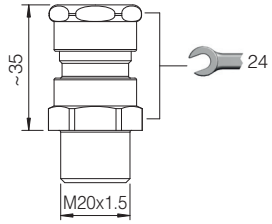
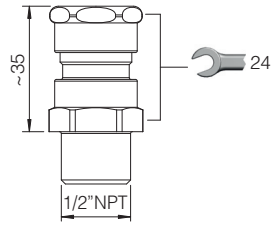
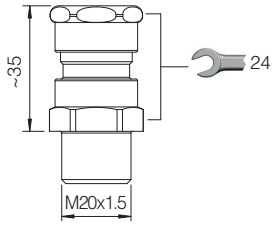


Cable glands for use with non-armoured plastic insulated cables
Flameproof **Exd IIC Gb**, Increased Safety **Exe IIC Gb** and Dust **Extb IIIC Db II 2 GD**, suitable for use in Zone 1, Zone 2, Zone 21, Zone 22.
Construction and Test Standards: IEC/EN 60079-0, IEC/EN60079-1, IEC/EN 60079-7 and IEC/EN 60079-31.
Ingress Protection: IP66, IP67 and IP 68 (30 meters for 7 days) to IEC/EN 60529 and NEMA 4X
Deluge Protection to DTS01
Operating Temperature Range: -60 °C to +100 °C

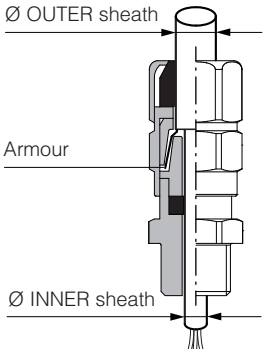
Material: Nickel Plated Brass or AISI 316
Cable glands are marked ATEX, IECEx and EAC

The electric cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of Atos ex-proof valves.

See section 4 for cable gland assembly.

CABLE GLAND CODE AND DIMENSIONS	MULTICERTIFICATION	CHARACTERISTICS	COMPONENTS
PAMC/GK  Tightening torque: **20 Nm**	Referred to certificates: - Baseefa 06 ATEX0056X - IECEx BAS 06.0013X Item type: 501-421 **ATEX:** EN 60079-0, EN 60079-1, EN 60079-7 and EN 60079-31 **IECEx:** IEC 60079-0, IEC 60079-1, IEC 60079-7 and IEC 60079-31 **EAC:** EN60079-0 and EN60079-1	**Material:** Nickel plated brass **Threaded connection:** GK-1/2" ISO/UNI-6125 (tapered) **Cable size:** 6,5 to 11,9 mm	On-off and proportional ex-proof valves, pumps with "GK" threaded connection (solenoid and LVDT transducer) **Approved only for the Italian market**
PAMC/M  Tightening torque: **20 Nm**		**Material:** Nickel plated brass **Threaded connection:** M20x1,5 UNI-4535 **Cable size:** 6,5 to 11,9 mm	On-off and proportional ex-proof valves, pumps with "M" threaded connection (solenoid, LVDT transducer and on-board driver)
PAMC/NPT  Tightening torque: **20 Nm**		**Material:** Nickel plated brass **Threaded connection:** 1/2" NPT ANSI/ASME B1.20.1 (tapered) **Cable size:** 6,5 to 11,9 mm	On-off and proportional ex-proof valves, pumps with "NPT" threaded connection (solenoid and LVDT transducer)
PAXMC/M  Tightening torque: **20 Nm**		**Material:** Stainless steel AISI 316 **Threaded connection:** M20x1,5 UNI-4535 **Cable size:** 6,5 to 11,9 mm	On-off ex-proof stainless steel valves type "X" and "XS"

2 MULTICERTIFIED CABLE GLAND FOR ARMOURED CABLES - Group II (surface plants)

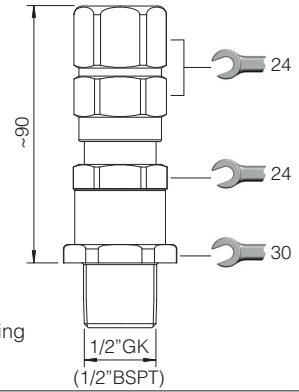
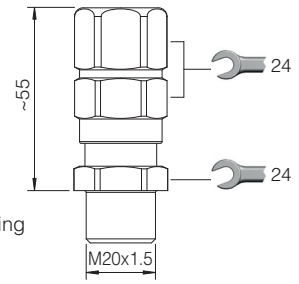
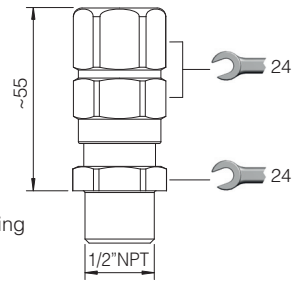
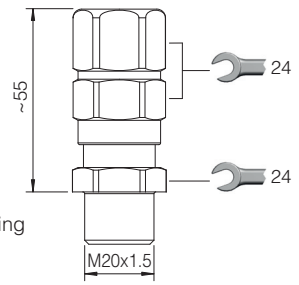


Cable glands for use with single wire armour 'W', wire braid 'X', steel tape armour 'Z', plastic insulated cables.
Flameproof **Exd IIC Gb**, Increased Safety **Exe IIC Gb**, Dust **Extb IIIC Db** and **ExnR IIC Gc II 2 / 3GD**, suitable for use in Zone 1, Zone 2, Zone 21, Zone 22.
Construction and Test Standards: IEC/EN 60079-0, IEC/EN 60079-1, IEC/EN 60079-7, IEC/EN 60079-15 and IEC/EN 60079-31.
Ingress Protection: IP66, IP67 and IP 68 (30 meters for 7 days) to IEC/EN 60529 and NEMA 4X
Deluge Protection to DTS01.
Operating Temperature Range: -60 °C to +80 °C

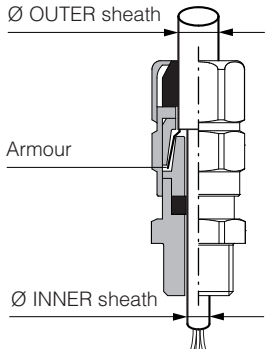
Seal on the cable inner sheath
Outer deluge seal to prevent moisture ingress to the cable armour / braid
Cable retention, low smoke
Material: Nickel Plated Brass or AISI 316
Cable glands are marked ATEX, IECEx and EAC

The electric cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of Atos ex-proof valves.

See section 4 for cable gland assembly.

CABLE GLAND CODE AND DIMENSIONS	MULTICERTIFICATION	CHARACTERISTICS	COMPONENTS
PAAMC/GK  Tightening torque: **20 Nm**	Referred to certificates: - Baseefa 06 ATEX0056X - IECEx BAS 06.0013X Item type: 501-453RAC CE Ex **ATEX:** EN 60079-0, EN 60079-1, EN 60079-7 and EN 60079-31 IECEx **IECEx:** IEC 60079-0, IEC 60079-1, IEC 60079-7 and IEC 60079-31 EAC **EAC:** EN60079-0 and EN60079-1	**Material:** Nickel plated brass **Threaded connection:** GK-1/2" ISO/UNI-6125 (tapered) **Cable size:** INNER sheath size 3,2 to 8 mm OUTER sheath size 5,5 to 12 mm	On-off and proportional ex-proof valves, pumps with "GK" threaded connection (solenoid and LVDT transducer) **Approved only for the Italian market**
PAAMC/M  Tightening torque: **20 Nm**		**Material:** Nickel plated brass **Threaded connection:** M20x1,5 UNI-4535 **Cable size:** INNER sheath size 3,2 to 8 mm OUTER sheath size 5,5 to 12 mm	On-off and proportional ex-proof valves, pumps with "M" threaded connection (solenoid, LVDT transducer and on-board driver)
PAAMC/NPT  Tightening torque: **20 Nm**		**Material:** Nickel plated brass **Threaded connection:** 1/2" NPT ANSI/ASME B1.20.1 (tapered) **Cable size:** INNER sheath size 3,2 to 8 mm OUTER sheath size 5,5 to 12 mm	On-off and proportional ex-proof valves, pumps with "NPT" threaded connection (solenoid and LVDT transducer)
PAAXMC/M  Tightening torque: **20 Nm**		**Material:** Stainless steel AISI 316 **Threaded connection:** M20x1,5 UNI-4535 (6H/6g) **Cable size:** INNER sheath size 3,2 to 8 mm OUTER sheath size 5,5 to 12 mm	On-off ex-proof stainless steel valves type "X" and "XS"

3 MULTICERTIFIED CABLE GLAND FOR ARMOURED CABLES - Group I (Mining)

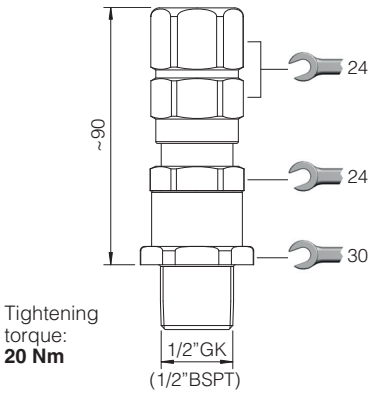
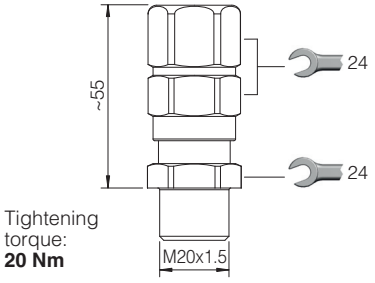
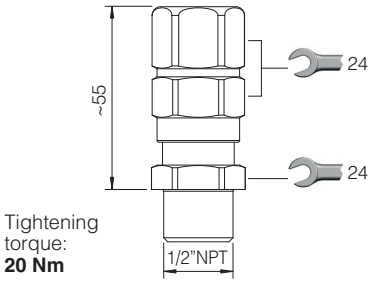


Cable glands for use with single wire armour 'W', wire braid 'X', steel tape armour 'Z', plastic insulated cables.
Flameproof **Exd I M2** and Increased Safety **Exe I M2**, suitable for use in Mines
Construction and Test Standards: IEC/EN 60079-0, IEC/EN 60079-1 and IEC/EN 60079-7
Ingress Protection: IP66, IP67 and IP 68 (30 meters for 7 days) to IEC/EN 60529
Operating Temperature Range: -60 °C to +80 °C

Seal on the cables inner sheath
Cable retention, low smoke
Material: Nickel Plated Brass
Cable glands are marked ATEX, IECEx and EAC

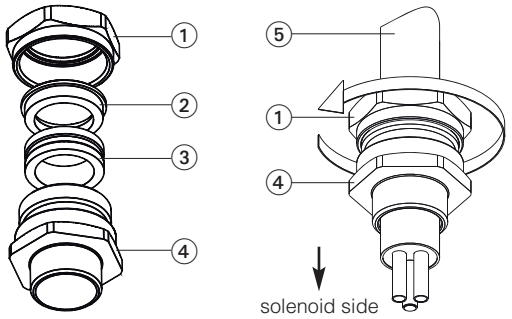
The electric cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of Atos ex-proof valves.

See section 4 for cable gland assembly.

CABLE GLAND CODE AND DIMENSIONS	MULTICERTIFICATION	CHARACTERISTICS	COMPONENTS
PAAMMC/GK  Tightening torque: **20 Nm**	Referred to certificates: - Baseefa 08 ATEX0331X - IECEx BAS 08.0112X Item type: 453RAC CE Ex **ATEX:** EN 60079-0, EN 60079-1, EN 60079-7 and EN 60079-31 IECEx **IECEx:** IEC 60079-0, IEC 60079-1, IEC 60079-7 and IEC 60079-31 EAC **EAC:** EN60079-0 and EN60079-1	**Material:** Nickel plated brass **Threaded connection:** GK-1/2" ISO/UNI-6125 (tapered) **Cable size:** INNER sheath size 3 to 8 mm OUTER sheath size 5,5 to 12 mm	On-off and proportional ex-proof valves with "GK" threaded connection (solenoid and LVDT transducer) **Approved only for the Italian market**
PAAMMC/M  Tightening torque: **20 Nm**		**Material:** Nickel plated brass **Threaded connection:** M20x1,5 UNI-4535 **Cable size:** INNER sheath size 3 to 8 mm OUTER sheath size 5,5 to 12 mm	On-off and proportional ex-proof valves with "M" threaded connection (solenoid, LVDT transducer and on-board driver)
PAAMMC/NPT  Tightening torque: **20 Nm**		**Material:** Nickel plated brass **Threaded connection:** 1/2" NPT ANSI/ASME B1.20.1 (tapered) **Cable size:** INNER sheath size 3 to 8 mm OUTER sheath size 5,5 to 12 mm	On-off and proportional ex-proof valves with "NPT" threaded connection (solenoid and LVDT transducer)

4 CABLE GLAND ASSEMBLY

Cable glands PAMC/* and PAXMC/M for non-armoured cables



Assembling procedure

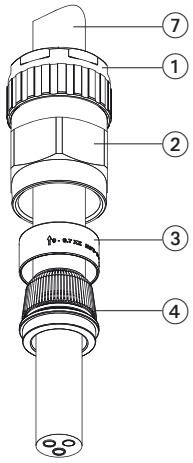
Unscrew the Back-nut ① from Entry ④
Push the electric cable ⑤ though the cable gland
Connect the cable wires to the solenoid terminal board
Screw-in the Entry ④ into the solenoid cable entrance lock it at relevant tightening torque specified in section 1
Lock the Back-nut ① using a wrench until a resistance is felt between internal seal ③ and the cable
Turn the Back-nut ① through a further half turn to ensure the complete inner sealing

① Back-nut
② Compression Spigot
③ Seal
④ Entry
⑤ Electric cable (non-armoured)

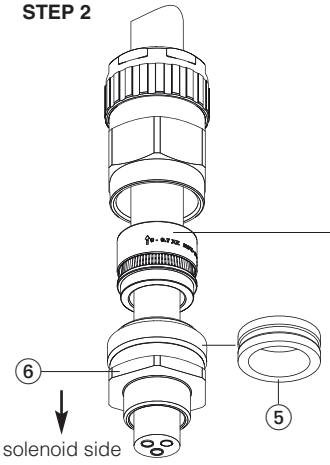
Cable glands PAAMC/*, PAAXMC/M and PAAMMC/* for armoured cables

① Back-nut
② Middle-nut
③ Reversible Armour Clamping Ring (RAC)
④ Armour Spigot
⑤ Inner Seal
⑥ Entry (with captive deluge seal), if required
⑦ Electric cable (armour type SWA, Braid X, Flat Steel wire Y, Steel type Z)

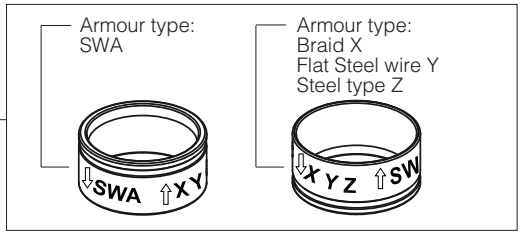
STEP 1



STEP 2



Reversible Armour Clamping ring (RAC) orientation



Note: the arrow corresponding to the correct armour type (SWA or X, Y, Z) must be orinted towards the ex-proof solenoid

Assembling procedure

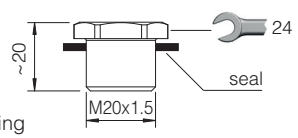
STEP 1

Unscrew Back-nut ① from Middle-nut ② and Entry ⑥ , push the cable through the Armour Spigot ④
Spread the armour over the Armour spigot ④ until the end of the armour is up against the shoulder of the armour cone
Position the Armour clamping ring ③ paying attention to its correct orientation depending to the armour type (see above)
Remove the Inner seal ⑤ from the Entry ⑥ , place the Entry ⑥ over the Armour Spigot ④
Move the sub-assembly ① + ② to meet the Entry ⑥ , connect the cable wires to the solenoid terminal board
Screw-in the Entry ⑥ into the solenoid cable entrance and lock it at relevant tightening torque specified in section 2 and 3
Hand tighten the Middle-nut ② to the Entry ⑥ and turn a further half turn with a wrench
Unscrew the Middle-nut ② and visually inspect that the armour has been successfully clamped between the armour spigot ④ and the armour clamping ring ③. If the armour is not correctly clamped, repeat the assembly

STEP 2

Re-assemble Middle-nut ② onto the components ③ + ④ + ⑤ + ⑥ paying attention to the correct orientation of the reversible armour Clamping ring ③ , tighten up the Middle-nut ② by hand first and then using a wrench a further 1 to 2 turns until fully tight
Hand tighten the Back-nut ① then tighten a further full turn using a wrench
Ensure that the Middle-nut ② does not rotate when tightening the Back-nut ①
Ensure that the deluge seal is compressed into correct position

5 THREADED PLUG

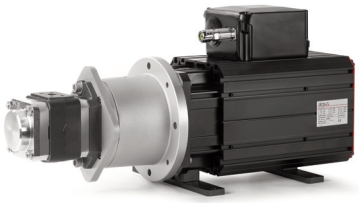
THREADED PLUG CODE AND DIMENSIONS	MULTICERTIFICATION	CHARACTERISTICS	COMPONENTS
ZMX-T  Tightening torque: **20 Nm**	**ATEX:** EN 60079-0, EN 60079-1, EN 60079-7 and EN 60079-31 **IECEx:** IEC 60079-0, IEC 60079-1, IEC 60079-7 and IEC 60079-31 **EAC:** EN60079-0 and EN60079-1	**Material:** Nickel plated brass **Threaded connection:** M20x1,5 UNI-4535	Proportional ex-proof valves and pumps with on-board driver

Operating and maintenance information for servopumps

conforming to Machine Directive 2006/42/EC

This operating and maintenance information applies to Atos Smart ServoPumps - SSP.
It is intended to provide useful guidelines to avoid risks when the servopumps are installed in the hydraulic system.
It contains important information on the safe and proper installation, commissioning, operation transport and maintenance of the products.
Atos disclaims any liability for damage and / or injury to persons, animals or property resulting from the requirements contained in this document.
The prescriptions included in this document must be strictly observed to avoid damages and injury.
The respect of this operating and maintenance information grants an increased working life, trouble-free operation and thus reduced repairing costs.

CE



1 SYMBOL CONVENTIONS

Following symbols are used in this documentation to evidence particular risks to be carefully avoided.
In the following are listed the symbol conventions with their meaning, in case of non-compliance with this operating and maintenance information.

⚠ **WARNING**	Death or serious injury could occur	risk classes to ANSI Z535.6 / ISO 3864
⚠ **CAUTION**	Minor or moderate injury could occur	
NOTICE	Property damage could occur	
⚠	Information to be observed	

2 GENERAL NOTES

This document is intended for machine manufacturers, assemblers and system end-users.

⚠ **WARNING**
Personal injury and property damage may be caused by incorrect use of the products!
The products have been designed for use in industrial environments and may only be used in the appropriate way.

Before using Atos servopumps, the following requisites must be met to ensure appropriate use of the products:

- personnel who uses Atos servopumps must first read and understand the operating and maintenance information, particularly the Safety Notes in section 5.
- the products must remain in their original state, no modifications are permitted
- it is not permitted to decompile software products or alter source codes
- damaged or faulty servopumps must not be installed or put into operation
- make sure that the products have been installed as described in section 6 and 7

3 CERTIFICATION

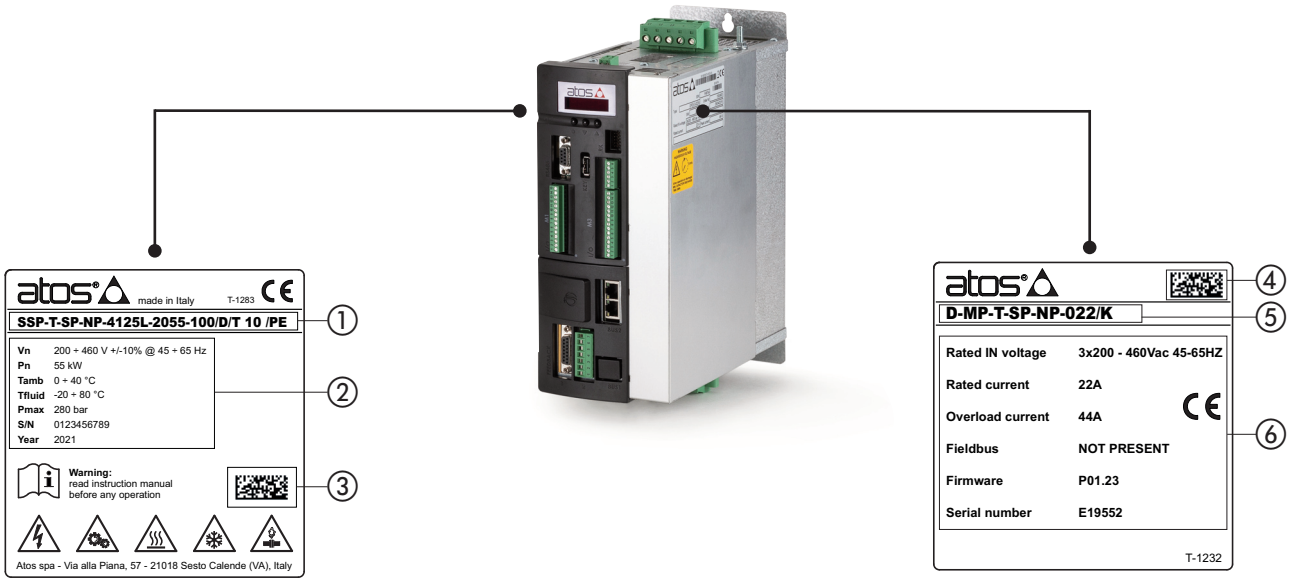
The servopump falls within the scope of Directive 2006/42/EC and it has been assessed to comply with the requirements set forth in Annex I of the Directive itself proceeding in accordance with Annex VIII implementing the provisions in the procedure "Internal control of production" by Atos.
The reference standards used in the performance of the verification of compliance are as follows:

Machinery Directive (2006/42/EC)
EN60204-1: 2018 - Safety of machinery. Electrical equipment of machines. General requirements
EN12100: 2010 - Safety of machinery - General principles for design - Risk assessment and risk reduction
EN 809:1998+A1:2009/AC:2010 - Pumps and pump units for liquids — Common safety requirements

EMC Directive (2014/30/EU)
EN61000-6-2: 2005 + AC:2005 - Electromagnetic compatibility - Part 6-2: generic standards - Immunity for industrial environment
EN61000-6-4: 2007 + A1:2011 - Electromagnetic compatibility - Part 6-4: generic standards - Emission for industrial environment

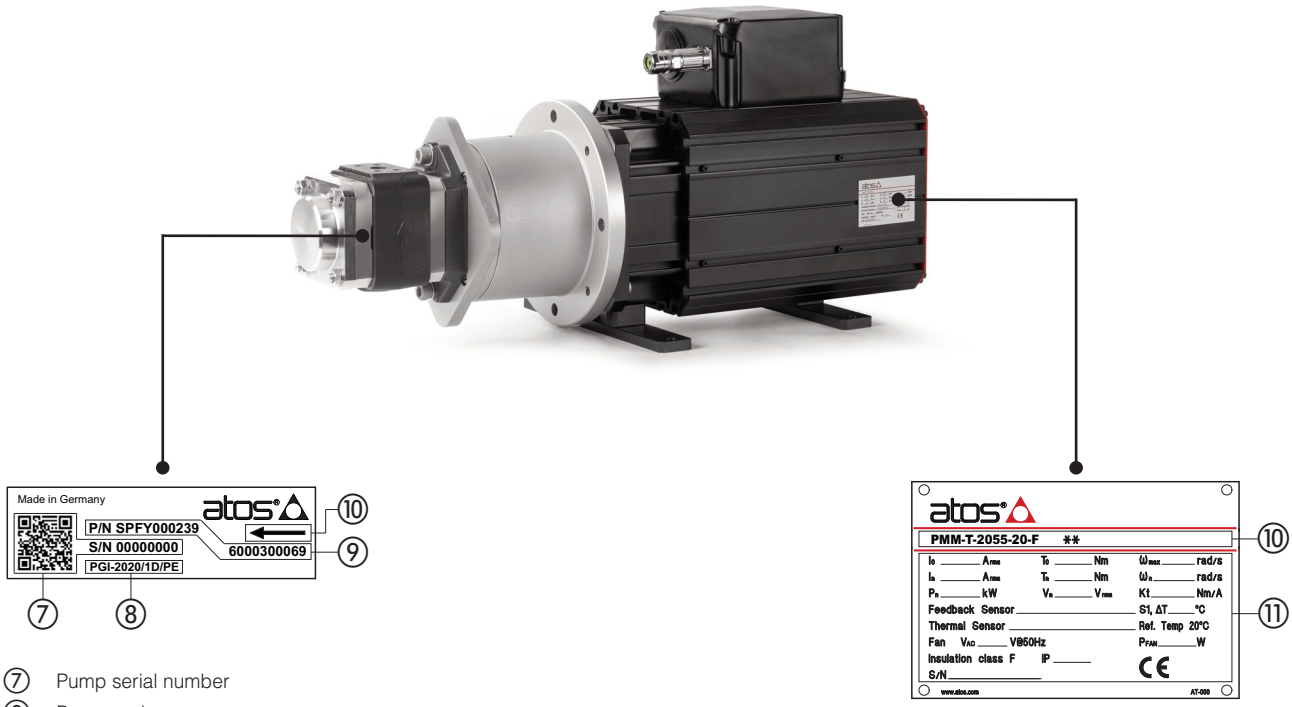
PED Directive (2014/68/EU)
Developed according clause 4.3 which applies to pressure equipment and assemblies below or equal to the limits set out in points (a), (b) and (c) of paragraph 1 and in paragraph 2 respectively, then designed and manufactured in accordance with the sound engineering practice of a Member State in order to ensure safe use.

4 PRODUCT IDENTIFICATION EXAMPLES - nameplates



① Smart Servopump system code
② Smart Servopump system main data
③ Smart Servopump system serial number

④ Digital electronic drive code
⑤ Digital electronic main data
⑥ Digital electronic drive serial number



⑦ Pump serial number
⑧ Pump code
⑨ Pump internal code Atos
⑩ Pump rotation direction

⑩ Synchronous servomotor code
⑪ Synchronous servomotor main data

5 SAFETY NOTES

5.1 Intended use

Atos servopumps may only be operated under the environmental and operating conditions described in the servopumps technical tables.

5.2 Improper use

Any improper use of the components is not admissible.

Improper use of the product includes:

- use in explosive environments
- incorrect storage
- incorrect transport
- lack of cleanliness during storage and installation
- incorrect installation
- use of inappropriate or non-admissible fluids
- operation outside the specified performance limits
- operation outside the approved temperature range

Atos spa does not assume any liability for damage caused by improper use. The user assumes all risks involved with improper use.

5.3 Installation

Installation must be performed following the recommendations contained in the S-MAN-HW installation manual.
The personnel operating in places with a number knowns risks shall be trained and instructed in relations with the precautions, the behaviour, the operating procedures which are regulated by the law.

WARNING: electrocution
Install appropriate differential protection device upstream of the electrical panel.
It is forbidden to remove or tamper the guards and safety devices installed on the machine.
Do not use or do not open the machine, in the presence of water, before removing the power supply and liberated the area from the water. Do not use or do not open the machine, in the presence of flammable substance, before removing the power supply and liberated the area from the flammable substance.

WARNING: emergency stop
As a result of the risk analysis, the system shall be equipped with devices and guards to minimize possible risks to persons who may be in the vicinity of the equipment, that taking into account the reasonably foreseeable conditions of use.

Minimum requirements:

- Emergency pushbutton
  - it must be proof tested not less than 1 per year
  - it must not be muted
  - it must not be altered of modified

In case of emergency and only if the conditions let the operation to be safe, it is possible to obtain the arrest of the machinery by pressing the emergency stop button (design, erection and installation of the entire safety instrumented systems making emergency stop operations, as described below, is on charge to the user).

Pressing the button by the operator results in the immediate shutdown and isolation of the machinery. Activate the emergency button in all foreseeable conditions of risk (machine malfunctions, emergencies or accidents in the workplace).

In the event of activation of the emergency stop, before restoring the function of the system, check that:

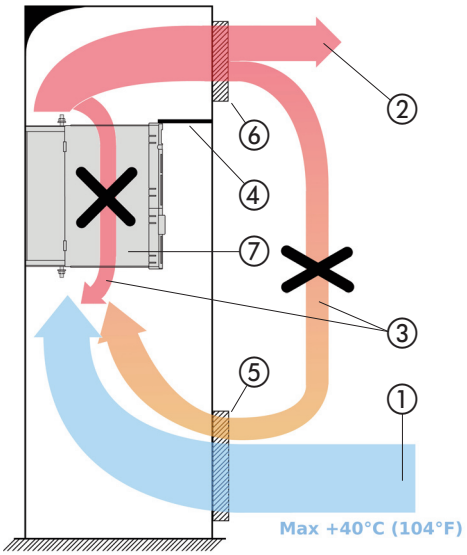
- the emergency situation has been removed
- whether to ensure the integrity of the mixer
- the safety devices are in proper working

WARNING: hot surface
The electrical motor and drive considerably heats up during operation. Allow the electrical motor and drive to cool down sufficiently before touching it. During operation, touch the electrical motor and drive only by using protective gloves.
Please also observe ISO 13732-1 and EN 982.

CAUTION:
Use of the servopump outside the approved temperature range may lead to functional failures like overheating of the pump/electrical motor/drive. Only use the servopump within the specified ambient and fluid temperature range.

CAUTION: pressurized systems
When working at hydraulic systems with stored energy (accumulator or cylinders working under gravity), servopump may even be pressurized after the hydraulic power supply has been switched off.
During assembly and disassembly works, serious injury may be caused by a powerful leaking of hydraulic fluid jet.
Ensure that the whole hydraulic system is depressurized and the electrical control is de-energized.

WARNING: drive cooling
Provide sufficient air ventilation to remove the heat generated by the drive and by other components as reported in the user manual.



1. Cabinet input air flow
2. Cabinet output air flow
3. Unattended air flow
4. Air baffle
5. Cabinet input air cooling filter
6. Cabinet output air cooling filter
7. Drive

WARNING: motor cooling
The motor must be fitted in such a way that heat loss can be adequately dissipated. Do not impede free ventilation of motors.

NOTICE: disconnection and connection of plug-in connectors
Do not plug-in or disconnect the electric connector as long as the voltage supply is ON.

NOTICE: impact
Impact or shock may damage the servopumps. Never use the servopumps as step.

NOTICE: dirt and foreign particles
Penetrating dirt and foreign particles lead to wear and malfunctions of the servopumps.
During assembly, be careful to prevent foreign particles such as metal chips getting into the pump or into the hydraulic system.

Environmental protection
Hydraulic fluids are harmful to the environment.
Leaking hydraulic fluid may leads to environmental pollution.
In case of fluid leakage immediately act to contain the problem.
Dispose of the hydraulic fluid in accordance with the currently applicable national regulations in your country.

6 HYDRAULIC AND MECHANICAL INSTALLATION

6.1 Commissioning

It must be possible for the pump to be started without load.
During initial system checkout, it is absolutely necessary to bleed the pressure line.
After bleeding the pump, the pressure control valve (present on the optional manifold available with options /C or /D, otherwise it's on customer behalf) must be secured against being readjusted.
Prior to switching off the pump, the load must be unpressurized.
After some operating hours, check the filter and oil temperature.

6.2 Fluid conditioning

A high-performance system must be thermally conditioned to ensure a limited fluid temperature excursion (generically between 40 and 50°C) so that the fluid viscosity remains constant during operation.
The machine working cycle should start after the prescribed temperature has been reached.

6.3 Air bleeds

On commissioning the pump, it is absolutely necessary to carry out sufficient bleeding of pressure control valves so that the pump does not run dry, get overheated or breaks down early due to lack of oil. The system has to be bled until no cracking noise or formation of foam can be determined any more.

6.4 System flushing

In order to obtain the required minimum cleanliness level, the hydraulic system must be flushed for a sufficient time.
A decisive factor for the flushing time is the contamination level of the hydraulic fluid which can only be determined by means of a particle counter. During the flushing procedure, perform a frequent monitor of the filters clogging indicator, replacing the filter elements when required.

6.5 Hydraulic fluids and operating viscosity range

Mineral oils type HLP having high viscosity index are recommended.
The hydraulic fluids must be compatible with the selected seals.
The type of fluid has to be selected in consideration of the effective working temperature range, so that the fluid viscosity remains at the optimal level.

Hydraulic fluid	Classification	Ref. Standard
Mineral oils	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524

Fluid viscosity: 20 ÷ 100 mm^2/s - max allowed range 15 ÷ 380 mm^2/s

CAUTION: easily inflammable hydraulic fluid
In connection with fire or other hot sources, leaking hydraulic fluid may lead to fire or explosions.

6.6 Filtration

The correct fluid filtration ensures a long service life of the pumps and it prevent anomalous wearing or sticking.

CAUTION
Contamination in the hydraulic fluid may cause functional failures e.g. jamming or blocking of the pump.
Ensure adequate hydraulic fluid cleanliness according to the cleanliness class required for the pump.

Max fluid contamination level, see also filter section at or KTF catalog:

- normal operation: ISO4406 class 20/18/15 NAS1638 class 9
- longer life: ISO4406 class 18/16/13 NAS1638 class 7

6.7 Drive fastening

Proceed with the drive installation observing the minimum distances around it.
Fix the drive to the wall by means of fixing screws (for screws size see related technical table).

6.8 Motorpump group fastening

Fix the motorpump group using the motor's feet (for screws size see related technical table).
Use vibration Dampers to absorb rotational vibrations.
Install the motorpump in horizontal position only, possibility with pump inlet under the oil level.

7 ELECTRICAL INSTALLATION

7.1 Power supply

Following additional notes have to be considered:

- Remove the D-MP drive from its packaging only in a protected working area
- Switch-off power supply before any wirings operation (wait at least 8 minutes for the capacitors to discharge)
- During the system start-up, verify electrical noise level and apply protection to avoid reference signals interference from electrical noise
- Use protection fuse on power supply line: see user-manual for fuses size
- Use inductance on power supply line. The 3-phase inductance is used to reduce the current peaks on the diode bridge DB and the effective value of the current through the capacitors. It is also used to reduce interference from the supply line to the drive and from the drive to the line: see user-manual for inductance type
- The power mains to which the drive is connected must meet the technical specifications (see technical specifications data) and fulfill the requirements of the laws in force in the country of use
- The manufacturer disclaims all liability for faults or malfunctions of the Atos drive due to voltage fluctuations beyond the tolerances specified by the electricity distribution authority (voltage ±10%).

Drive power supply (L1, L2, L3)

The drive must be connected to the main power supply trought terminals L1, L2, L3 and with the ground cable connected to the PE stud.
The drive must be wired steadily through appropriately sized cables: see the relevant technical table for wize size.

Motor power supply (U, V, W)

The PMM motor must be connected to terminals U, V, W of the drive with the ground cable connected to the PE stud. In sizes from 090 to 140 pass the motor three-phase through the present toroid inside, without shield and ground. Always use cables of appropriate size.
Atos recommends to use an inductance between the drive and the motor. With cables longer than 50 meters, the inductance is obligatory.

7.2 Electrical wiring

Any type of electrical material (cables, sockets, plugs and so on…) used to make the connections must be suitable for use, must bear the "CE" marking if it is subject to the low voltage directive 2014/35/EU and must comply with the requirements of the laws in force in the country where the drive is used.

Connect the motor by means of shielded or armored cables only and ground the shield on the drive side as well as on motor side. If shielded cables cannot be used, the motor cables should be placed in a metallic raceway connected to ground.

Use recommended shielded cable size for logic connection:
1,5 mm^2 max 30m for 24VDC power supply and relay digital output; 0.75 mm^2 max 30 m for logic

7.3 Ground connection

All conductive parts of the servopump assembly are equipotential: in case they are adopted, do not remove any wire intended to equalize the conductive parts (for example do not remove wires connecting metalling parts of the assembly, if any screw, bolts, etc). If necessary, in ordere to bond the assembly to the local structures, installe and user shall adopt technique to equalize potentials of all conductive parts.

Drive type	Servomotor type (1)	Power Cables (mm^2)		Protection Cables (mm^2)		Max length [m]
		drive **L1 - L2 - L3**	servomotor **U - V - W**	drive **PE**	servomotor **PE**	drive and servomotor
D-MP-*-022	PMM-*009	6	6	6	6	20
D-MP-*-032	PMM-*015	10	10	10	10	
D-MP-*-046	PMM-*024	16	25	16	25	
D-MP-*-060	PMM-*032	25	25	25	25	
D-MP-*-090	PMM-*042	35	35	25	25	
D-MP-*-100	PMM-*055	50	70	35	35	
D-MP-*-140		70	70	50	35	
D-MP-*-165	PMM-*080	120	120	70	70	
D-MP-*-210	PMM-*100					

Grounding the drive

The leakage current is the current that the drive discharges towards the ground (earth) connection.
The amount of such current depends on the voltage, the PWM frequency and the parasitic capacity to ground the motor and connection cable. Also the noise filters, if any, are likely to increase the amount of leakage current.

If an RDC (Residual Current Device) is installed, the drive will work without false input as long as:

- a type B RDC is being used
- the RDC release limit is 300 mA (TT or TN systems)
- each RDC powers only one drive
- the output cables are shorter than 50 m (screened) or 100 m (unscreened)

The RDC used must supply protection from the direct current components present in the fault current and must be suitable for suppressing current peaks quickly. We reccommend protecting the drive separately using fuses, and observing the regulations of the individual user countries.

Always make sure that the Atos drive is disabled before disconnection from the motor.

This drive cannot work unless the protection conductor is steadily grounded (earthed).

7.3 Suppression of interferences by electrical noise

When starting the system, it is always advisable to check that feedback, references signal are free from interferences and electrical noise which can affect the characteristics of the signals and generate instability in the whole system.

Electrical noises can be suppressed by shielding and grounding the signal cables, see section 8.

Most of electrical noises are due to external magnetic fields generated by transformers, electric motors, switchboards, etc.

8 SHIELD CONNECTION

The correct shielding of signal cables has to be provided to protect the electronics from electrical noise disturbances, which could affect the servo-pumps functioning.
In general following basic rules should be observed:

- use shielded wirings to avoid electromagnetic noise: it is an essential part of the EMC protection from the noises that could otherwise bring disturbance through the signal and power supply connections.
- power supply cables and signal cables should be routed in separate cable conduits.
- connect cable shield at PLC/machine side and leave the other end (drive side) open to prevent ground loops
- if possible, connect shields to a protected earth (a noise-free connection with a different path from safety earth and power supply ground); it is just designed to connect command signals ground, cables shields and all other noise sensitive devices
- verify that all the ground/earth points are equipotential otherwise position and dimension of the connections must be checked
- earth connection of the drives is available on drive case; take care to the correct earthing also of the motor
- in case of high noise levels, use additional shields and filters to allow the correct working of the electronic drive

Refer to the applicable international standards for details about the shielding criteria.

9 MAINTENANCE

Maintenance must be carried out only by qualified personnel with a specific knowledge of hydraulics and electrohydraulics

9.1 Ordinary maintenance

- If Atos pumps are operated properly according to the permissible technical specifications and the operating fluid is properly filter within the max contamination level, they excel by an extremely long operating life.
- To intercept any sign of incipient wear, it must be monitored: increase the pump's running noise, increase of temperature differences of operating fluid between the pump's inlet and outlet with determined amount of cooling water
- Results of maintenance and inspection must be planned and documented
- Follow the maintenance instructions of the fluid manufacturer
- Atos Electrical motors are foreseen with ball bearings prelubricated for their life with maintenance free. Check anyway their temperature and vibrations every 2000 hours operation.
- Cleaning the external surfaces using a wet cloth to avoid accumulation of dust layer
- Don't use compressed air for cleaning to avoid any dangerous dust dispersion on the surrounding atmosphere
- Any sudden increment in temperature requires the immediate stop of the system and the inspection of the relevant components

9.2 Repairing

In case of incorrect functioning or beak-down it is recommended to send the servopumps back to Atos or to Atos authorized service centers which will provide for the reparation.
Unauthorized opening of the servopumps during the warranty period invalidates the warranty.

9.3 Transport

Check the motor-pump unit carefully to make sure it has not undergone any damage during transport. For transport, use only lifting eyes if they are present on the motor pump.

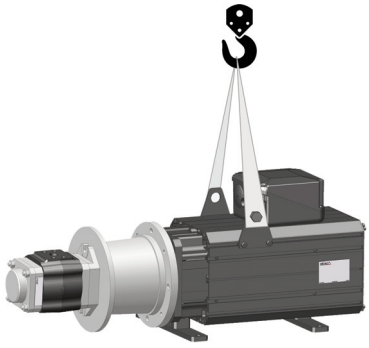
Do not use lifting eyes if the temperature is lower than -20°C .

Do not add any additional load.

As motors contain permanent magnets, avoid closeness to people who have internal medical devices (e.g. pace-maker) or to material that can be damaged by magnetic fields.
If motor pumps are stored, make sure that they are kept in a dry, dustfree and without vibrations environment. Measure the insulation resistance before putting the motors into operation for the first time. Dry out the winding if the insulation resistance is lower than 2MΩ.

The packaging that contains the drive shuld be lifted with utmost care.

Manual handling of the package must be carried out in compliance with the regulations on "manual handling of loads", to avoid unfavourable ergonomic conditions that involve risks of back or lumbar injury.



9.4 Storage

Servopumps are boxed using a VpCi protective packing system, offering best protection to oxidation during components sea transport or long storage in humid environments. For the servopump transporting and storing always observe the environmental conditions specified in the relevant technical tables. Improper storage may damage the product.

The servopump can be stored for up to 12 months under the following conditions:

	Motorpump group	**Drive**
Temperature	0°C ÷ +40°C	-10°C ÷ +60°C
Humidity	+5°C ÷ +95°C	+5 ÷ +95 %
Condensation	NO	NO

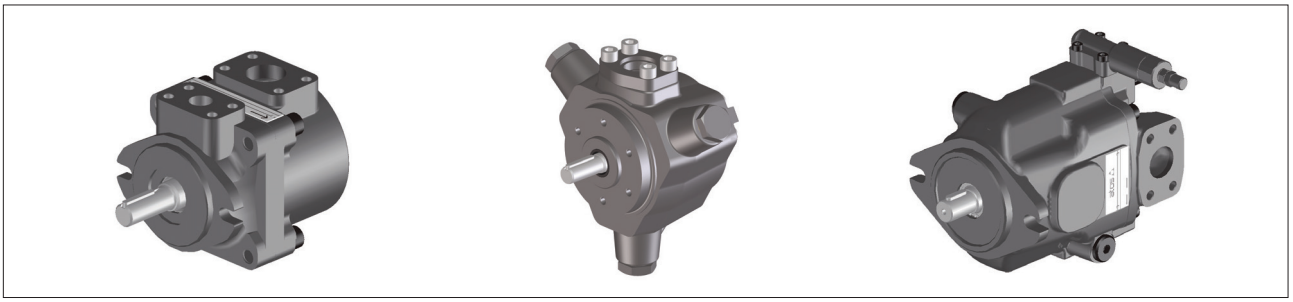
- Do not store the servopumps outdoors
- Protect the servopumps against water and humidity in case of storage in open air
- Store the servopumps in the shelf or on a pallet
- Store the servopumps in the original packaging or comparable packaging in order to protect them from dust and dirt
- Remove the plastic covers from the pump pressure and suction connectors only before the assembly

Every 6 months or 1 year the regeneration of Drive is necessary: see the user manual for the complete procedure

Operating and maintenance information for pumps

fixed and variable displacement

This operating and maintenance information apply to ATOS fixed vane, fixed piston and variable piston pumps, is intended to provide useful guidelines to avoid risks when the pumps are installed in a system.
It contains important information on the safe and proper installation, transport, commissioning, operation and maintenance of the products.
The prescriptions included in this document must be strictly observed to avoid damages and injury.
The respect of this operating and maintenance information grants an increased working life, trouble-free operation and thus reduced repairing costs.



1 SYMBOL CONVENTIONS

Following symbols are used in this documentation to evidence particular risks to be carefully avoided.
In the following are listed the symbol conventions with their meaning, in case of non-compliance with this operating and maintenance information.

WARNING	Death or serious injury could occur	risk classes to ANSI Z535.6 / ISO 3864
CAUTION	Minor or moderate injury could occur	
NOTICE	Property damage could occur	
	Information to be observed	

2 GENERAL NOTES

This document is intended for machine manufacturers, assemblers and system end-users.

WARNING
Personal injury and property damage caused by incorrect use of the products!
The products have been designed for use in industrial environments and may only be used in the appropriate way.

Before using Atos pumps, the following requisites must be met to ensure appropriate use of the products:

- personnel who uses Atos pumps must first read and understand the operating and maintenance information, particularly the Safety Notes in section 4.
- the products must remain in their original state, no modifications are permitted
- damaged or faulty pumps must not be installed or put into operation
- make sure that the products have been installed as described in the relevant documentation

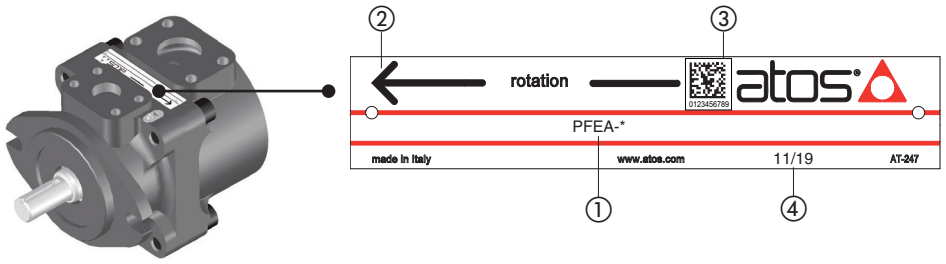
2.1 Warranty

The expiration of warranty results from the following operations:

- incorrect assembly and commissioning
- improper use, see 4.2
- improper handling and storage, see 6.4
- modification of the original condition

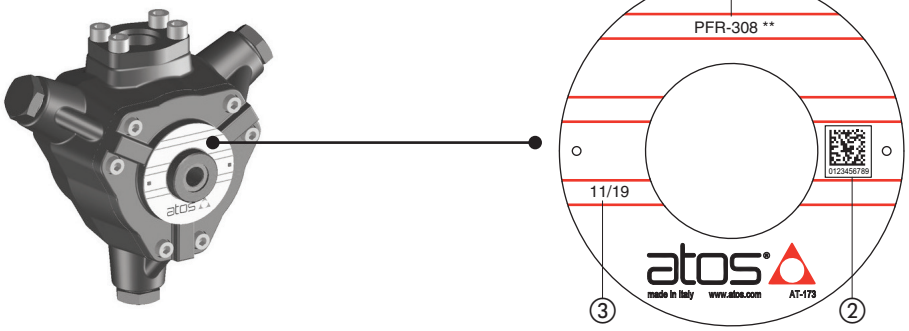
3 PRODUCT IDENTIFICATION EXAMPLES - nameplates

3.1 **PFE** vane pumps - example



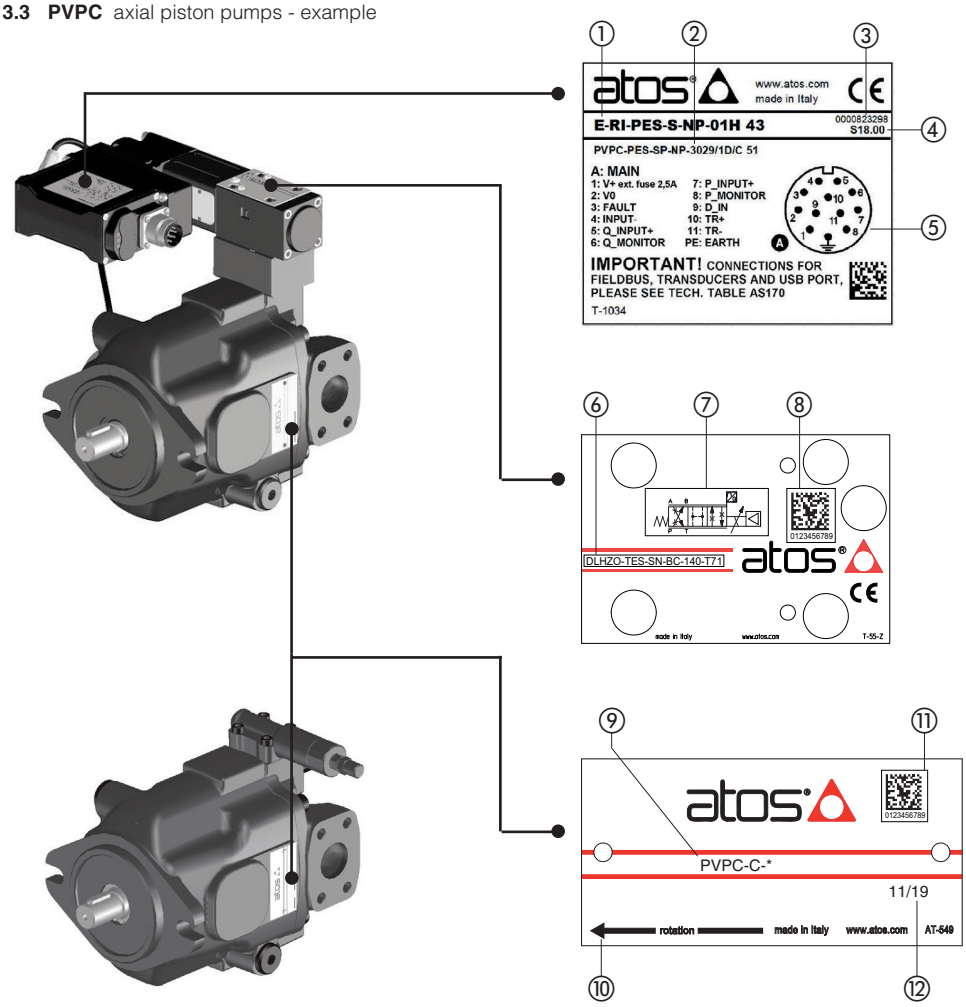
① Pump code
② Pump shaft rotation direction
③ Pump serial number
④ Delivery date

3.2 **PFR** radial piston pumps - example



① Pump code
② Pump serial number
③ Delivery date

3.3 **PVPC** axial piston pumps - example



① Digital driver code
② Pump code
③ Digital driver serial number
④ Digital driver factory firmware version
⑤ Connectors pinout

⑥ Pilot valve code
⑦ Hydraulic symbol (simplified)
⑧ Pilot valve serial number

⑨ Pump code
⑩ Pump shaft rotation direction
⑪ Pump serial number
⑫ Delivery date

4 SAFETY NOTES

4.1 Intended use

Atos pumps are intended for integration in industrial systems and machines or for the assembly with other components to form a machine or a system.
They may only be operated under the operating condition described in the relevant technical table.

Pumps must be used observing following prescriptions:

- complying with the application and environmental conditions according to the relevat technical tables
- complying with operating conditions and performance limits specified in the relevant technical tables
- use in the original condition, without damage

4.2 Improper use

Any improper use of the pumps is not admissible.
Improper use of the product includes:

- use in explosive environments
- incorrect storage
- incorrect transport
- lack of cleanliness during storage and assembly
- incorrect installation
- use of inappropriate or non-admissible fluids
- operation outside the specified performance limits
- operation outside the approved temperature range

Atos spa does not assume any liability for damage caused by improper use.
The user assumes all risks involved with improper use.

4.3 Installation

Installation must be performed following the recommendations contained in the relevant technical tables and in section 5 of this document.

WARNING: hot surface
The pumps may heats up during operation.
Allow the pump to cool down sufficiently before touching it.
During operation, touch the valve solenoid only by using protective gloves.
Please also observe ISO 13732-1 and EN 982.

CAUTION
Use of the pumps outside the approved temperature range may lead to functional failures like overheating and seizure.
Only use the valve within the specified fluid temperature range.

CAUTION: penetrating water and humidity - for PVPC pumps with proportional controls
In case of use in humid or wet environments, water or humidity may penetrate at electrical connectors or into the valve electronics.
This may lead to malfunctions at the pump and to unexpected movements in the hydraulic system which may result in personal injury and damage to property:

- only use the pumps within the intended IP protection class
- ensure that all seals and caps of the plug-in connections are tight and intact

NOTICE: impact
Impact or shock may damage the pumps. Never use the pump as step.

NOTICE: dirt and foreign particles
Penetrating dirt and foreign particles lead to wear, malfunction and seizure
During assembly, be careful to prevent foreign particles such as metal chips getting into the pump or into the hydraulic system
Do not use linting fabric for cleaning, it may release contamination.

Environmental protection
Hydraulic fluids are harmful to the environment.
Leaking hydraulic fluid may leads to environmental pollution.
In case of fluid leakage immediately act to contain the problem.
Dispose of the hydraulic fluid in accordance with the currently applicable national regulations in your country.

Atos components do not contain substances hazardous for the environment.
The materials contained in Atos components are mainly: Copper, Steel, Aluminium, Electronic components, Rubber
Due to the high content of reusable metals, the main components of Atos can be completely recycled after disassembling of the relevant parts.

5 HYDRAULIC AND MECHANIC INSTALLATION

General:

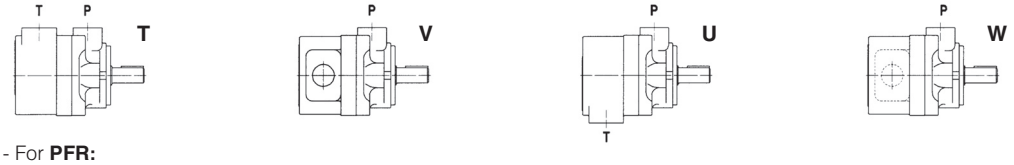
- Before start up make sure that the pump is always filled with the working fluid.
- The pump must never be operated with "OUT" port closed; in order to limit the maximum working pressure a relief valve must be installed on the pressure line.
- Make sure that the maximum working conditions shown in relevant technical tables are not exceed

5.1 Installation position and port orientation

The installation must ensure that the pump remains always filled with the working fluid.

- For **PFE:**

the pump can operate in any position, the available orientation of the oil ports is according to the below pictures. In the ordering code must be specified the selected orientation.



- For **PFR:**

- The pumps can be installed in horizontal or in vertical position. In case of vertical position it is advisable to install on the outlet pipe a proper valve for air bleeding (consult our technical dept.).
- These pumps are not self-priming therefore their installation under oil level is recommended. Installation above oil level requires foot valve on inlet line and pump central point located no more than 150 mm above minimum oil level.
- The shaft of the pump has an eccentric cam which rotates with the shaft generating the stroke of the pistons and thus generating the flow rate. For best functioning a balanced coupling should be provided between the shaft of the motor and the shaft of the pump.

- For **PVPC:**

- The pumps can be installed in horizontal or in vertical position. In case of vertical position the pump shaft must be oriented upward.
- The drain pipe must be oriented so that the pump body always remains filled with the fluid, specially when not working. For this reason the pump is provided with 2 drain connections located in opposite side of the body, so that, depending to the pump orientation, the optimal drain piping can be arranged
- Before the commissioning, the pump body must be filled with the working fluid through one of the drain connections.
- The connection with the electric motor must be performed by means of proper elastic coupling.

5.2 Shaft loads

PFE, PFR: axial and radial loads acting on shaft are not permitted.
PVPC: axial and radial loads acting on shaft are permitted, max permissible loads are indicated in the table A160, section 2 .
The coupling with the electric motor must be sized to absorb the power peaks.
The coupling alignment between the motor and pump shaft must ensured

5.3 Shaft rotation

The direction of shaft rotation (D = clockwise, S = counterclockwaise, viewed from the shaft end) must be the same of the arrow on the nameplate.

5.4 Oil level

Make sure that the pump is always filled with flui. The installer / end user has to provide a level meter to verify the presence of fluid inside the power unit tank.

5.5 Important notes

- A pressure relief valve must be installed on the pressure line near the pump outlet port.
- The piping have to be sized according to the max pressure and max flow rate
- All pipes and surfaces must be cleaned from dirt before mounting
- Make sure that connections are sealed before giving pressure to the system
- Ensure to not exchange the pump IN/OUT ports when connecting the pipes
- Ensure that the pump installation allows an easy acces for maintenance purpose

5.6 Hydraulic fluids and operating viscosity range

Mineral oils type HLP having high viscosity index are recommended.
The hydraulic fluids must be compatible with the selected seals.
The type of fluid has to be selected in consideration of the effective working temperature range, so that the fluid viscosity remains at the optimal level.

Note: for PVPC the temperature of the fluid contained in the pump body (drain line) is always higher than the tank temperature, specially if the pump is working for long time in null flow conditions and at high pressure.

Fluid viscosity: 10 mm^2/s for short periods at max fluid temperature on drain line
24 to 100 mm^2/s during normal operation
1000 mm^2/s for short periods at cold start-up (800 mm^2/s for PVPC)

Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

Fluid viscosity: 15 ÷ 100 mm^2/s - max allowed range 2,8 ÷ 500 mm^2/s

CAUTION: easily inflammable hydraulic fluid
In connection with fire or other hot sources, leaking hydraulic fluid may lead to fire or explosions.

5.7 Filtration

The correct fluid filtration ensures a long service life of the pumps and it prevent anomalous wearing or sticking.
Contamination in the hydraulic fluid may cause functional failures e.g. loss of efficiency and increased noise level.
In the worst case, this may result in heavy damages and breakages.
Ensure adequate hydraulic fluid cleanliness according to the cleanliness classes of the pumps over the entire operating range.

Max fluid contamination level:

- normal operation: **PFE, PFR** = ISO4406 class 21/19/16 NAS1638 class 10; **PVPC** = ISO4406 class 20/18/15 NAS1638 class 9
- longer life: **PFE, PFR** = ISO4406 class 19/17/14 NAS1638 class 8; **PVPC** = ISO4406 class 18/16/13 NAS1638 class 7

Note: see also filter section at or KTF catalog

6 MAINTENANCE

Maintenance must be carried out only by qualified personnel with a specific knowledge of hydraulics and electrohydraulics.

6.1 Ordinary Maintenance

Service work perfomed on the valve by end user or not qualified personnel invalidates the certification

- Cleaning the external surfaces using a wet cloth to avoid accumulation of dust layer over 5 mm
- Don't use compressed air for cleaning to avoid any dangerous dust dispersion on the surrounding atmosphere
- Any sudden increment in temperature requires the immediate stop of the system and the inspection of the relevant components
- The pump does not require other maintenance operations except for front shaft seal, and vane cartridge (for PFE)

6.2 Repairing

In case of incorrect functioning or beak-down it is recommended to send the valve back to Atos or to Atos authorized service centers which will provide for the reparation.
Unauthorized opening of the valves during the warranty period invalidates the warranty.

6.3 Transport

Observe the following guidelines for transportation of pumps:

- Pumps should be transported using a forklift or a lifting gear ensuring a stable position of the pump
- Use soft lifting belts to move or lift the pumps in order to avoid damages
- Before any movement check the pumps weight specified in the rilevant technical table

WARNING
The valve may fall down and cause damage and injuries, if transported improperly.
Use personal protective equipment, such as: gloves, working shoes, safety goggles, working clothes, etc.

6.4 Storage

Valves are boxed using a VpCi protective packing system, offering best protection to oxidation during components sea transport or long storage in humid environments.
PFE and PFR surface is protected with zinc coating whish guarantees a corrosion resistance over 200h in salt spry test.
PVPC corrosion protection is achieved with surface painting.
Additionally all pumps are tested with mineral oil OSO 46; the oil film left after testing ensure the internal corrosion protection.

For the pumps transporting and storing always observe the environmental conditions specified in the relevant technical tables.
Improper storage may damage the product.

The pumps can be stored for up to 12 months under the following conditions:

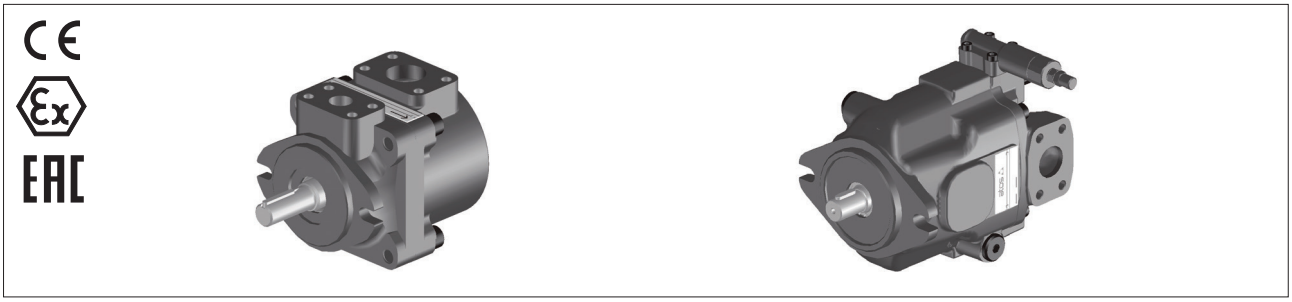
- If there is no specific information in the components technical tables, comply with a storage temperature of –20 °C to +50 °C
- Do not store the pumps outdoors
- Protect the pumps against water and humidity in case of storage in open air
- Store the pumps in the shelf or on a pallet
- Store the pumps in the original packaging or comparable packaging in order to protect them from dust and dirt
- Remove the plastic covers from the valves mounting surface only before the assembly

In case of storage period longer than 12 months please contact our technical office

Operating and maintenance information for ex-proof pumps

fixed and variable displacement

This operating and maintenance information apply to ATOS ex-proof pumps and is intended to provide useful guidelines to avoid risks when the pumps are installed in a system.
These norms must be strictly observed to avoid damages and to ensure trouble-free operation. The respect of these operating and maintenance norms grant an increased working life, trouble-free operation and thus reduced repairing costs.
Information and notes on the transport and storage of the pumps are also provided.



1 SYMBOLS CONVENTIONS

This symbol refers to possible dangers which can cause serious injuries

2 GENERAL NOTES

The operating and maintenance information are part of the operating instructions for the complete machine but thay cannot replace them

This document is relevant to the installation, use and maintenance of ex-proof fixed displacement vane pumps and ex-proof variable displacement piston pumps for application in explosive hazardous environments.

2.1 Warranty

All the hydraulic pumps have 1 year warranty; the expiration of warranty results from the following operations:
- Unauthorized mechanical interventions
- The hydraulic pumps are not used exclusively for their intended porpose as defined in these operating and maintenance information
- Respect the working limits indicated on nameplate and on technical tables: AX010 for PFEA and AX050 for PVPCA

3 CERTIFICATIONS AND PROTECTION MODE

The ex-proof pumps subject of this operating and maintenance information are certified ATEX and EAC
They are in compliance with following protection mode:

II 2/2 G Ex h IIC T5 Gb **II 2/2 D Ex h IIIC T100°C Db**

4 HARMONIZED STANDARDS

The Essential Health and Safety Requirements are assured by compliance to the following standards:

EN ISO 80079-36 Explosive atmospheres – Part 36: Non-electrical equipment for explosive atmospheres – Basic method and requirements
EN ISO 80079-37 Explosive atmospheres – Part 37: Non-electrical equipment for explosive atmospheres – Non electrical type of protection constructional safety “c”, control of ignition source “b”, liquid immersion “k”

The pumps may exclusively be used in areas and zones assigned to the equipments group and category. See section 6 for zones in relation to equipment groups and category.

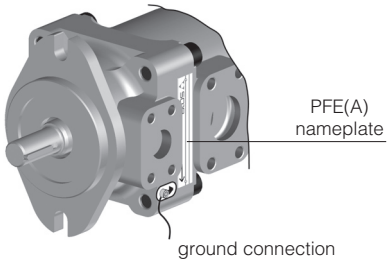
Check the code in the nameplate to ensure that the pump is suitable for the installation area.

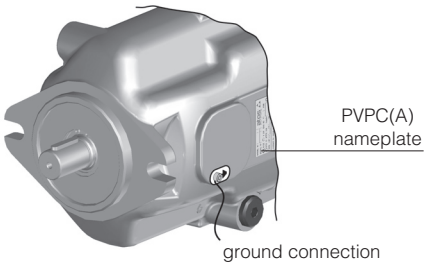
5 WORKING CONDITIONS

Pumps type		**PFEA**		**PVPCA**	
Pumps version		**STD, /PE**	**/7 /PE**	**STD, /PE**	**/7 /PE**
Ambient temperature	[°C]	-20 ÷ +60	-20÷+70	-20 ÷ +60	-20÷+70
Max inlet fluid temperature	[°C]	+60	+80	+60	+80
Protection degree		IP 66			
Max working pressure (1)		**PFEA*-*1**: from 160 to 210 bar, **PFEA*-*2**: from 210 to 300 bar		280 bar for size 29, 46, 73 250 bar for size 90	
Recommended pressure at inlet port		**PFEA*-*1**: from -0,15 to +1,5 bar for speed up to 1800 rpm; from 0 to +1,5 bar for speed over 1800 rpm **PFEA*-*2**: from 0 to +1,5 bar		from -0,2 to +24 bar	
Speed range (1)	[rpm]	from 800 to 2800 rpm, depending to the size		from 600 to 3000 rpm, depending to the size	

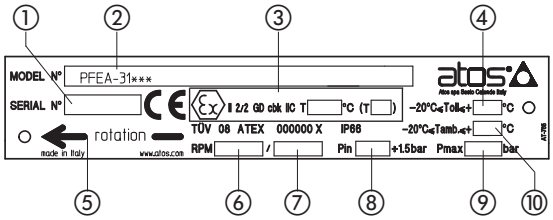
(1) Max working pressure and speed range must be reduced for HFDU, HFDR and HFC fluids, see tab. **AX10** for PFEA and **AX050** for PVPCA-*

5 NAMEPLATES

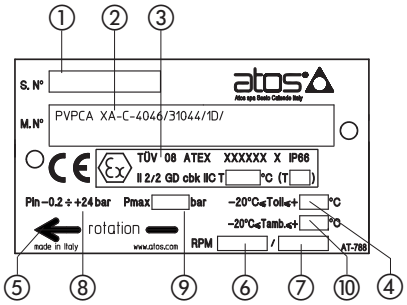




Nameplate for PFEA



Nameplate for PVPCA



Description

① Serial number
② Pump code
③ Marking according to ATEX
④ Maximum inlet fluid temperature
⑤ Pump shaft rotation direction: clockwise or counterclockwise
⑥ Minimum pump rotation speed in RPM = revolution/min
⑦ Maximum pump rotation speed in RPM = revolution/min
⑧ Mimimun inlet pressure (PFEA), range inlet pressure (PVPCA)
⑨ Maximum working pressure
⑩ Maximum ambient temperature
⑪ Delivery date

Ex II 2/2G Ex h IIC T(*) Gb or **Ex II 2/2D Ex h IIIC T(**)°C Db**

Ex = Equipment for explosive atmospheres
II = Group II for surfaces plants
2/2 = Pump category
G or **D** = **G** for gas and vapours, **D** for dust
h = Marking includes one on more of the following types of protection (“c”, “b”, “k”)
IIC = Gas group (acetylene, hydrogen)
IIIC = Conduictive dust
T* = Temperature class (T6, T5, T4)
T°C** = Max surface temperature (85, 100, 135)

6 EQUIPMENT GROUP, CATEGORY AND INSTALLATION ZONE

The user must define the overall areas of the system into different explosive atmospheres zones in accordance with directive 99/92/CE.
The table below shows the available installation zones related to the equipment group and category.

Equipment group	Category	Application, properties	Zone
II	2/2G	Potentially explosive atmospheres, in which explosive gases, mists or vapors are likely to occur occasionally. **High level of protection**	1, 2
II	2/2D	Potentially explosive atmospheres, in which explosive dust/air mixtures are likely to occur occasionally. **High level of protection**	21, 22

PUMP VERSION	Equipment group	Category	Gas and Dust group	Temperature class	Zone
PFEA and PVPCA	II	2/2G and 2/2D	IIC and IIIC	PFEA T6 (T85°C), PVPCA T5 (T100°C)	1, 2, 21, 22
PFEA* /7 /PE and PVPCA* /7 /PE	II	2/2G and 2/2D	IIC and IIIC	PFEA* T5 (T100°C), PVPCA* T4 (T135°C)	1, 2, 21, 22

7 SAFETY NOTES

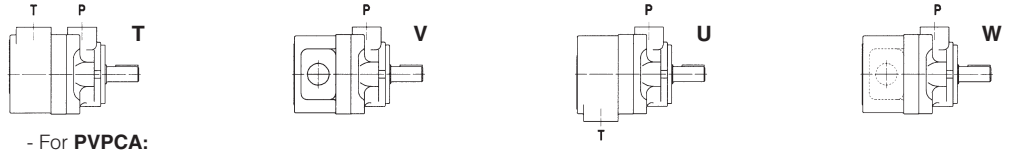
- General:

- Before start up make sure that the pump is always filled with the working fluid. See section 7.4.
- The pump must not be used with "OUT" port closed; in order to limit the maximum working pressure a relief valve must be installed on the pressure line.
- Make sure that the maximum working conditions shown in section 5 are not exceeded

7.1 Installation position and port orientation

The installation must ensure that the pump remains always filled with the working fluid.

- For **PFEA:** the pump can operate in any position, the available orientation of the oil ports is according to the below picture. In the ordering code must be specified the selected orientation.



- For **PVPCA:**
  - The pumps can be installed in horizontal or in vertical position. In case of vertical position the pump shaft must be oriented upward.
  - The drain pipe must be oriented so that the pump body always remains filled with the fluid, specially when not working. For this reason the pump is provided with 2 drain connections located in opposite side of the body, so that, depending to the pump orientation, the optimal drain piping can be arranged
  - Before the commissioning the pump body must be filled with the working fluid through one of the drain connections.
  - The connection with the electric motor must be realized by means of proper elastic coupling.

7.2 Shaft loads

PFEA: axial and radial loads acting on shaft are not permitted.
PVPCA: axial and radial loads acting on shaft are permitted, max permissible loads are indicated in the table AX050, section 2 .
The coupling with the electric motor must be sized to absorb the power peaks.
The coupling alignment between the motor and pump shaft must ensured

7.3 Shaft rotation

The direction of shaft rotation (D = clockwise, S = counterclockwaise, viewed from the shaft end) must be the same of the arrow on the nameplate.

7.4 Oil level and temperature

Make sure that the pump is always filled with flui. The installer / end user has to provide a level meter to verify the presence of fluid inside the tank.

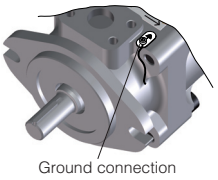
The monitoring of the inlet fluid temperature it is required only when it can reach critical values.

This monitoring should be performed on the surface of the fluid inlet pipe, near the pump's suction flange.
The monitoring system must operating with a tolerance of -5 °C of the maximum declared value.
For example, if the maximum inlet fluid temperature is 60 °C, the control system must be operating between + 55 °C and + 60 °C.
The sensor used for monitoring the fluid level and the temperature must be ATEX certified and conform to the installation area:
the control unit (PLC) must be certified IPL1 or SIL 1 also.

7.5 Important notes

- A pressure relief valve must be installed on the pressure line near the pump outlet port.
- The electric motor to be used for the pump operation must be also certified in compliance with installation zone. The compliance with applicable norms is extended to all electrical components connected with the installed pump.
- The piping have to be dimensioned according to the max pressure and max flow rate
- All pipes and surfaces must be cleaned from dirt before mounting
- Make sure that connections are sealed before giving pressure to the system
- Ensure to not exchange the pipe ports when connecting the system
- Ensure that the pump installation allows an easy acces for maintenance purpose
- According to EN 1127-1:2008, the maximum surface temperature indicated in the nameplate must be lower than the following Tmax values:

  Gas - Tmax= max value (80% of gas ignition temperature) **Dust** - Tmax = dust ignition tempeature - 75°C
- Make sure that the pump is suitable for the use in the designated installation area, on the base of the zone classification according to the Directive 99/92/CE and to the type of flammable atmosphere (gas, vapor, dust)
- The fluid ignition temperature must be 50K greater than the maximum surface temperature indicated in the nameplate
- The maximum operating pressure and minimum inlet pressure are indicated on pump's nameplate
- The pump must be connected to ground using the ground facility (screw M3x5) provided on the pump body and evidenced with grounding nameplate
- The pump's body and the electric motor, or other devices used to drive the pump, must be connected at the same electric equipotential level
- Pumps PVPCA with control devices type CH are equipped with Explosion-proof solenoid valves (assembled to the pump body and certified according to ATEX 2014/34/EU
- Pumps PVPCA with control devices type LW are equipped with a device to achieve a constant power, factory set at a specific power value required by customer


Ground connection


Grounding nameplate

7.6 Hydraulic fluids and operating viscosity range

Recommended mineral oils type HLP having high viscosity index. Ensure to use hydraulic fluids compatible with the selected seals.
The type of fluid has to be selected in consideration of the effective working temperature range, so that the fluid viscosity remains at the optimal level.
Note: for PVPCA the temperature of the fluid contained in the pump body (drain line) is always higher than the tank temperature, specially if the pump is working for long time in null flow conditions and at high pressure.

Fluid viscosity limits:
- 10 mm^2/s for short periods at max fluid temperature on drain line
- 24 to 100 mm^2/sduring normal operation
- 1000 mm^2/s for short period at cold start-up (800 mm^2/sec for PVPCA)

7.7 Filtration

The correct fluid filtration ensures a long service life of the pumps and it prevent anomalous wearing or sticking.
Contamination in the hydraulic fluid may cause functional failures e.g. loss of efficiency and increased noise level.
In the worst case, this may result in heavy damages and breakages.
Ensure adequate hydraulic fluid cleanliness according to the cleanliness classes of the pumps over the entire operating range.

Max fluid contamination level:
- normal operation: **PFEA** = ISO4406 class 21/19/16 NAS1638 class 10; **PVPCA** = ISO4406 class 20/18/15 NAS1638 class 9
- longer life: **PFEA** = ISO4406 class 19/17/14 NAS1638 class 8; **PVPCA** = ISO4406 class 18/16/13 NAS1638 class 7

Note: see also filter section at or KTF catalog

8 MAINTENANCE

Maintenance must be carried out only by qualified personnel with a specific knowledge of hydraulics and electrohydraulics.

8.1 Ordinary Maintenance

- Service work perfomed on the valve by end user or not qualified personnel invalidates the certification
- Cleaning the external surfaces using a wet cloth to avoid accumulation of dust layer over 5 mm
- Don't use compressed air for cleaning to avoid any dangerous dust dispersion on the surrounding atmosphere
- Any sudden increment in temperature requires the immediate stop of the system and the inspection of the relevant components
- The pump does not require other maintenance operations except for bearing and front shaft seal, according to the following schedule:
  PFEA must be replaced after reaching **20000 working hours**
  PVPCA without radial loads must be replaced after reaching **20000 working hours**

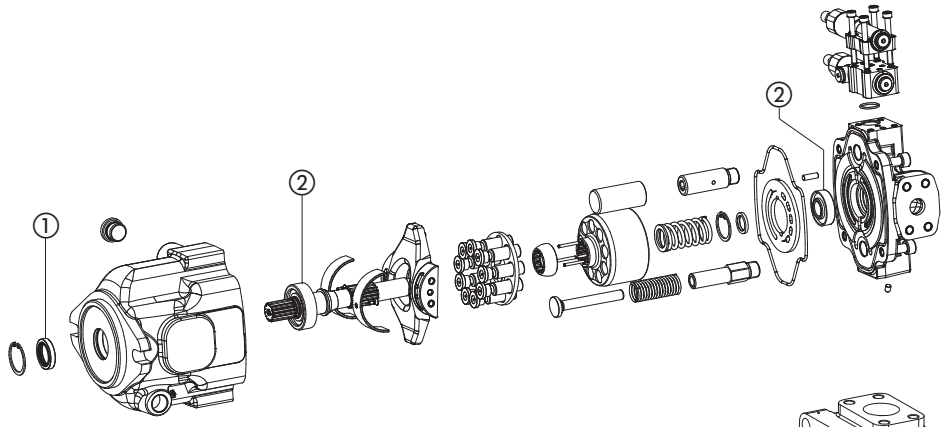
In presence of radial loads (permitted only for PVPCA) the following maintenance schedule must be considerated:

PVPCA-3029 must be replaced after reaching **1550 working hours**
PVPCA-4046 must be replaced after reaching **2600 working hours**
PVPCA-5073 must be replaced after reaching **5000 working hours**
PVPCA-5090 must be replaced after reaching **5000 working hours**

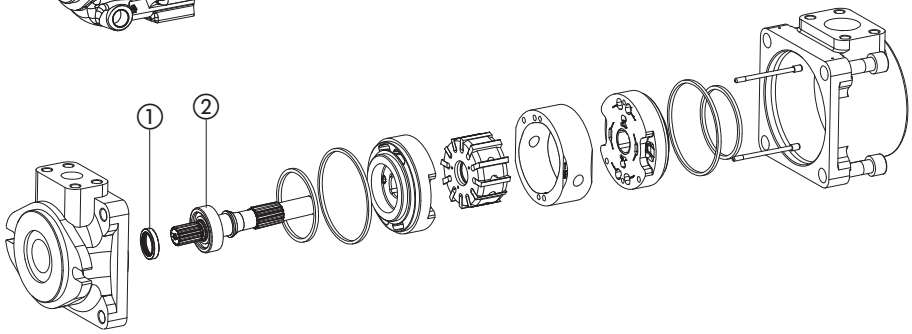
- When mounting bearings and front seal, observe the correct position as indicated in the drawing below: any incorrect positioning can result in oil leakages
- Results of maintenance and inspection must be planned and documented
- Follow the maintenance instructions of the fluid manufacturer

① Front seal
② Bearings

PVPCA



PFEA



8.2 Repairing

Before beginning any repairing activity, the following guidelines must be observed:

- Unauthorized opening of the pump during the warranty period invalidates the warranty
- Be sure to use only original spare parts manufactured or supplied by ATOS factory
- Provide all the required tools to make the repair operations safely and to don't damage the components

9 TRANSPORT AND STORAGE

9.1 Transport

Observe the following guidelines for transportation of pumps:

- Hydraulic pumps should be transported using a forklift or a lifting gear ensuring a stable position of the pump
- Use soft lifting belts to move or lift the pumps in order to avoid damages
- Before any movement check the pumps weight specified in the rilevant technical tables AX010 and AX050

9.2 Storage

PFEA corrosion protection is achieved with zinc phosphating: this treatment protect the pump to grant a storage period up to 12 months.
PVPCA corrosion protection is achieved with trasparent oil film.
Additionally all pumps are tested with mineral oil OSO 46; the oil film left after testing ensure the internal corrosion protection.

In case of storage period longer than 12 months please contact our technical office.

Ensure that pumps are well protected against water and humidity in case of a storage in the open air.

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Барнаул (3852)73-04-60
Белгород (4722)40-23-64
Благовещенск (4162)22-76-07
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