Dutch Hydraulic Consultants

HANSA · TMP srl

HYDRAULIC COMPONENTS
HYDROSTATIC TRANSMISSIONS
GEARBOXES - ACCESSORIES

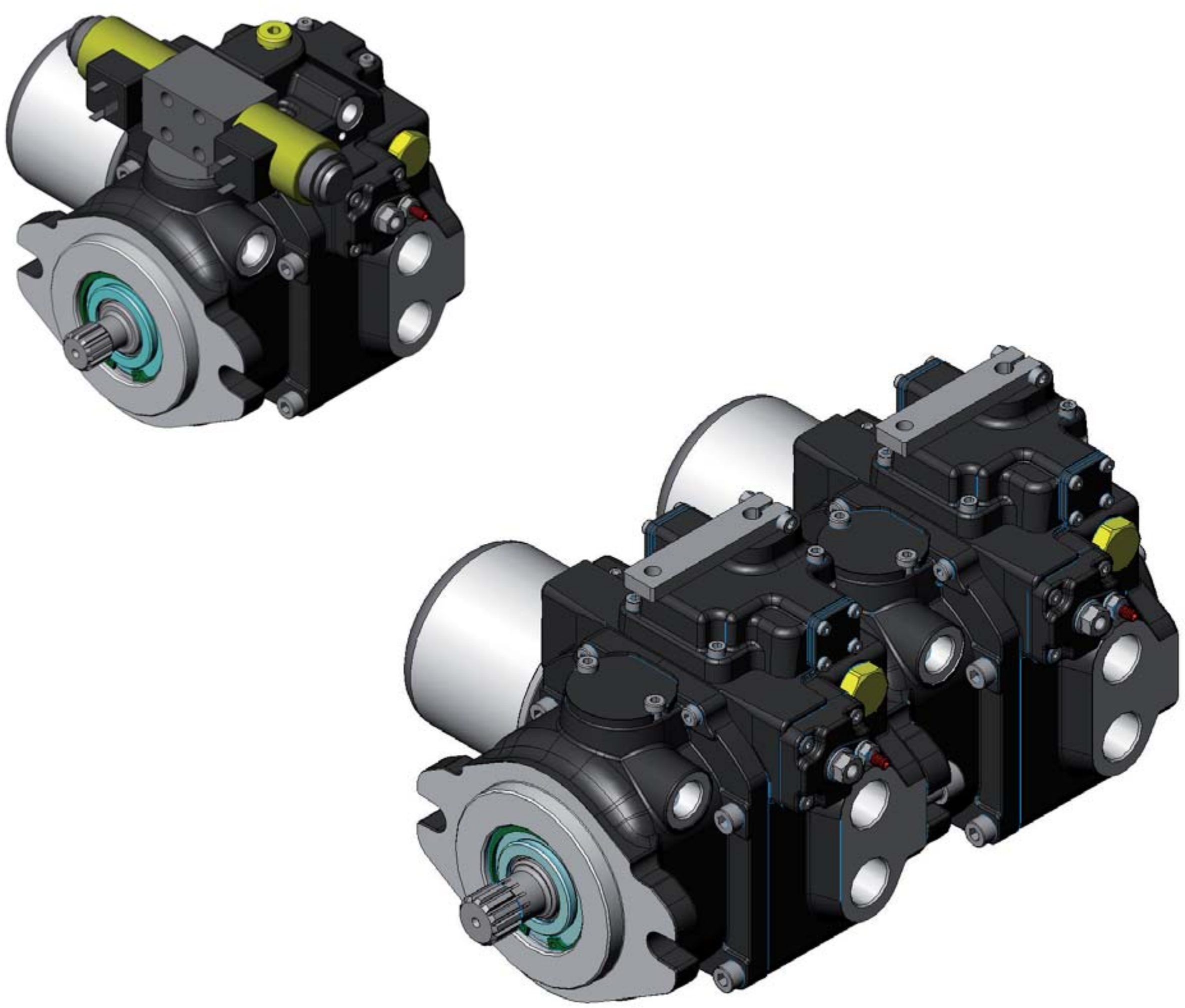
Certified ISO 9001 and 14001

HT 16 / M / 503 / 0413 / E

THE PRODUCTION LINE OF HANSA-TMP

Variable Displacement Closed Loop System Axial Piston Pump

TPV 3200



CONTENTS

GENERAL INFORMATION

Fluids

Use fluids with mineral oil basis and anticorrosive, antioxidant and wear preventing addition agents (HL or HM).
Viscosity range at operating temperature must be of 15÷60 cSt.
For short periods and upon cold start, a max. viscosity of 800 cSt is allowed.
Viscosities less then 10 cSt are not allowed.
A viscosity range of 10 ÷15 cSt is allowed for extreme operating conditions and for short periods only.

Operating temperature

The operating temperature of the oil must be within -25 ºC ÷ 80 ºC.
The running of the axial piston unit with oil temperature higher than 80 ºC or lower than -25 ºC is not allowed.

Filtration

In order to improve the control of the fluid contamination levels the TPV 3200 pump series can be equipped with a boost flow filter positioned on the delivery outlet of the boost pump.
Only the flow necessary to reintegrate the oil lost due to leakage will pass through this filter, all the excess flow, which is discharged through the boost pump valve is therefore not filtered to ensure a longer life of the filter cartridge. The filtering cartridge (microfibre) is a 22 micron absolute grade (10 micron nominal).
In order to ensure a correct functioning of the unit, the max. permissible contamination level in the circuit is 20/18/15 according to ISO 4406:1999.

Suction pressure

The minimum pressure on the auxiliary pump suction must be of 0.8 bar absolute.
On cold starting and for short-term an absolute pressure of 0.5 bar is allowed.
In no case inlet pressure can be lower.

Case drain pressure

Maximum case drain pressure is 2 bar. On cold starting and for short-term a pressure of 6 bar is allowed.
A higher pressure can damage the main shaft seal or reduce its life.

Seals

Standard seals used on pumps are NBR. In case of use special fluids, contact our Tech. Dept.

Displacement limiting

The pump is equiped with the displacement mechanical limiting device.
Displacement limitation is obtained by means of two setting screws which limit the control piston stroke.

GENERAL INFORMATION (continued)

General rules

These installation and commissioning specifications are intended for use with TPV 3200 axial piston pumps for closed circuit "medium duty".

Adherence to these recommendations has a decisive effect on the service life of the units.

The following specifications refer to standard units with standard internal elements, used with common hydraulic fluids.

Carefully read this rules before installing and commissioning the application.

For ports reference see the product catalogue.

A standard requirement is that the pump casing must becompletely filled with already filtered hydraulic oil before commissioning or re-commissioning it, and the casing must remain filled also when operating.

Commissioning or re-commissioning the unit without filling the housing or with too little fluid in it will result in damage or in the immediate destruction of the rotating group.

In the following text, we will differentiate between installation position (pump to tank) and installation orientation (pump shaft vertical, horizontal, etc.).

The ideal filling orientation is specified after. Only in this position can complete filling be ensured.

On commissioning or re-commissioning, this position should be maintained.

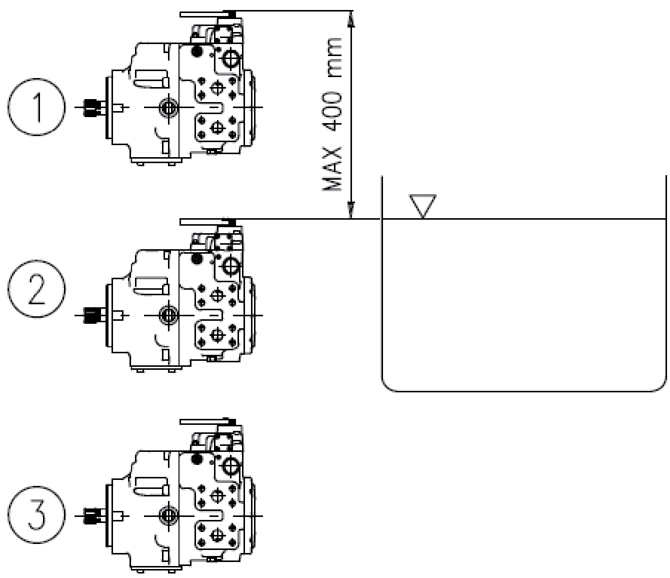
Installation position

The following installation positions are possible (see figure below).

1 - Pump above the tank (above the minimum oil level). Possible but not recommended.

2 - Pump alongside the tank (below the minimum oil level) or where the upper point on the unit housing is levelled with the minimum oil level.

3 - Pump below the tank (below the minimum oil level).



GENERAL INFORMATION (continued)

Dimensioning lines

The minimum absolute pressure in suction line should never be below 0.8 bar absolute.

To achieve this, the fluid velocity in the suction line must be kept as low as possible.

Moreover, the pressure and drain lines should also be dimensioned in such a way to keep the pressure drop across them limited.

Recommended ranges for the fluid velocity in relation to the service are shown in the table below.

The lower the fluid velocity is kept, the more efficient and safe the operation of the pump will be.

Practical and cost limitations will tell how far to go in this direction.

Service	Fluid Velocity (m/sec.)
Suction	0.6 - 1.2
Drain	1.5 - 4
Pressure lines	2 - 5.5

To calculate fluid velocity (see also Flow - Velocity Nomogram in the following page):

$$V = Q \times 21.22 / D2$$

Where:

V = velocity in metres per second (m/sec.)

Q = flow rate in litres per minute (l/min.)

D = inside diameter of pipe or hose in millimetres (mm.)

Example

If boost pump of displacement 64 cm^3 is 13 cm^3, and maximum engine speed is 3600 n/min the boost pump output flow will be 46 l/min.

To avoid cavitation conditions or not fall below 0.8 absolute pressure in the suction line a 1.0 m/s fluid velocity is to be considered as acceptable.

At 46 l/min. this require a line of 31 mm. minimum inside diameter (1-1/4” BSP).

Always avoid elbows and sharp bends.

When the pump is in neutral the flow above is the amount of flow that will pass through the case drain ports and drain lines.

If the pump is working under load the case drain flow can be increased due to external leakage flow peaks.

Considering a 5% reduction of pump efficiency under peak loading conditions, the case drain lines can be dimensioned for 46 + (64 x 3.6 x 0.05) = 57.5 l/min.

This, considering a flow velocity of 3.0 m/sec. require a 3/4” BSP drain line.

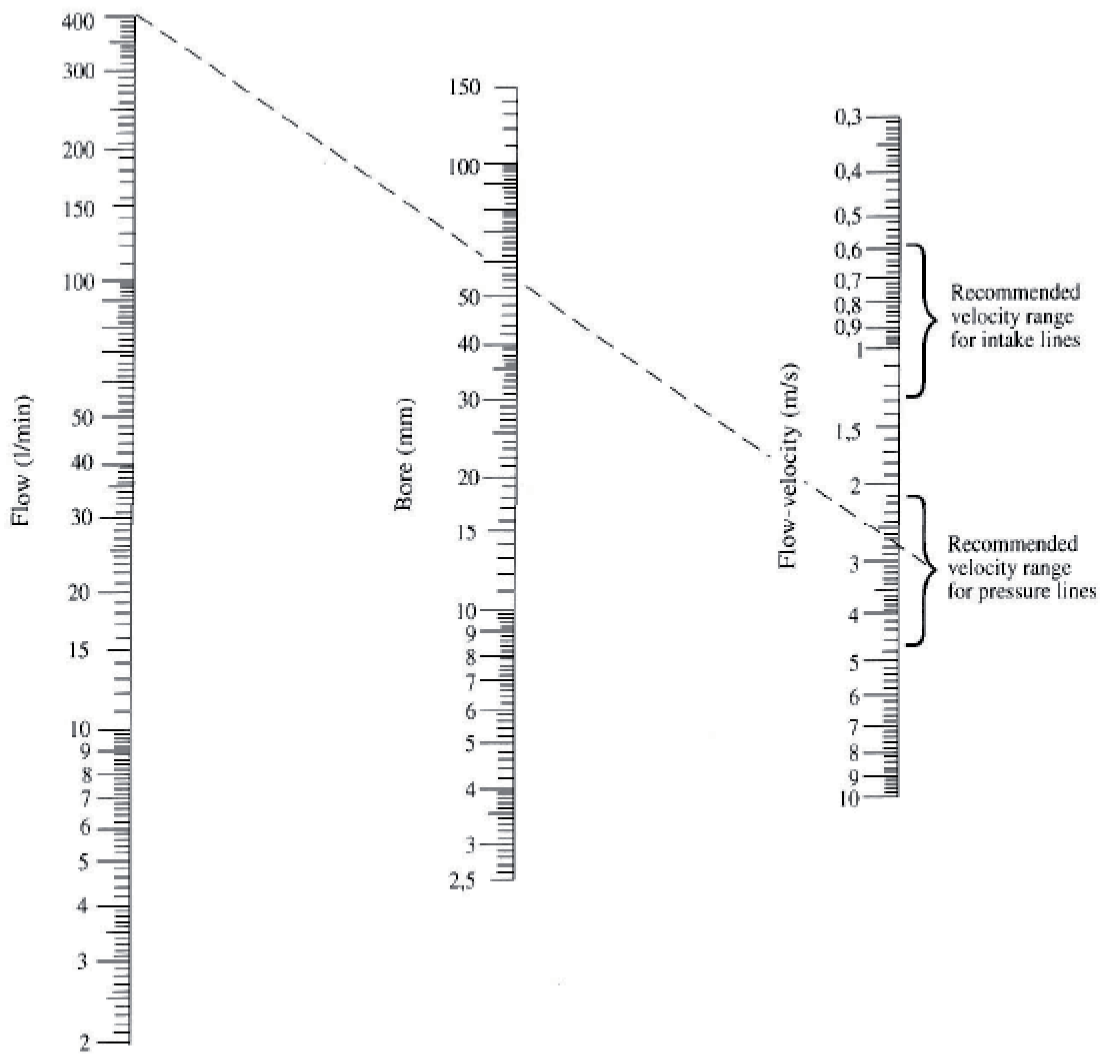
GENERAL INFORMATION (continued)

As for the pressure lines, the maximum output flow of the 64 cm^3 displacement pump at 3600 n/min. is 230 l/min. Using a 4.5 m/sec. flow velocity the required line diameter should be 32 mm., close to a 1-1/4” BSP line.

WARNING:

whatever is the theoretical calculation, **NEVER** use fittings or line diameters lower than the port dimension on the pump. Larger lines are viceversa welcome.

FLOW - VELOCITY NOMOGRAM



GENERAL INFORMATION (continued)

First starting / re-starting

Before starting any procedure, it is strictly required that all the pipes and hoses in the circuit are pre-flushed and the reservoir filled completely with pre-filtered oil (preferable filter rating for both operation 4μm absolute - 10μm absolute can be used as an alternative).

After the installation is complete and the pump casing has been filled (see filling procedure) proceed as follows:

1) Connect a 0-600 bar pressure gauge on both “GA” and “GB” ports (available only for 50 and 64 cm^3 displacement).
2) Connect a 0-60 bar pressure gauge on “P” port.
3) Check that the suction line and the suction filter are completely filled with oil. If not, fill them and bleed air from suction line.
   Failing to check this can result in pump failure: if there is air in the boost pump suction, the boost pump could take some time to self prime and could therefore be damaged.
4) Start and immediately after stop the motor or the engine, in such a way that the pump only turns for a few turns. Repeat this operation until the pressure gauge on “P” port reads at least 20 - 23 bar.

WARNING: during this operation and the following ones do not operate the control!

5) Start the motor or the engine and check that the reading on pressure gauge on “P” port keeps constant and at the required value: 22 - 23 bar (standard values, can change in some cases).
6) Stop the engine and proceed with the closed loop flushing (see closed loop flushing procedure).
7) Check for hoses and fitting leaks and perform the machine test under load, eventual pressure settings and machine acceptance tests.

Maintenance

First oil change to be made after approximately 500 hours of operation, filtering element must be replaced first time after 50 hours for preliminary circuit cleaning and then every 500 hours; subsequently change oil every 2000 hours.

Such intervals should be reduced when the filter clogging indicator shows that the cartridge is clogged or when the system works in a heavily polluted environment.

GENERAL INFORMATION (continued)

Closed loop flushing procedure

After the first starting is completed, the closed loop flushing must be done.

This procedure applies to brand new machines, after a major maintenance work or when the pressure lines between pump and motor have been changed or disconnected.

This procedure is mandatory to remove any presence of contaminant in hoses, pipes and fittings.

Both pump and motor will function even if the flushing procedure is not performed, but the service life of both could be seriously reduced.

To flush the closed loop it must be used an in line filter with suitable pressure and flow rate rating.

The filter element must be preferably 4µm absolute - 10µm absolute can be used as an alternative.

Since the filter has only one possible flow direction, the pump control must be operated to achieve the correct flow direction (if one it's not sure of it, check the highest pressure side between A or B: this will be the output flow side).

The in line filter can be mounted in two different position on option:

A - Connecting the pressure lines of the motor to the filter.

B - Connecting the filter on the return line before the oil goes back to the pump and by passing the motor by the means of an additional hose (preferable solution).

The flushing can be stopped as the oil contamination level in the closed loop according to ISO 4406 is at least 18/16/13 or lower.

The same maximum 18/16/13 acceptable oil contamination level applies to the whole circuit.

WARNING:

When two or more motors are connected in parallel layout to the pump, it is necessary to ensure the correct flushing of each of the circuit sections connecting the motors.

To do so, it is advisable to bypass each of the motors connecting a ball type high pressure valve (two way-two positions, manually operated) to the by pass line (as per position B - see above).

By opening one of said valves while the others are closed and starting the above mentioned flushing procedure it is possible to ensure the correct flushing of the correspondent circuit section.

The procedure must be repeated for each of the circuit sections.

When the flushing is completed, the in line filter and the eventual auxiliary hoses must be removed to configure the circuit to the design layout.

After the circuit has been restored to the design layout, the machine can be tested under load, and the eventual pressure adjustments and final tests can be done.

GENERAL INFORMATION (continued)

Product description

TPV 3200 pump series is a family of variable displacement axial piston pumps for use in closed circuits.

The displacement is infinitely variable by means of a tilting swash plate, the oil flow can be reversed over the neutral point.

Various controls are available: manual, servocontrol lever operated, electric, etc.

Each pump is provided with a charge pump that makes up for internal leakage, maintains a positive pressure in the main circuit and provides oil to the control system.

All pumps have maximum pressure relief valves and can be supplied single or tandem version.

Different through drive options are available for auxiliary pump mounting as well as a wide range of options: by-pass valve, pressure filter and others.

The following range of controls is available:

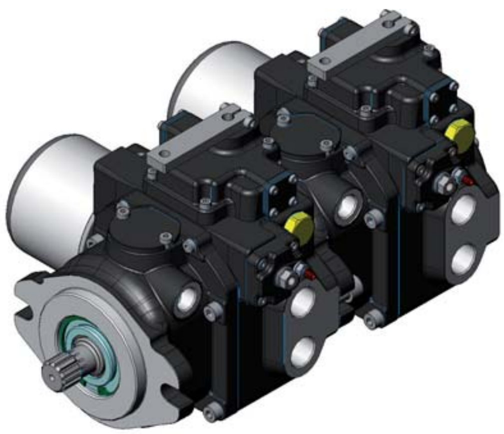
- Automotive
- Hydraulic proportional without feed-back
- Hydraulic proportional with feed-back
- Manual lever with feed-back
- Manual with zeroing
- Electric two position (On-Off)
- Electric impulse
- Electric proportional with feed-back
- Electric proportional without feed-back

Accessories:

- Pressure filter
- Filter with electrical clogging sensor
- Power limiter
- Exchange valve
- Electric Cut-Off Valve
- Hydraulic inching
- Mechanical inching

Through drive options:

- Through drive - SAE “A” 9T - 16/32-DP
- Through drive - SAE “B” 13T - 16/32-DP
- Through drive - SAE “B-B” 15T - 16/32-DP



Main applications:

- Industrial machinery
- Heart moving and building machinery
- Agricultural, Forestry and Harvesting machinery
- Naval and Off-shore application

TECHNICAL SPECIFICATIONS

Pump model			TPV 21	TPV 28
Max. displacement [4]	$V_{max.}$	$cm^3/min.$	21	28
Flow rating [1]	Q	l/min.	75,6	100,8
Power rating [1]	W	kW	31,8	42
Boost pump displacement	V_{bp}	cm^3/n	11	
Continuous pressure	$P_{nom.}$	bar	250	
Peak pressure	$P_{max.}$	bar	350	
Boost system pressure [2]	P_{bp}	bar	15-25 (standard 20)	
Suction pressure [3]	P_s	bar	>= 0,8	
Absolute cold suction pressure	P_{s1}	bar	>= 0,5	
Max. housing pressure	$P_{housing}$	bar	2	
Moment of inertia	J	kgm^2	0,0018	
Minimum speed	$n_{min.}$	n/min.	700	
Continuous speed [5]	$n_{max\text{-}cont.}$	n/min.	3.600	
Intermittent speed	$n_{max\text{-}int.}$	n/min.	3.900	
Max. fluid temperature	T	°C	80	
Fluid viscosity	v	$mm^2/sec.$	15 - 60	
Fluid contamination			18/16/13 according ISO 4406 (NAS 9)	
Mass (single pump) [6]	m	kg	22	
Mass (tandem pump) [6]	m	kg	45	
Mounting flange			SAE B	

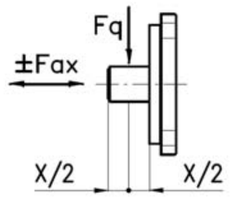
Notes:
(1) $[V_{max.} \times n_{max.}]$
(2) 1500 n/min.
(3) v <= 30 mm²/s
(4) The pump 21 and 28 use the same external housing
(5) The shown values are valid for an absolute press.1 bar at the suction port, using mineral oil
(6) Approximate values, can change depending on different regulator

Peak operations must not exceed 1% of every minute.
A simultaneous max. pressure and speed are not recommended.

Drive shaft radial and axial loads

The drive shaft can stand both radial and axial loads.

Themaximum permissible loads in the following table are calculated in such a way as to guarantee a service life of at least 80% of the service life of bearings to which no load is applied.

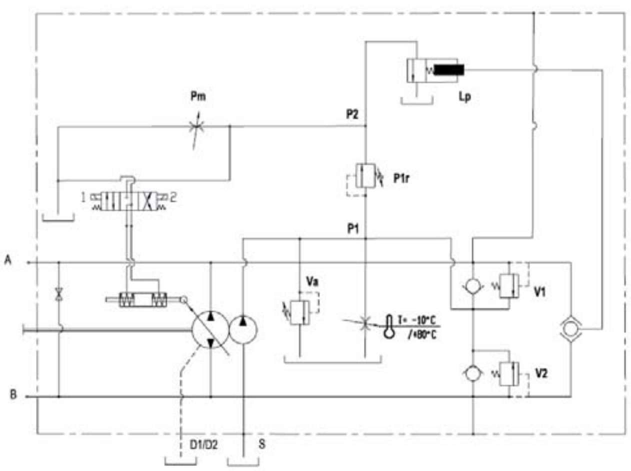
Displacement				21 / 28
	**Radial Load**	$F_{q\ max}$	N	1200
	Axial Load	$F_{ax\ max}$	N	950

AUTOMOTIVE CONTROL with HYDRAULIC INCHING AM2/AM4-II

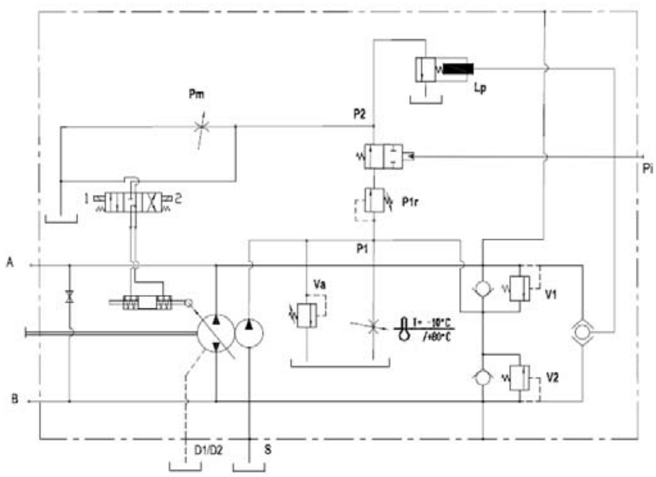
The automotive control pump has the function of automatically adapt the displacement to the variation in the number of revolutions of the pump (and thus of the diesel engine); set the number of revolution whenever the machine start up and limit the power absorbed by the transmission to the diesel engine output.

The inching valve (variable restrictor) is available as optional, with mechanical or hydraulic control version.

Automotive Control

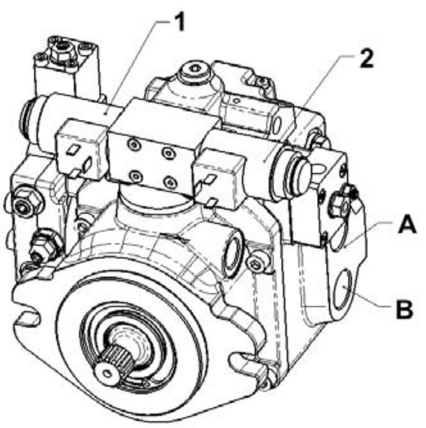


Automotive Control with Hydraulic Inching



Direction of rotation

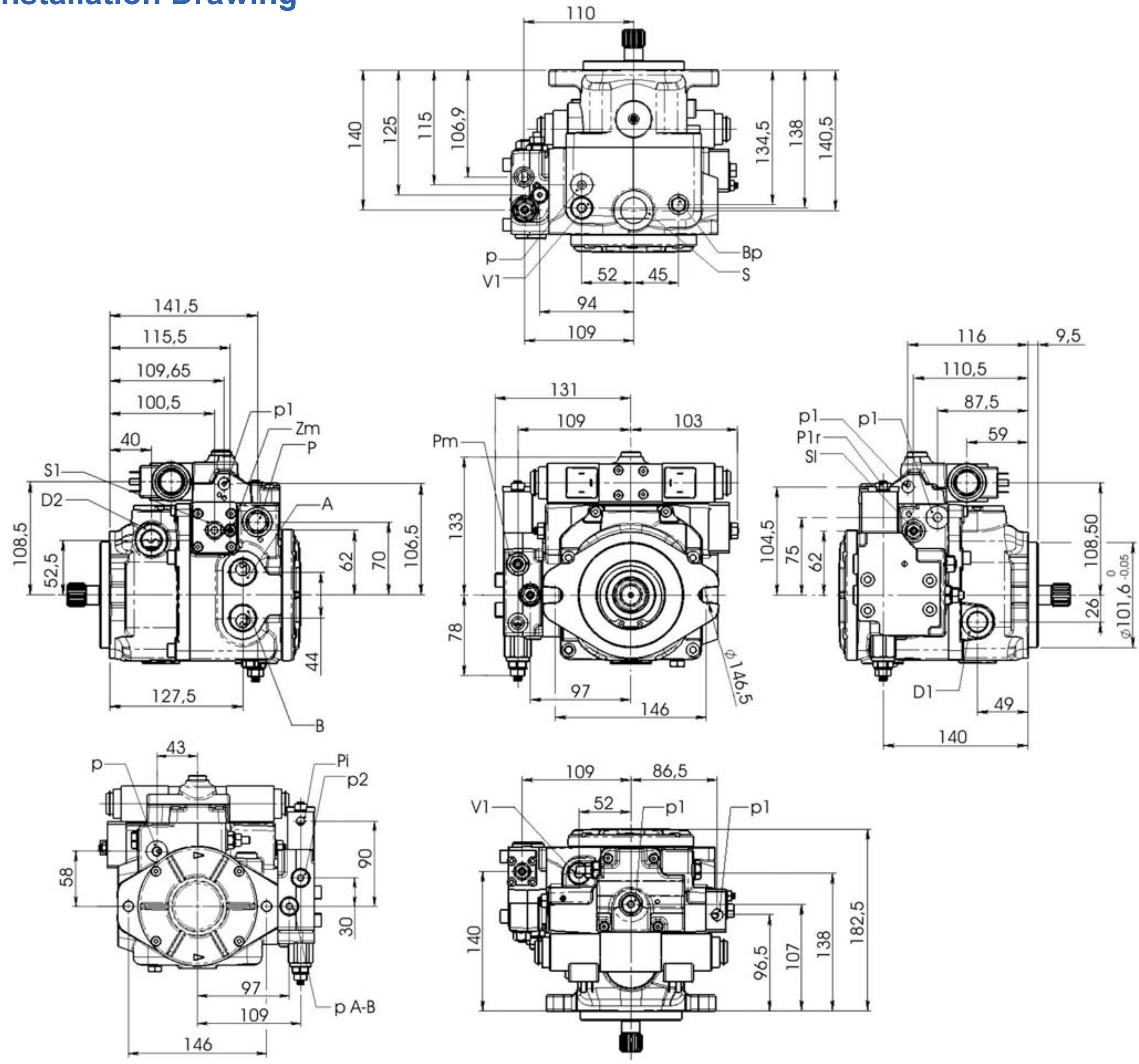
Correlation between direction of rotation (shaft view) control and direction of flow.



	PUMP FLOW DIRECTION	
SHAFT ROTATION	Energized Solenoid	Pressure Port
LEFT (counterclockwise)	1	B
	2	A
RIGHT (clockwise)	1	A
	2	B

AUTOMOTIVE CONTROL with HYDRAULIC INCHING AM2/AM4-II

Installation Drawing



METRIC Version

A – B: Pressure Ports – 3/4" G
D1 – D2: Drain Ports – 1/2" G
S: Suction – 3/4 G
P: Boost Presure port – ¾ "-16 UNF-2B -> ¼" G
Va: Boost Pump Pressure Relief Valve
V1 – V2: Main Port Pressure Relief Valve
Bp: By-pass Valve
Sl: Stroke Limiter
Zm: Mechanical Zero adjustment screw
p: Boost Pressure gauge Port – 1/8" G
p1: a – b Pilot Line Gauge Port – 1/4" G
Pi: Inching Inlet Line – 1/8" G
Lp: Power Limiter Adjusting Screw
Pm: Machine Start-Up Adjusting Screw
P1r: Minimum Pressure Adjusting Screw
p 2:Pilot Pressure Gauge Port – ¼ "G
p A-B: A-B Gauge Port – ¼" G

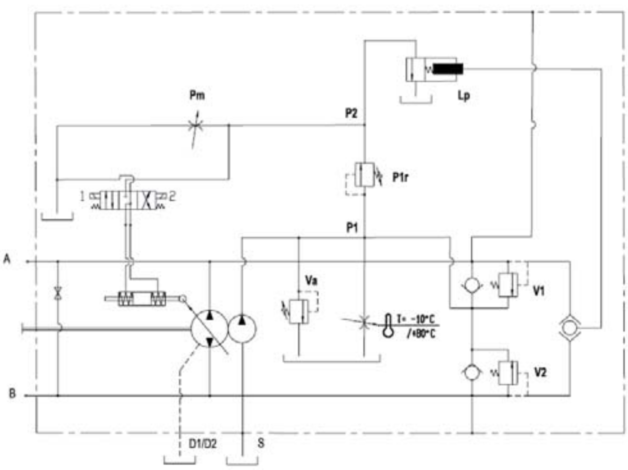
SAE Version

A – B: Pressure Ports – 7/8"-14 UNF-2B
D1 – D2: Drain Ports – 3/4"-16 UNF-2B
S: Suction – 1 1/16 UNF-2B
P: Boost Pressure Port –3/4"-16 UNF-2B -> 7/16"-20 UNF-2B
Va: Boost Pump Pressure Relief Valve
V1 – V2: Main Port Pressure Relief Valve
Bp: By-pass Valve
Sl: Stroke Limiter
Zm: Mechanical Zero adjustment screw
p: Boost Pressure gauge Port – 3/8"-24 UNF-2B
p1: a – b Pilot Line Gauge Port – 7/16"-20 UNF-2B
Pi: Inching Inlet Line - 3/8"-24 UNF-2B
Lp: Power Limiter Adjusting Screw
Pm: Machine Start-Up Adjusting Screw
P1r: Minimum Pressure Adjusting Screw
p 2: Pilot Pressure Gauge Port – 7/16"-20 UNF-2B
p A-B: A-B Gauge Port – 7/16"-20 UNF-2B

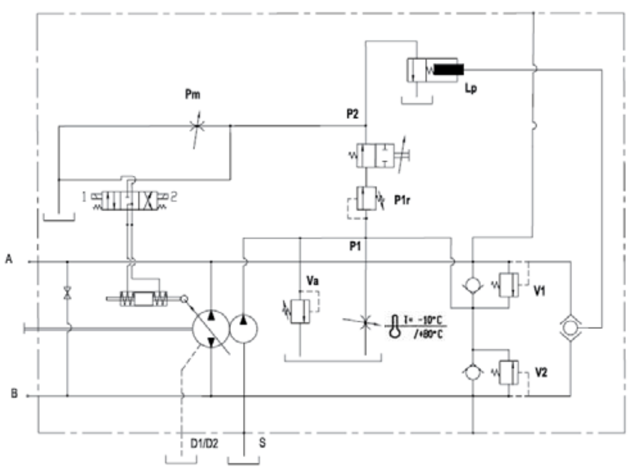
AUTOMOTIVE CONTROL with MECHANICAL INCHING AM2/AM4-IM

The automotive control pump has the function of automatically adapt the displacement to the variation in the number of revolutions of the pump (and thus of the diesel engine); set the number of revolution whenever the machine start up and limit the power absorbed by the transmission to the diesel engine output.
The inching valve (variable restrictor) is available as optional, with mechanical or hydraulic control version.

Automotive Control

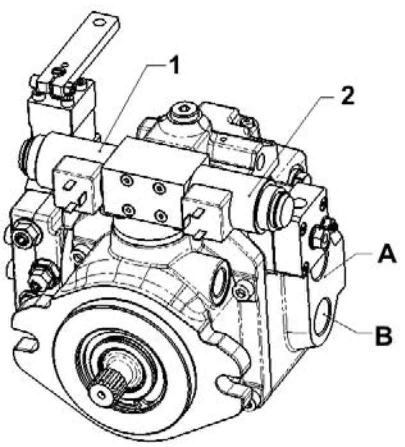


Automotive Control with Mechanical Inching



Direction of rotation

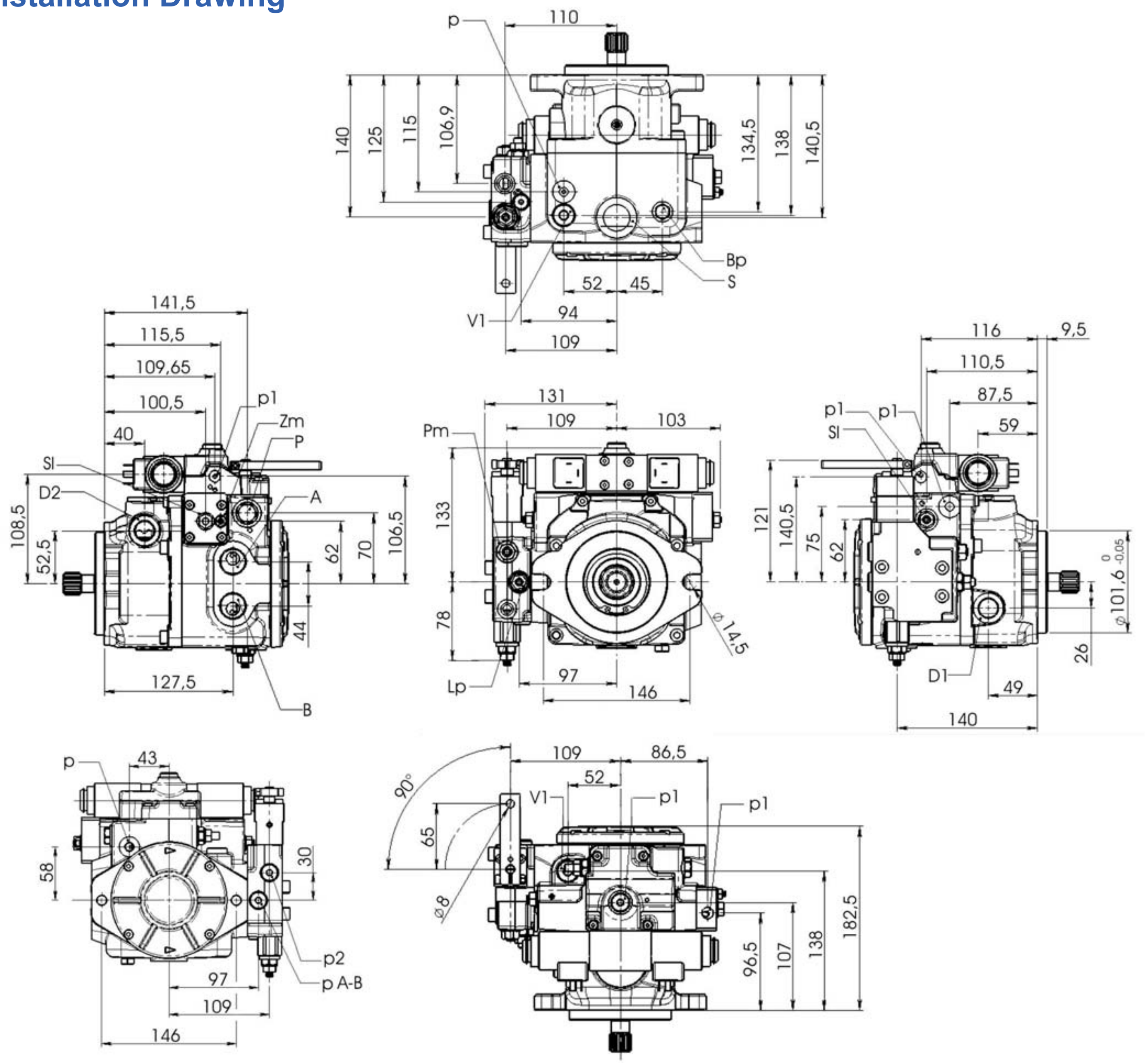
Correlation between direction of rotation (shaft view) control and direction of flow.



SHAFT ROTATION	PUMP FLOW DIRECTION Energized Solenoid	Pressure Port
LEFT (counterclockwise)	1	B
	2	A
RIGHT (clockwise)	1	A
	2	B

AUTOMOTIVE CONTROL with MECHANICAL INCHING AM2/AM4-IM

Installation Drawing



METRIC Version

A – B: Pressure Ports – 3/4" G
D1 – D2: Drain Ports – 1/2" G
S: Suction – 3/4 G
P: Boost Presure port – ¾ "-16 UNF-2B -> ¼" G
Va: Boost Pump Pressure Relief Valve
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Bp: By-pass Valve
Sl: Stroke Limiter
Zm: Mechanical Zero adjustment screw
p: Boost Pressure gauge Port – 1/8" G
p1: a – b Pilot Line Gauge Port – 1/4" G
Pi: Inching Inlet Line – 1/8" G
Lp: Power Limiter Adjusting Screw
Pm: Machine Start-Up Adjusting Screw
P1r: Minimum Pressure Adjusting Screw
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p A-B: A-B Gauge Port – ¼" G

SAE Version

A – B: Pressure Ports – 7/8"-14 UNF-2B
D1 – D2: Drain Ports – 3/4"-16 UNF-2B
S: Suction – 1 1/16 UNF-2B
P: Boost Pressure Port –3/4"-16 UNF-2B -> 7/16"-20 UNF-2B
Va: Boost Pump Pressure Relief Valve
V1 – V2: Main Port Pressure Relief Valve
Bp: By-pass Valve
Sl: Stroke Limiter
Zm: Mechanical Zero adjustment screw
p: Boost Pressure gauge Port – 3/8"-24 UNF-2B
p1: a – b Pilot Line Gauge Port – 7/16"-20 UNF-2B
Pi: Inching Inlet Line - 3/8"-24 UNF-2B
Lp: Power Limiter Adjusting Screw
Pm: Machine Start-Up Adjusting Screw
P1r: Minimum Pressure Adjusting Screw
p 2: Pilot Pressure Gauge Port – 7/16"-20 UNF-2B
p A-B: A-B Gauge Port – 7/16"-20 UNF-2B

HYDRAULIC PROPORTIONAL CONTROL (without Feed-Back)

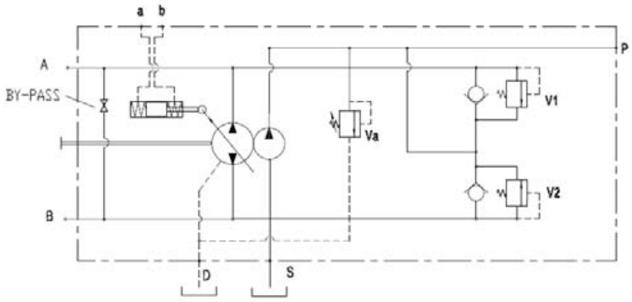
IND

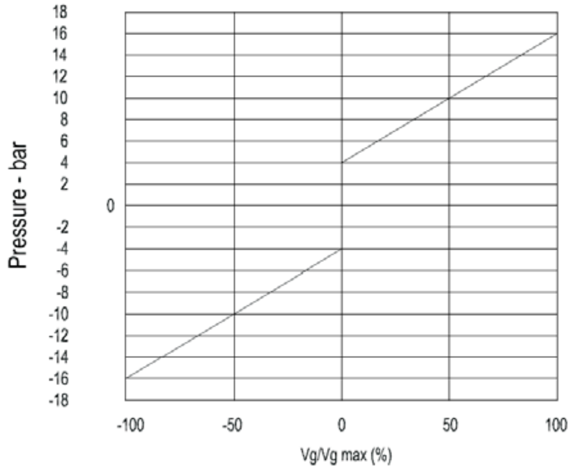
With distributor direct pilot port

The pump displacement is proportional to the pilot pressure on “a” or “b” piloting ports, which also affect flow direction.

Feeding pressure to the control joystick can be provided by charge pressure from "P" port.

The piloting pressure must then be controlled by said joystick or by a pressure reducing valve (not supplied).





Pilot Pressure = 4÷16 bar (on a - b)

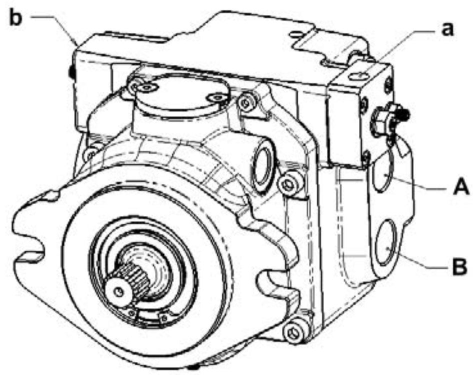
Start of control = 4 bar

End of control = 16 bar (Max. displacement)

Max. Pressure = 30 bar

Direction of rotation

Correlation between direction of rotation (shaft view) control and direction of flow.



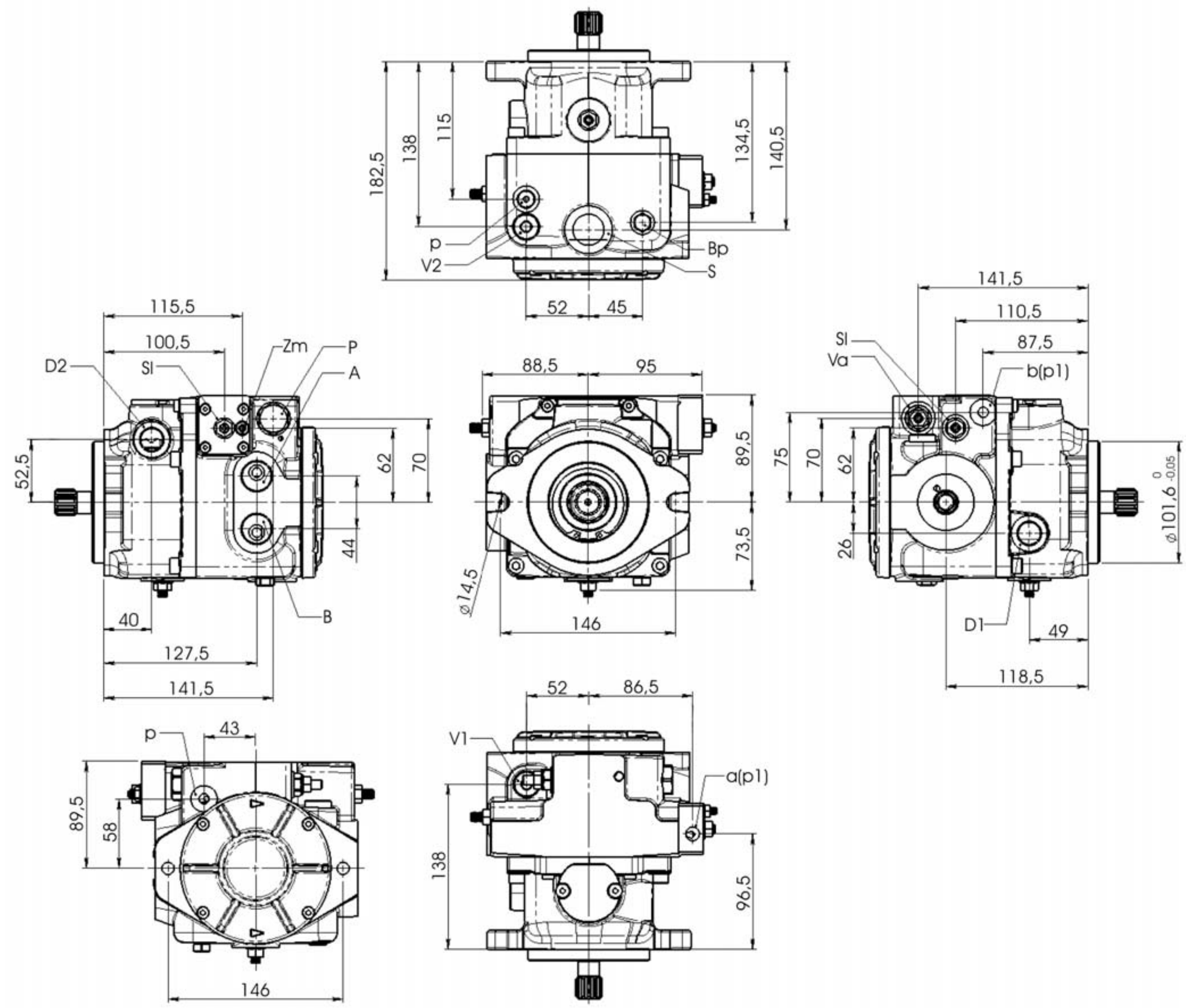
	PUMP FLOW DIRECTION	
SHAFT ROTATION	Piloting Pressure	Pressure Port
RIGHT (clockwise)	a	A
	b	B
LEFT (counterclockwise)	a	B
	b	A

HYDRAULIC PROPORTIONAL CONTROL (without Feed-Back)

IND

With distributor direct pilot port

Installation Drawing



METRIC Version

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S: Suction – 3/4 G
P: Boost Presure port – ¾ "-16 UNF-2B -> ¼" G
Va: Boost Pump Pressure Relief Valve
V1 – V2: Main Port Pressure Relief Valve
Bp: By-pass Valve
Sl: Stroke Limiter
Zm: Mechanical Zero adjustment screw
a-b: Pilot Port - 1/8" G
p: Boost Pressure Gauge Port – 1/8" G
p1: a – b Pilot Line Gauge Port – 1/4" G

SAE Version

A – B: Pressure Ports – 7/8"-14 UNF-2B
D1 – D2: Drain Ports – 3/4"-16 UNF-2B
S: Suction – 1 1/16 UNF-2B
P: Boost Pressure Port –3/4"-16 UNF-2B -> 7/16"-20 UNF-2B
Va: Boost Pump Pressure Relief Valve
V1 – V2: Main Port Pressure Relief Valve
Bp: By-pass Valve
Sl: Stroke Limiter
Zm: Mechanical Zero adjustment screw
a-b: Pilot Port - 3/8-24 UNF-2B
p: Boost Pressure Gauge Port – 3/8"-24 UNF-2B
p1: a – b Pilot Line Gauge Port – 7/16"-20 UNF-2B

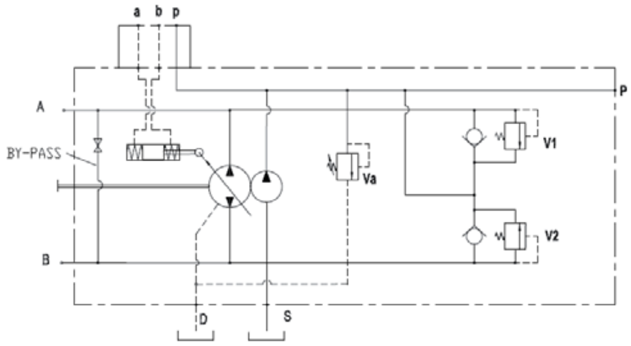
HYDRAULIC PROPORTIONAL CONTROL (without Feed-Back) INP

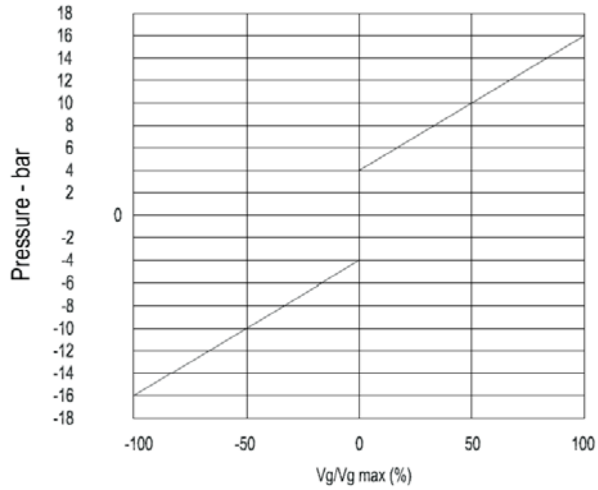
With pilot port on the upper valve

The pump displacement is proportional to the pilot pressure on “a” or “b” piloting ports, which also affect flow direction.

Feeding pressure to the control joystick can be provided by charge pressure from "P" port.

The piloting pressure must then be controlled by said joystick or by a pressure reducing valve (not supplied).





Pilot Pressure = 4÷16 bar (on a - b)

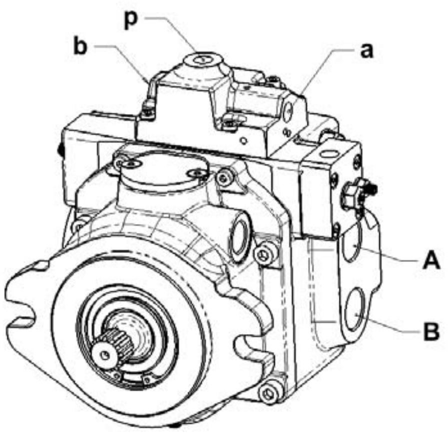
Start of control = 4 bar

End of control = 16 bar (Max. displacement)

Max. Pressure = 30 bar

Direction of rotation

Correlation between direction of rotation (shaft view) control and direction of flow.



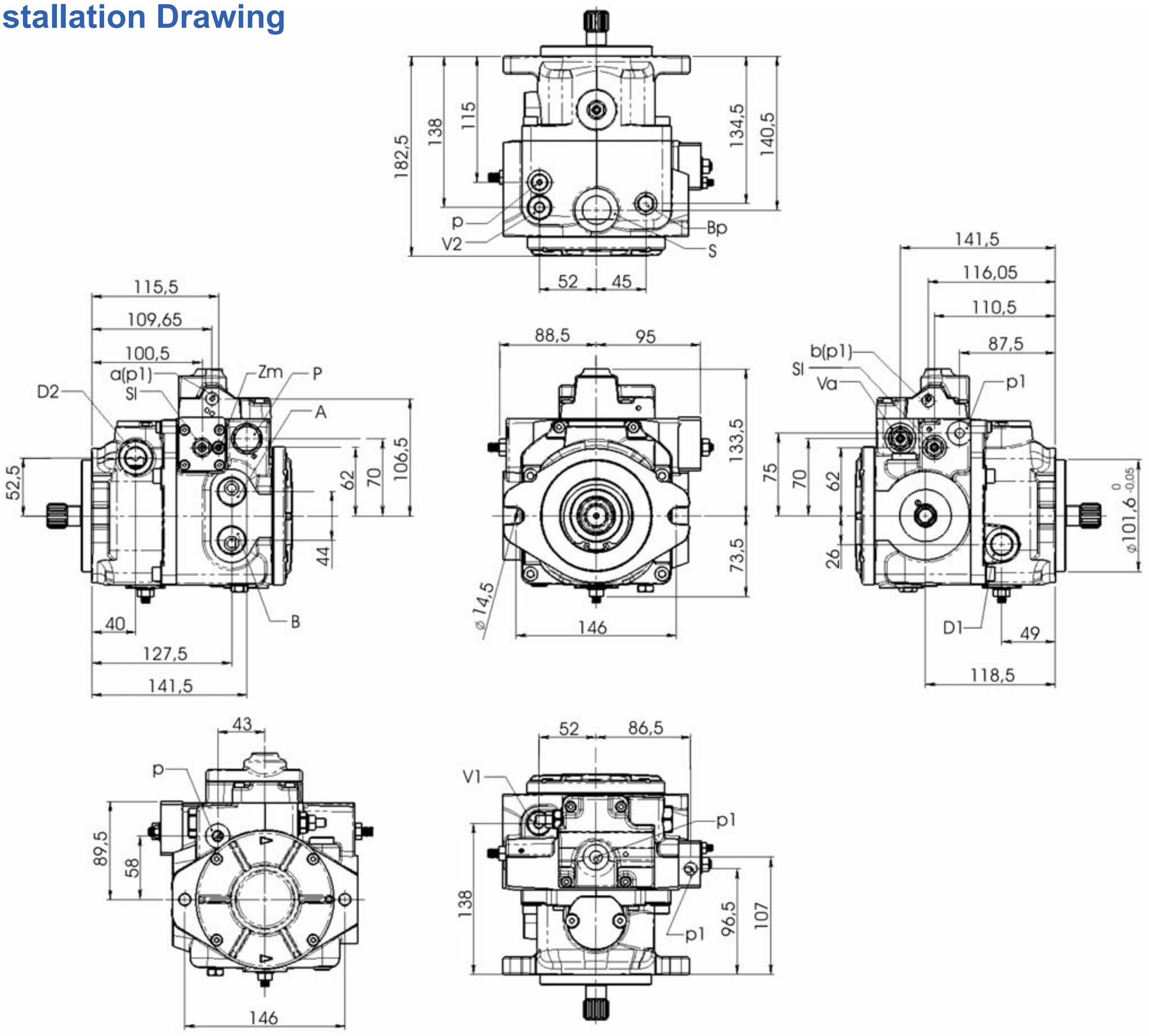
	PUMP FLOW DIRECTION	
SHAFT ROTATION	Piloting Pressure	Pressure Port
RIGHT (clockwise)	a	A
	b	B
LEFT (counterclockwise)	a	B
	b	A

HYDRAULIC PROPORTIONAL CONTROL (without Feed-Back)

INP

With pilot port on the upper valve

Installation Drawing



METRIC Version

A – B: Pressure Ports – 3/4" G
D1 – D2: Drain Ports – 1/2" G
S: Suction – 3/4 G
P: Boost Presure port – ¾ "-16 UNF-2B -> ¼" G
Va: Boost Pump Pressure Relief Valve
V1 – V2: Main Port Pressure Relief Valve
Bp: By-pass Valve
Sl: Stroke Limiter
Zm: Mechanical Zero adjustment screw
a-b: Pilot Port - 1/8" G
p: Boost Pressure Gauge Port – 1/8" G
p1: a – b Pilot Line Gauge Port – 1/4" G

SAE Version

A – B: Pressure Ports – 7/8"-14 UNF-2B
D1 – D2: Drain Ports – 3/4"-16 UNF-2B
S: Suction – 1 1/16 UNF-2B
P: Boost Pressure Port –3/4"-16 UNF-2B -> 7/16"-20 UNF-2B
Va: Boost Pump Pressure Relief Valve
V1 – V2: Main Port Pressure Relief Valve
Bp: By-pass Valve
Sl: Stroke Limiter
Zm: Mechanical Zero adjustment screw
a-b: Pilot Port - 3/8-24 UNF-2B
p: Boost Pressure Gauge Port – 3/8"-24 UNF-2B
p1: a – b Pilot Line Gauge Port – 7/16"-20 UNF-2B

ELECTRIC IMPULSE CONTROL

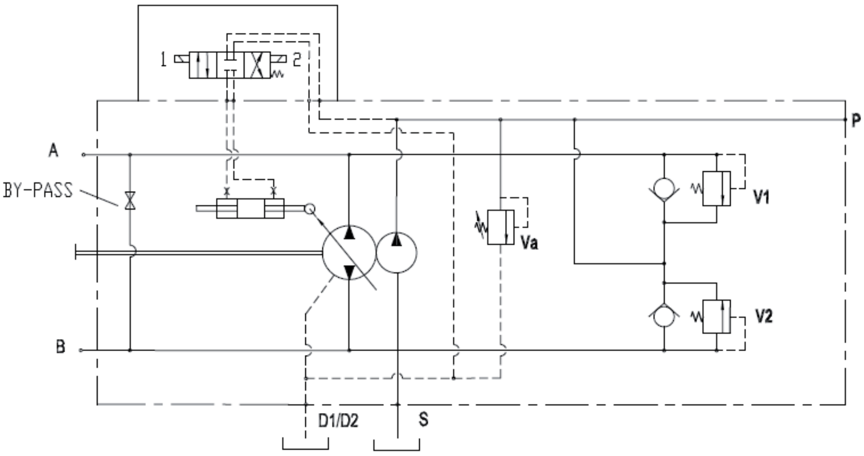
EI2-EI4

Impulse control where the displacement of the pump is function of the number of inputs of current to one of the two solenoids.

The servocontrol is without zeroing spring, therefore the piston of the servocontrol stays in the position until a new input of current is fed to the solenoids. Flow direction depends on which solenoid is energized.

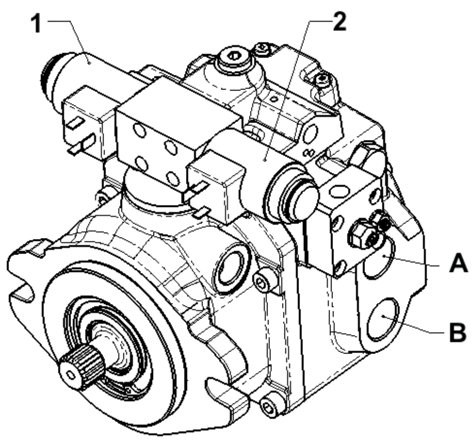
Standard solenoids are On-Off at 24V d.c. max. current 1A.

(Optional solenoids 12V d.c. max. current 2A).



Direction of rotation

Correlation between direction of rotation (shaft view) control and direction of flow.

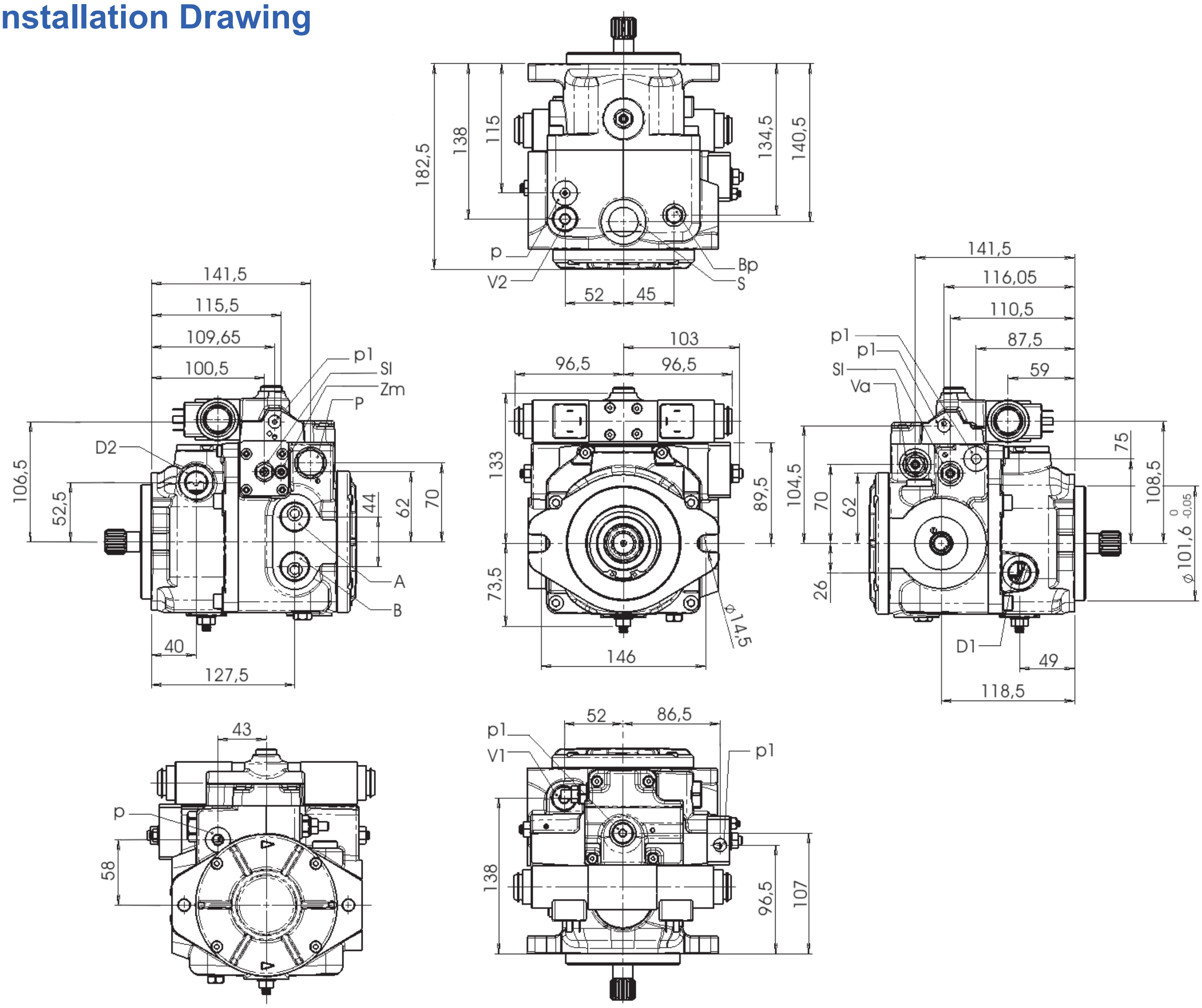


SHAFT ROTATION	PUMP FLOW DIRECTION	
	Energized Solenoid	Pressure Port
LEFT (counterclockwise)	1	B
	2	A
RIGHT (clockwise)	1	A
	2	B

ELECTRIC IMPULSE CONTROL

EI2-EI4

Installation Drawing



METRIC Version
A – B: Pressure Ports – 3/4" G
D1 – D2: Drain Ports – 1/2" G
S: Suction – 3/4 G
P: Boost Presure port – ¾ "-16 UNF-2B -> ¼" G
Va: Boost Pump Pressure Relief Valve
V1 – V2: Main Port Pressure Relief Valve
Bp: By-pass Valve
Sl: Stroke Limiter
Zm: Mechanical Zero adjustment screw
p: Boost Pressure Gauge Port – 1/8" G
p1: a – b Pilot Line Gauge Port – 1/4" G

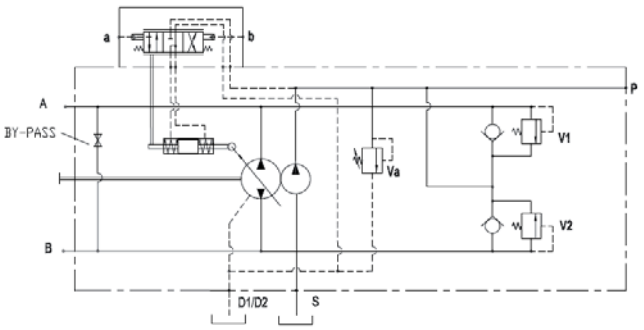
SAE Version
A – B: Pressure Ports – 7/8"-14 UNF-2B
D1 – D2: Drain Ports – 3/4"-16 UNF-2B
S: Suction – 1 1/16 UNF-2B
P: Boost Pressure Port –3/4"-16 UNF-2B -> 7/16"-20 UNF-2B
Va: Boost Pump Pressure Relief Valve
V1 – V2: Main Port Pressure Relief Valve
Bp: By-pass Valve
Sl: Stroke Limiter
Zm: Mechanical Zero adjustment screw
p: Boost Pressure Gauge Port – 3/8"-24 UNF-2B
p1: a – b Pilot Line Gauge Port – 7/16"-20 UNF-2B

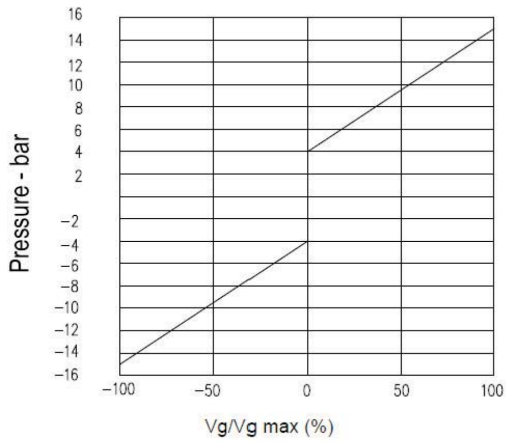
HYDRAULIC PROPORTIONAL CONTROL (with Feed-Back) IRX

The pump displacement is proportional to the pilot pressure on “a” or “b” ports; which also affect flow direction.

Piloting can be provided by charge pressure from "P" port.

The piloting pressure will then have to be controlled by a joystick or by a pressure reducing valve (not supplied).





Pilot Pressure = 6÷16 bar (on a - b)

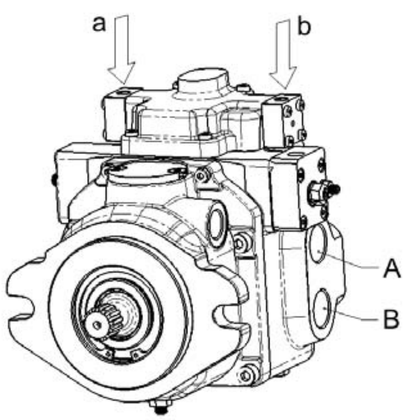
Start of control = 6 bar

End of control = 16 bar (Max. displacement)

Max. Pressure = 30 bar

Direction of rotation

Correlation between direction of rotation (shaft view) control and direction of flow.

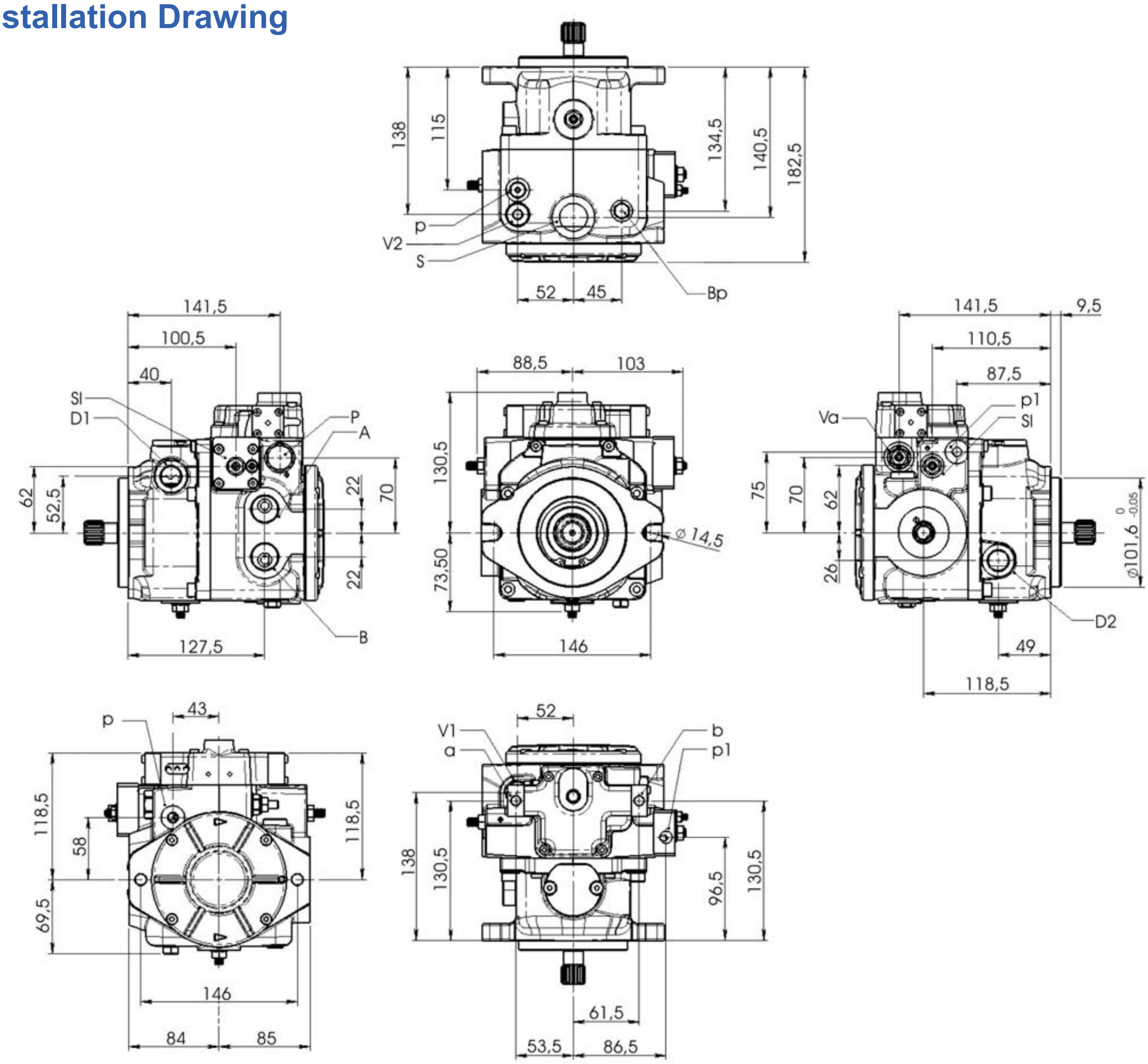


	PUMP FLOW DIRECTION	
SHAFT ROTATION	Pilot Pressure	Pressure Port
LEFT (counterclockwise)	a	B
	b	A
RIGHT (clockwise)	a	A
	b	B

HYDRAULIC PROPORTIONAL CONTROL (with Feed-Back)

IRX

Installation Drawing



METRIC Version

A – B: Pressure Ports – 3/4" G
D1 – D2: Drain Ports – 1/2" G
S: Suction – 3/4 G
P: Boost Presure port – ¾ "-16 UNF-2B -> ¼" G
Va: Boost Pump Pressure Relief Valve
V1 – V2: Main Port Pressure Relief Valve
Bp: By-pass Valve
Sl: Stroke Limiter
Zm: Mechanical Zero adjustment screw
a-b: Pilot Port - 1/8" G
p: Boost Pressure Gauge Port – 1/8" G
p1: a – b Pilot Line Gauge Port – 1/4" G

SAE Version

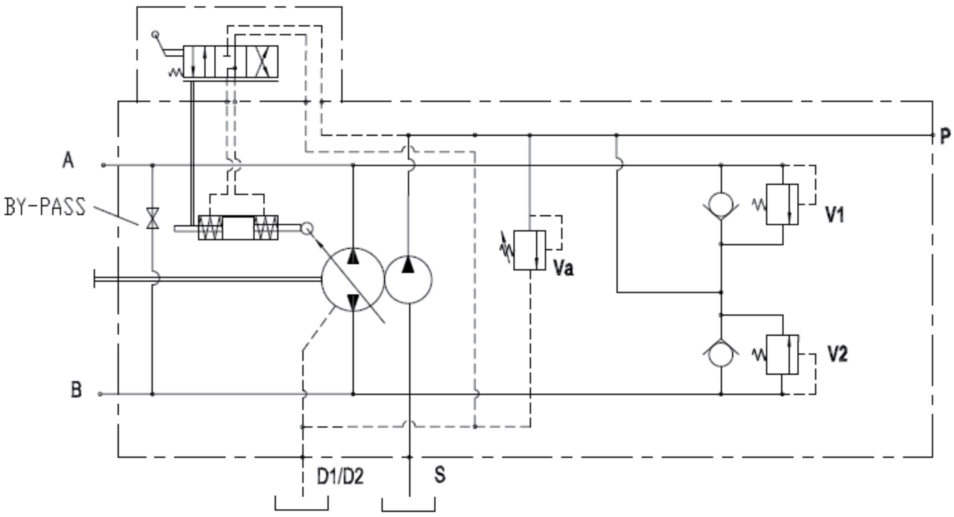
A – B: Pressure Ports – 7/8"-14 UNF-2B
D1 – D2: Drain Ports – 3/4"-16 UNF-2B
S: Suction – 1 1/16 UNF-2B
P: Boost Pressure Port –3/4"-16 UNF-2B -> 7/16"-20 UNF-2B
Va: Boost Pump Pressure Relief Valve
V1 – V2: Main Port Pressure Relief Valve
Bp: By-pass Valve
Sl: Stroke Limiter
Zm: Mechanical Zero adjustment screw
a-b: Pilot Port - 3/8-24 UNF-2B
p: Boost Pressure Gauge Port – 3/8"-24 UNF-2B
p1: a – b Pilot Line Gauge Port – 7/16"-20 UNF-2B

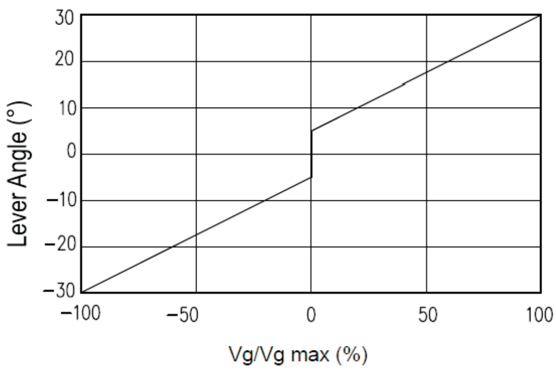
MANUAL LEVER CONTROL (with Feed-Back)

LRX

The displacement of the pump is directly proportional to the angle of the lever.

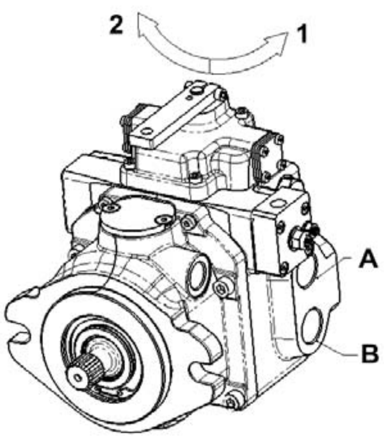
The diagram below shows the relationship between angle and displacement.





Direction of rotation

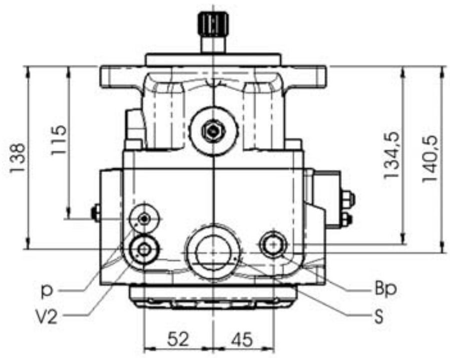
Correlation between direction of rotation (shaft view) control and direction of flow.

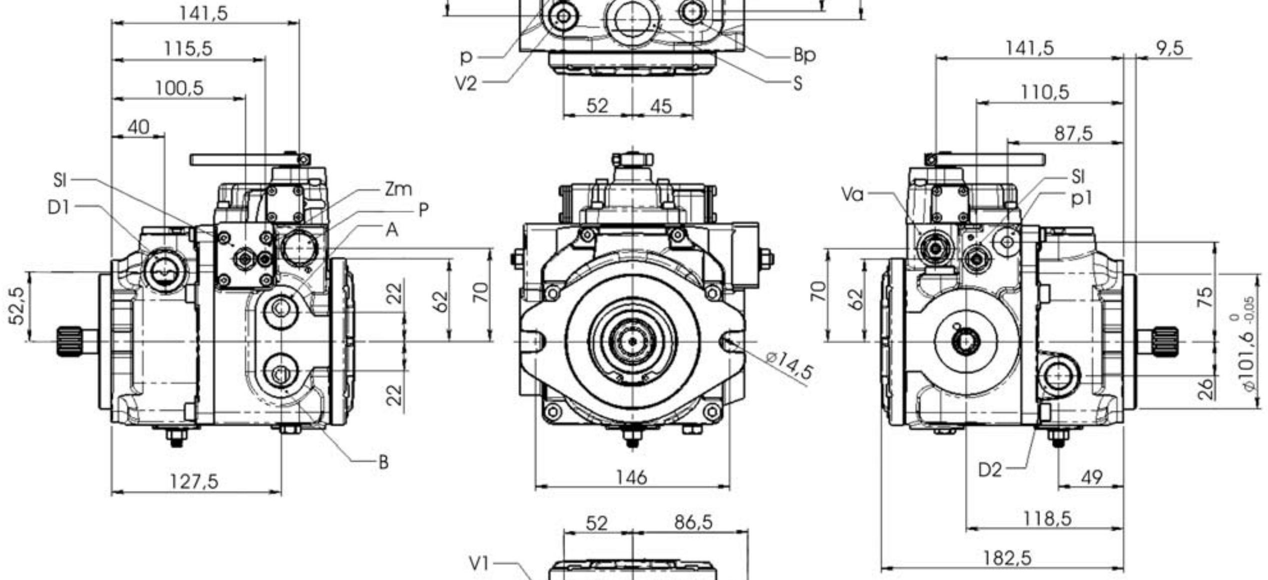


	PUMP FLOW DIRECTION	
SHAFT ROTATION	Control Rotation	Pressure Port
LEFT (counterclockwise)	1	A
	2	B
RIGHT (clockwise)	1	B
	2	A

MANUAL LEVER CONTROL (with Feed-Back) LRX

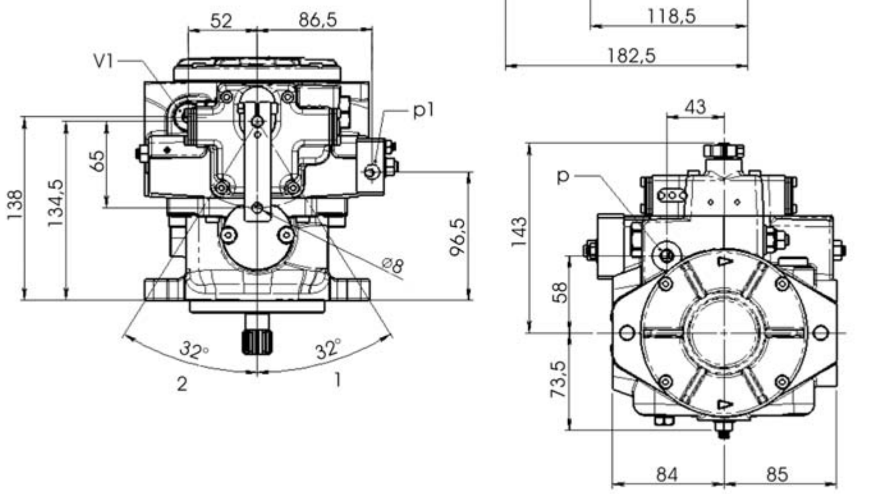
Installation Drawing





Required torque on the control lever is normally between 0,6 -1,2 Nm.

Max. permissible torque 3 Nm.



METRIC Version

A – B: Pressure Ports – 3/4" G
D1 – D2: Drain Ports – 1/2" G
S: Suction – 3/4 G
P: Boost Presure port – ¾ "-16 UNF-2B -> ¼" G
Va: Boost Pump Pressure Relief Valve
V1 – V2: Main Port Pressure Relief Valve
Bp: By-pass Valve
Sl: Stroke Limiter
Zm: Mechanical Zero adjustment screw
p: Boost Pressure Gauge Port – 1/8" G
p1: a – b Pilot Line Gauge Port – 1/4" G

SAE Version

A – B: Pressure Ports – 7/8"-14 UNF-2B
D1 – D2: Drain Ports – 3/4"-16 UNF-2B
S: Suction – 1 1/16 UNF-2B
P: Boost Pressure Port –3/4"-16 UNF-2B -> 7/16"-20 UNF-2B
Va: Boost Pump Pressure Relief Valve
V1 – V2: Main Port Pressure Relief Valve
Bp: By-pass Valve
Sl: Stroke Limiter
Zm: Mechanical Zero adjustment screw
p: Boost Pressure Gauge Port – 3/8"-24 UNF-2B
p1: a – b Pilot Line Gauge Port – 7/16"-20 UNF-2B

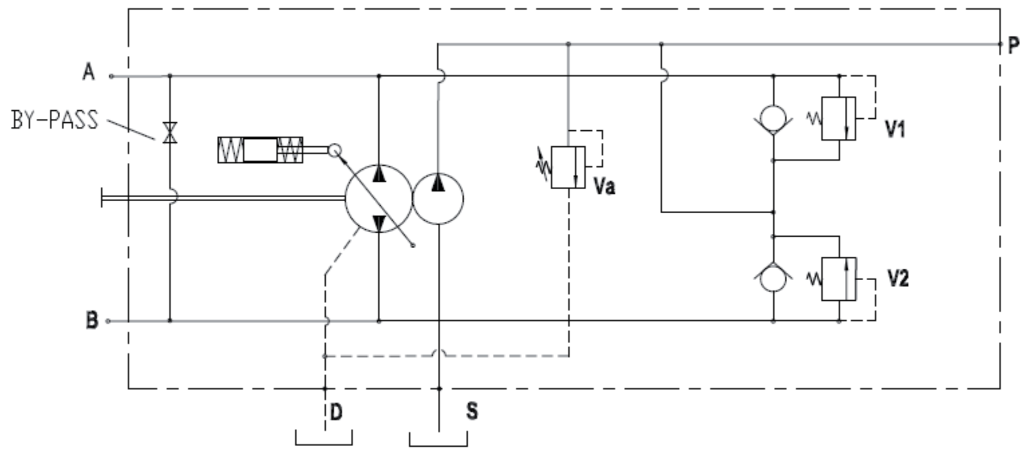
MANUAL CONTROL (with Zeroing)

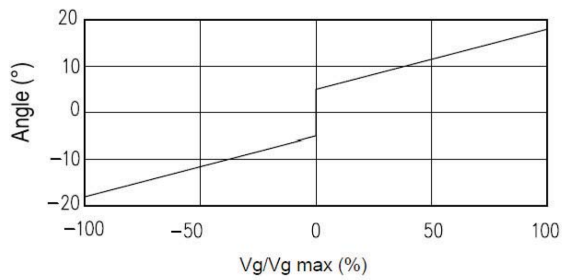
The pump displacement variation of the pump is achieved rotating the control pivot (i.e. by the means of a lever - not supplied).

The control pivot is built-in to the swash plate of the pump.

The return to zero displacement of the pump is guaranteed by an internal spring.

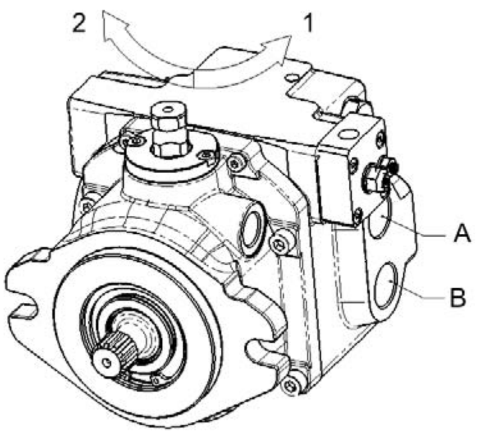
The diagram below shows the relationship between angle and displacement.





Direction of rotation

Correlation between direction of rotation (shaft view) control and direction of flow.

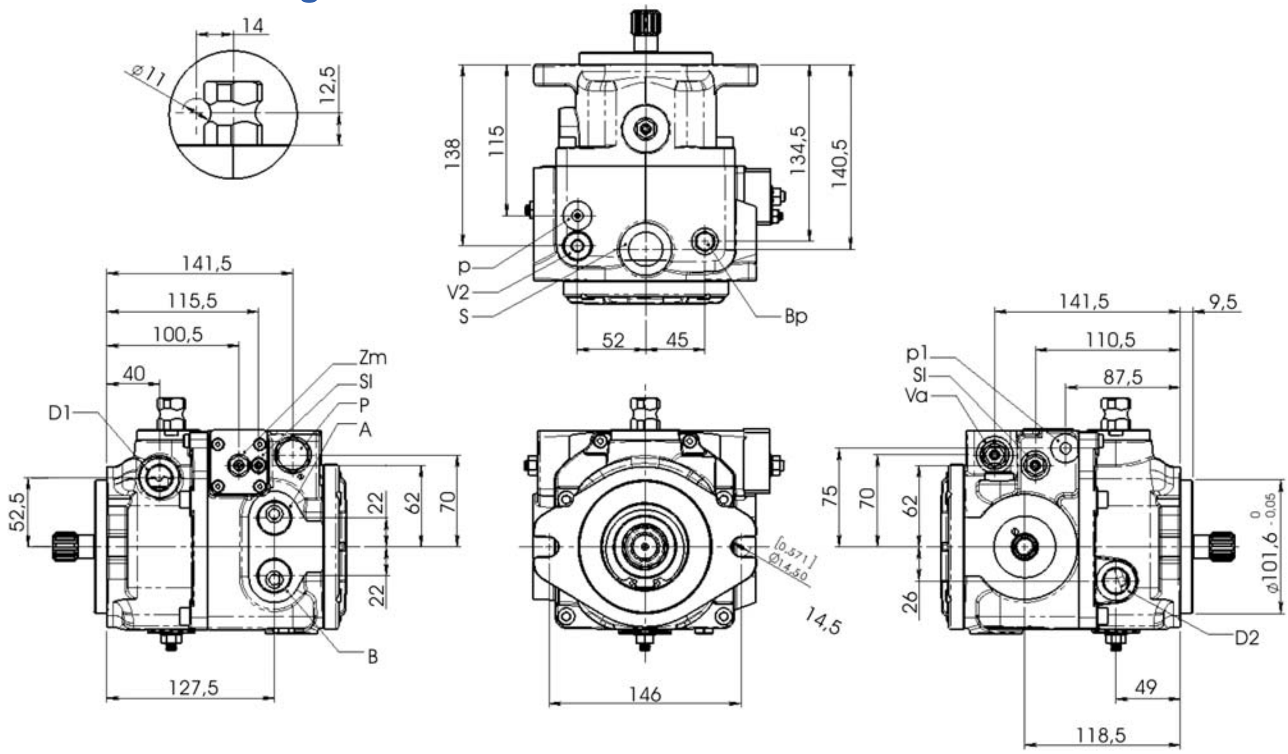


	PUMP FLOW DIRECTION	
SHAFT ROTATION	Control Rotation	Pressure Port
LEFT (counterclockwise)	1	B
	2	A
RIGHT (clockwise)	1	A
	2	B

MANUAL CONTROL (with Zeroing)

LNX

Installation Drawing



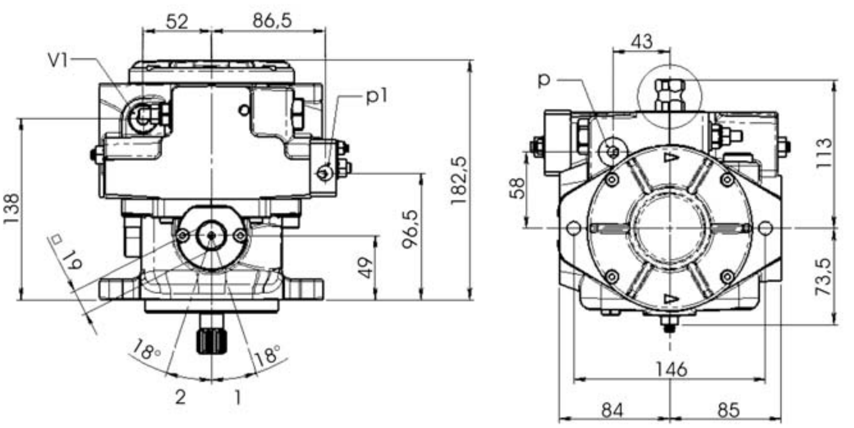
Required torque on the control pivot is:

P = 40 bar = min. 6 Nm.

max. 15 Nm.

P = 200 bar = min. 12 Nm.

max. 25 Nm.

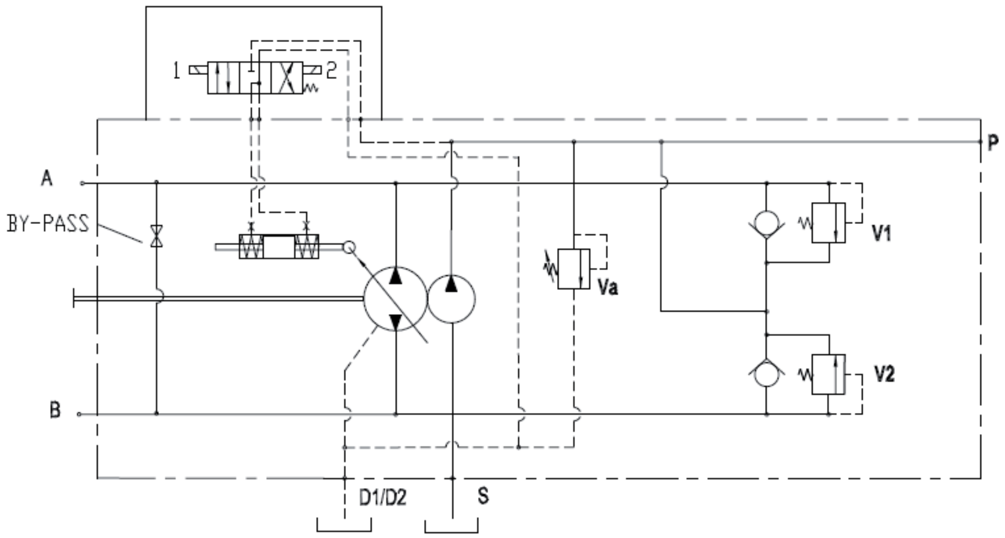


METRIC Version
A – B: Pressure Ports – 3/4" G
D1 – D2: Drain Ports – 1/2" G
S: Suction – 3/4 G
P: Boost Presure port – ¾ "-16 UNF-2B -> ¼" G
Va: Boost Pump Pressure Relief Valve
V1 – V2: Main Port Pressure Relief Valve
Bp: By-pass Valve
Sl: Stroke Limiter
Zm: Mechanical Zero adjustment screw
p: Boost Pressure Gauge Port – 1/8" G
p1: a – b Pilot Line Gauge Port – 1/4" G

SAE Version
A – B: Pressure Ports – 7/8"-14 UNF-2B
D1 – D2: Drain Ports – 3/4"-16 UNF-2B
S: Suction – 1 1/16 UNF-2B
P: Boost Pressure Port –3/4"-16 UNF-2B -> 7/16"-20 UNF-2B
Va: Boost Pump Pressure Relief Valve
V1 – V2: Main Port Pressure Relief Valve
Bp: By-pass Valve
Sl: Stroke Limiter
Zm: Mechanical Zero adjustment screw
p: Boost Pressure Gauge Port – 3/8"-24 UNF-2B
p1: a – b Pilot Line Gauge Port – 7/16"-20 UNF-2B

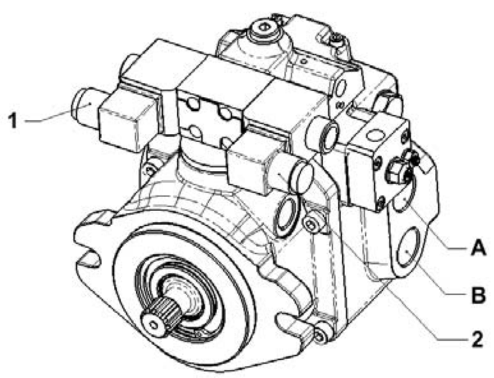
ELECTRIC TWO POSITION ON-OFF CONTROL E22-E24

By switching on one of the On-Off solenoids (standard 24V d.c. optional 12V d.c.), the pump swivels to maximum displacement in the corresponding output flow direction.
Switching off the stated solenoid will result in swivelling back the pump tozero displacement position.



Direction of rotation

Correlation between direction of rotation (shaft view) control and direction of flow.

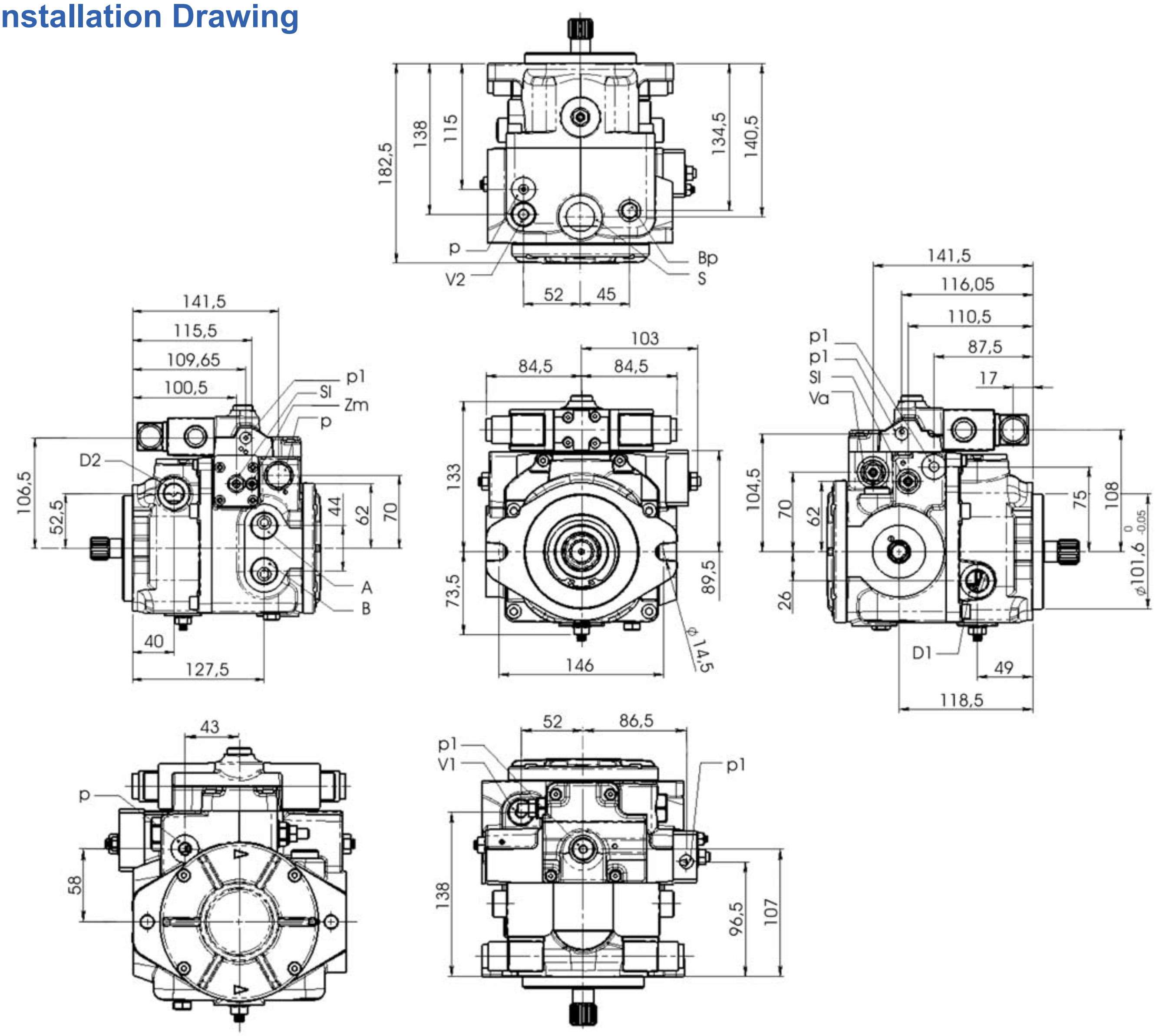


	PUMP FLOW DIRECTION	
SHAFT ROTATION	Energized Solenoid	Pressure Port
LEFT (counterclockwise)	1	B
	2	A
RIGHT (clockwise)	1	A
	2	B

ELECTRIC TWO POSITION ON-OFF CONTROL

E22-E24

Installation Drawing



METRIC Version
A – B: Pressure Ports – 3/4" G
D1 – D2: Drain Ports – 1/2" G
S: Suction – 3/4 G
P: Boost Presure port – ¾ "-16 UNF-2B -> ¼" G
Va: Boost Pump Pressure Relief Valve
V1 – V2: Main Port Pressure Relief Valve
Bp: By-pass Valve
Sl: Stroke Limiter
Zm: Mechanical Zero adjustment screw
p: Boost Pressure Gauge Port – 1/8" G
p1: a – b Pilot Line Gauge Port – 1/4" G

SAE Version
A – B: Pressure Ports – 7/8"-14 UNF-2B
D1 – D2: Drain Ports – 3/4"-16 UNF-2B
S: Suction – 1 1/16 UNF-2B
P: Boost Pressure Port –3/4"-16 UNF-2B -> 7/16"-20 UNF-2B
Va: Boost Pump Pressure Relief Valve
V1 – V2: Main Port Pressure Relief Valve
Bp: By-pass Valve
Sl: Stroke Limiter
Zm: Mechanical Zero adjustment screw
p: Boost Pressure Gauge Port – 3/8"-24 UNF-2B
p1: a – b Pilot Line Gauge Port – 7/16"-20 UNF-2B

ELECTRIC PROPORTIONAL CONTROL (with Feed-Back) ER2-ER4

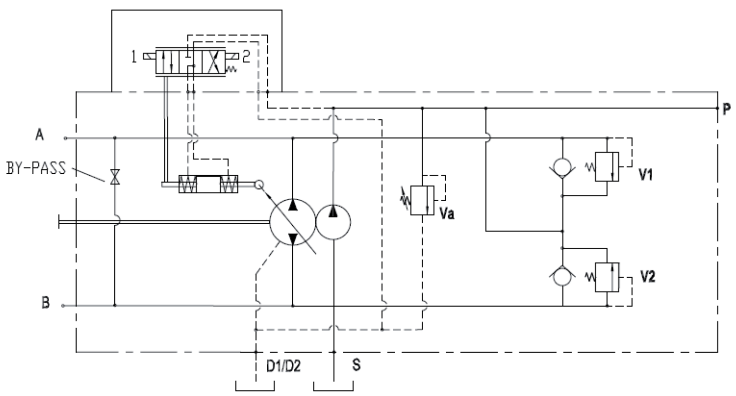
The displacement of the pump is directly proportional to the input current of one of the two proportional solenoids.

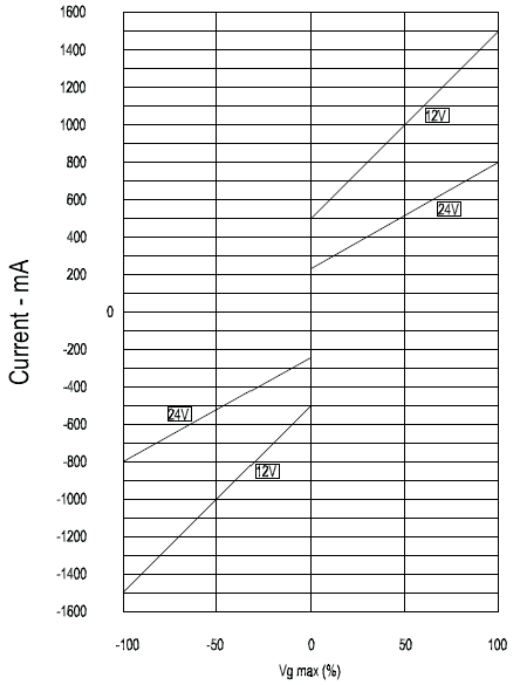
Flow direction depends on which solenoid is energized.

Standard solenoids are proportional at 24V d.c. max. current 1A.

(Optional solenoids 12V d.c. max. current 2A).

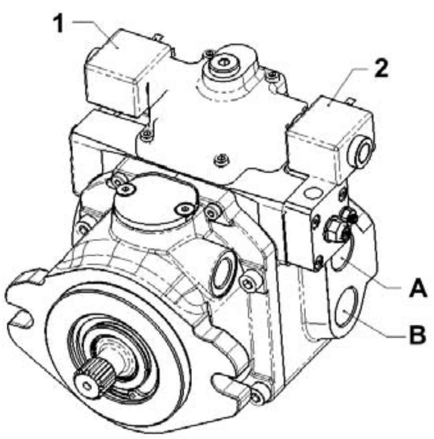
Solenoid 24V:
Current: min. 240 mA - max. 800 mA
Solenoid 12V:
Current: min. 500 mA - max. 1500 mA





Direction of rotation

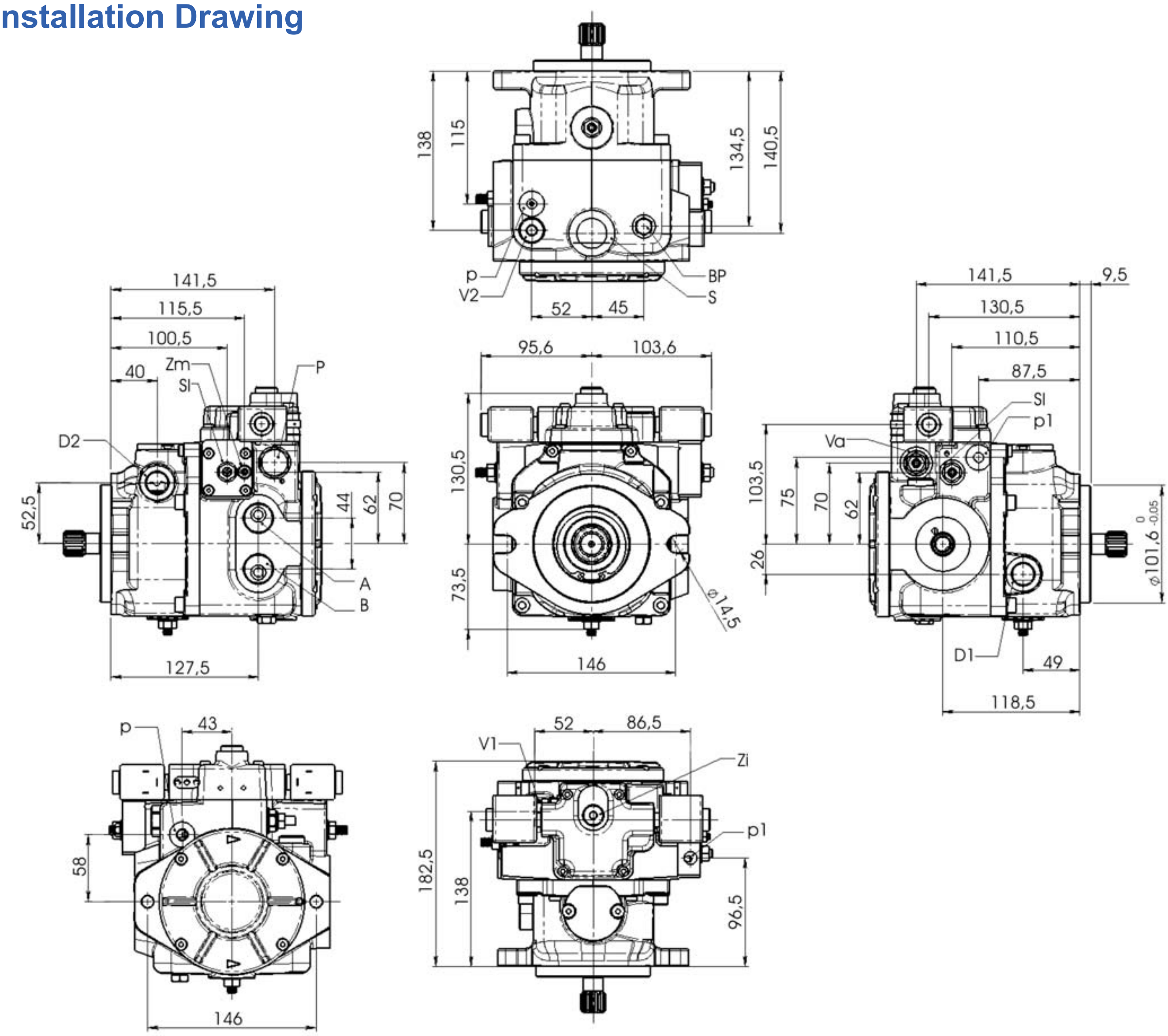
Correlation between direction of rotation (shaft view) control and direction of flow.



	PUMP FLOW DIRECTION	
SHAFT ROTATION	Energized Solenoid	Pressure Port
LEFT (counterclockwise)	1	B
	2	A
RIGHT (clockwise)	1	A
	2	B

ELECTRIC PROPORTIONAL CONTROL (with Feed-Back) ER2-ER4

Installation Drawing



METRIC Version
A – B: Pressure Ports – 3/4" G
D1 – D2: Drain Ports – 1/2" G
S: Suction – 3/4 G
P: Boost Presure port – ¾ "-16 UNF-2B -> ¼" G
Va: Boost Pump Pressure Relief Valve
V1 – V2: Main Port Pressure Relief Valve
Bp: By-pass Valve
Sl: Stroke Limiter
Zm: Mechanical Zero adjustment screw
p: Boost Pressure Gauge Port – 1/8" G
p1: a – b Pilot Line Gauge Port – 1/4" G
Zi: Hydraulic Zero

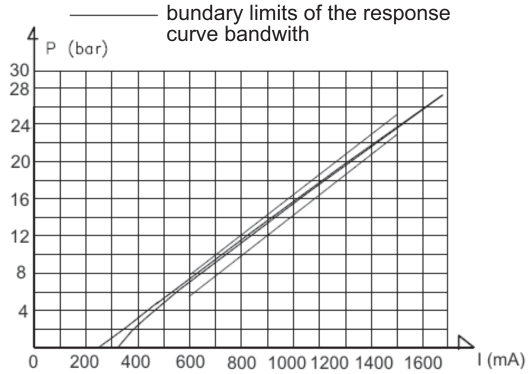
SAE Version
A – B: Pressure Ports – 7/8"-14 UNF-2B
D1 – D2: Drain Ports – 3/4"-16 UNF-2B
S: Suction – 1 1/16 UNF-2B
P: Boost Pressure Port –3/4"-16 UNF-2B -> 7/16"-20 UNF-2B
Va: Boost Pump Pressure Relief Valve
V1 – V2: Main Port Pressure Relief Valve
Bp: By-pass Valve
Sl: Stroke Limiter
Zm: Mechanical Zero adjustment screw
p: Boost Pressure Gauge Port – 3/8"-24 UNF-2B
p1: a – b Pilot Line Gauge Port – 7/16"-20 UNF-2B
Zi: Hydraulic Zero

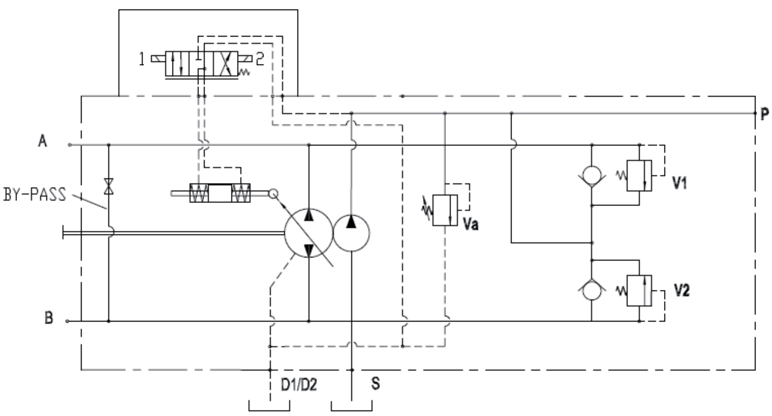
ELECTRIC PROPORTIONAL CONTROL (without Feed-Back) EP2-EP4

The displacement of the pump is directly proportional to the input current of one of the two proportional solenoids.
Flow is also influenced by the working pressure.
With a given input signal (piloting current) the pump can slightly vary the displacement and the flow when working pressure increases.
The input current of the two proportional solenoids must be controlled by an external amplifier card.
Flow direction depends on which solenoid is energized.
Standard solenoids are proportional 24V d.c. max. current 1A.
(Optional solenoids 12V d.c. max. current 2A).
For emergency operation only it is however possible to control solenoids directly with 24V d.c. voltage (or 12V d.c.), by-passing the amplifier.

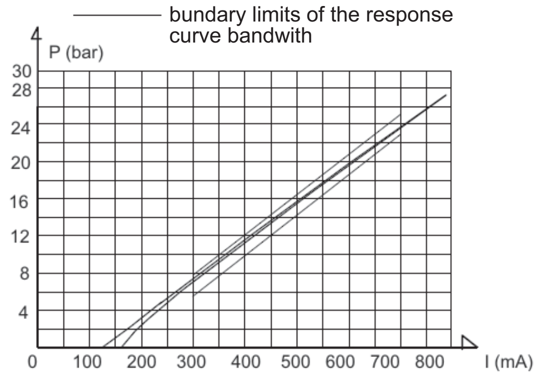
Electrical specifications:	Solenoid 12V	Solenoid 24V
Coil resistance:	5,4 Ohm	21 Ohm
Supply charachteristics:	PWM	PWM
Current range:	150 - 1.500 mA	100 - 800 mA
Dither frequence:	100 - 200 Hz	
Coil termination:	DTO4 - 2P	
Environmental protection:	IP 67	
Corrosion protection (salt spay):	72 hours (white rust)	
	200 hours (red rust)	
Connector:	DEUTSCH CONNECTOR - DTO4 - 2P	

PRESSURE VS. CURRENT CHARACTERISTIC
12 V DC coil / 5,4 Ohm - Oil Temperature 50°C



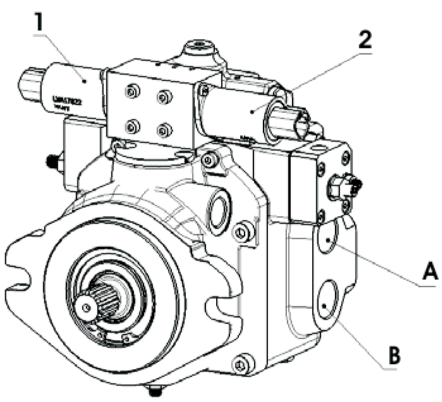


PRESSURE VS. CURRENT CHARACTERISTIC
24 V DC coil / 21 Ohm - Oil Temperature 50°C



Direction of rotation

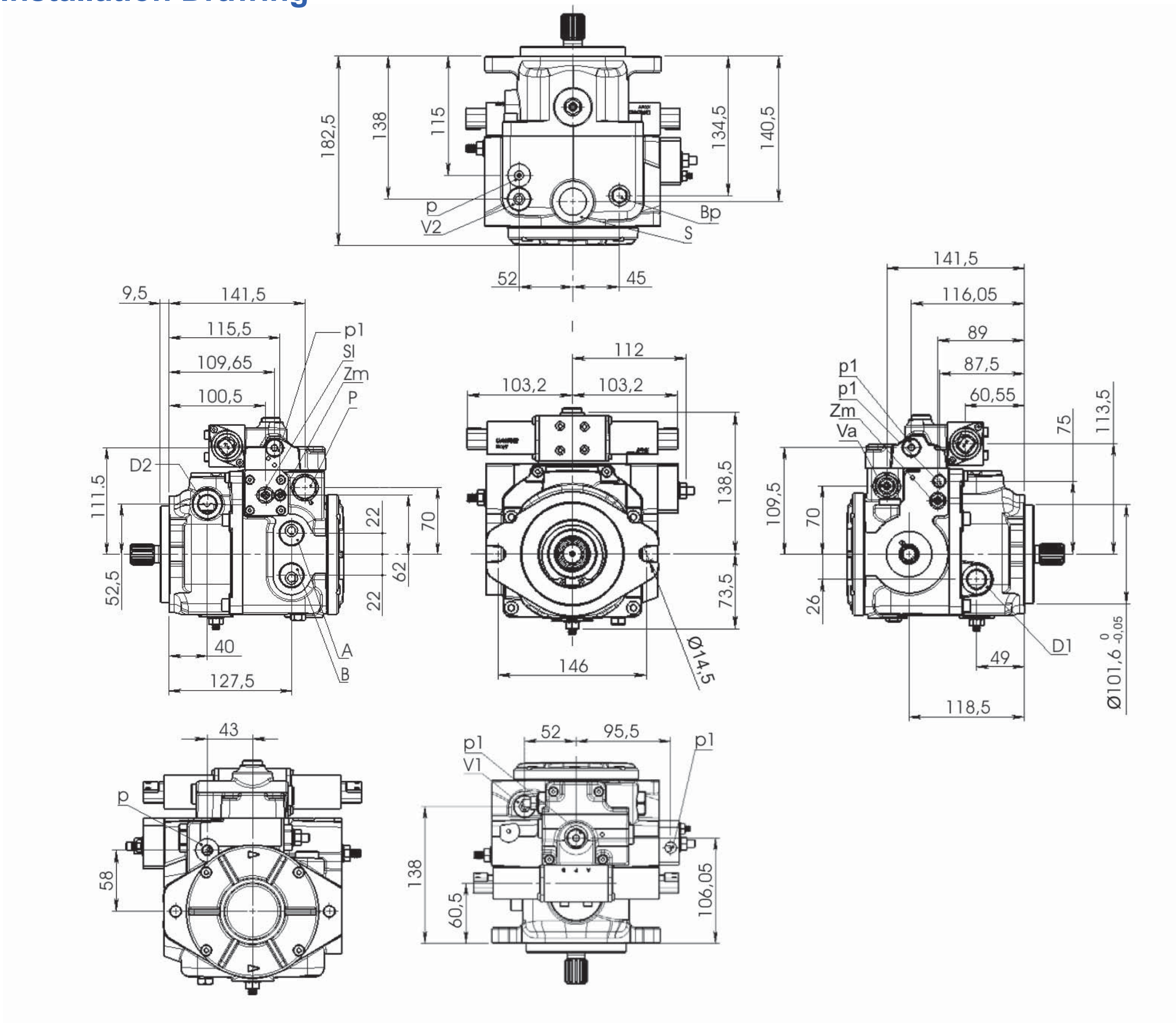
Correlation between direction of rotation (shaft view) control and direction of flow.



SHAFT ROTATION	PUMP FLOW DIRECTION	
	Energized Solenoid	Pressure Port
LEFT (counterclockwise)	1	B
	2	A
RIGHT (clockwise)	1	A
	2	B

ELECTRIC PROPORTIONAL CONTROL (without Feed-Back) EP2-EP4

Installation Drawing



METRIC Version

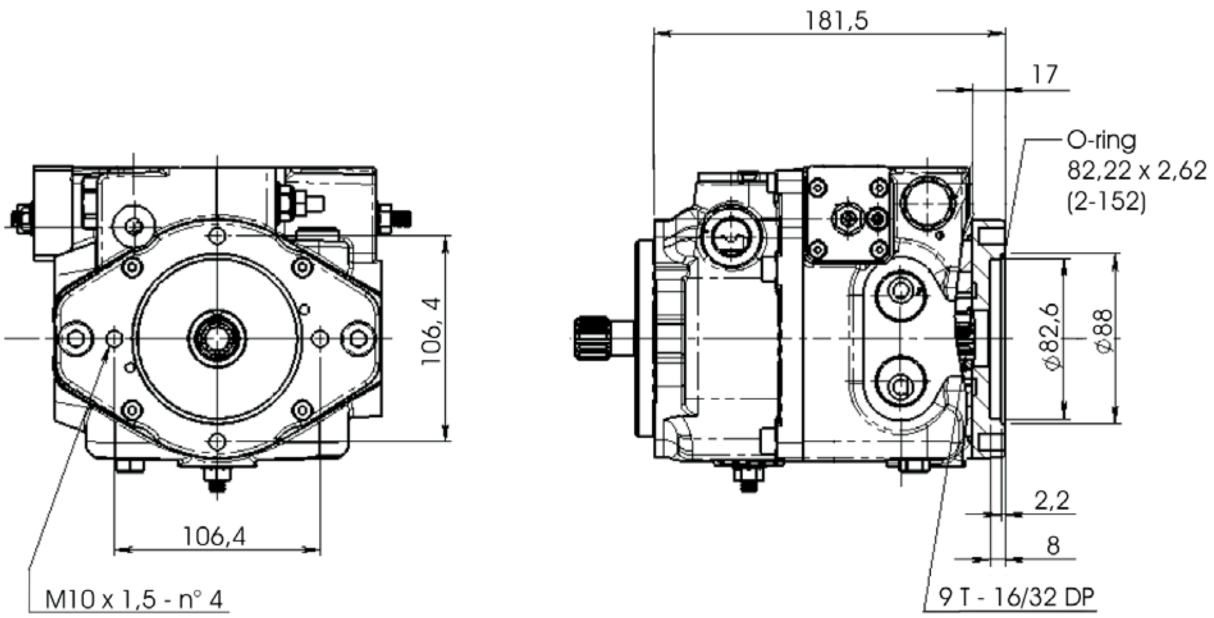
A – B: Pressure Ports – 3/4" G
D1 – D2: Drain Ports – 1/2" G
S: Suction – 3/4 G
P: Boost Presure port – ¾ "-16 UNF-2B -> ¼" G
Va: Boost Pump Pressure Relief Valve
V1 – V2: Main Port Pressure Relief Valve
Bp: By-pass Valve
Sl: Stroke Limiter
Zm: Mechanical Zero Adjustment Screw
p: Boost Pressure Gauge Port – 1/8" G
p1: a – b Pilot Line Gauge Port – 1/4" G

SAE Version

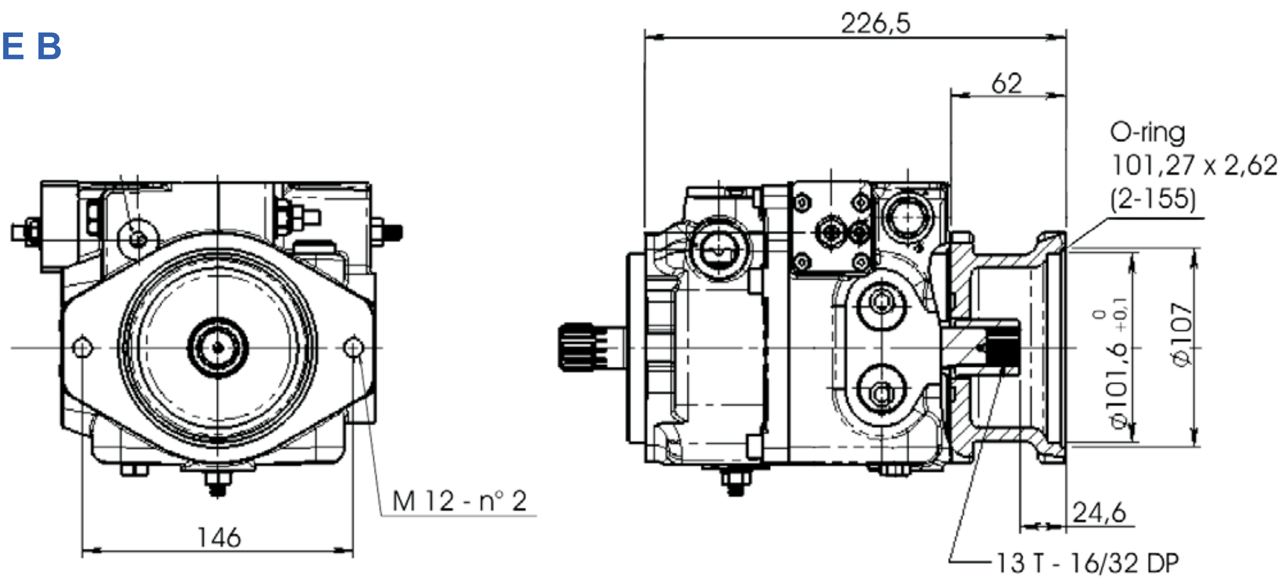
A – B: Pressure Ports – 7/8"-14 UNF-2B
D1 – D2: Drain Ports – 3/4"-16 UNF-2B
S: Suction – 1 1/16 UNF-2B
P: Boost Pressure Port –3/4"-16 UNF-2B -> 7/16"-20 UNF-2B
Va: Boost Pump Pressure Relief Valve
V1 – V2: Main Port Pressure Relief Valve
Bp: By-pass Valve
Sl: Stroke Limiter
Zm: Mechanical Zero Adjustment Screw
p: Boost Pressure Gauge Port – 3/8"-24 UNF-2B
p1: a – b Pilot Line Gauge Port – 7/16"-20 UNF-2B

THROUGH DRIVES
Installation Drawing

SAE A

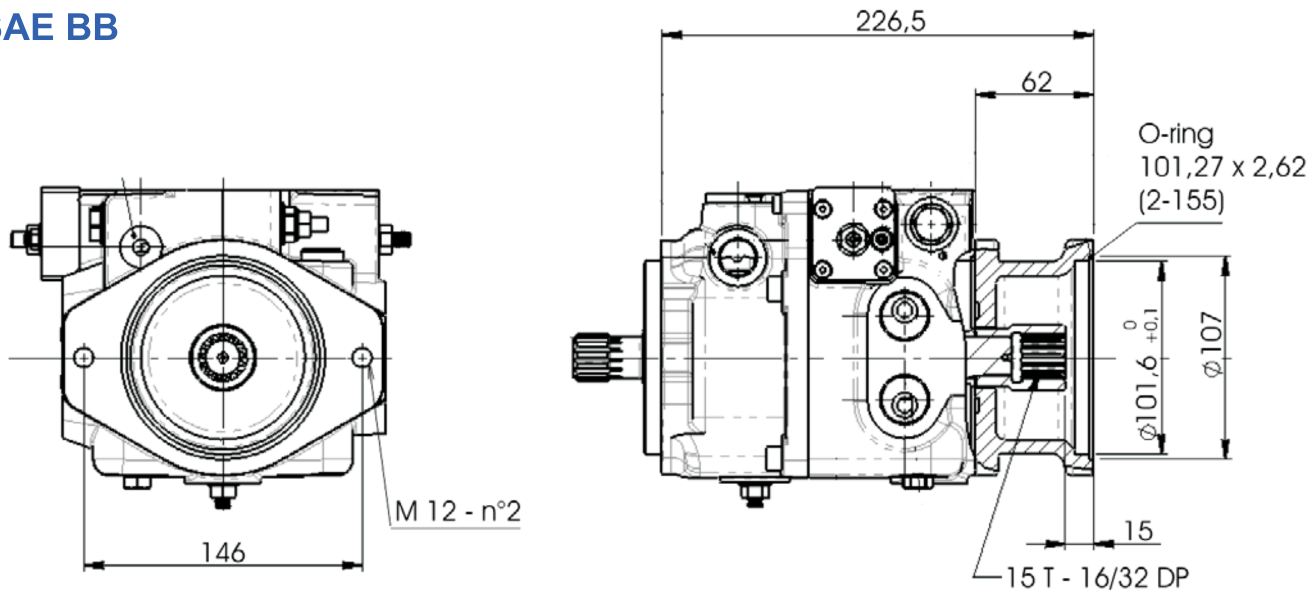


SAE B



THROUGH DRIVES (continued)

SAE BB



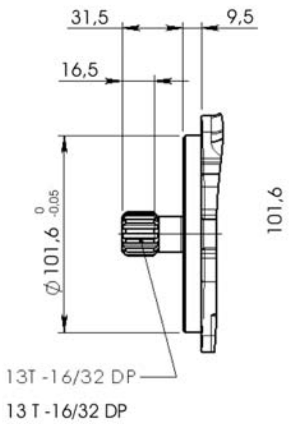
Code	Denomination	SHAFT END					
		1	2	3	4	5	6
1	Without through drive with charge pump	•			•	•	•
2	Without through drive without charge pump	•				•	•
3	SAE A = 9T 16/32 DP with charge pump	•			•	•	•
4	SAE B = 13T 16/32 DP with charge pump			•			
5	Tandem pump combination (short version)		•				
6	SAE A = 9T 16/32 DP without charge pump	•			•	•	•
7	SAE B = 13T 16/32 DP without charge pump			•			
8	Tandem pump combination c/w through drive SAE A = 9T 16/32 DP	•				•	•
9	Tandem pump combination c/w through drive SAE B = 13T 16/32 DP			•			
10(1)	Tandem pump combination c/w through drive SAE B-B = 15T 16/32 DP			•			

Notes:

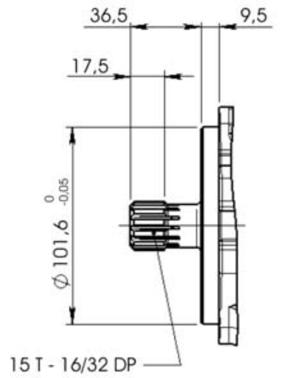
(1) With coupling Internal Splined - Female 13T - Female 15T

SHAFT
Installation Drawing

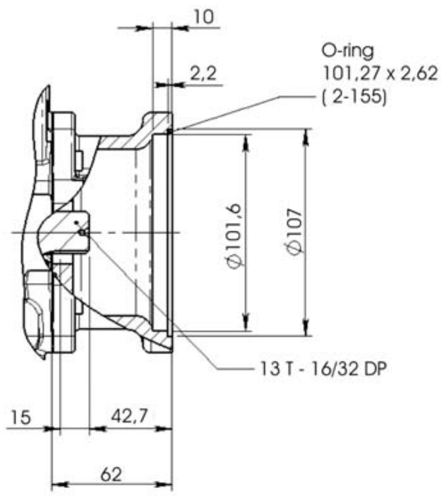
Type 1 - 13T Male



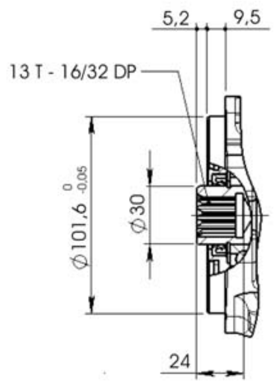
Type 2 - 15T Male



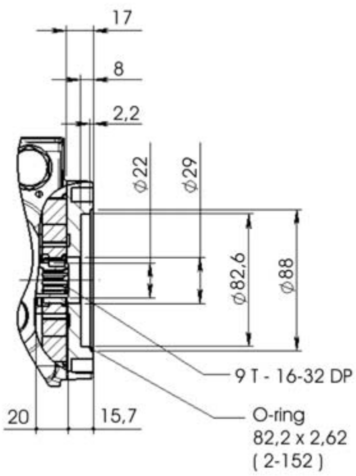
Type 3 - 13T Male



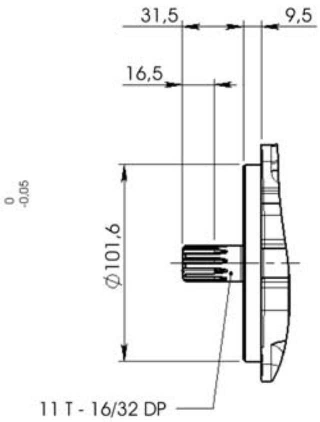
Type 4 - 13T Female



Type 5 - 9T Female



Type 6 - 11T Male



Code	Denomination	Single	1° Tandem	2° Tandem
1(1)	Splined 13T 16/32 DP / Internal splined 9T 16/32 DP	•	•	•
2(2)	Splined 15T 16/32 DP / Splined 13T 16/32 DP (Tandem)	•	•	
3(3)	Splined 15T 16/32 DP / Splined 13T 16/32 DP	•	•	•
4(4)	Splined 13T 16/32 DP / Internal splined 9T 16/32 DP (Tandem)	•	•	•
5(5)	Splined 15T 16/32 DP / Internal splined 9T 16/32 DP (SAE-A)	•	•	
6(1)	Splined 11T 16/32 DP / Internal splined 9T 16/32 DP	•	•	•

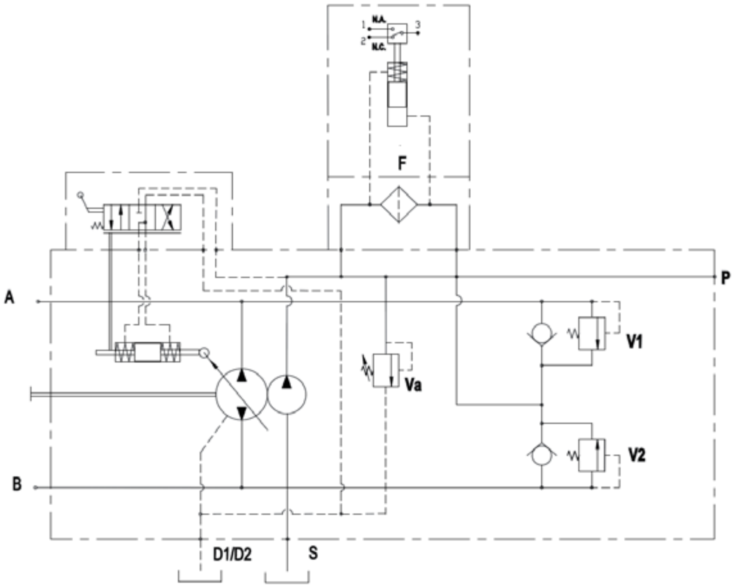
Note:

(1) Used for single pump
Used for second tandem pump 21/28 + 21/28
Used for second tandem pump 50/64 + 21/28
(2) Used for first tandem pump 21/28 + 21/28 short version
(3) Used for single pump with through drive SAE B
Used for first tandem pump 21/28 + 21/28 with through drive SAE B
Used for second tandem pump 50/64 + 21/28 with through drive SAE B
(4) Used for second tandem pump 21/28 + 21/28 short version
(5) Used for single pump with through drive SAE A

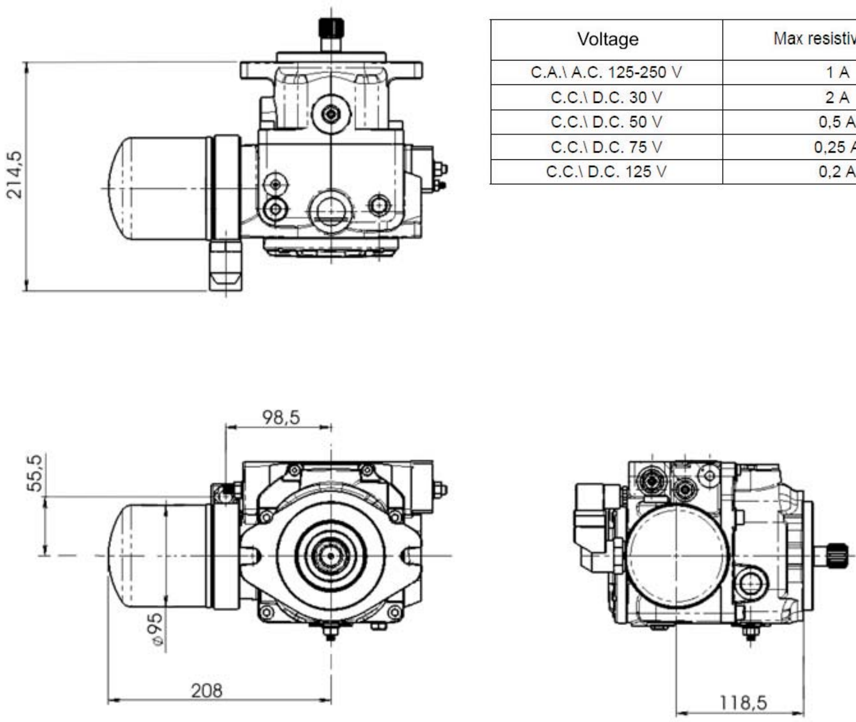
ACCESSORIES - FILTERS

In order to guarantee an optimum stability of the fluid contamination conditions the pump TPV 3200 series can be equipped with a filter positioned on the delivery outlet of the booster pump.
Only the flow necessary to reintegrate the lost oil due to drainage will pass through this filter, all the excess flow, which is drained by the booster pump valve, is therefore not filtered, in this way it is garantee a longer life of the filter.
Upon request it is possibile to add an electrical filter clogging sensor (Connector DIN 43650A).

BOOSTER PUMP FILTER (with electric clogging sensor) FE



Installation Drawing



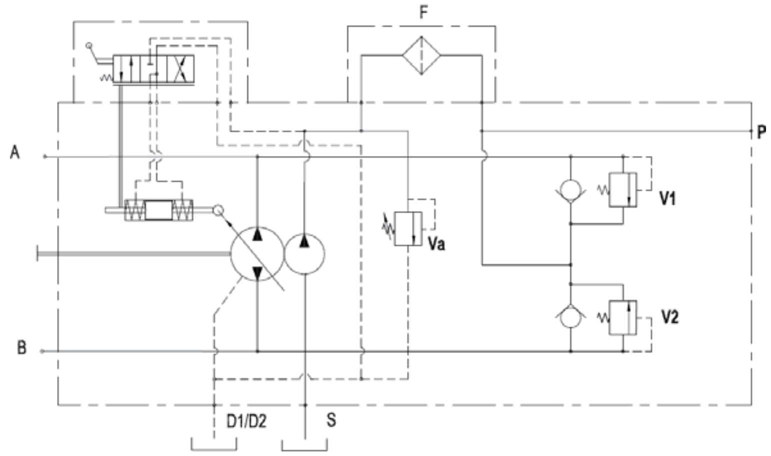
Electric specification

Voltage	Max resistive load	Max inductive load
C.A.\ A.C. 125-250 V	1 A	1 A
C.C.\ D.C. 30 V	2 A	2 A
C.C.\ D.C. 50 V	0,5 A	0,5 A
C.C.\ D.C. 75 V	0,25 A	0,25 A
C.C.\ D.C. 125 V	0,2 A	0,03 A

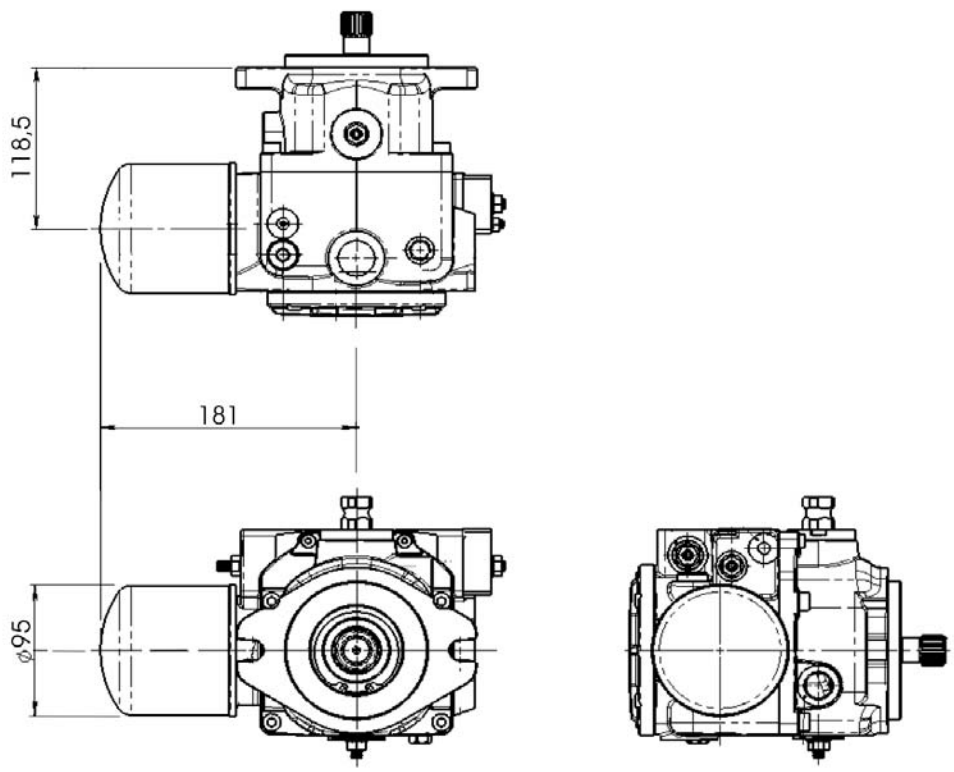
ACCESSORIES - FILTERS (continued)

BOOSTER PUMP FILTER (without clogging sensor)

FI



Installation Drawing

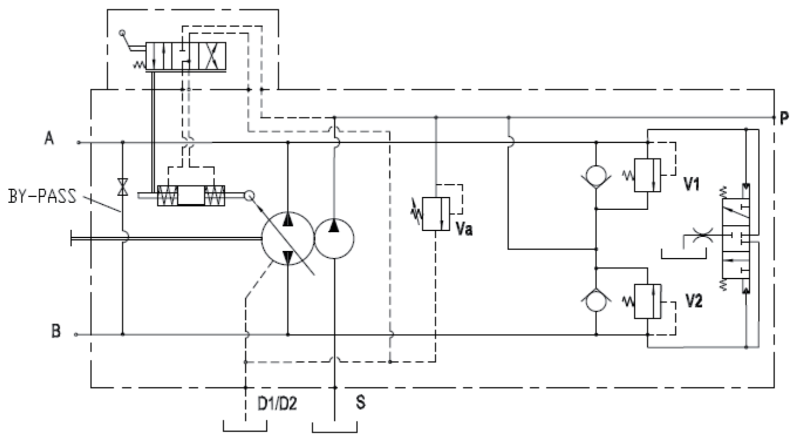


ACCESSORIES

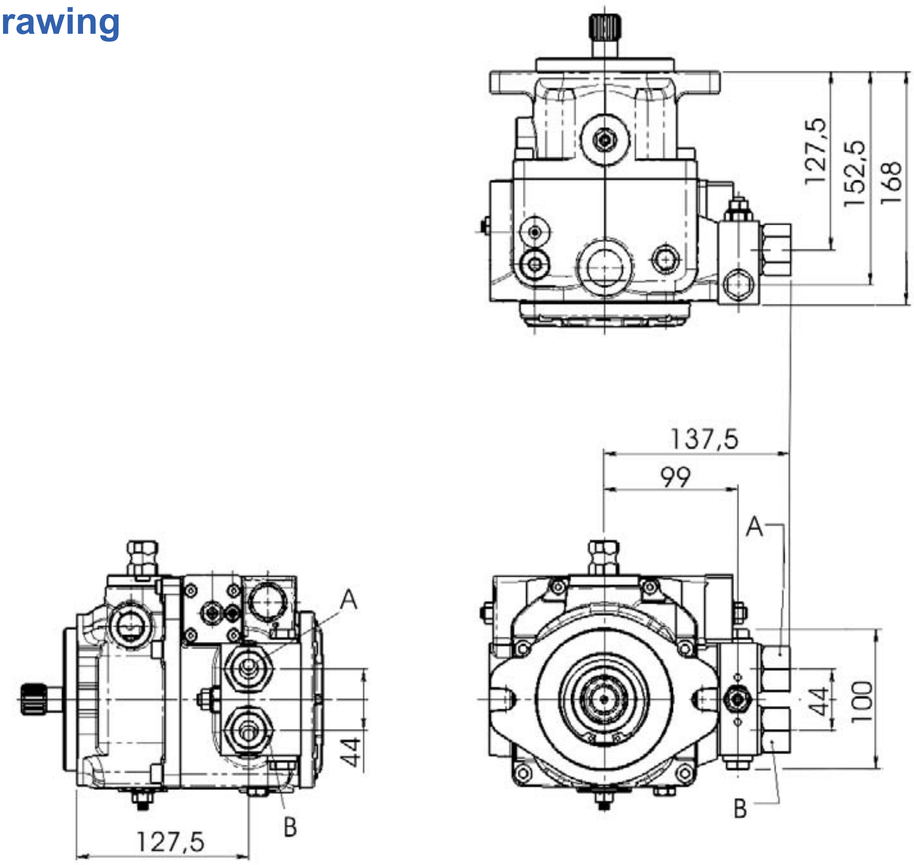
PURGE VALVE

VS

The purge valve allows an oil cooling action, which is recommended when operating at high speed and power.



Installation Drawing

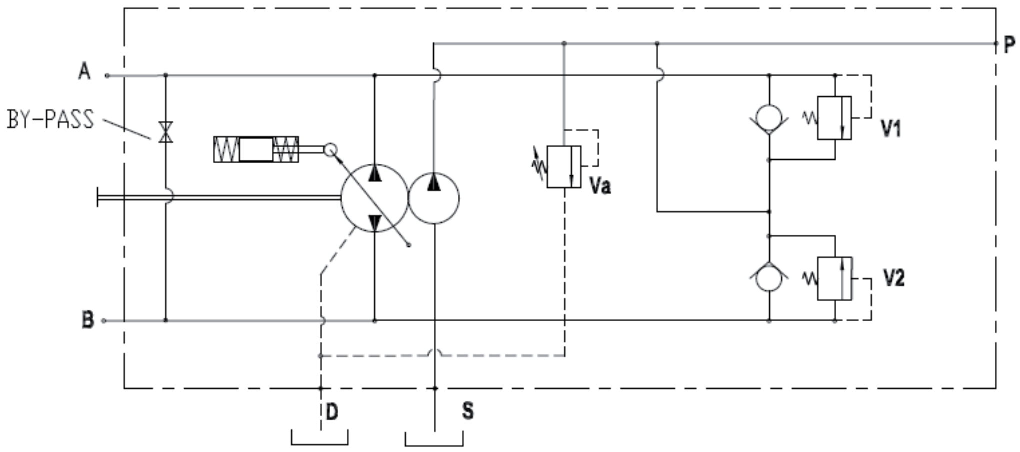


ACCESSORIES (continued)

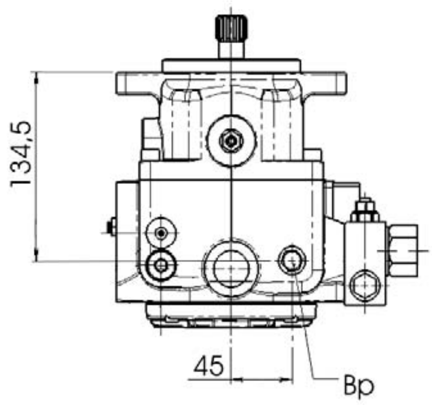
BY-PASS VALVE

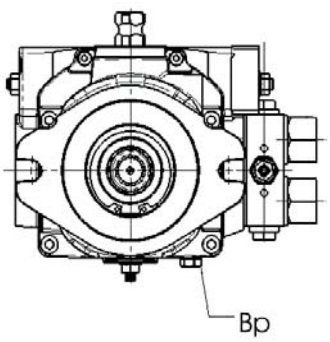
Bp

The by-pass valve is a tap inside the pump that allows, if necessary, to connect the pressure port line A and B.



Installation Drawing





ACCESSORIES (continued)

ELECTRIC CUT-OFF VALVE

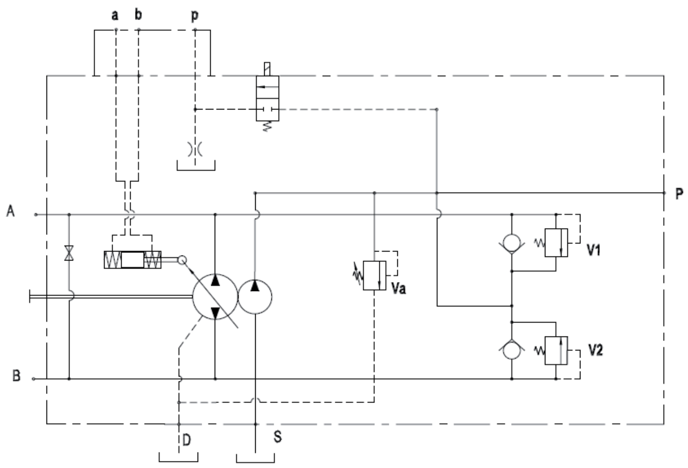
P1- P2

The electric cut-off valve, brings to zero the displacement of the pump when power supply to the on/off solenoid is cut-off.

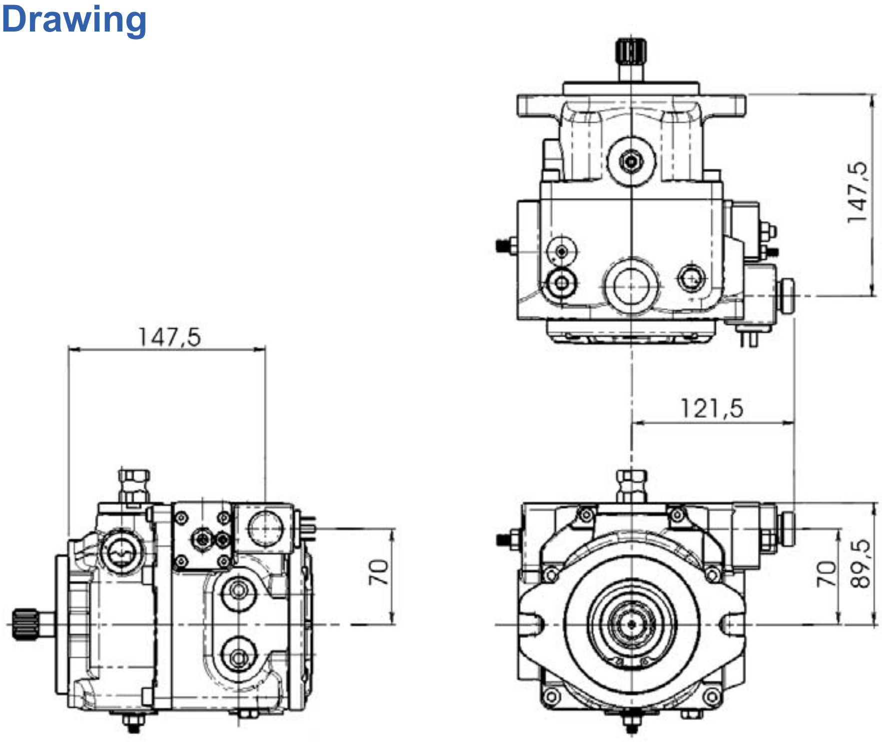
Feed voltage is 12V d.c or 24V d.c.

Is not possible to assemble the cut-off valve on the tandem pump short version.

CONNECTOR = DIN 43650A

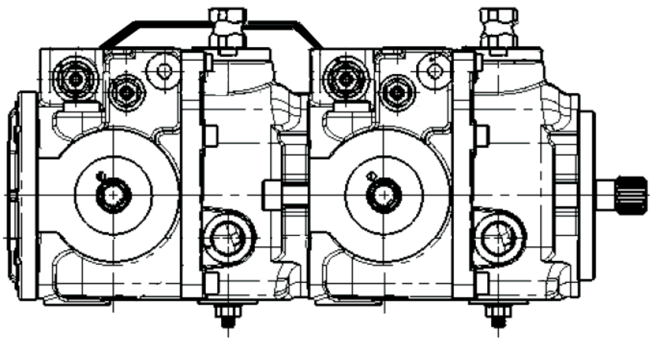


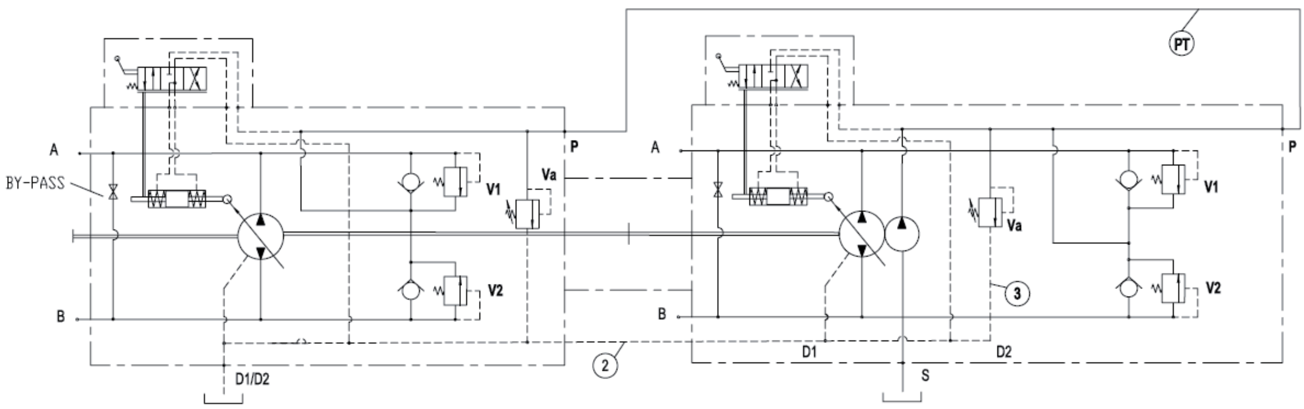
Installation Drawing



TANDEM PUMP SHORT VERSION

TPVT C





The hose (1) used to connect the charge pressure ports (P) is supplied with the units.

The hoses (2) and (3) connecting the drain ports must be relized and mounted by the customer.

Warning: Ordering a tandem pump it is necessary to indicate for each pump the kind of shaft and the through drive option needed.

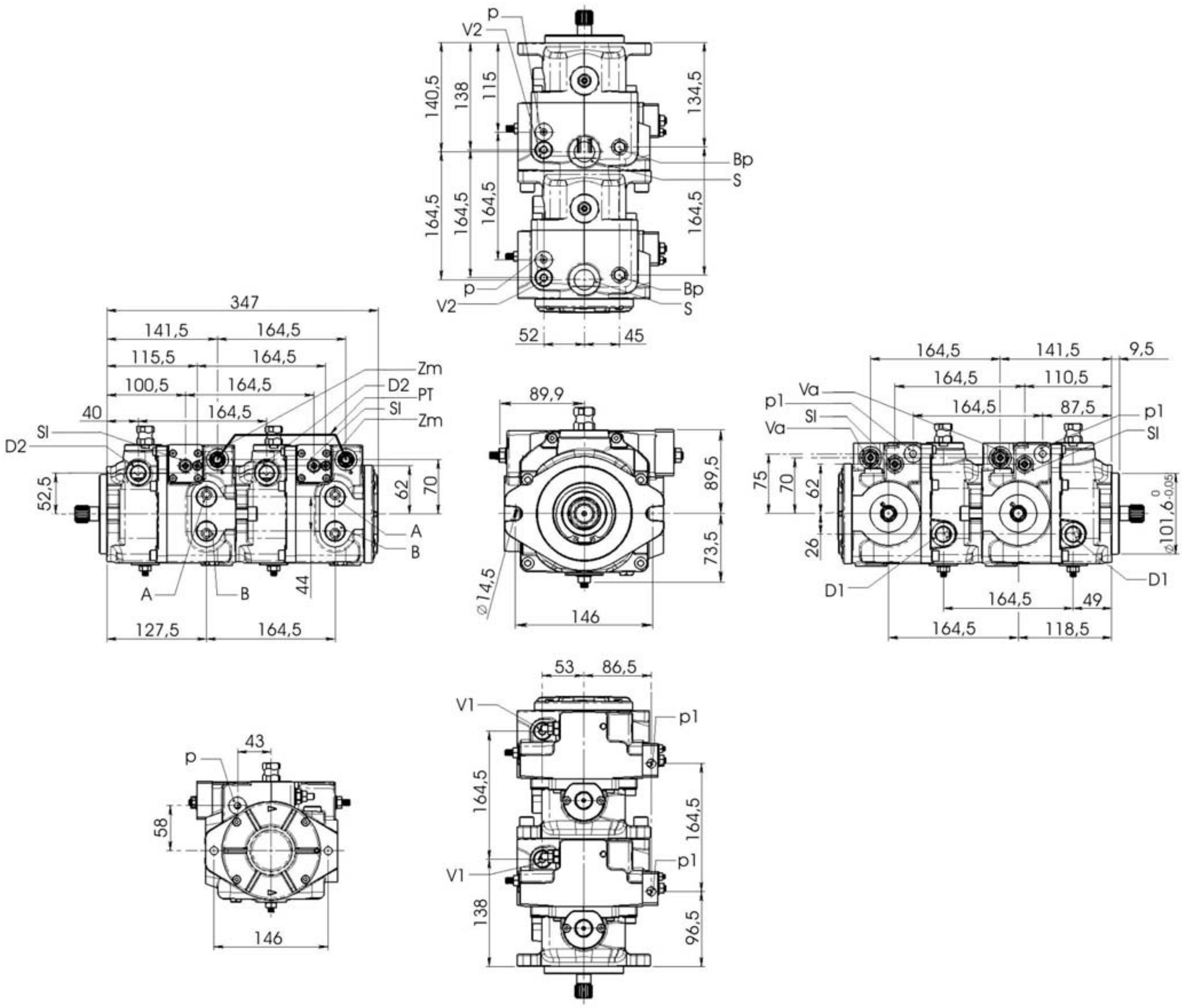
With this configuration, only the second pump mount the boost pump.

Configurations	TPV 3200 (21/28 + 21/28) Short version	
Pump	1st.	2nd.
Shafts	**2**	**4**

TANDEM PUMP SHORT VERSION

TPVT C

Installation Drawing



METRIC Version

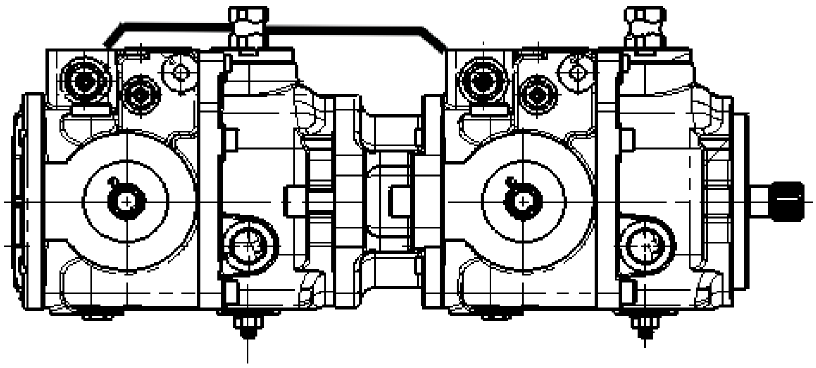
A – B: Pressure Ports – 3/4" G
D1 – D2: Drain Ports – 1/2" G
S: Suction – 3/4 G
P: Boost Presure port – ¾ "-16 UNF-2B -> ¼" G
Va: Boost Pump Pressure Relief Valve
V1 – V2: Main Port Pressure Relief Valve
Bp: By-pass Valve
Sl: Stroke Limiter
Zm: Mechanical Zero adjustment screw
p: Boost Pressure Gauge Port – 1/8" G
p1: a – b Pilot Line Gauge Port – 1/4" G
PT: Boost Pressure connecting line

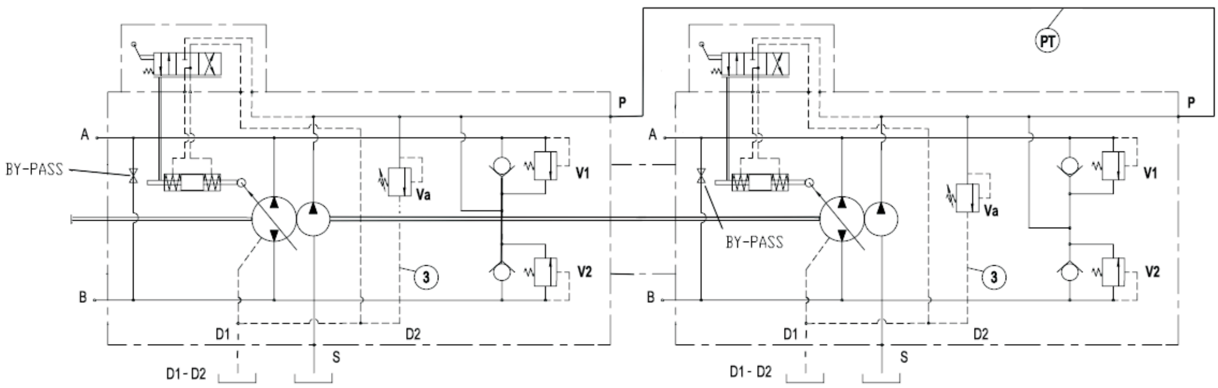
SAE Version

A – B: Pressure Ports – 7/8"-14 UNF-2B
D1 – D2: Drain Ports – 3/4"-16 UNF-2B
S: Suction – 1 1/16 UNF-2B
P: Boost Pressure Port –3/4"-16 UNF-2B -> 7/16"-20 UNF-2B
Va: Boost Pump Pressure Relief Valve
V1 – V2: Main Port Pressure Relief Valve
Bp: By-pass Valve
Sl: Stroke Limiter
Zm: Mechanical Zero adjustment screw
p: Boost Pressure Gauge Port – 3/8"-24 UNF-2B
p1: a – b Pilot Line Gauge Port – 7/16"-20 UNF-2B
PT: Boost Pressure connecting line

TANDEM PUMP LONG VERSION

TPVT L





The hose (1) used to connect the charge pressure ports (P) is supplied with the units.

The hoses connecting the drain ports must be relized and mounted by the customer.

Warning: Ordering a tandem pump it is necessary to indicate for each pump the kind of shaft and the through drive option needed.

With this configuration, both the pumps mount the boost pump.

Configurations	TPV 3200 (21/28 + 21/28)	
Pump	1st.	2nd.
Shafts	**3(1)**	**1(2)**

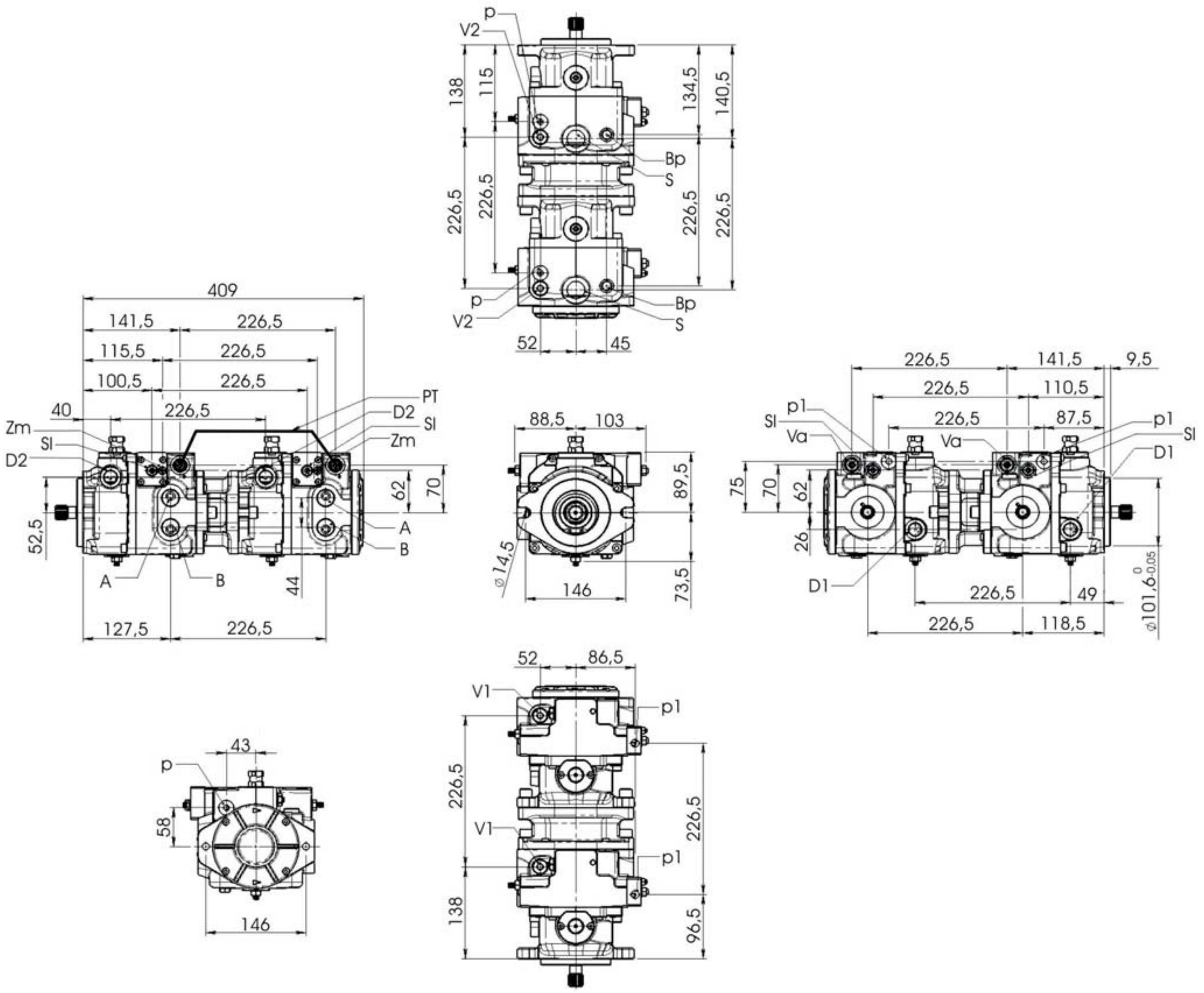
(1) It is necessary to mount on the first pump the through drive-SAE B

(2) Splined Shaft 13T 16/32 DP (TPV 3200 21/28)

TANDEM PUMP LONG VERSION

TPVT L

Installation Drawing



METRIC Version

A – B: Pressure Ports – 3/4" G
D1 – D2: Drain Ports – 1/2" G
S: Suction – 3/4 G
P: Boost Presure port – ¾ "-16 UNF-2B -> ¼" G
Va: Boost Pump Pressure Relief Valve
V1 – V2: Main Port Pressure Relief Valve
Bp: By-pass Valve
Sl: Stroke Limiter
Zm: Mechanical Zero adjustment screw
p: Boost Pressure Gauge Port – 1/8" G
p1: a – b Pilot Line Gauge Port – 1/4" G
PT: Boost Pressure connecting line

SAE Version

A – B: Pressure Ports – 7/8"-14 UNF-2B
D1 – D2: Drain Ports – 3/4"-16 UNF-2B
S: Suction – 1 1/16 UNF-2B
P: Boost Pressure Port –3/4"-16 UNF-2B -> 7/16"-20 UNF-2B
Va: Boost Pump Pressure Relief Valve
V1 – V2: Main Port Pressure Relief Valve
Bp: By-pass Valve
Sl: Stroke Limiter
Zm: Mechanical Zero adjustment screw
p: Boost Pressure Gauge Port – 3/8"-24 UNF-2B
p1: a – b Pilot Line Gauge Port – 7/16"-20 UNF-2B
PT: Boost Pressure connecting line

ORDER CODE

3200	TPV	21	21	AM2	1	14	R	1	G	00	-
0	1	2	2A	3	4	5	6	7	8	9	10

		Pag.
	0 - Pump Series	
3200	= Pump TPV 3200	
	1 - Pump Type	
TPV	= Closed loop circuit single pump	
TPVT C	= Closed loop circuit tandem pump (short version)	42
TPVT L	= Closed loop circuit tandem pump (long version)	44
	2 - Primary or Single Pump Displacement	11
21	= 21 cm^3/n	
28	= 28 cm^3/n	
	2A - Secondary or Tandem Pump Displacement	11
21	= 21 cm^3/n	
28	= 28 cm^3/n	
	3 - Controls	
AM2	= Automotive 12V	12
AM4	= Automotive 24V	12
IND	= Hydraulic proportional without feed-back (with direct port on the distributor)	16
INP	= Hydraulic proportional without feed-back (with ppilot port on the valve)	18
EI 2	= Electric impulse 12V	20
EI 4	= Electric impulse 24V	20
IRX	= Hydraulic proportional with feed-back	22
LRX	= Manual lever with feed-back	24
LNX	= Manual with zeroing	26
LWX	= Manual without zeroing	
E 22	= Electric two position On-Off 12V	28
E 24	= Electric two position On-Off 24V	28
ER 2	= Electric proportional with feed-back 12V	30
ER 4	= Electric proportional with feed-back 24V	30
EP 2	= Electric proportional without feed-back 12V	32
EP 4	= Electric proportional without feed-back 24V	32
EH 2	= Electric proportional with feed-back 12V + Hydraulic proportional with feed-back	
EH 4	= Electric proportional with feed-back 24V + Hydraulic proportional with feed-back	
	4 - Through Drive Option	34
1	= Without through drive with charge pump	
2	= Without through drive without charge pump	
3	= SAE A = 9 teeth 16/32 DP with charge pump	
4	= SAE B = 13 teeth 16/32 DP with charge pump	
5	= Tandem pump combination short version	
6	= SAE A = 9 teeth 16/32 DP without charge pump	
7	= SAE B = 13 teeth 16/32 DP without charge pump	
8	= Tandem combination with SAE A = 9 teeth 16/32 DP	
9	= Tandem combination with SAE B = 13 teeth 16/32 DP	
10	= Tandem combination with SAE BB = 15 teeth 16/32 DP	

ORDER CODE (continued)

3200	TPV	21	21	AM2	1	14	R	1	G	00	-
0	1	2	2A	3	4	5	6	7	8	9	10

			Pag.
	5 - Pressure Relief Valve Setting		
14	= 140 bar		
17	= 170 bar		
21	= 210 bar		
25	= 250 bar (standard)		
30	= 300 bar		
35	= 350 bar		
	6 - Direction of Rotation (shaft view)		
R	= Right (clockwise)		
L	= Left (counter-clockwise)		
	7 - Shaft End		36
	Mounting Flange Side	**Trough Drive Side**	
1	= Splined male 13 teeth 16/32 DP	Internal splined 9 teeth 16/32 DP	
2	= Splined male 15 teeth 16/32 DP	Splined male 13 teeth 16/32 DP (tandem)	
3	= Splined male 15 teeth 16/32 DP	Splined male 13 teeth 16/32 DP	
4	= Internal splined 13 teeth 16/32 DP	Internal splined 9 teeth 16/32 DP (tandem)	
5	= Splined male 15 teeth 16/32 DP	Internal splined 9 teeth 16/32 DP (SAE A)	
6	= Splined male 11 teeth 16/32 DP	Internal splined 9 teeth 16/32 DP	
	8 - Ports		
G	= Metric (BSPP threads)		
U	= SAE (UNF threads)		
	9 - Optional		
00	= Without optional		
AC	= C.T. distribution (motor swash plate)		
FI	= Filter without clogging sensor		38
FE	= Filter with clogging sensor		37
FR	= Remote mounted filter		
01	= Power limiter		
P1	= Pressure Cut-Off valve 12V		41
P2	= Pressure Cut-Off valve 24V		41
VS	= Purge valve		39
II	= Hydraulic inching		12
IM	= Mechanical inching		14
	10 - Special Versions (blank if not request)		

As HANSA-TMP has a very extensive range of products and some products have a variety of applications, the information supplied may often only apply to specific situations.

If the catalogue does not supply all the information required, please contact HANSA-TMP.
In order to provide a comprehensive reply to queries we may require specific data regarding the proposed application.

Whilst every reasonable endeavour has been made to ensure accuracy, this publication cannot be considered to represent part of any contract, whether expressed or implied.

HANSA-TMP reserves the right to amend specifications at their discretion.

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