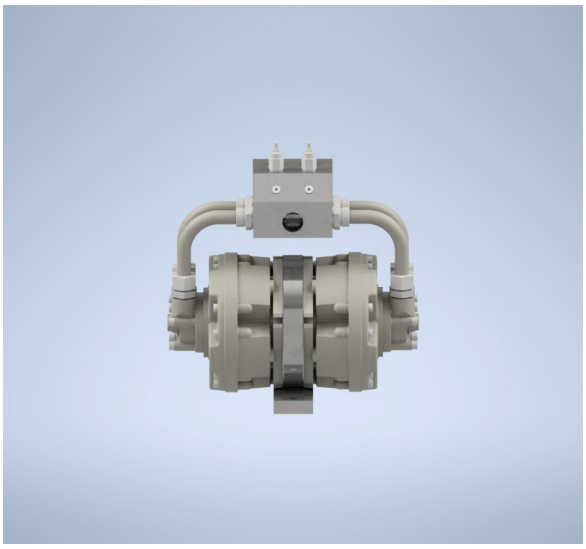
Radial-piston **fl**ow-divider

RPC to RPD



FLOW EQUALIZER*FLOW DIVIDER

Flow divider application

Synchronised running

If several motors or cylinders are operate from a single pump without any means of controlling their individual flows only the motor or cylinder with the lowest pressure requirement would start its work cycle. The motor or cylinder with the next lowest pressure requirement would only start when the first unit has completed its work cycle. This mode of operation is generally un desi ra ble and it is therefore necessary for the total pump fl ow to be divided into a series of partia fl ows.This can be achieved in the following ways:

- Throttles or flow regulation valves in each of the motor or cylinders connections.
- Oprerating the units in a series circuit. •

With flow divider valves for 2 sections. •

With flow dividers of various designs.

Rpoint flow dividers are of the rotating motor type and offer, indipendently of their design, the following synchro - ni sation advantages:

- High degree of synchronisation even with the simpler gear-motor fl ow dividers.
- High degree of synchronisation is maintained over a wide range of flows.
- Due to low leakage rates in the individual section the high degree of synchronisation is maintained with differing load conditions.

The use of flow dividers is not complicated if applied with an appropriate hydraulic circuit design. Additional installation alterations are not necessary.

For applications, where only a lower degree of synchroni sation is necessary, Rpoint offers flow divider valves, too. These valves are a very economical ternative.

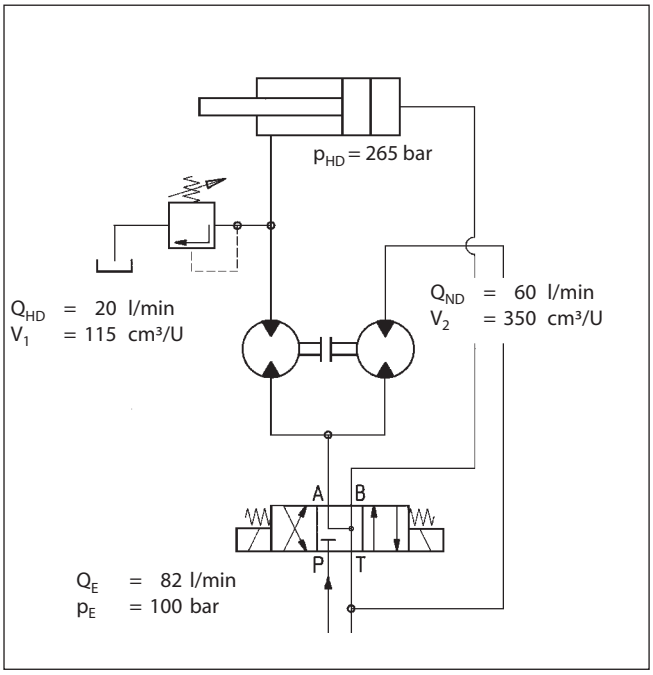
Pressure multipliers

As mentioned earlier as well as operating as a synchroni sing instrument the flow divider can be utilised as a pressure multiplier. The entire range of gear-motor flow dividers can be used for this type of application and due their low internal pressure losses and low cost they often represent the optimal solution.

The RPC series is suitable when the requiered output pressure exceeds 300 bar. It is possible, on request, to provide special units when a large difference in in dividual sction displacements in order to achieve high pressure multiplication ratios.

The pressure values in the example diagramm below are indicative of an RPC. The theoretical output pressure value of approx. 400 bar will be lower due to effi ency losses. It should be noted that the pressure gain achie vedis made possible through an increase in system flow. This type of hydraulic circuit can be used where a low pressure circuit is already in use and where there is only need of s small high pressure flow.

The installation of a supplementary high pressure circuit with pump, electric motor, pressure relief valve and manometer would not be convient in this case as it would be possible to utilise the existing low pressure circuit.



Lubricating-oil flow divider

Shafts with multiple sets of friction bearings require a sure supply of lubrifi cating oil in equal quantities to each of the bearings. With the gear-motor flow dividers, that do not have any external leakages, if the gear of one of the sections are turning then a synchronised flow in all the other sections is ensured. It is therefore only necessary to check the speed of on of the shafts with an electronic sensor and Rpoint can be supply the component required for this solution.

Flow divider application

Synchronisation differences

With particular reference to the gear-motor flow dividers RH but also for the radial-motor flow dividers RPC and RPD synchronisation differences depend on the following parameters:

- Oil viscosity and temperature
- Pressure load varability
- System pressure levels
- Total flow rate to be divided

Precise indications of synchronisation levels are only possible if the details of all the above parameters are known.

A general indication may be obtained from the following values:

RHA serie 10 and 20 (aluminium housing)

running more than 2200 rpm

synchronisation tollerances ± 1,5 bis ± 2,0 %

RHC serie 30 and 35 (cast iron housing)

synchronisation tollerances ± 2 % bis ± 3 %

RPC synchronisation tollerances± 0,5 bis ± 0,8 %

RPD synchronisation tollerances ± 0,5 bis ± 0,8 %

Rpoint is able to carry out test-bench simulations of specified working conditions in order to determine the synchronisation levels of a customer's particular ap plicati on. In this way it is possible for the customer to avoid incorporating large “safety margins” in the design.

Internal pressure drop in gear-motor flow dividers

The RH geared flow dividers have an approximate pressure loss of 3-5 bar. Whilst the oil flow rate is a determining factor, it is possible that particular units will actually achieve values greater than those stated above.

Internal pressure drop in radial-piston flow dividers

The radial piston motor design has larger pressure drops than the gear motor design and the pressure drop also depend on the outlet pressure. The following of the outlet pressure for all RPC an RPD models:

Required output pressure p_o (bar)	Input pressure p_i (bar)	Pressure drop Δp (bar)
50	60	10
80	100	20
100	120	20
140	175	35
150	190	40
180	225	45
190	240	50
210	265	55
230	285	55

pressure drop in radial-piston flow-dividers RPC and RPD

Means of overcoming the disadvat-ge of pressure drop

- Often for cylinders the high pressure is only required in one flow direction. The flow divider can be built into the return line were the pressure is much lower.
- In several applications synchronisation is not required during the high pressure phase of the work cycle, for example, in a 2 cylinder press synchronisation is only needed when the cylinders are working at low pressure. During the high pressure phase of the work cycle the fl ow divider can be by-passed using check valves.

Flow divider application

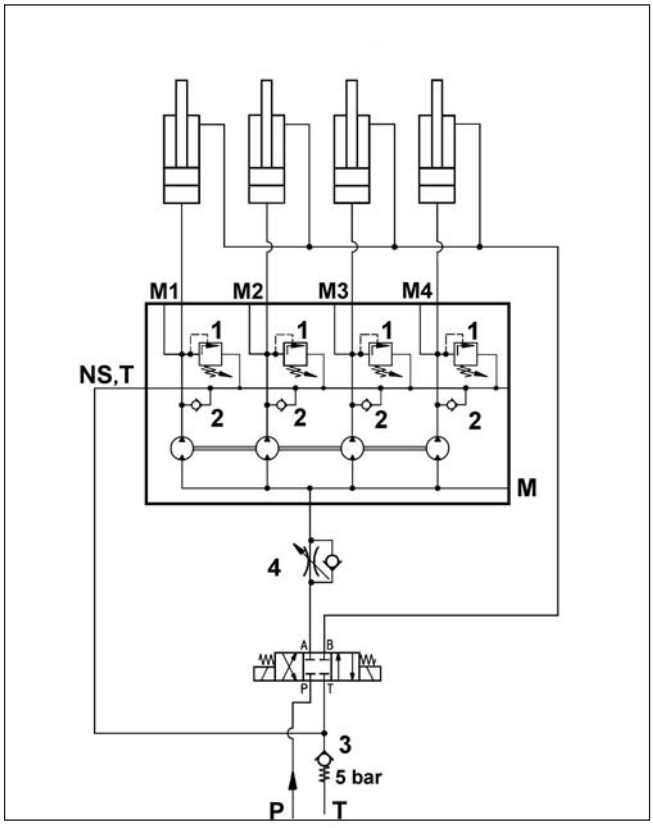
Using a “driver”

This is achieved by adding an extra section of equal or greater displacement to the flow divider. The return line of this section is connected directly to tank so that it in effect works as a motor for the other sections in the flow divider thereby increasing their outlet pressures. This is useful, for example, in lifting platforms that should lower under action of their own weight, but where the weight of the empty platform is insuffi cient for this to occur.

Compensating synchronisation errors - installation of the flow divider in the hydraulic circuit

As the low divider is an independent flow control mecha-nism without any direct means of measuring the synchroni sations errors that will always occur, any corrections have to take place as the cylinders reach the end of their stroke.

The diagramm below shows an example of such a circuit.



The valves in the circuit have the following functions: The pressure relief valves 1 serve as protection against excess pressure in the cylinder outlet lines as may be caused by the pressure multiplier effect. In this way all cylinders are able to complete their strokes even if one of them has reached the stroke-end. Valves 2 and 3 maintain a minimum pressure of approx. 4 bar in each of the flow divider sections. The difference of 1 bar from the opening tension of valve 3 is due to the opening tension of valves 2 of 1 bar.

The minimum pressure feed is important, for example, when one of the cylinder has reached its end stroke, but the flow divider continues running due to the slower cylinders. The pressure feed then prevents suction occuring in the line connecting the fastest cylinder.

Valve 4 has an important function which is often ignored on flow dividers:

If the oil flow from the pump reaches the cylinders and the flow divider has the task of collection the returnline oil in order to perform an equalisation of the flows, valve 4 ensures that the fl ow divider is not made to run at the speed of the fastest cylinder hen the other cylinders do not follow due to friction, loading, pinching etc.: the flow divider can only operate as a collector if all the cylinders operate at the same speed.

A pressure relief valve or an over-centre valve could be used instead of the throttle valve 4.

The use of such a valve in the circuit becomes particularly important when the cylinder return strokes occur whitout a controlling pump flow, eg. under action of their own weight.

Minimum flows

The gear-motor flow dividers in particular are not low speed components. Generally the minimum flows per section are as follows:

Q_{min} (l/min) = $V_{section}$ (cm^3/U) x 0.5

For radial-piston fl ow-divider use:

RPC : Q_{min} = 0.15 x Q_{max}

RPD : Q_{min} = 0.25 x Q_{max}

Flow divider application

Flow divider start-up

The smallest flow dividers in particular do not start if there is already a high outlet pressure at the beginning of the cycle.

This situation occurs, for example, with the fl ow divider installed between the pump and cylinders, when the lifting of a load is stopped and held by pressure in the fl ow di vi der outlet.

In this case it is possible to use check valves to hold the load while the fl ow divider outlets are relieved of pres-su re. Depending on the type of application a variety of solutions are possible; it is merely a question of taking this into consideration when designing the circuit.

Use of flow dividers in special condition

If the use of a flow divider is beeing considered, but it is not clear whether it will be suitable for the application, we recommend that you contact us and if possible send us the diagram of the proposed hydraulic circuit.

The many years of experience of working together with our clienst in the field of flow divider applications enables us to expertly evalate any application.

Synchronisation ratios

In general, the synchronisation ratio required is 1:1. Different ratios are possible on request. If so, please contact Rpoint technical staff. Obtaining different ratios is made easier if it is possible to obtain the required section displacement difference in the same section housing.

Synchronisation errors due to differing oil compression

The flow divider is not able to compensate for errors due to differing oil compression caused by differing cylinder loads. It is advisable to minimise oil volumes between the flow divider and the cylinder by using short tubes of equal length for all cylinders. If the difference in load in the cylinders is unchanging then it is possible to correect or eliminate oil compression synchronisaton errors with the appropriate use of pressure relief valves.

Noise-levels

Specially the gear-motor flow dividers cause a noise-level run ning over 1800 rpm that can not always be accepted. Please choice the displacement according to this fact.

Inlet / outlet-blocks

To achieve a minimum of piping and fittings and to guarantee the proved quality of important valves for the hydraulic circuit, you can get from Rpoint so called inlet/ outlet blocks for RPC and RPD flow divider. They have to be ordered directly together with the flow dividers, because a later assembly is generally impossible or causes problems. The blocks for the RPC series are not separated into inlet/ outlet ports, but integrated in one block only.

The present outlet-blocks have a relief-valve for each section and a separate port to measure the pressure. The pressure a setting should be done, when the cylinder are in the external stroke-end. The pressure-setting should be 20 bar over the pressure to lift the cylinder with their charge. The port NS, T should be coneccted with the return-line. This return-line should have a pre-tension of 4-5 bar.

Use of other fluids than mineraloil

Specially the radial-piston flow dividers, but the flow-divider valves, too, accept other fluids than mineraloil, such as HFC, HFD, non-contaminating fluids. Please contact Rpoint in those cases.

Flow divider application

How to install the flow divider, start-up

- Gear-motor flow-dividers have no drain-line connection and, consequently, are not subject of prefilling.
- The RPC-series require a drain-line connection to both sides. Max. drain-pressure is 1,5 bar.
- Radial-piston flow-dividers series RPD have a drain-line connection on both end-sides. It's sufficient to connect only one drain-line, because the drains of the sections are connected internally. Max. drain-pressure is 10 bar (1,5 bar only for items with external shaftf.e. to measure the flow by the speed).
- Drain-line piping is to be installed in a way that it cannot get empty. Due to the low quantity of drain it is necessary to fill the radial-piston flow-dividers complete before the first start. Otherwise the flow-divider has to run a long time with dry shaft and bearings. Specially this important detail is often forgoten even by skilled.

RPC Series Piston Flow Divider

TYPE	displace-ment	Min flow	Max flow	Min speed	Max speed	Rated P1	Peak P2	Max P differe-nce	Case oil filling amount	weight/ piece
	ml/rev	l/min	l/min	rpm	rpm	bar	bar	bar	L	kg
RPC1 • 100	99	5	54.4	50	550	250	300	250	1	27
RPC1 • 175	172	8.6	94.6	50	550	250	300	175	1	27
RPC2 • 300	304	15.2	152.0	50	500	250	300	175	2	51
RPC2 • 500	493	24.7	225.0	50	450	250	300	120	2	51
RPC3 • 800	792	34.5	316.0	50	400	250	300	130	4.5	86
RPC5 • 1600	1634	81.7	408.5	50	250	250	300	145	10	170
RPC6 • 2100	2127	106.4	477.2	50	225	250	300	160	25	240
RPD1 • 100	99	5	34.7	50	350	250	300	200	1	35
RPD1 • 175	172	8.6	94.6	50	550	250	300	200	1	35
RPD1 • 250	243	12.2	85.1	50	550	250	300	200	1	35
RPD1 • 320	314	15.7	109.9	50	550	250	300	200	1	35
RPD2 • 250	251	12.6	87.9	50	500	250	300	200	2	53
RPD2 • 350	347	17.4	160.0	50	500	250	300	200	2	53
RPD2 • 500	493	24.7	172.6	50	450	250	300	200	2	53
RPD2 • 630	623	31.2	218.1	50	350	250	280	165	2	53

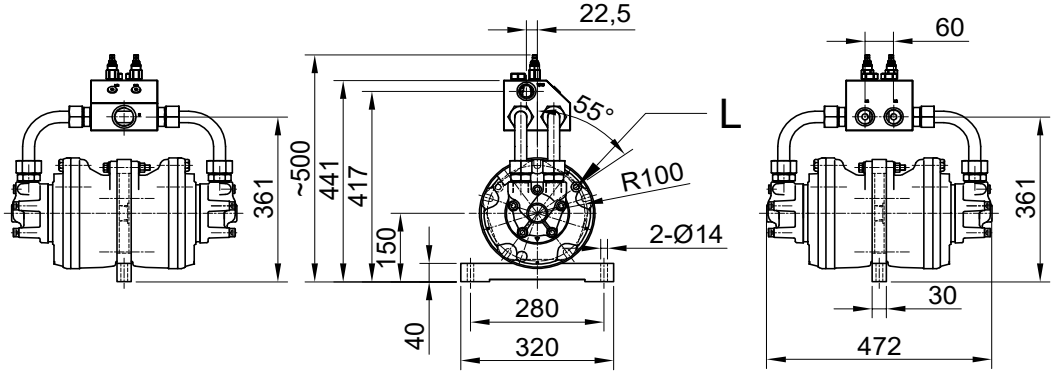
RPC/RPD Series Oil port Code

TYPE	displacement ml/rev	IN	OUT	T/NS	L	M
RPC1 • 100	99	G1 1/4″	G1″	G1″	G1/4″	G1/4″
RPC1 • 175	172	G1 1/4″	G1″	G1″	G1/4″	G1/4″
RPC2 • 300	304	G1 1/2″	G1 1/4″	G1 1/4″	G1/2″	G1/4″
RPC2 • 500	493	G1 1/2″	G1 1/4″	G1 1/4″	G1/2″	G1/4″
RPC3 • 800	792	G1 1/2″	G1 1/4″	G1 1/4″	G1/2″	G1/4″
RPC5 • 1600	1634	SAE1 1/2″ 6000psi	SAE1 1/2″ 6000psi	G1 1/2″	G1/2″	G1/4″
RPC6 • 2100	2127	SAE1 1/2″ 6000psi	SAE1 1/2″ 6000psi	G1 1/2″	G1/2″	G1/4″

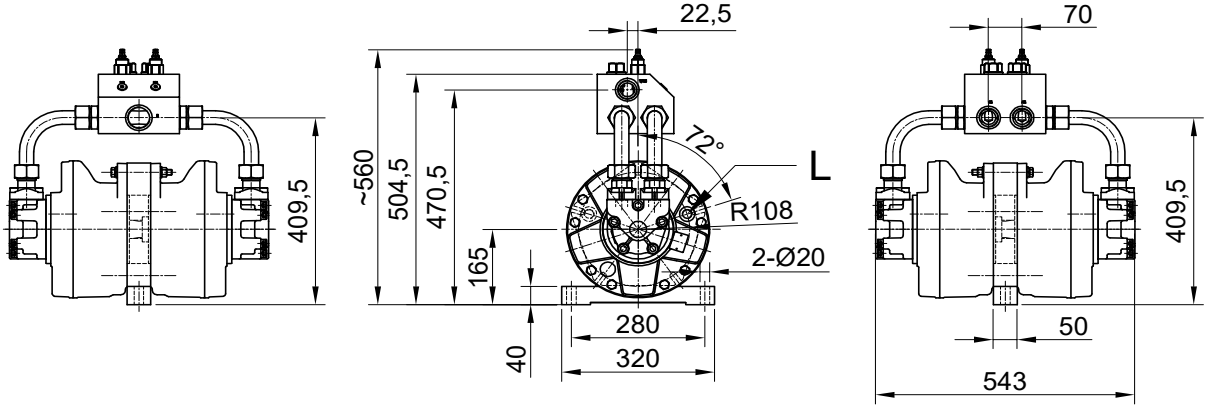
TYPE	displacement ml/rev	IN	OUT	T/NS	L	M
RPD1 • 100	99	G1″	SAE3/4″ 3000psi	G1″	G1/4″	G1/4″
RPD1 • 175	172	G1″	SAE3/4″ 3000psi	G1″	G1/4″	G1/4″
RPD1 • 250	243	G1″	SAE3/4″ 3000psi	G1″	G1/4″	G1/4″
RPD1 • 320	314	G1″	SAE3/4″ 3000psi	G1″	G1/4″	G1/4″
RPD2 • 250	251	G1 1/4″	SAE1″ 3000psi	G1 1/4″	G1/2″	G1/4″
RPD2 • 350	347	G1 1/4″	SAE1″ 3000psi	G1 1/4″	G1/2″	G1/4″
RPD2 • 500	493	G1 1/4″	SAE1″ 3000psi	G1 1/4″	G1/2″	G1/4″
RPD2 • 630	623	G1 1/4″	SAE1″ 3000psi	G1 1/4″	G1/2″	G1/4″

RPC/RPD Series Overall dimensions

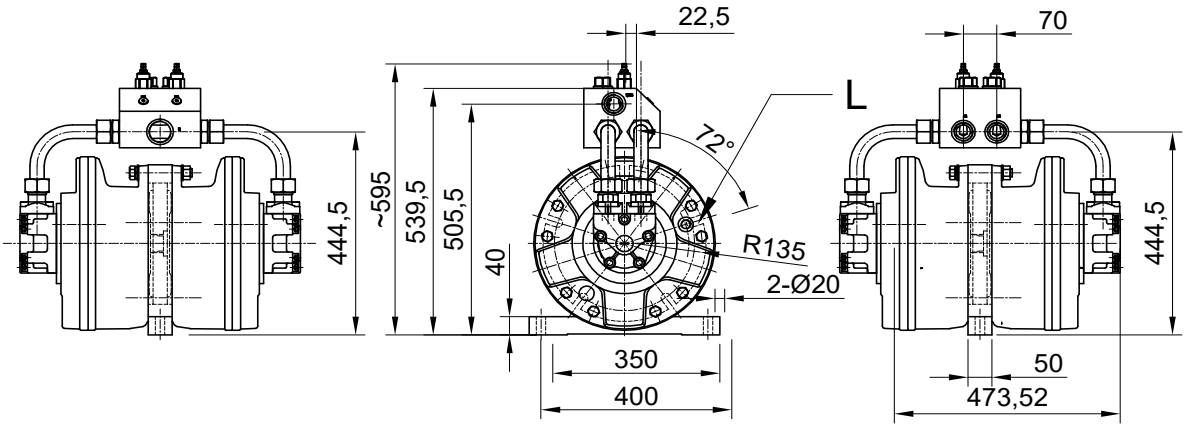
RPC1·100-2V***-N、RPC1·175-2V***-N



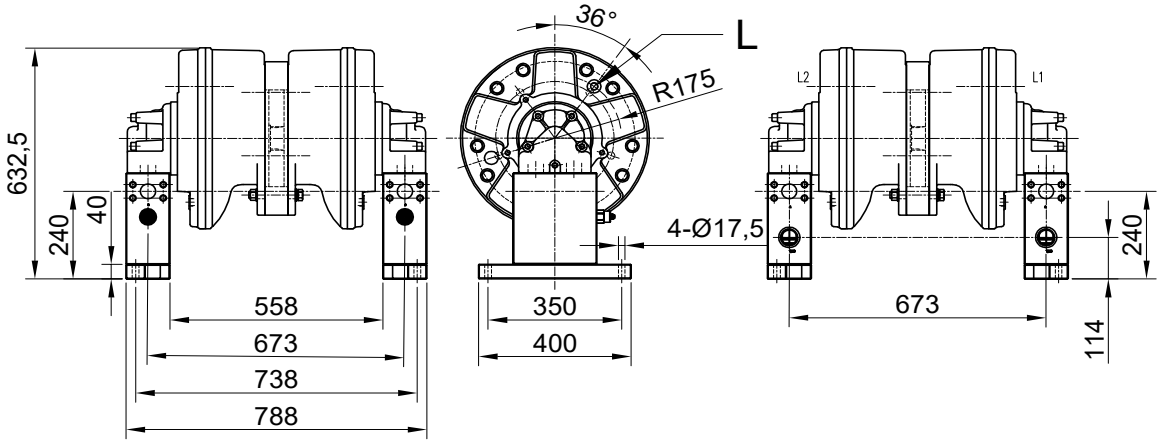
RPC2·300-2V***-N、RPC2·500-2V***-N



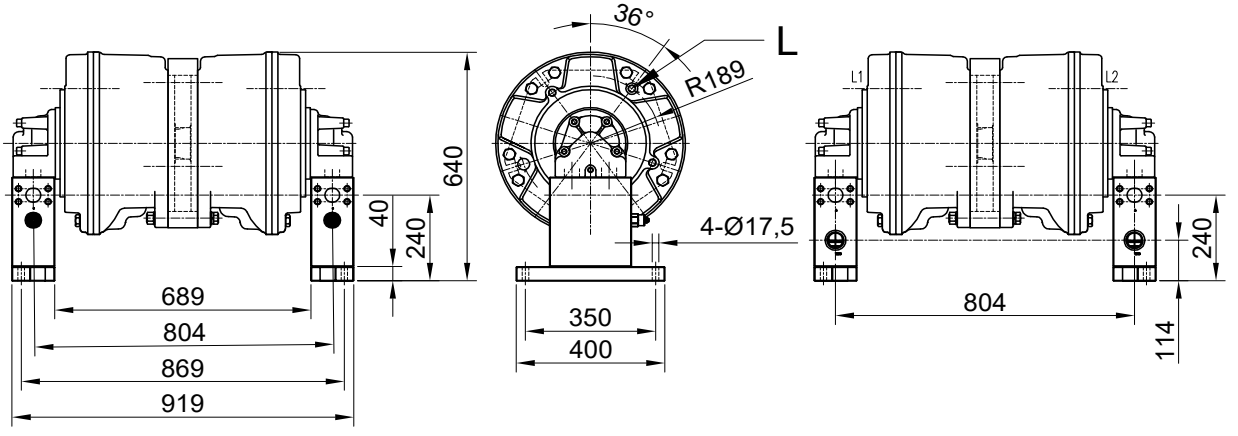
RPC3·800-2V***-N



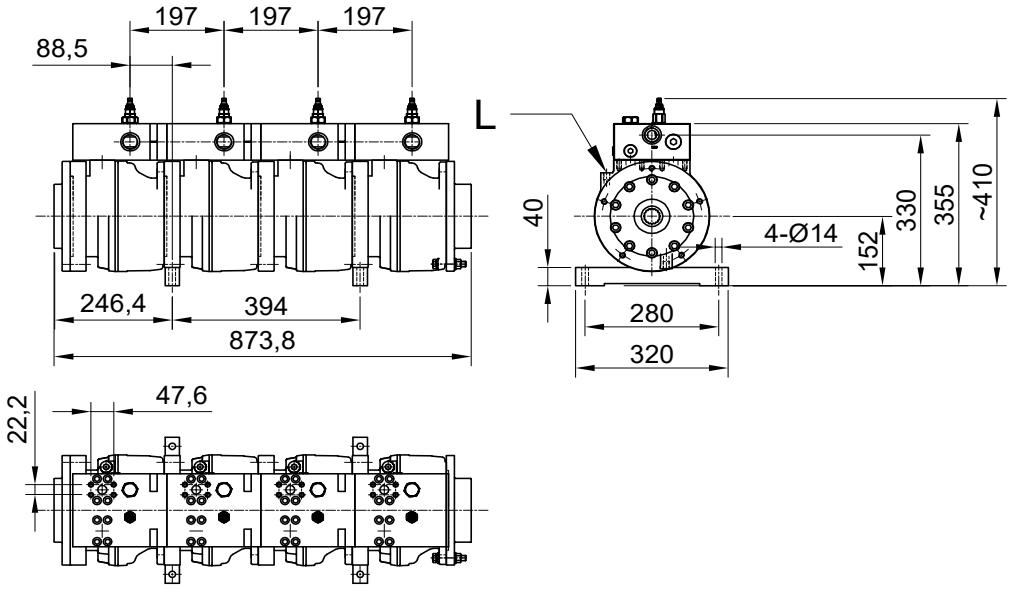
RPC5·1600-2V***-N



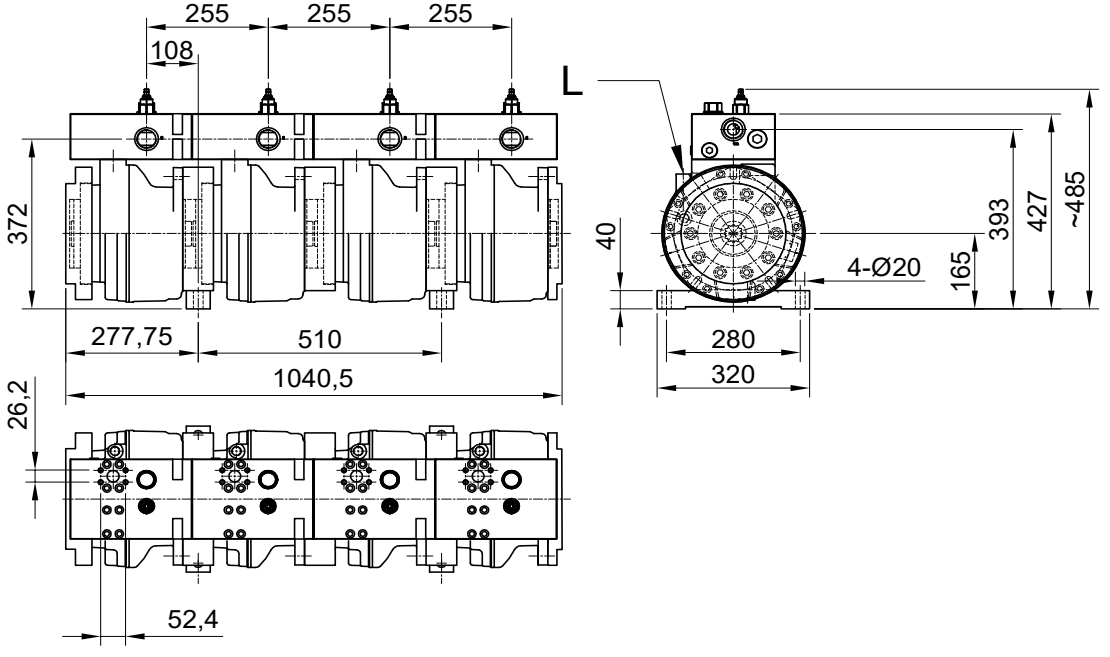
RPC6·2100-2V***-N



RPD1·***-4V***-N



RPD2·***-4V***-N



RPC/RPD Serise Order Form