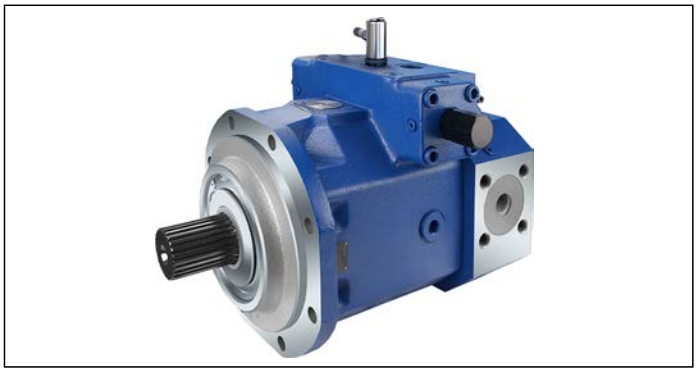
RE 92160/2020.07.31
Replaces: preliminary edition 11.2014

rexroth
A Bosch Company

Axial piston variable pump A4VHO Series 30



- Optimized high pressure pump for maximal power requirements up to 700 bar
- Size 450
- Nominal pressure 630 bar
- Maximum pressure 700 bar
- Open circuit

Features

- Axial piston variable pump in swashplate design for hydrostatic drives in open circuit as well as operation with boosted inlet.
- For use particularly in industrial application areas
- Flow is proportional to the drive speed and displacement.
- Flow can be infinitely varied by controlling the swashplate angle.
- Good power to weight ratio
- Modular design
- Short control time
- Low noise level
- Long service life
- Optical swivel angle indicator

Contents

Type code

01	02	03	04		05	06	07	08	09	10	11
A4VH	**O**	**450**	**HS5**	**/**	**30**		**V**	**Z**	**H**	**25**	

Axial piston unit

01	Swashplate design, variable, nominal pressure 630 bar, maximum pressure 700 bar	**A4VH**

Operating mode

02	Pump, open circuit	**O**

Size (NG)

03	Geometric displacement, see table of values on page 8	**450**

			450	
Control device				
04	Control system with proportional valve (see data sheet 92076)		●	**HS5**
Series				
05	Series 3, index 0		●	**30**
Direction of rotation				
06	Viewed on drive shaft	clockwise	●	**R**
		counter-clockwise	○	**L**
Sealing material				
07	FKM (fluoroelastomer)		●	**V**
Drive shaft				
08	Splined shaft DIN 5480		●	**Z**
Mounting flange				
09	In accordance with ISO 3019-2 metric	8-hole	●	**H**
Working port				
10	Port **B** side position; B_1 opposite at delivery with closed flange plate, SAE flange port **S** below, metric fastening thread.		●	**25**

Through drive (for mounting options, see page 13)

11	Flange ISO 3019-2 metric		Hub for splined shaft[1)]		
	Diameter	Attachment	Diameter	450	
	125, 4-hole		32×2×14×9g	●	**K31**
	140, 4-hole		40×2×18×9g	●	**K33**
	160, 4-hole		50×2×24×9g	●	**K34**
	224, 4-hole		60×2×28×9g	●	**K35**
	224, 4-hole		70×3×22×9g	●	**K77**
	315, 8-hole		80×3×25×9g	●	**K43**
	315, 8-hole		80×3×25×9g	●	**K97**
	400, 8-hole		90×3×28×9g	●	**K76**
	With through-drive shaft, without hub, without intermediate flange, closed with cover			●	**K99**

● = Available ○ = On request – = Not available

Notice

- ▶ Note the project planning notes on page 17.
- ▶ In addition to the type code, please specify the relevant technical data when placing your order.
- ▶ For details of the mounting situation of combination pumps, see page 13.

1) Nabe nach DIN 5480

Hydraulic fluid

The axial piston unit is designed for operation with HLP mineral oil according to DIN 51524.
Application instructions and requirements for hydraulic fluid selection, behavior during operation as well as disposal and environmental protection should be taken from the following data sheets before the start of project planning:

- 90220: Hydraulic fluids based on mineral oils and related hydrocarbons

Selection of hydraulic fluid

Bosch Rexroth evaluates hydraulic fluids on the basis of the Fluid Rating according to the technical data sheet 90235. Hydraulic fluids with positive evaluation in the Fluid Rating are provided in the following technical data sheet:

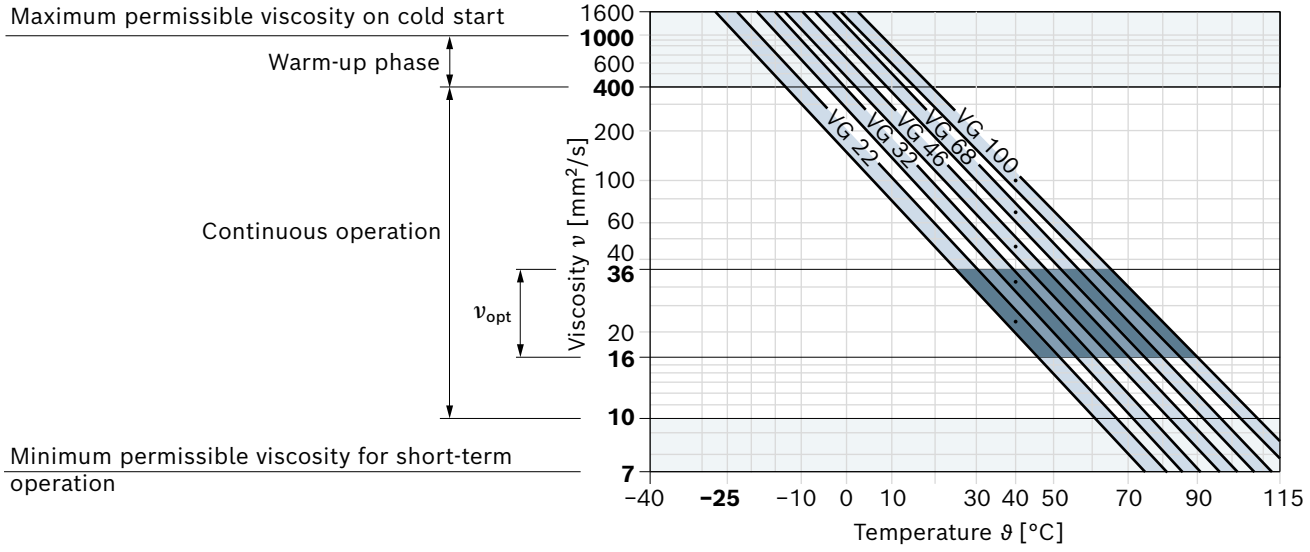
- 90245: Bosch Rexroth Fluid Rating List for Rexroth hydraulic components (pumps and motors)

The hydraulic fluid should be selected so that the operating viscosity in the operating temperature range is within the optimum range (v_{opt}; see selection diagram).

Viscosity and temperature of hydraulic fluids

	Viscosity	Shaft seal	Temperature[2]	Comment
Cold start	v_{max} ≤ 1000 mm²/s	FKM	ϑ_{St} ≥ −25°C	t ≤ 3 min, without load (p ≤ 50 bar) Permissible temperature difference between axial piston unit and hydraulic fluid in the system maximum 25 K
Warm-up phase	v = 1000 ... 400 mm²/s			t ≤ 15 min, p ≤ 0.7 × p_{nom} and n ≤ 0.5 × n_{nom}
Continuous operation	v = 400 ... 10 mm²/s[1]	FKM	ϑ ≤ +85°C	Measured at port **T**
	v_{opt} = 36 ... 16 mm²/s			Optimal operating viscosity and efficiency range

▼ **Selection diagram**



1) This corresponds, for example on VG 46, to a temperature range of +4 °C to +85 °C (see selection diagram)2)
2) If the temperature at extreme operating parameters cannot be ad-hered to, please contact us.

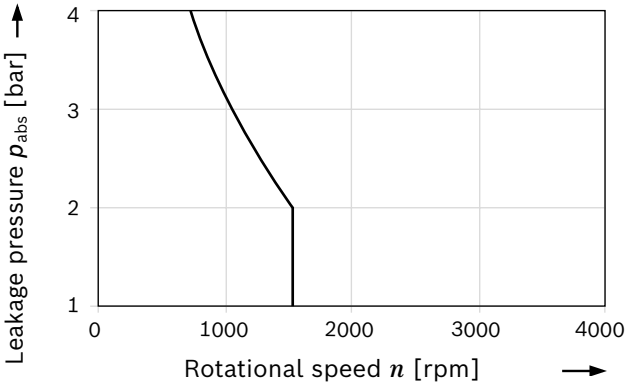
Filtration of the hydraulic fluid

Finer filtration improves the cleanliness level of the hydraulic fluid, which increases the service life of the axial piston unit.
A cleanliness level of at least 20/18/15 is to be maintained according to ISO 4406
At a hydraulic fluid viscosity of less than 10 mm^2/s (e.g. due to high temperatures during short-term operation) at the drain port, a cleanliness level of at least 19/17/14 under ISO 4406 is required.
For example, viscosity is 10 mm^2/s at:

- HLP 32 corresponds to a temperature of 73 °C
- HLP 46 corresponds to a temperature of 85 °C

Leakage pressure

The permissible leakage pressure (case pressure) depends on the rotational speed (see diagram).



Maximum leakage pressure (case pressure)	
$P_{L\ abs\ max}$	4 bar absolute

These data are guideline figures; a restriction may be necessary under operating conditions.

Shaft seal

The FKM shaft seal ring may be used for leakage temperatures from –25°C bis +90°C.

Flow direction
S to **B**

Bearing flushing

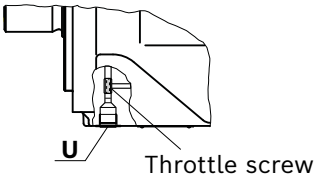
Bearing flushing is realized at port **U** and **U_1** of the variable pump. The flushing fluid flows through the front and rear bearing and emerges from case drain port together with the drain fluid.

- At port **U** and **U_1** a bearing flushing quantity of q_{Sp}: 10 l/min each is required.

The specified flushing flow results in a pressure differential between port **U** of approx. 3 bar and **U_1** with 0.5 bar (including fitting) over the drain fluid area.

Notice

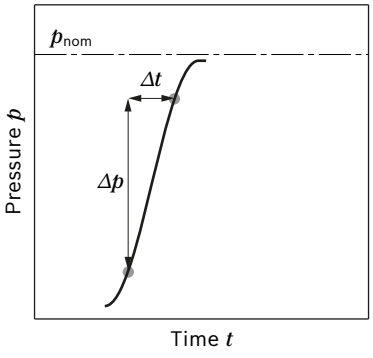
- Ports **U** and **U_1** for bearing flushing must always be closed.
- It must be ensured that the throttle screw is fully screwed into port **U**.



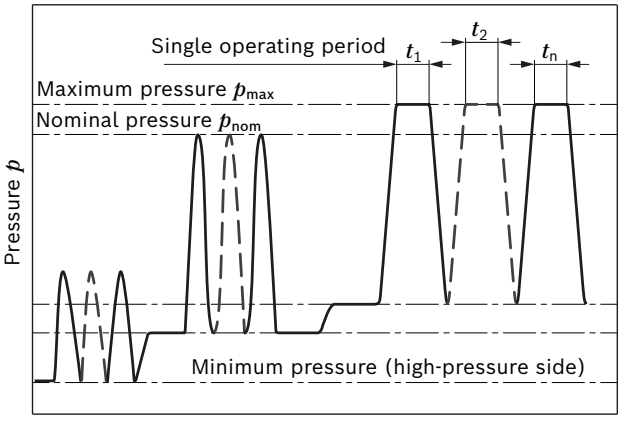
Working pressure range

Pressure at the working port B and B_1		**Definition**
Nominal pressure p_{nom}	630 bar	The nominal pressure is equivalent to the maximum design pressure at 850 rpm (see diagram "Permissible speed / load range").
Maximum pressure p_{max}	700 bar	The maximum pressure corresponds to the maximum working pressure within a single operating period. The sum of single operating periods must not exceed the total operating period.
Single operating period	1 s	
Total operating period	300 h	
Minimum pressure $p_{B\,abs}$ (High-pressure side)	15 bar at a swivel angle of > 20%, for further parameters, see diagram on page 7	Minimum pressure on the high-pressure side (**B** (**B_1**)) which is required in order to prevent damage to the axial piston unit. The minimum pressure depends on the speed of the working pressure. Please contact us for any project planning at lower pressures. The minimum flow rate for continuous operation and between two operating conditions is >15% V_g. Minor swivel angle is permitted for a period of 10 minutes. Pressure drops by 15 bar during the cycle are permissible for up to 1 minute.
Rate of pressure change $R_{A\,max}$	16000 bar/s	Maximum permissible pressure build-up and reduction speed during a pressure change across the entire pressure range.
Pre-charge pressure at suction port S (inlet)		
Minimum pressure $p_{S\,min}$	≥ 12 bar absolute at $q_{V\,max}$	Minimum pressure for partial flows at suction port **S** (inlet) at maximum flow rates which is required to prevent damage to the axial piston unit. The minimum pressure depends on the pressure and flow of the axial piston unit (see diagram "Pre-charge pressure at suction port" (**S**) on page 7).
Maximum pressure $p_{S\,max}$	≤ 30 bar absolute	
Leakage pressure at port T_1, T_2, T_3		
Maximum pressure $p_{L\,max}$	4 bar	Maximum 1.2 bar higher than inlet pressure at port **S**, but not higher than $p_{L\,max}$. A drain line to the reservoir is required.

▼ **Rate of pressure change $R_{A\,max}$**



▼ **Pressure definition**



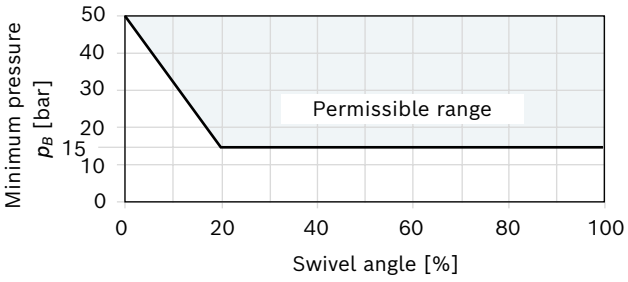
Total operating period = $t_1 + t_2 + ... + t_n$

Notice

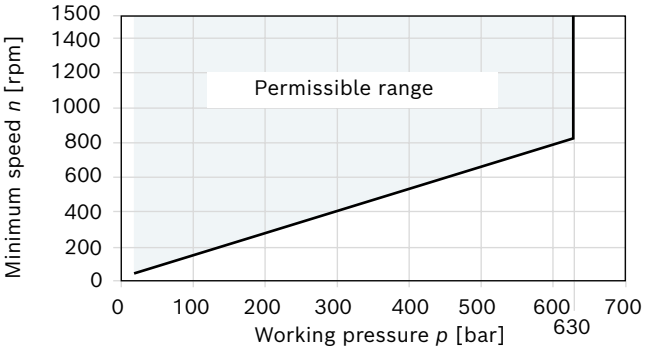
- Working pressure range applies when using hydraulic fluids based on mineral oils.

Characteristic curves of working pressure range

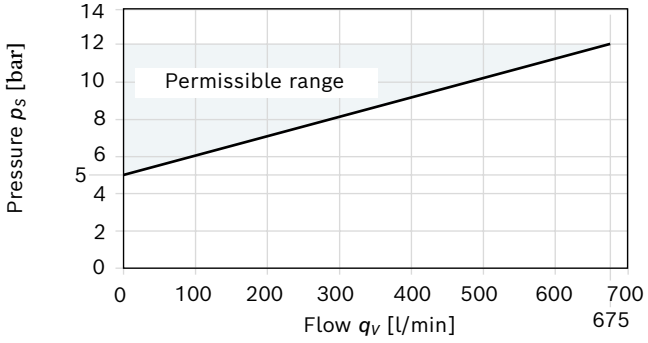
▼ Minimum pressure on high-pressure side



▼ Permissible speed / load range



▼ Pre-charge pressure at suction port (S)



Technical data

Size		NG		450
Geometric displacement, per revolution		$V_{g\,max}$	cm³	450
Maximum rotational speed	at $V_{g\,max}$[2]	n_{max}	rpm	1500
Flow[1]	at n_{nom} and $V_{g\,max}$	q_v	l/min	675
Power	at n_{nom}, $V_{g\,max}$ and Δp = 630 bar	P	kW	709
Torque	at $V_{g\,max}$ and Δp = 630 bar[2]	M	Nm	4508
	at $V_{g\,max}$ and Δp = 100 bar[2]	M	Nm	1002
Rotary stiffness Drive shaft	Splined shaft Z	c	kNm/rad	1.96
Moment of inertia of the rotary group		J_{TW}	kgm²	0.72
Maximum angular acceleration[3]		α	rad/s²	2000
Case volume		V	L	19
Weight (without through drive) approx.		m	kg	570

Determination of the operating characteristics

Flow	$q_v = \frac{V_g \times n \times \eta_v}{1000}$	[L/min]
Torque	$M = \frac{V_g \times \Delta p}{20 \times \pi \times \eta_{hm}}$	[Nm]
Power	$P = \frac{2 \pi \times M \times n}{60000} = \frac{q_v \times \Delta p}{600 \times \eta_t}$	[kW]

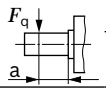
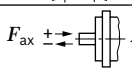
Key

V_g	=	Displacement per revolution [cm³]
Δp	=	Differential pressure [bar]
n	=	Rotational speed [rpm]
η_v	=	Volumetric efficiency
η_{hm}	=	Hydraulic-mechanical efficiency
η_t	=	Total efficiency ($\eta_t = \eta_v \times \eta_{hm}$)

Notice

- Theoretical values, without efficiency and tolerances; values rounded
- Operation above the maximum values or below the minimum values may result in a loss of function, a reduced service life or in the destruction of the axial piston unit.

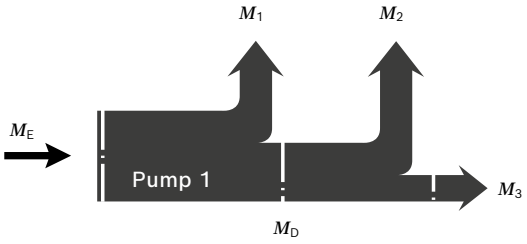
Permissible radial and axial loading on the drive shafts

Size		NG		450
Drive shaft				W90×3×28×9g
Maximum radial force at distance a (to the shaft collar)		$F_{q\,max}$	N	3000
		a	mm	50
Axial force maximum		$+F_{ax\,max}$	N	2200
		$-F_{ax\,max}$	N	500

Permissible input and through-drive torques

Size		NG		450
Torque at $V_{g\,max}$ und Δp = 630 bar[4]		M_{max}	Nm	4508
Maximum input torque at drive shaft, [5]	Z W90×3×28×9g	$M_{E\,max}$	Nm	9016
Maximum through-drive torque		$M_{D\,max}$	Nm	4508

▼ **Distribution of torques**



Torque at pump 1	M_1		
Torque at pump 2	M_2		
Torque at pump 3	M_3		
Input torque	M_E	=	$M_1 + M_2 + M_3$
	M_E	<	$M_{E\,max}$
Through-drive torque	M_D	=	$M_2 + M_3$
	M_D	<	$M_{D\,max}$

Notice

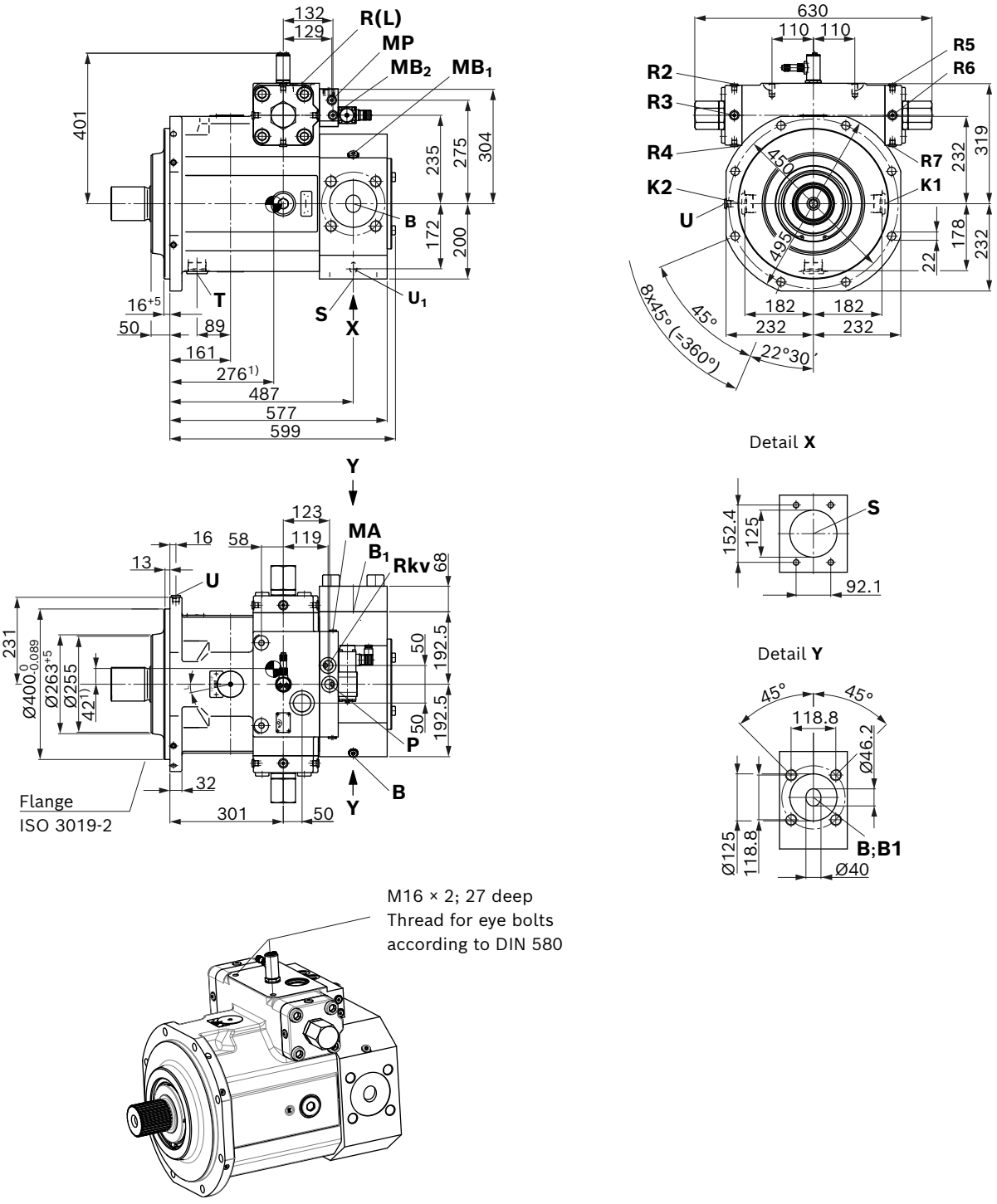
- Special requirements apply in the case of belt drives. Please contact us.

1) The values are applicable:
   – for the optimum viscosity range from v_{opt} = 36 to 16mm²/s
2) The values apply at absolute pressure p_{abs} = 12 bar at suction port **S**.
3) The limit value is only valid for a single pump. The load capacity of the connection parts must be considered.
4) Efficiency not considered
5) For drive shafts free of radial force

Dimensions, size 450

HS5 – controller for displacement as well as pressure and power control with optical swivel angle indicator

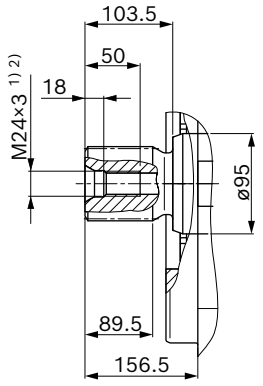
Clockwise rotational direction



1) Center of gravity

▼ **Splined shaft DIN 5480**

Z – W90×3×28×9g



Ports		Standard	Size	$p_{max\ abs}$ [bar][2]	State[5)6)]
B, B1	Working port Fastening thread	ISO/DIS 6164-3 DIN 13	DN-40 M30 × 3.5; 45 deep	700	O
S	Suction port (without charge pump) Fastening thread	SAE J518[3)] DIN 13	5 in M16 × 2; 30 deep	30	O
K_1	Flushing port	ISO 6149[4)]	M48 × 2; 22 deep	4	O
K_2	Flushing port	ISO 6149[4)]	M48 × 2; 22 deep	4	X
MB_1	Working pressure measuring port	ISO 6149[4)]	M18 × 1.5; 14.5 deep	700	X
MA	Control pressure measuring port	DIN 3852	M14 × 1.5; 11.5 deep	315	X
MB_2	Control pressure measuring port	DIN 3852	M14 × 1.5; 11.5 deep	315	X
MP	Control pressure measuring port	DIN 3852	M14 × 1.5; 11.5 deep	315	X
P	Control pressure port	DIN 3852	M27 × 2; 19 deep	315	X
Rkv	Return line control fluid	DIN 3852[4)]	M27 × 2; 19 deep	210	O
R(L)	Fluid filling and air bleed port (drain port)	ISO 6149[4)]	M48 × 2; 22 deep	4	O
R2 to R7	Air bleed port control	DIN 3852[4)]	M14 × 1.5; 11.5 deep	315	X
T	Fluid drain port (drain port)	ISO 6149[4)]	M48 × 2; 22 deep	4	X
U, U_1	Flushing port (bearing flushing)	ISO 6149[4)]	M18 x 1.5; 14.5 deep	8	X

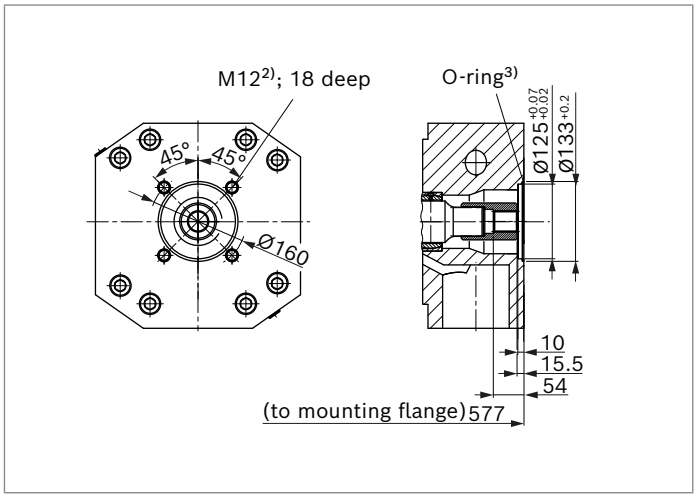
1) Center bore according to DIN 332 (thread according to DIN 13)
2) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
3) Metric fastening thread is a deviation from standard.
4) The countersink can be deeper than specified in the standard.
5) Refer also to the installation instructions on page 15.
6) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions for through drives

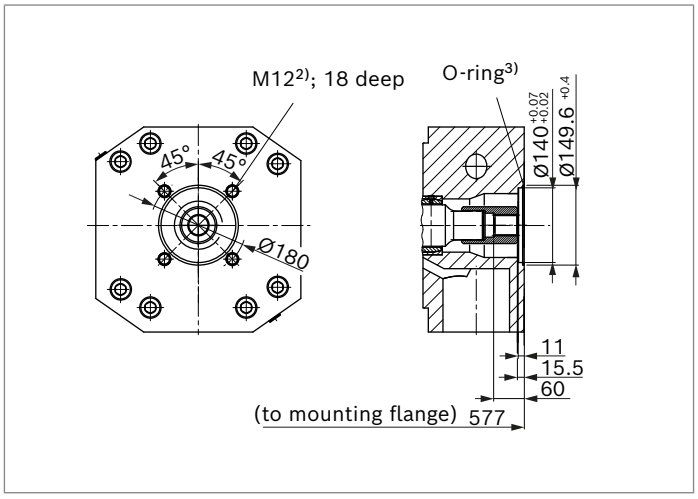
Flange ISO 3019-2		Hub for splined shaft DIN 5480	Availability [NG]		Code
Diameter	Mounting[1)]	Diameter		450	
125-4	⌘	32×2×14×8H		●	K31
140-4	⌘	40×2×18×9g		●	K33
160-4	⌘	50×2×24×9g		●	K34
224-4	⌘	60×2×28×9g		●	K35

● = Available ○ = On request

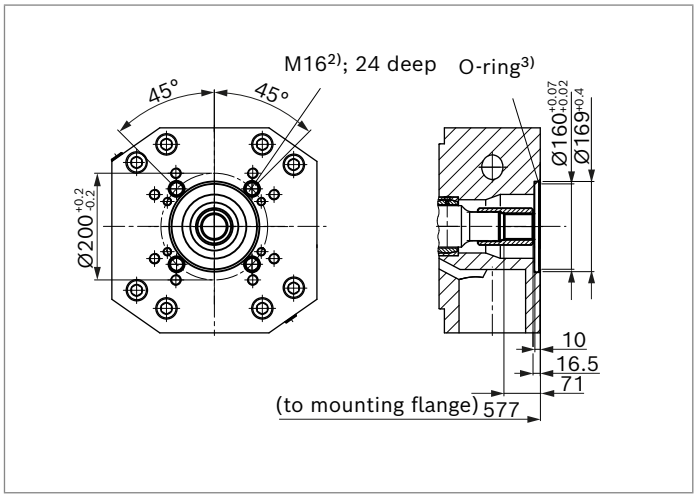
▼ **125-4 – K31**



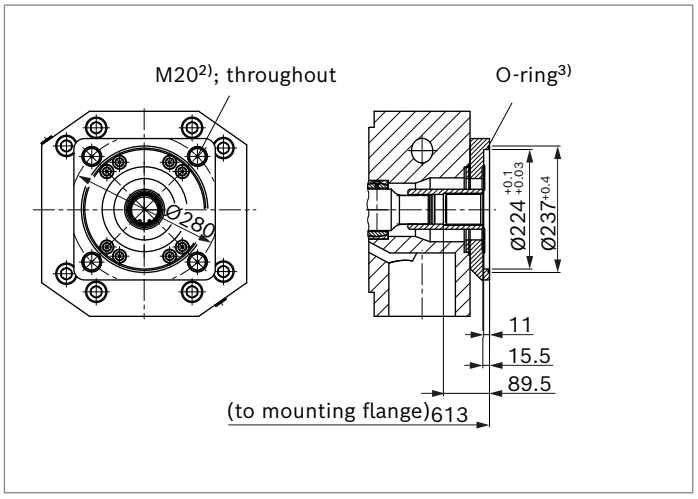
▼ **140-4 – K33**



▼ **160-4 – K34**



▼ **224-4 – K35**



1) Mounting holes pattern viewed on through drive with control at top

2) Thread according to DIN 13.

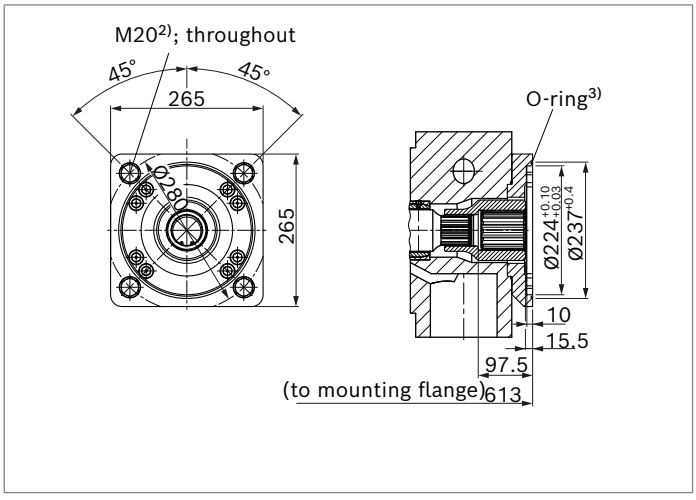
3) Hub, mounting bolts, O-ring and if possible an intermediate flange included in the scope of supply

Dimensions for through drives

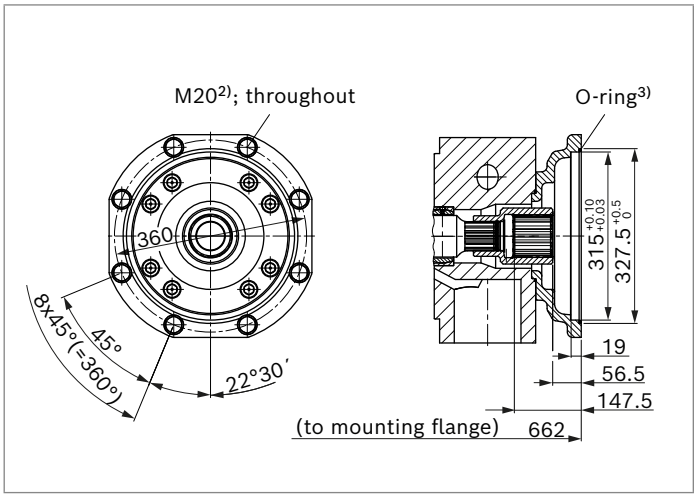
Flange ISO 3019-2		Hub for splined shaft DIN 5480	Availability [NG]		Code
Diameter	Mounting[1)]	Diameter		450	
224-4		70×3×22×9g		●	K77
315-8		80×3×25×9g		●	K43
315-8		80×3×25×9g		●	K97
400-8		90×3×28×9g		●	K76

● = Available ○ = On request

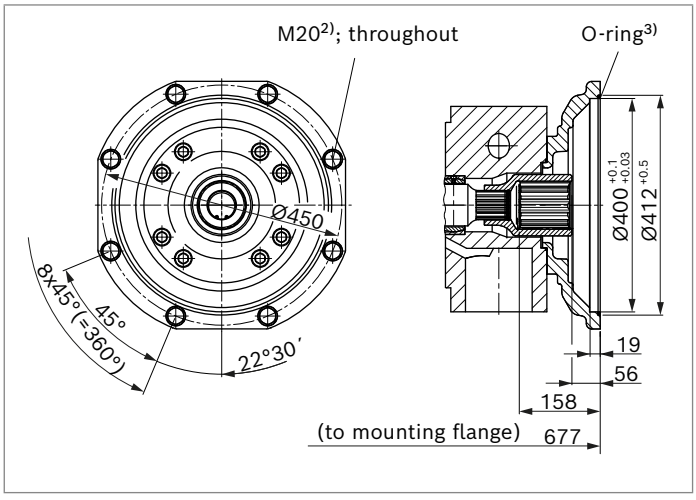
▼ **224-4 – K77**



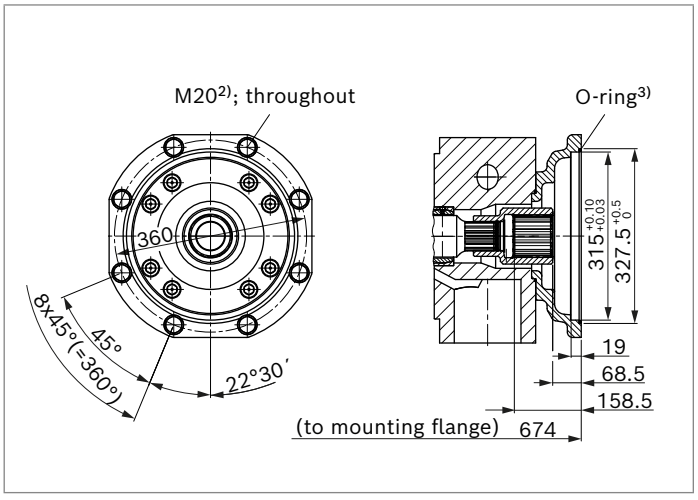
▼ **315-8 – K43**



▼ **400-8 – K76**



▼ **315-8 – K97**



1) Mounting holes pattern viewed on through drive with control at top

2) Thread according to DIN 13.

3) Hub, mounting bolts, O-ring and if possible an intermediate flange included in the scope of supply

Overview of mounting options

Through drive			Mounting options – Pump 2			
Flange	**Hub for splined shaft**	**Code**	**A4VBO/30 NG (shaft)**	**A4VHO/30 NG (shaft)**	**A4VSO/10 NG (shaft)**	**A4VSO/30 NG (shaft)**
125-4	32×2×14×9g	K31	–	–	40 (Z)	–
140-4	40×2×18×9g	K33	71 (Z)	–	71 (Z)	–
160-4	50×2×24×9g	K34	125 (Z)	–	–	125 (Z) 180 (Z)
224-4	60×2×28×9g	K35	250 (Z)	–	–	250 (Z)
224-4	70×3×22×9g	K77	–	–	–	355 (Z)
315-8	80×3×25×9g	K43	–	–	–	500 (Z)
315-8	80×3×25×9g	K97	450 (R)	–	–	–
400-8	90×3×28×9g	K76	–	450 (Z)	–	750 (Z)

Combination pumps A4VHO + A4VSO and A4VHO + A4VHO

Total length A

A4VHO (Pump 1)	**A4VSO../..N00 (Pump 2)**							
	NG40	**NG71**	**NG125**	**NG180**	**NG250**	**NG355**	**NG500**	**NG750**
	K31	**K33**	**K34**	**K34**	**K35**	**K77**	**K43**	**K76**
NG450	843	872	932	952	1048	1077	1182	1237

A4VHO (Pump 1)	**A4VBO../..(K/U)99 (Pump 2)**				
	NG71	**NG125**	**NG250**	**NG450**	
	K33	**K34**	**K35**	**K97**	
NG450	883.5	944	1088	1242	

A4VHO (Pump 1)	**A4VHO (Pump 2)**	
		NG450
		K76
NG450		1273

By using combination pumps, it is possible to have independent circuits without the need for splitter gearboxes. When ordering combination pumps, the type designations of pump 1 and 2 must be connected with a "**+**" and are combined into one part number. Each single pump should be ordered according to type code.

Notice

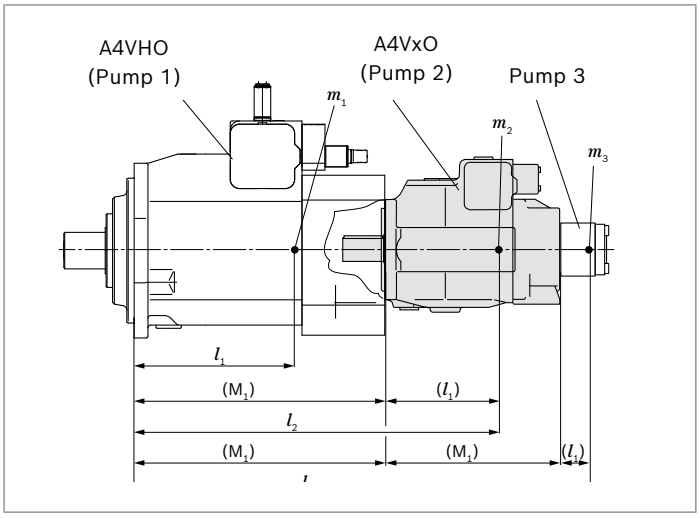
- The combination pump type code is shown in shortened form in the order confirmation.
  Example:
  A4VHO 450 HS5/30R+A4VBO 71 HS5/10R
- Each through drive is plugged with a **non–pressure-resistant** cover. This means the units must be sealed with a pressure-resistant cover before commissioning. Through drives can also be ordered with a pressure-resistant cover. Please specify in plain text.

Order example:
A4VHO450HS5/30R-VZH25K76+
A4VHO450HS5/30R-VZH25K99

An overall parts list number is generated from the individual parts list number.

A tandem pump, with two pumps of equal size, is permissible without additional supports, assuming that the dynamic mass acceleration does not exceed maximum 10 g (= 98.1 m/s²).

For combination pumps consisting of more than two pumps, the mounting flange must be calculated for the permissible mass torque.



m_1, m_2, m_3	Weight of pump	[kg]
l_1, l_2, l_3	Distance from center of gravity	[mm]

$$M_m = (m_1 \bullet l_1 + m_2 \bullet l_2 + m_3 \bullet l_3) \bullet \frac{1}{102}$$ [Nm]

Calculation for multiple pumps		
l_1	=	Front pump distance from center of gravity (values from "Permissible moments of inertia" table)
l_2	=	Dimension "M1" from through drive drawings (page 13 to 14) + l_1 of Pump 2 (see respective data sheet)
l_3	=	Dimension "M1" from through drive drawings (page 13 to 14) of Pump 1 + "M1" of Pump 2 + l_1 of Pump 3 (see respective data sheet)

Permissible moments of inertia

Size			**450**
static	M_m	Nm	19500
dynamic at 10 *g* (98.1 m/s²)	M_m	Nm	1950
Weight	m	kg	570
Distance from center of gravity	l_1	mm	276

Installation instructions

General

The axial piston unit must be filled with hydraulic fluid and air bled during commissioning and operation. This must also be observed following a longer standstill as the axial piston unit may empty via the hydraulic lines.
Particularly in the installation position "drive shaft upwards", filling and air bleeding must be carried out completely as there is, for example, a danger of dry running. Observe details regarding bearing flushing via the ports "**U** and **U_1**" (see page 5 "Bearing flushing").

Notice

- Ports **U** and **U_1** for bearing flushing must always be closed.

The leakage in the housing area should be directed to the reservoir via the highest drain port (**R(L), T, K_1, K_2**).
If a shared drain line is used for several units, make sure that the respective case pressure in each unit is not exceeded. The shared drain line must be dimensioned to ensure that the maximum permissible case pressure of all connected units is not exceeded in any operating condition, particularly at cold start. If this is not possible, separate drain line must be laid, if necessary.
In all operating conditions, the drain line must flow into the reservoir below the minimum fluid level.
The minimum suction pressure at port **S** according to the diagram on page 7 "Pre-charge pressure at suction port" must not be fallen below.
For the reservoir design, ensure that there is an adequate distance between the suction line and the drain line. This minimizes oil turbulence and carries out degassing, which prevents the heated hydraulic fluid from being sucked directly back in again.

Notice

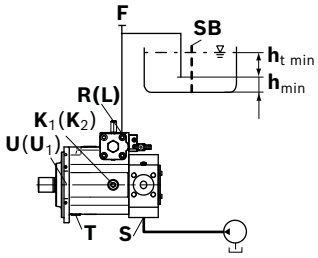
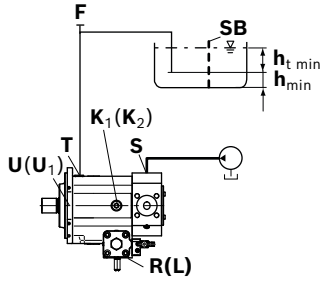
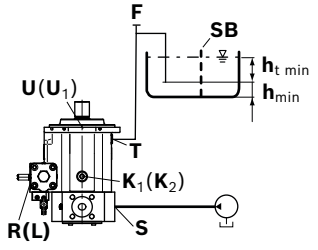
In certain installation positions, an influence on the adjustment or control can be expected. Gravity, dead weight and case pressure can cause minor characteristic shifts and changes in actuating time.

Installation position

See the following examples **1** to **5**.
Further installation positions are available upon request.
Recommended installation position: **1** and **2**

Below-reservoir installation (standard)

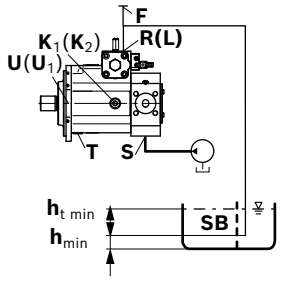
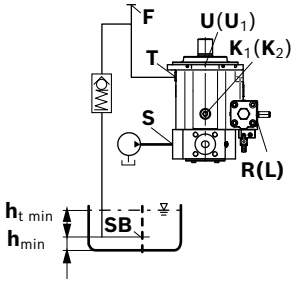
Below-reservoir installation means that the axial piston unit is installed outside of the reservoir below the minimum fluid level.

Installation position		Air bleed	Filling
1		R(L), F	R(L) + U, U_1
2		T, F	R(L) + U, U_1
3		T, F	R(L) + U, U_1

Key	
F	Filling / Air bleeding (observe notice on page 16)
R(L)	Filling / Air bleeding
S	Suction port
U; **U_1**	Bearing flushing
T	Drain port
K_1; **K_2**	Flushing port
SB	Baffle (baffle plate)
$h_{t\ min}$	Minimum required immersion depth (200 mm)
h_{min}	Minimum required distance to reservoir bottom (100 mm)
⊖	Boost pump

Above-reservoir installation

Above-reservoir installation means that the axial piston unit is installed above the minimum fluid level of the reservoir. At position 5 a check valve is to be provided in the **T** line to prevent the draining of the axial piston unit.

Installation position	Air bleed	Filling
4 	**F**	**R(L) + U, U_1 (F)**
5 	**F**	**R(L) + U, U_1 (F)**

Notice

Port **F** is part of the external piping and must be provided on the customer side to make filling and air bleeding easier.

For key, see page 15.

Inside-reservoir installation

Please contact us regarding inside-reservoir installation

Project planning notes

- The axial piston variable pump A4VHO is designed to be used in open circuit.
- Project planning, installation and commissioning of the axial piston units requires the involvement of skilled personnel.
- Before using the axial piston unit, please read the corresponding instruction manual completely and thoroughly. If necessary, this can be requested from Bosch Rexroth.
- Before finalizing your design, request a binding installation drawing.
- The specified data and notes contained herein must be observed.
- Depending on the operating conditions of the axial piston unit (working pressure, fluid temperature), the characteristic curve may shift.
- Preservation: Our axial piston units are supplied as standard with preservation protection for a maximum of 12 months. If longer preservation protection is required (maximum 24 months), please specify this in plain text when placing your order. The preservation periods apply under optimal storage conditions, details of which can be found in the data sheet 90312 or the instruction manual.
- Depending on the type of control used, electromagnetic effects can be produced when using solenoids. Applying a direct voltage signal (DC) to solenoids does not create electromagnetic interference (EMI) nor is the solenoid affected by EMI. Electromagnetic interference (EMI) potential exists when operating and controlling a solenoid with a modulated direct voltage signal (e.g. PWM signal). Appropriate testing and measures should be taken by the machine manufacturer to ensure other components or operators (e.g. with pacemaker) are not affected by this potential.
- Pressure controllers are not safeguards against pressure overload. Be sure to add a pressure relief valve to the hydraulic system.
- In drives, the natural frequency of the hydraulic system can be stimulated by the excitation frequency of the pump (rotational speed frequency ×9). This can be prevented with suitably designed hydraulic lines.
- Working ports:
  - The ports and fastening threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure the connecting elements and lines correspond to the specified application conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.
  - The service ports and function ports are only designed to accommodate hydraulic lines.

Safety instructions

- During and shortly after operation, there is a risk of burning on the axial piston unit and especially on the solenoids. Take the appropriate safety measures (e.g. by wearing protective clothing).
- Moving parts in control equipment (e.g. valve spools) can, under certain circumstances, get stuck in position as a result of contamination (e.g. contaminated hydraulic fluid, abrasion, or residual dirt from components). As a result, the hydraulic fluid flow and the build-up of torque in the axial piston unit can no longer respond correctly to the operator's specifications. Even the use of various filter elements (external or internal flow filtration) will not rule out a fault but merely reduce the risk. The machine/system manufacturer should test whether additional measures are required on the machine for the relevant application in order to bring the driven consumer into a safe position (e.g., safe stop) and make sure any measures are properly implemented.

▼ **Related documentation**

Product	Data sheet	Topic
A4VSO	92050	Axial piston variable pump
A4VBO	92122	Axial piston variable pump
Controller	92076	Control HM, HS5x, EO

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