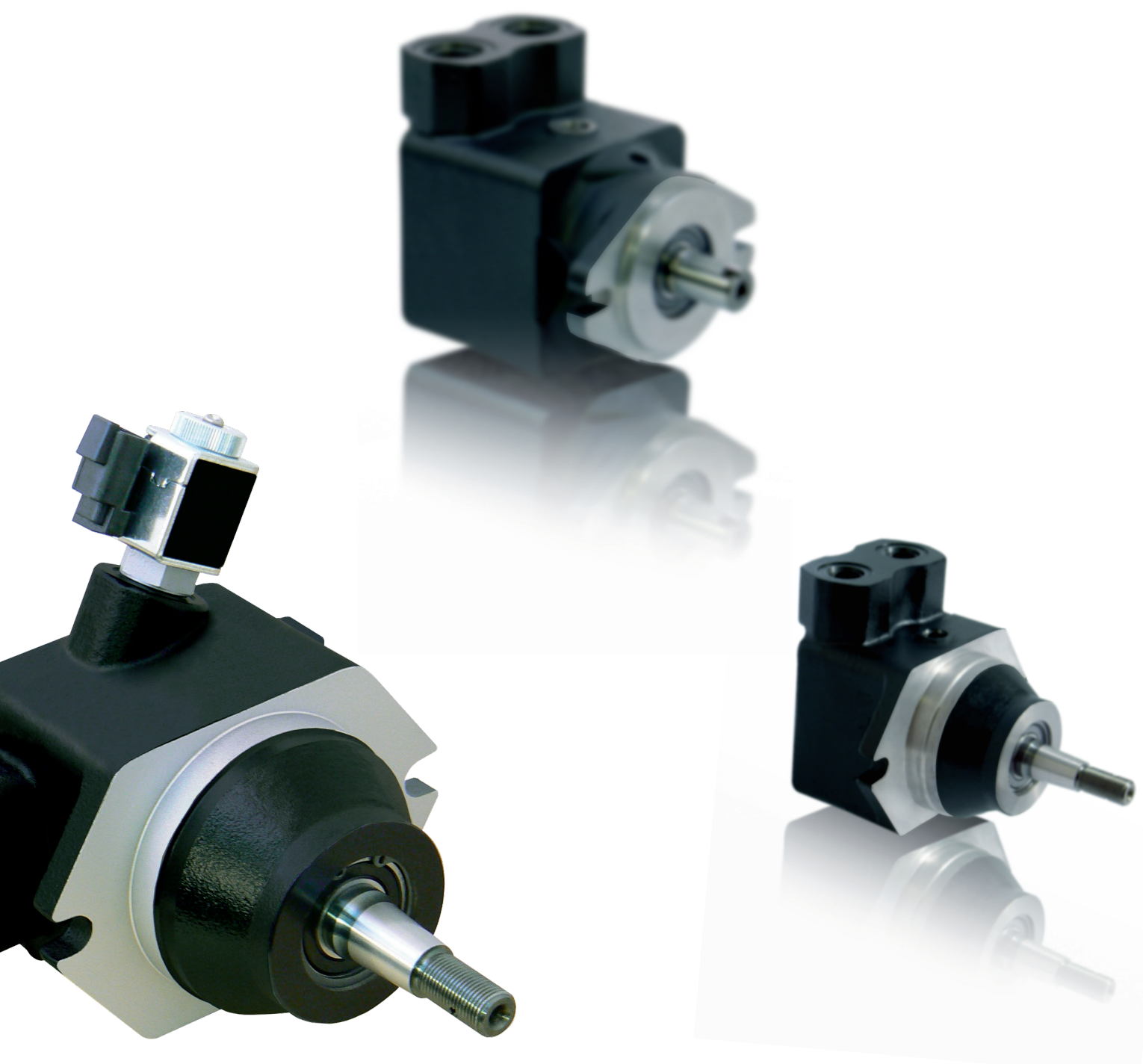




Hydraulic Motors M5AS/M5ASF

Denison Vane Technology, fixed displacement

aerospace
climate control
electromechanical
filtration
fluid & gas handling
hydraulics
pneumatics
process control
sealing & shielding



ENGINEERING YOUR SUCCESS.

GENERAL

M5A - M5AS

M5ASF

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Fluid power formulas 6

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Ordering code 11

Motor with side ports - Dimensions 12

Motor with opposite ports - Dimensions 13

Ordering code 11

Motor with side ports - Dimensions 14

Motor with opposite ports - Dimensions 15



WARNING – USER RESPONSIBILITY

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

This document and other information from Parker-Hannifin Corporation, its subsidiaries and authorized distributors provide product or system options for further investigation by users having technical expertise.

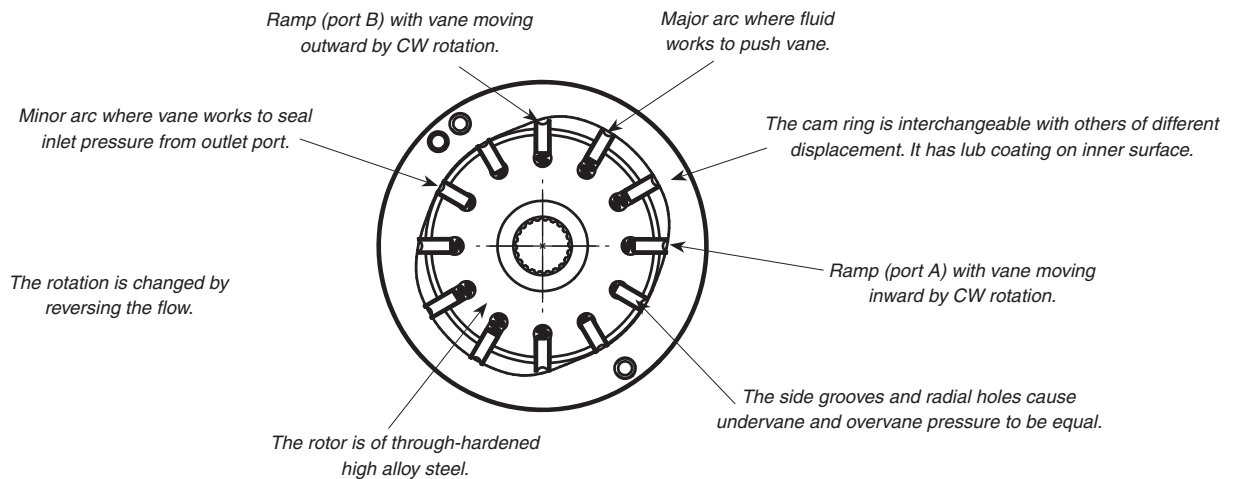
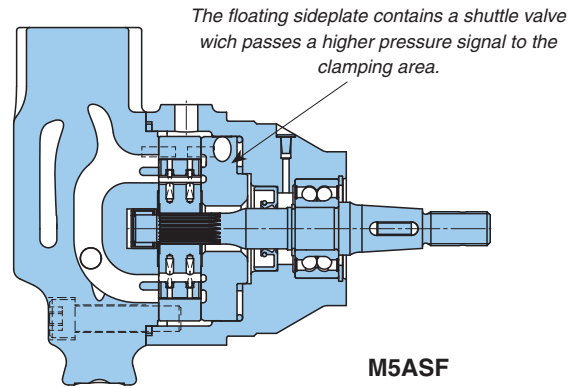
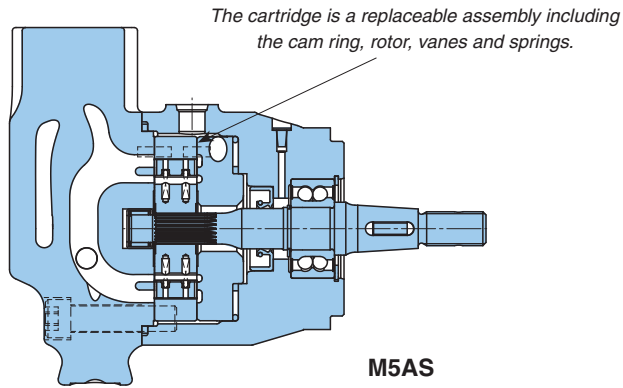
The user, through its own analysis and testing, is solely responsible for making the final selection of the system and components and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application,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

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

Offer of Sale

Please contact your Parker representation for a detailed "Offer of Sale".

LOW NOISE MOTOR	12 vanes and a patented cartridge design allows a very low noise level, whatever the speed.
HIGH PERFORMANCE MOTOR	The M5 series have been designed especially for severe duty applications wich require high pressure , high speed and low fluid lubricity. Max. pressure (continuous) : 280 bar Max. speed (continuous) M5AS* 006 and 010 : 5000 rpm M5AS* 012 and 016 : 3800 rpm M5AS* 018 : 3300 rpm M5AS* 023 and 025 : 2800 rpm
HIGH STARTING TORQUE	The high starting torque efficiency of the vane type motors allows them to start under high load without pressure overshoots, jerks and high instantaneous horsepower loads.
LOW TORQUE RIPPLE	This 12 vane type motor exhibits a very low torque ripple (typical $\pm 1,5\%$), even at low speeds.
LONG LIFETIME	The vane, rotor and cam ring are pressure balanced to increase life over the full speed range. Double lip vanes reduce the sensitivity to fluid pollution.
INTERCHANGEABLE ROTATING GROUPS	Our precise manufacturing allows any component to be interchangeable. Rotating groups may be easily replaced to renew the motor or change the displacement to suit altered requirements for speed or torque.
ROTATION AND DRAIN	The M5AS and M5ASF externally drained, are available in three types of rotation : bi-directional, clockwise, counter-clockwise.
CROSS PORT CHECK VALVE	The uni-directional M5AS, M5ASF are designed with an internal valve that allows smooth dynamic braking, with a very simple hydraulic circuit and without risk of motor cavitation.
MOUNTING	The M5AS, M5ASF motors have a stiff tapered or cylindrical keyed shaft and a high load capacity double ball bearing allow the direct mounting on shaft (like a fan for example). For applications with motors in series or with high back pressure, please contact Parker.

**OPERATION - SINGLE CARTRIDGE**

- The motor shaft is driven by the rotor. Vanes, closely fitted into the rotor slots move radially to seal against the cam ring. The ring has two major and two minor radial sections joined by transitional sections called ramps. These contours and the pressures exposed to them are balanced diametrically.
- Light springs urge the vanes radially against the cam contour assuring a seal at zero speed so that the motor can develop starting torque. The springs and pins are assisted by centrifugal force at higher speeds. Radial grooves and holes through the vanes equalize radial hydraulic forces on the vanes at all times. Fluid enters and leaves the motor cartridge through opening in the side plates at the ramps. Each motor port connects to two diametrically opposed ramps. Pressurized fluid entering at Port A torques the rotor clockwise. The rotor transports it to the ramp openings which connect to Port B from which it returns to the low pressure side of the system. Pressure at Port B torques the rotor counter-clockwise.
- The rotor is separated axially from the sideplate surface by the fluid film. The front sideplate is clamped against the cam ring by the pressure, maintains optimum clearance as dimensions change with temperature and pressure. A 3-way shuttle valve in the sideplate causes clamping pressure in Port A or B, whichever is the highest.
- Materials are chosen for long life efficiency. The vanes, rotor and cam ring are made out of hardened high alloy steels. Cast semi-steel sideplates are chemically etched to have a fine crystalline surface for good lubrication at start-up.

EXTERNAL DRAIN	This motor must have a drain line connected to the housing drain connection of sufficient size to prevent back pressure in excess of 3,5 bar, and returned to the reservoir below the surface of the oil as far away as possible from the suction pipe of the pump.	
RECOMMENDED FLUIDS	Petroleum base anti-wear R & O fluids (covered by Parker Denison HF-0 and HF-2 specifications). Maximum catalogue ratings and performance data are based on operation with these fluids.	
ACCEPTABLE ALTERNATE FLUIDS	The use of fluids other than petroleum base anti-wear R & O fluids requires that the maximum ratings of the motor will be reduced. In some cases, the minimum replenishment pressure must be increased. HF-1 : non antiwear petroleum base. HF-4 : water glycols solutions. HF-5 : synthetic fluids. Max. continuous pressure : 210 bar (HF-1, HF-4, HF-5) Max. speed : 1500 RPM (HF-4, HF-5)	
VISCOSITY	Max. (cold start, low speed and pressure) Max. (full speed and pressure) Optimum (max. lifetime) Min. (full speed and pressure, HF-1 fluid) Min. (full speed and pressure, HF-0 & HF-2 fluids) For cold starts, the motor should operate at low speed and pressure until fluid warms up to an acceptable viscosity for full power operation.	2000 mm2/s (cSt) 100 mm2/s (cSt) 30 mm2/s (cSt) 18 mm2/s (cSt) 10 mm2/s (cSt)
VISCOSITY INDEX	90 min. Higher values extend the range of operating temperatures and lifetime.	
TEMPERATURE	Max. fluid temperature (HF-0, HF-1 & HF-2) Min. fluid temperature (HF-0, HF-1 & HF-2)	+ 100° C - 18° C
FLUID CLEANLINESS	The fluid must be cleaned before and during operation to maintain a contamination level of NAS 1638 class 8 (or ISO 19/17/14) or better. Filters with 25 micron (or better, B10 ≥ 100) nominal ratings may be adequate but do not guarantee the required cleanliness levels.	
WATER CONTAMINATION IN FLUID	Maximum acceptable content of water is : • 0,10 % for mineral base fluids. • 0,05 % for synthetic fluids, crankcase oils, biodegradable fluids. If amount of water is higher, then it should be drained off the circuit.	

Motor performances required
 Torque..... T [Nm.] 55
 Speed..... n [rpm] 1500
 Pump available data
 Flow..... Q [l/min] 30
 Δ Pressure..... Δ p [bar] 250

1. Check if available power is greater than required power (0.85 estimated overall efficiency).

$$0,85 \times \frac{Q \times p}{600} \geq \frac{T \times \pi \times n}{30 \times 1000}$$

$$0,85 \times \frac{30 \times 250}{600} \geq \frac{55 \times \pi \times 1500}{30 \times 1000}$$

$$10,6 > 8,7 \text{ kW}$$

2. Two ways of calculation : Calculate V_i from T required torque, or from Q available flow.

2a.

$$V_i = \frac{20 \times \pi \times T}{p} = \frac{20 \times \pi \times 55}{250} = 13,8 \text{ cm}^3/\text{rev}$$

3a. Choose motor from V_i immediately greater
 M5AS* 016 : $V_i = 16,0 \text{ cm}^3/\text{rev}$

4a. Check theoretical motor pressure

$$\Delta p = \frac{20 \times \pi \times T}{V_i} = \frac{20 \times \pi \times 55}{16,0} = 216 \text{ bar}$$

Torque loss at this pressure = 3,0 Nm

(See page 9)

Calculate real pressure

$$\Delta p_{\text{eff.}} = \frac{20 \times \pi \times (T + T_l)}{V_i} = \frac{20 \times \pi \times 58}{16,0} = 228 \text{ bar}$$

5a. Flow loss at this pressure : 3,5 l/min

(See page 9)

Real flow used by the motor :

$$Q_{\text{eff.}} = 30 - 3,5 = 26,5 \text{ l/min}$$

6a. Real speed of the motor :

$$n_{\text{eff.}} = \frac{Q_{\text{eff.}} \times 1000}{V_i} = \frac{26,5 \times 1000}{16,0} = 1656 \text{ rpm}$$

Real performances

$$V_i = 16,0 \text{ cm}^3/\text{rev}$$

$$n_{\text{eff.}} = 1656 \text{ rpm}$$

$$T = 55 \text{ Nm.}$$

$$\Delta p_{\text{eff.}} = 228 \text{ bar}$$

2b.

$$V_i = \frac{1000 \times Q}{n} = \frac{1000 \times 30}{1500} = 20,0 \text{ cm}^3/\text{rev}$$

3b. Choose motor from V_i immediately smaller
 M5AS* 018 : $V_i = 18,0 \text{ cm}^3/\text{rev}$

4b. Check theoretical motor pressure with

T = 55 Nm

$$\Delta p = \frac{20 \times \pi \times T}{V_i} = \frac{20 \times \pi \times 55}{18,0} = 192 \text{ bar}$$

Torque loss at this pressure = 3,3 Nm

(See page 9)

Calculate real pressure

$$\Delta p_{\text{eff.}} = \frac{20 \times \pi \times (T + T_l)}{V_i} = \frac{20 \times \pi \times 58,3}{18,0} = 204 \text{ bar}$$

5b. Flow loss at this pressure : 4 l/min

(See page 9)

Real flow used by the motor :

$$Q_{\text{eff.}} = 30 - 4 = 26,0 \text{ l/min}$$

6b. Real speed of the motor:

$$n_{\text{eff.}} = \frac{Q_{\text{eff.}} \times 1000}{V_i} = \frac{26,0 \times 1000}{18,0} = 1444 \text{ rpm}$$

Real performances

$$V_i = 18,0 \text{ cm}^3/\text{rev}$$

$$n_{\text{eff.}} = 1444 \text{ rpm}$$

$$M = 55 \text{ Nm.}$$

$$\Delta p_{\text{eff.}} = 204 \text{ bar}$$

FLUID POWER FORMULAS

$$\text{Volumetric efficiency} = \frac{1}{1 + \frac{\text{total leakage} \times 1000}{\text{speed} \times \text{displacement}}}$$

$$\text{Mechanical efficiency} = 1 - \frac{\text{torque loss} \times 20 \times p}{\Delta \text{ pressure} \times \text{displacement}}$$

$$\text{Fluid motor speed} \quad \text{rpm} = \frac{1000 \times \text{flow rate} \times \text{volumetric eff.}}{\text{displacement}}$$

$$\text{Fluid motor torque} \quad \text{N.m} = \frac{\Delta \text{ pressure} \times \text{displacement} \times \text{mech. eff.}}{20 \times p}$$

$$\text{Fluid motor power} \quad \text{kW} = \frac{\text{speed} \times \text{displacement} \times \Delta \text{ pressure} \times \text{overall eff.}}{600 \ 000}$$

Speed [rpm]
 Displacement [cm³/rev]
 Pressure [bar]
 Flow rate [l/min]
 Leakage [l/min]
 Torque [Nm]
 Torque loss [Nm]

$$\text{or} \quad \frac{\text{torque} \times \text{speed} \times 20 \times p}{600 \ 000}$$

	Mounting flange	Threaded port A	Threaded port B	Threaded drain port	Shaft end
M5A Uni-rotational	2-bolts ISO 3019-2 80 A2 HW	M22 x 1,5	M27 x 2	M12 x 1,5	Taper 1/5 Keyed ISO G20N
M5A Bi-rotational		M22 x 1,5		M12 x 1,5	
M5AS Uni-rotational	2-bolts SAE A J744	SAE 10 - (7/8"-14 UNF) 1/2" BSPP	SAE 12 - (1.1/16"-12 UNF) 3/4" BSPP	SAE 6 - (9/16" -18 UNF) 1/4" BSPP	Taper SAE B Keyed SAE B Taper 1/5 Keyed ISO G20N
M5AS Bi-rotational		SAE 12 - (1.1/16"-12 UNF) 3/4" BSPP		SAE 6 - (9/16"-18 UNF) 1/4" BSPP	
M5ASF Uni-rotational	2-bolts Ø 101,6 h8 cartridge / outrigger bearing version	M22 x 1,5 SAE 10 - (7/8"-14 UNF) 1/2" BSPP	M27 x 2 SAE 12 - (1.1/16"-12 UNF) 3/4" BSPP	M12 x 1,5 SAE 6 - (9/16"-18 UNF) 1/4" BSPP	Taper SAE B Keyed SAE B Taper 1/5 Keyed ISO G20N
M5ASF Bi-rotational		M22 x 1,5 SAE 12 - (1.1/16"-12 UNF) 3/4" BSPP		M12 x 1,5 SAE 6 - (9/16"-18 UNF) 1/4" BSPP	

Series	Theoretical Displacement V_i	Theoretical torque	Theoretical power at 100 rpm	Typical data at 2000 rpm - 280 bar	
	cm ³ /rev	N.m/bar	kW/bar	N.m	kW
M5A M5AS M5ASF	6,3	0,100	0,0011	24,4	5,1
	10,0	0,159	0,0017	40,8	8,6
	12,5	0,199	0,0021	52,0	10,9
	16,0	0,255	0,0027	67,6	14,2
	18,0	0,286	0,0030	75,8	15,9
	23,0	0,366	0,0038	98,4	20,4
	25,0	0,398	0,0042	107,4	22,5

PERMISSIBLE SHAFT LOADS

Theoretical lifetime [10⁶ rev] : L₁₀

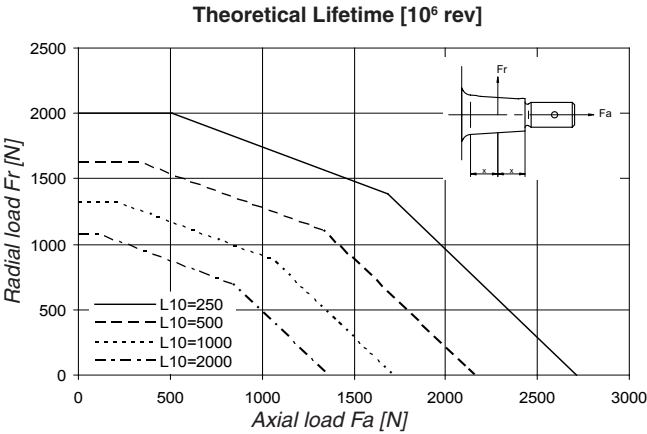
Theoretical lifetime [Hours] : $L_{10H} = \frac{16\ 666}{N\ [min^{-1}]} \times L_{10}$

Example of theoretical lifetime calculation

Axial load Fa = 1000 N
Radial load Fr = 500 N
Motor speed N = 1500 rpm

L10 = 2000 [10⁶ rev] (See Curve)

$L_{10H} = \frac{16\ 666}{1500} \times 2000$ L_{10H} = 22 221 hours.

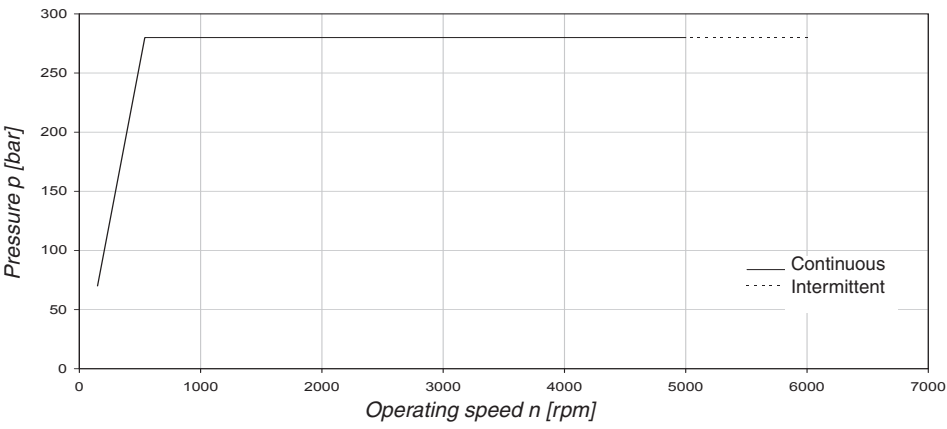


STARTING PERFORMANCES

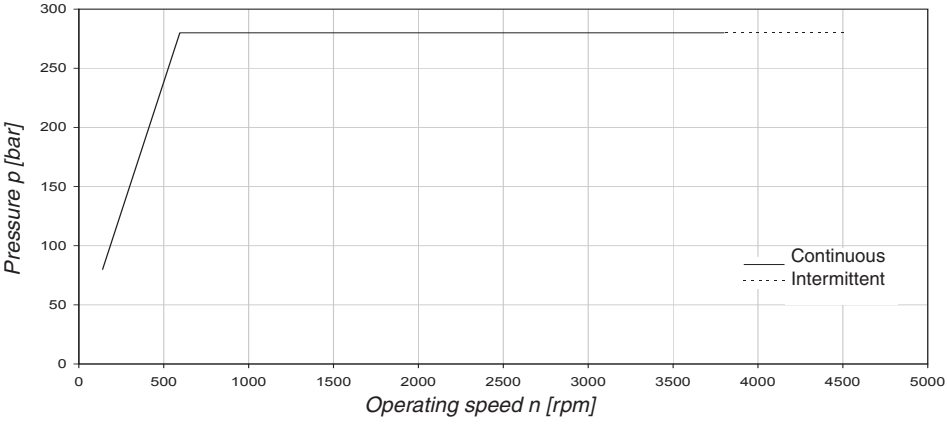
Typical data at 24 cSt @ 45° C

Maximum cross flow 100 bar : 0,6 l/min
200 bar : 7,4 l/min
280 bar : 8,9 l/min

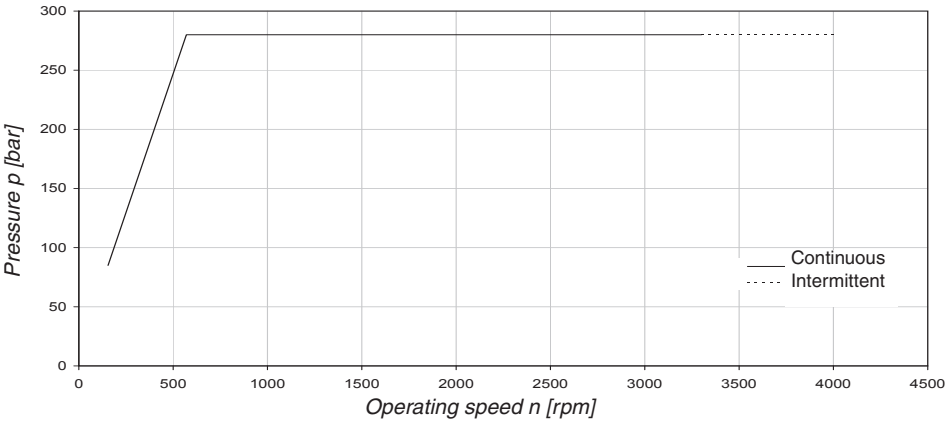
006 - 010



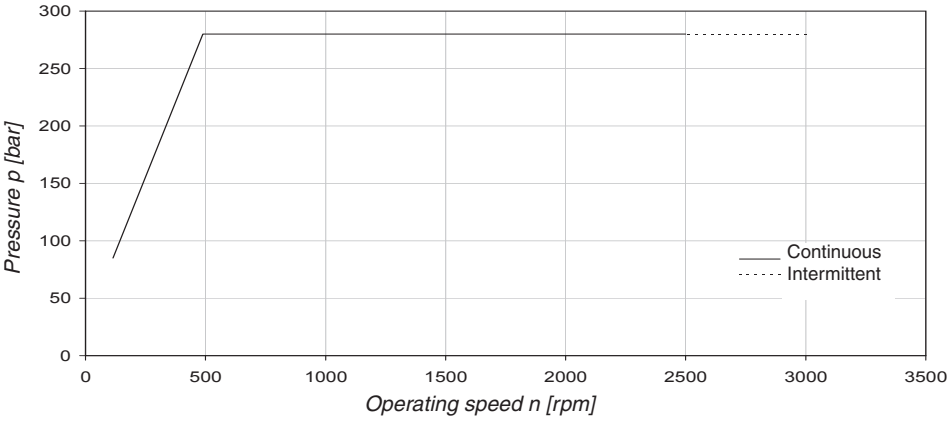
012 - 016



018

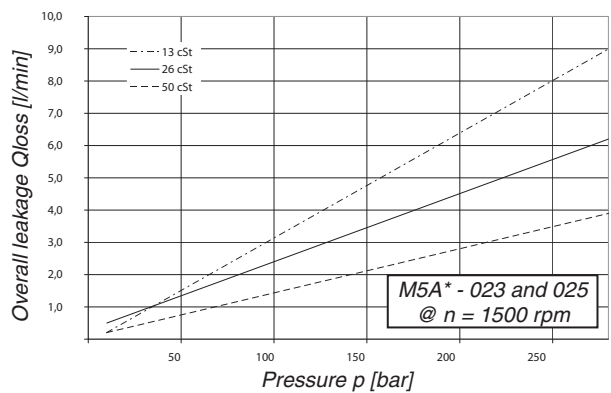
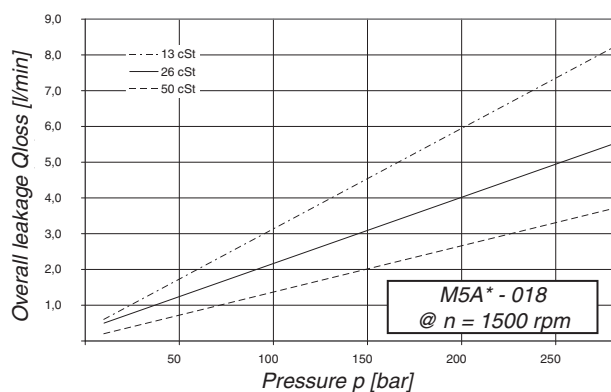
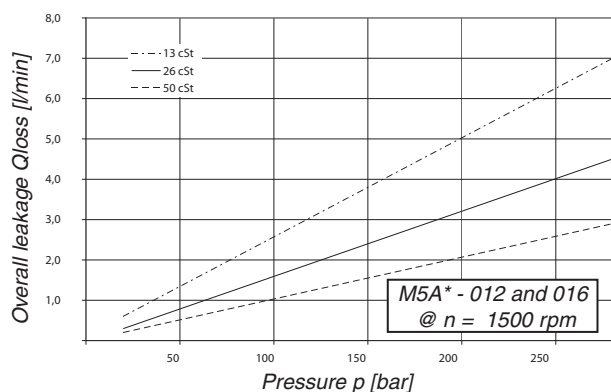
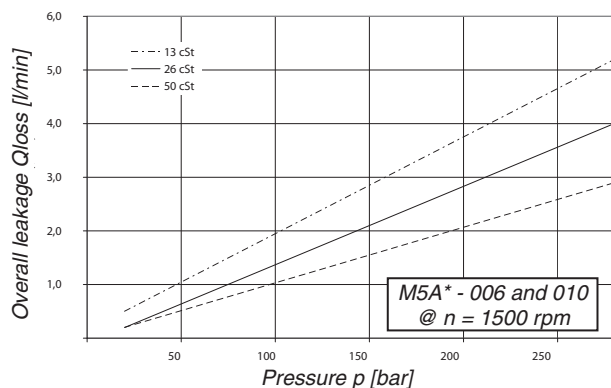


023 - 025

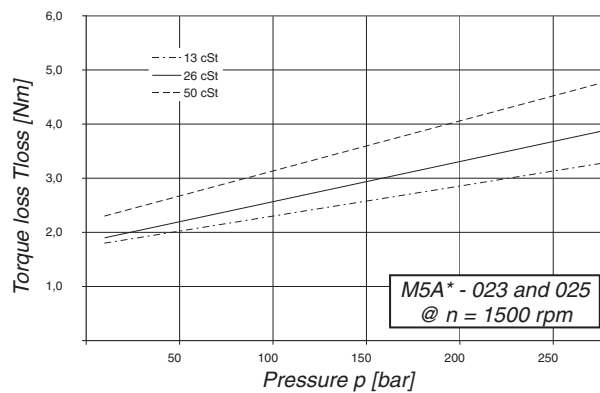
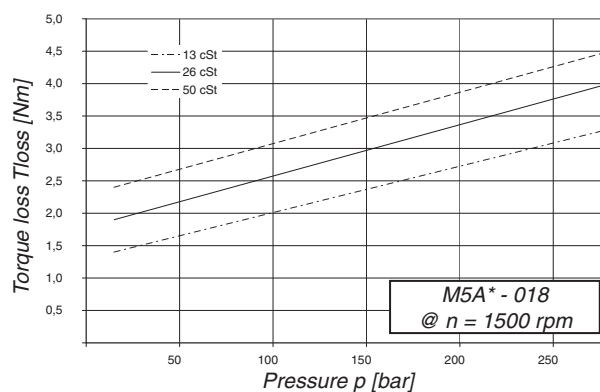
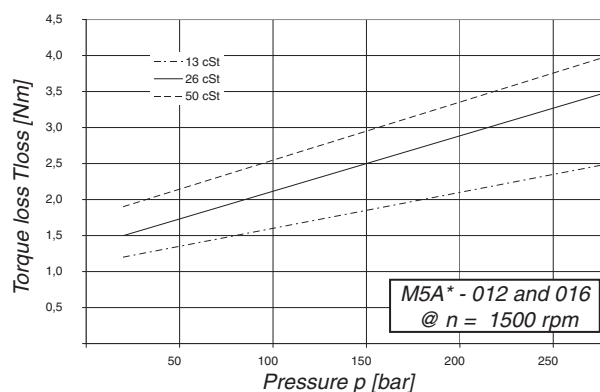
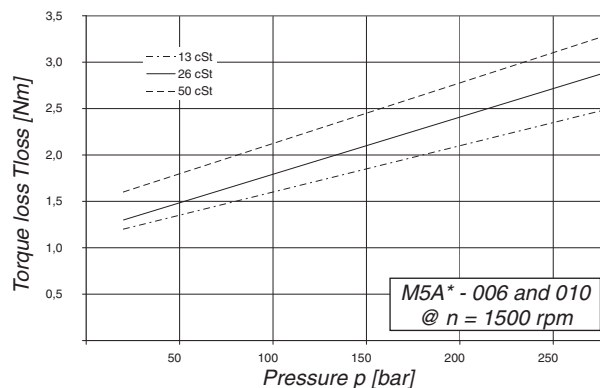


- These are running condition limits; for starting performances see page 7.
- Typical curves, at 24 cSt @ 45° C.
- For higher specifications or for operating speed under < 100 rpm, please consult us.

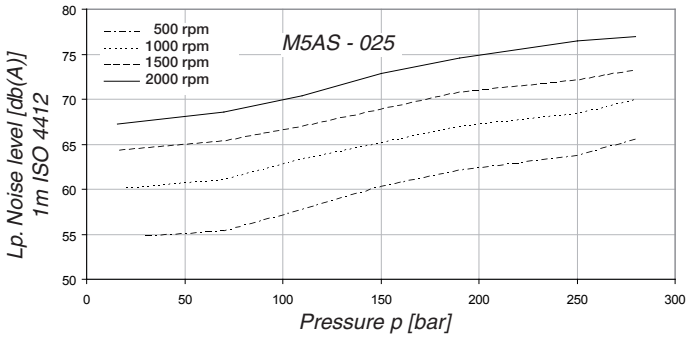
OVERALL LEAKAGE (internal + external)



TORQUE LOSS



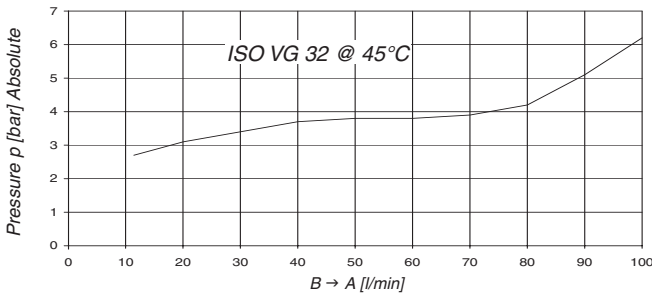
NOISE LEVEL



MINIMUM REPLENISHMENT PRESSURE DURING DECELERATION

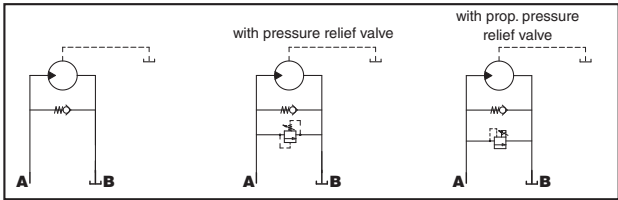
The hydraulic circuit should be designed in a way that when switching off the hydraulic motor, it remains supplied with fluid, without risk of cavitation (anti-cavitation valve may be needed). Uni rotational M5AS* Motors are fitted with an internal anti-cavitation valve.

Necessary pressure [bar absolute] at B port of M5AS* uni-rotational during deceleration



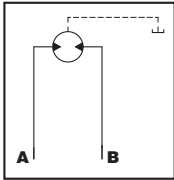
R OR L ROTATION New rotation concept - (Patent pending) :

R or L rotation are featuring a new internal concept where A is always “in” and B is always “out”.



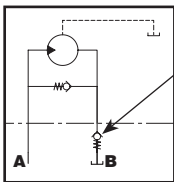
View from shaft end : CW or CCW rotations A = inlet
B = outlet

BI-ROTATIONAL (N)



View from shaft end : CW rotation A = inlet
B = outlet
CCW rotation A = outlet
B = inlet

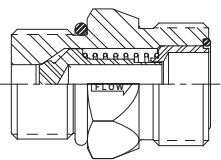
OPTION FOR M5AS - M5ASF UNI-ROTATIONAL MOTORS : ANTI STARVE VALVE



An anti-starve check valve can be screwed directly onto the B port of the uni-rotational motors, to ensure the minimum replenishment pressure during deceleration phases of high inertia systems (i.e. fan drive).

Parker DT series check valves

Ex : for SAE 12 treads DT - 750 - MOMF - 65
DT - 75 - MOMS - 65



Model No. M5AS - 018 - 1 N 02 - A 1 W - P21

M5A series - ISO 3019-2

Mounting flange 80 A2 SW

M5AS series - SAE A 2-bolts

J744 mounting flange

Cam ring

Volumetric displacement (ml/rev)

006 = 6,3 **018 = 18,0**

010 = 10,0 **023 = 23,0**

012 = 12,5 **025 = 25,0**

016 = 16,0

Type of shaft M5AS

1 = Taper (SAE B)

2 = Keyed (SAE B)

Type of shaft M5A or M5AS

5 = Taper 1/5

6 = Keyed (ISO G20N)

Direction of rotation (shaft end view)

R = Clockwise (with anti-cavitation check valve)

L = Counter-clockwise (with anti-cavitation check valve)

N = Bi-rotational (without anti-cavitation check Valve)

End cap type

0 = with opposite ports

1 = with side ports

Porting combination

(See table)

Modifications or special option

Ex. : P21 = Proportional pressure relief valve
set at 210 bar at 1000 rpm

End cap variables

M5A bi-rotational series		
Code	A & B ports	Drain port
Y	Metric thread M22 x 1,5	Metric thread M12 x 1,5

M5A uni-rotational series			
Code	A port	B port	Drain port
Y	Metric thread M22 x 1,5	Metric thread M27 x 2	Metric thread M12 x 1,5

M5AS bi-rotational series		
Code	A & B ports	Drain Port
W	SAE 12 thread 1.1/16"-12 UNF	SAE 6 thread 9/16"-18 UNF
Z	3/4" BSPP	1/4" BSPP

M5AS uni-rotational series			
Code	A port	B port	Drain port
W	SAE 10 thread 7/8"-14 UNF	SAE 12 thread 1.1/16"-12 UNF	SAE 6 thread 9/16"-18 UNF
Z	1/2" BSPP	3/4" BSPP	1/4" BSPP

Seal class

1 = S1 BUNA N

5 = S5 - VITON®

Design letter

Model No. M5ASF - 018 - 1 N 02 - A 1 W - P21

M5ASF - 2-bolts flange

Ø 101,6 h8

Cam ring

Volumetric displacement (ml/rev)

006 = 6,3 **018 = 18,0**

010 = 10,0 **023 = 23,0**

012 = 12,5 **025 = 25,0**

016 = 16,0

Type of shaft

1 = Taper (SAE B)

2 = Keyed (SAE B)

5 = Taper 1/5

6 = Keyed (ISO G20N)

Direction of rotation (shaft end view)

R = Clockwise (with anti-cavitation check valve)

L = Counter-clockwise (with anti-cavitation check valve)

N = Bi-rotational (without anti-cavitation check Valve)

End cap type

0 = with opposite ports

1 = with side ports

Porting combination

(See table)

Modifications or special option

Ex. : P21 = Proportional pressure relief valve
set at 210 bar at 1000 rpm

End cap variables

M5ASF bi-rotational series		
Code	A & B ports	Drain port
Y	Metric thread M22 x 1,5	Metric thread M12 x 1,5
W	SAE 12 thread 1.1/16"-12 UNF	SAE 6 thread 9/16"-18 UNF
Z	3/4" BSPP	1/4" BSPP

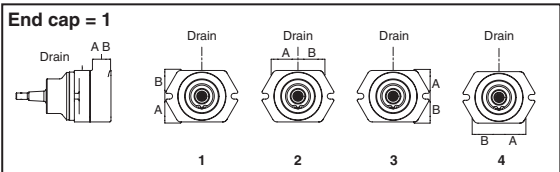
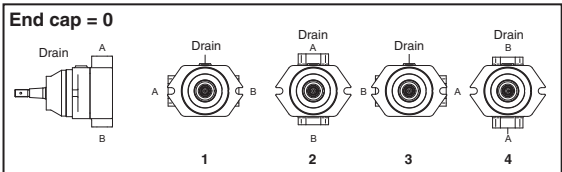
M5ASF uni-rotational series			
Code	A port	B port	Drain port
Y	Metric thread M22 x 1,5	Metric thread M27 x 2	Metric thread M12 x 1,5
W	SAE 10 thread 7/8"-14 UNF	SAE 12 thread 1.1/16"-12 UNF	SAE 6 thread 9/16"-18 UNF
Z	1/2" BSPP	3/4" BSPP	1/4" BSPP

Seal class

1 = S1 BUNA N

5 = S5 - VITON®

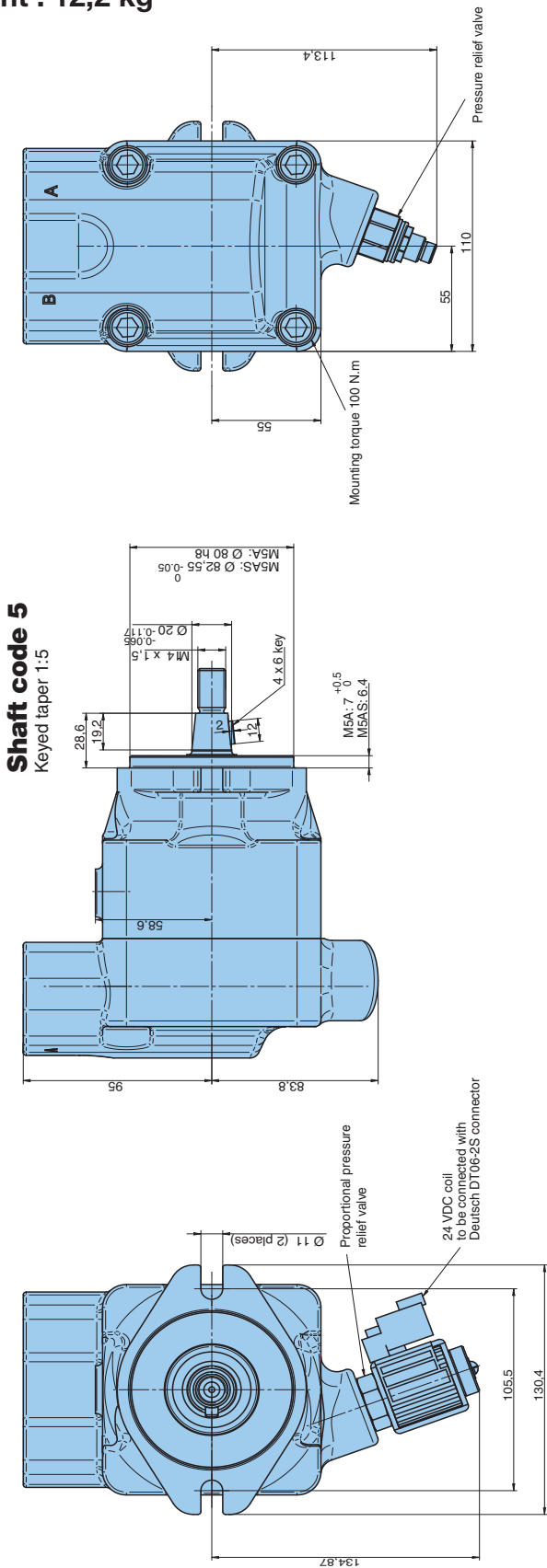
Design letter



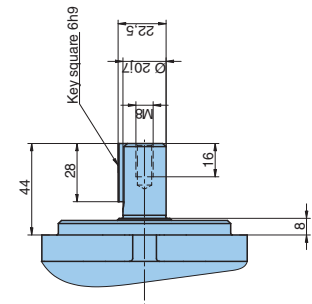
Empfohlene Typen sind fett gedruckt.

Motor with side ports

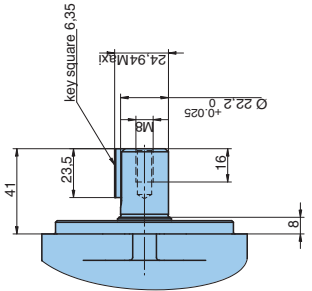
Weight : 12,2 kg



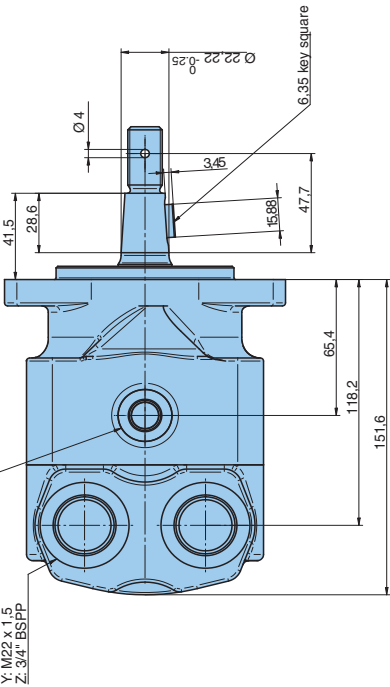
Shaft code 6
ISO G20N keyed



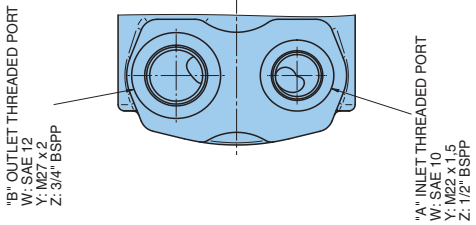
Shaft code 2
SAE B keyed



Shaft code 1
SAE B - J744 (modified)
Taper 125:1000

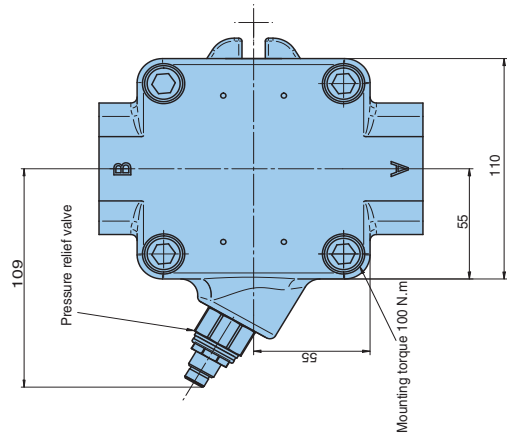


Uni-rotational version

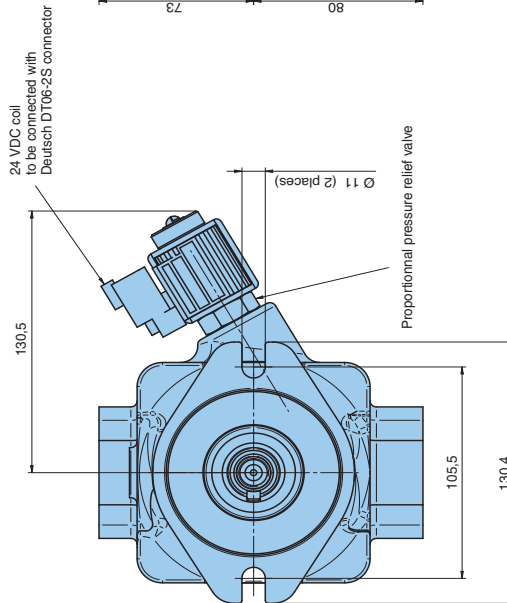
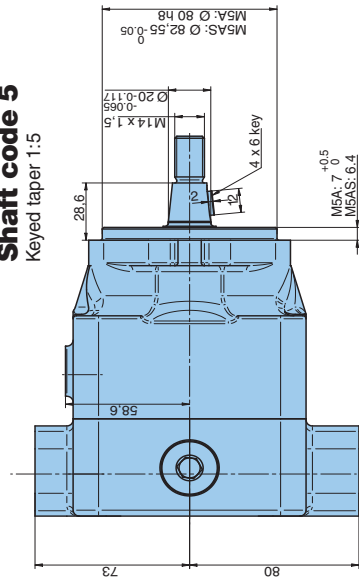


Motor with opposite ports

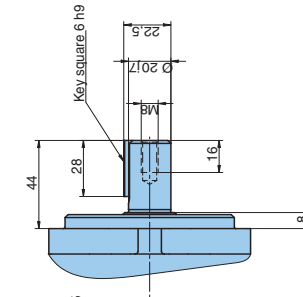
Weight : 11,2 kg



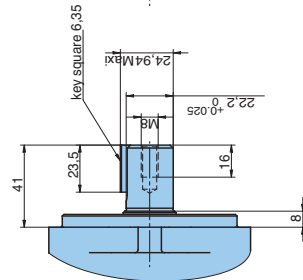
Shaft code 5
Keyed taper 1:5



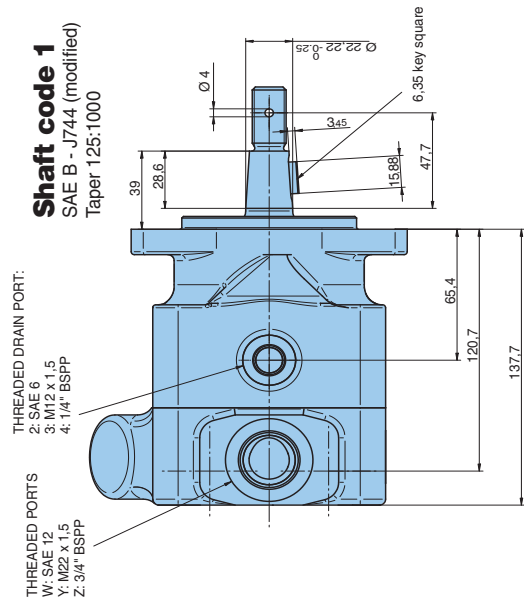
Shaft code 6
ISO G20N keyed



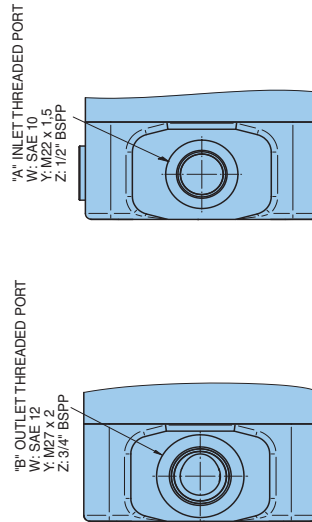
Shaft code 2
SAE B keyed



Shaft code 1
SAE B - J744 (modified)
Taper 125:1000

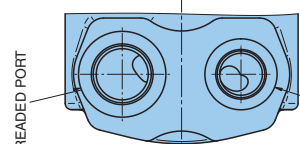
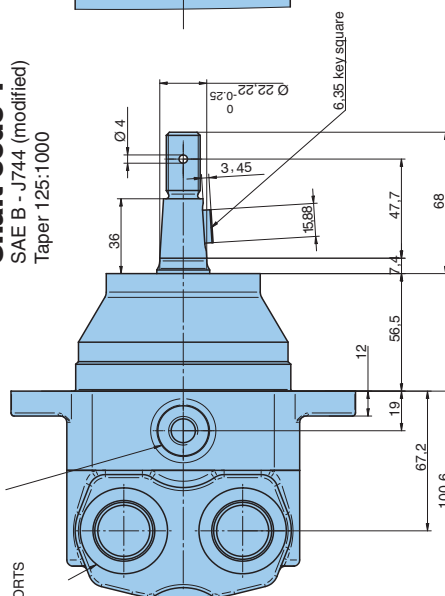
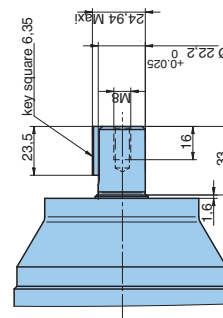
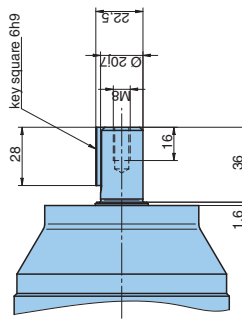
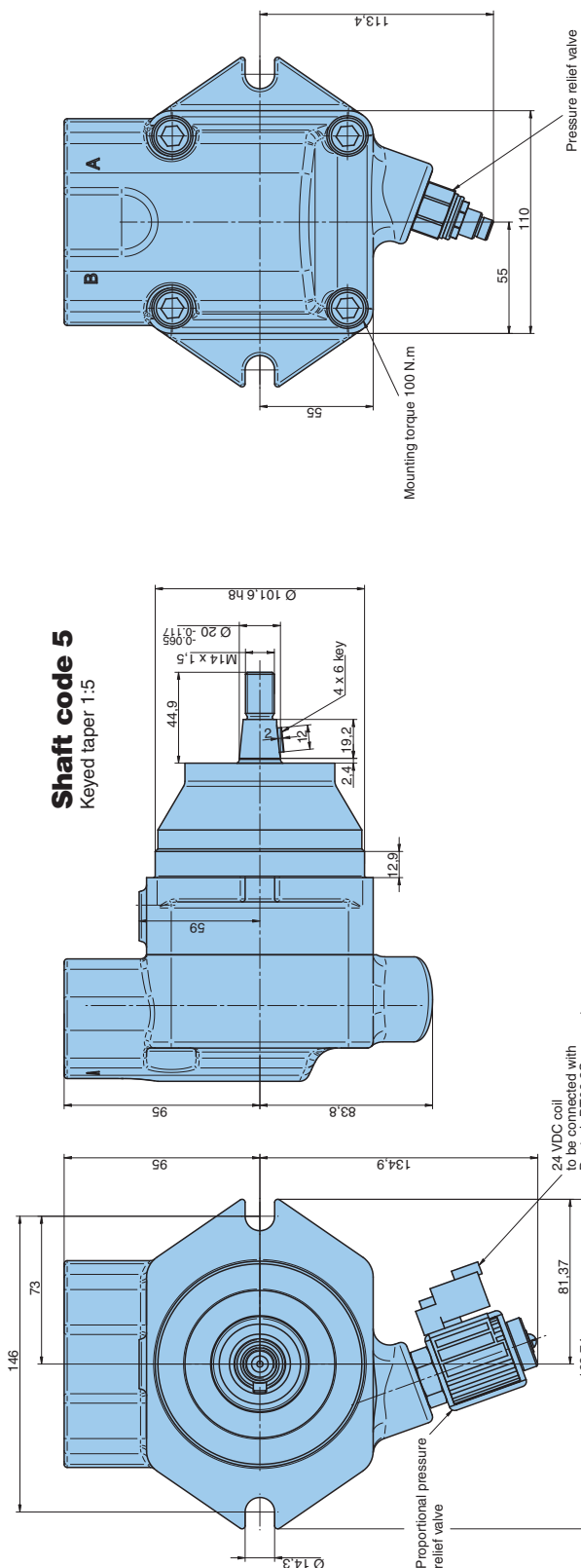


Uni-rotational version



Motor with side ports

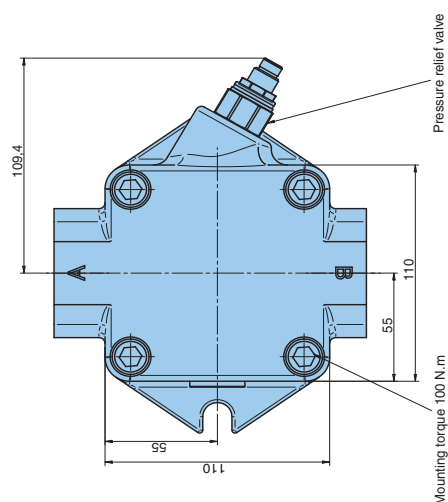
Weight : 11,5 kg



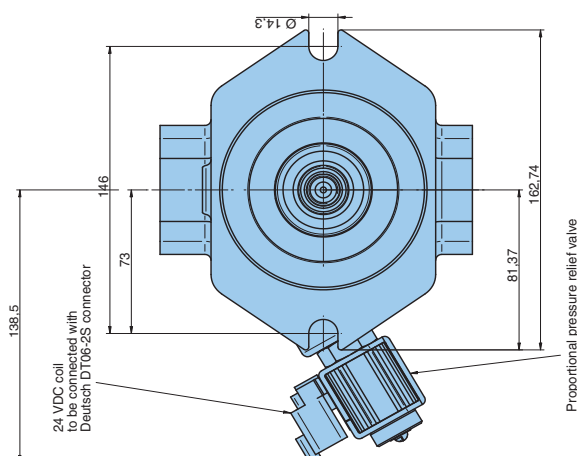
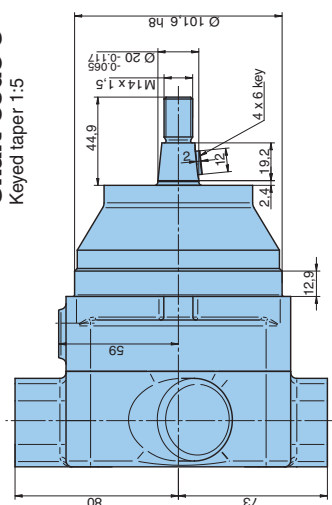
"A" INLET THREADED PORT
W: SAE 10
Y: M22 x 1,5
Z: 1/2" BSPP

Motor with opposite ports

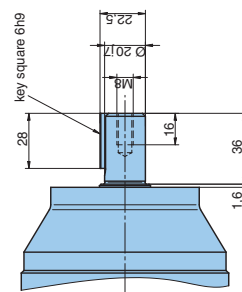
Weight : 10,5 kg



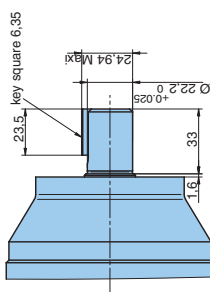
Shaft code 5
Keyed taper 1:5



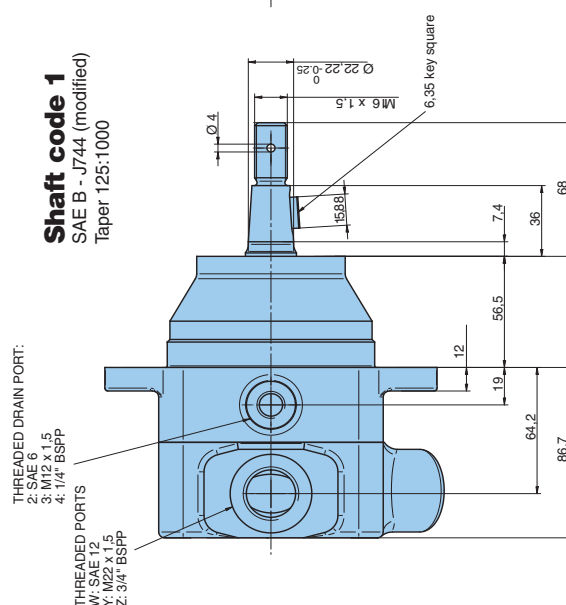
Shaft code 6
ISO G20N keyed



Shaft code 2

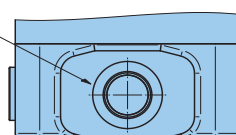
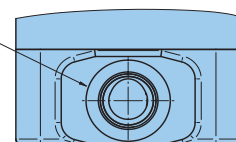


Shaft code 1
SAE B - J744 (modified)
Taper 125:1000



Uni-rotational version

"A" INLET THREADED PORT
W: SAE 10
L: M22 x 1.5
Z: 1/2" BSPP



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