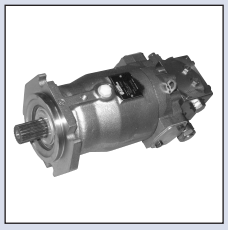
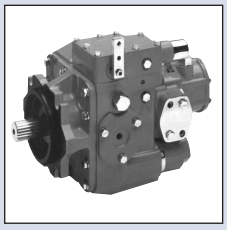
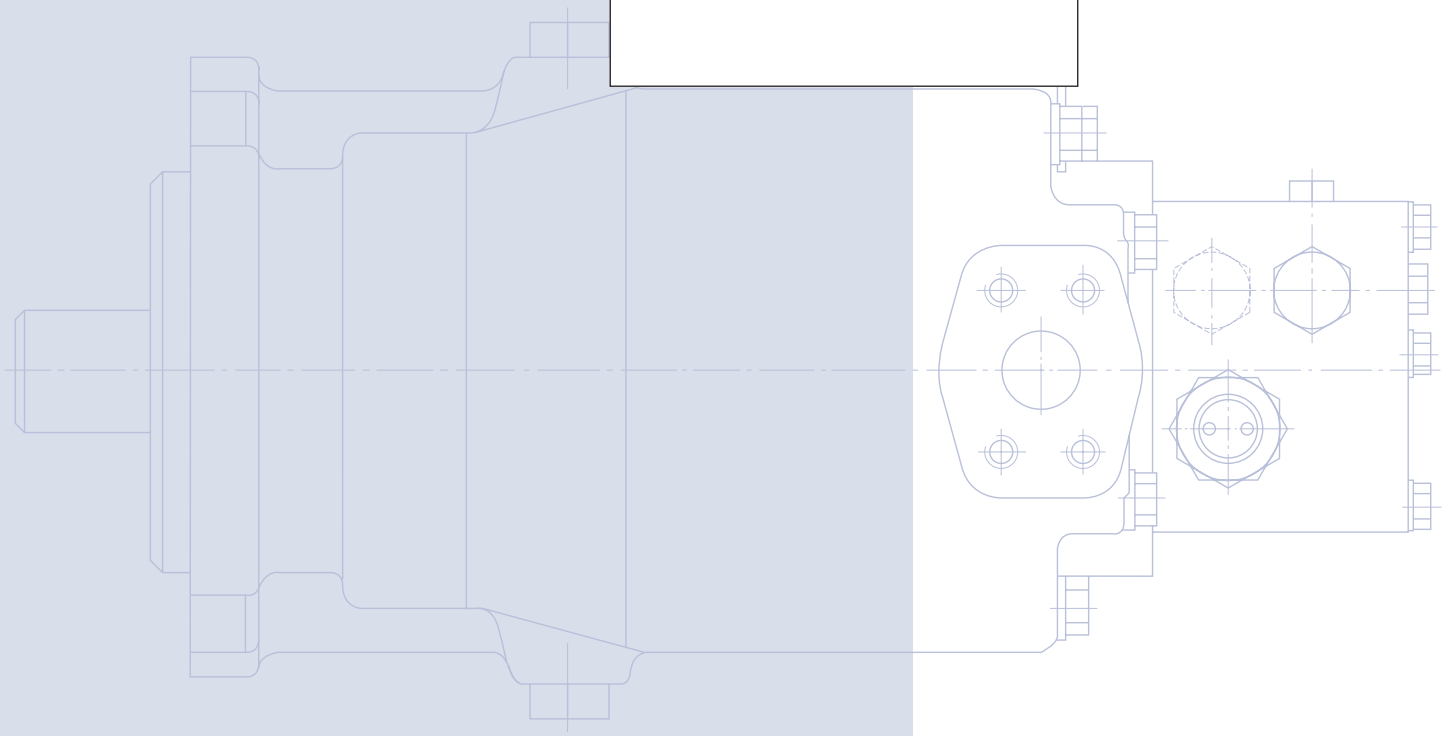
SAUER DANFOSS

Series 20
Axial Piston Motors

Technical Information







Series 20 – Axial Piston Motors
Technical Information
General Description

INTRODUCTION

Sauer-Danfoss a world leader in hydraulic power systems has developed a family of axial piston motors.

DESCRIPTION

Sauer-Danfoss axial pistons fixed displacement motors are of swash plate design with preset displacement suitable for hydrostatic transmissions with closed loop circuit.
The output speed is proportional to the motor's input flow.
The output torque is proportional to the differential pressure applied to the main pressure ports.
The direction of motor (output) shaft rotation depends on flow input to the main pressure ports.

Sauer-Danfoss axial piston fixed displacement motors are well engineered and easy to handle.
The full-length shaft with a highly efficient tapered roller bearing arrangement offers a high loading capacity for external radial forces.
High case pressures can be achieved without leakage even at the lowest temperatures by using suitable shaft seals.
Sauer-Danfoss axial piston units are designed for easy servicing. Complete dismantling and reassembly can be carried out with standard hand tools, and all components or sub-assemblies are replaceable.
Axial piston fixed displacement motors of the Sauer-Danfoss pattern are made by licensed producers worldwide, providing consistent service and fully inter-changeable parts.

TYPICAL MARKETS

- Industrial
- Mining
- Transit Mixer
- Utility Vehicles

Front page: F005 103, F000 249, F000 150, F000 248

DKMH.PN.340.C1.02 **520L0516**

Series 20 – Axial Piston Motors
Technical Information
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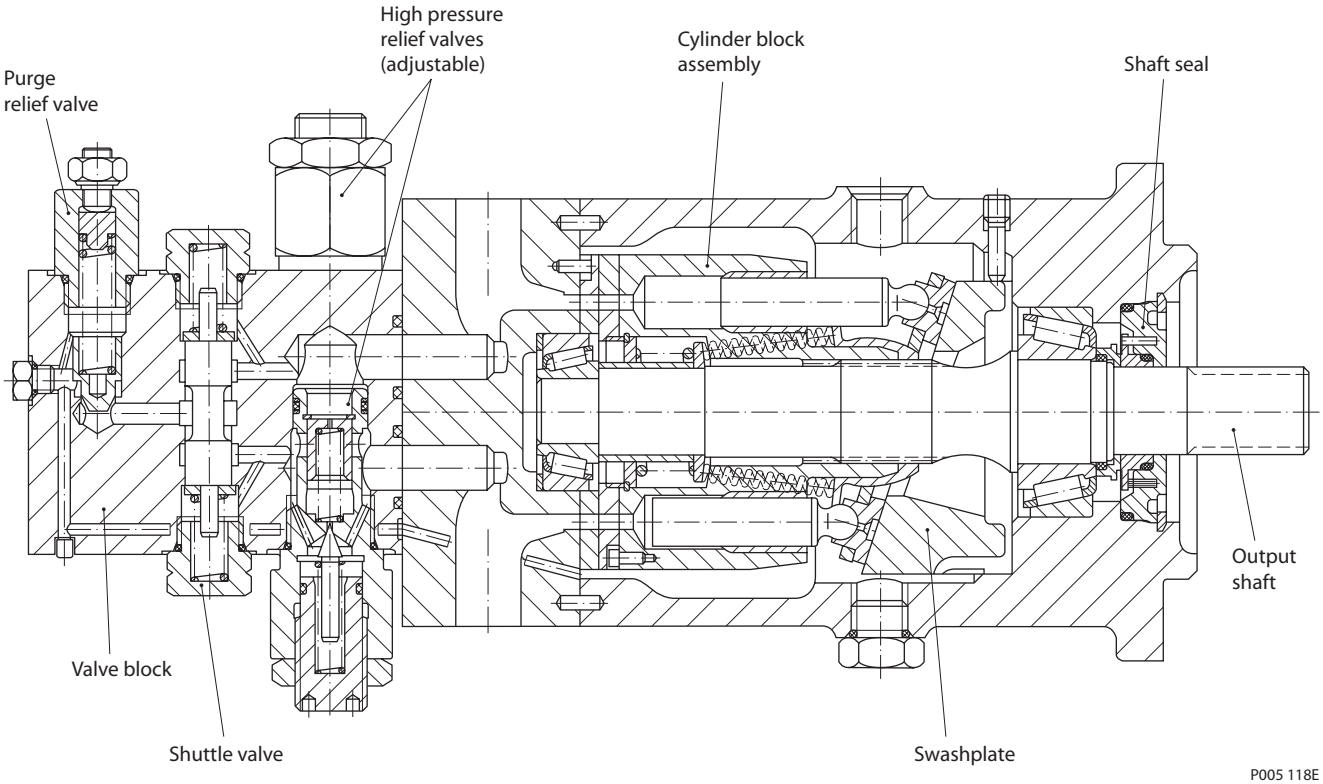
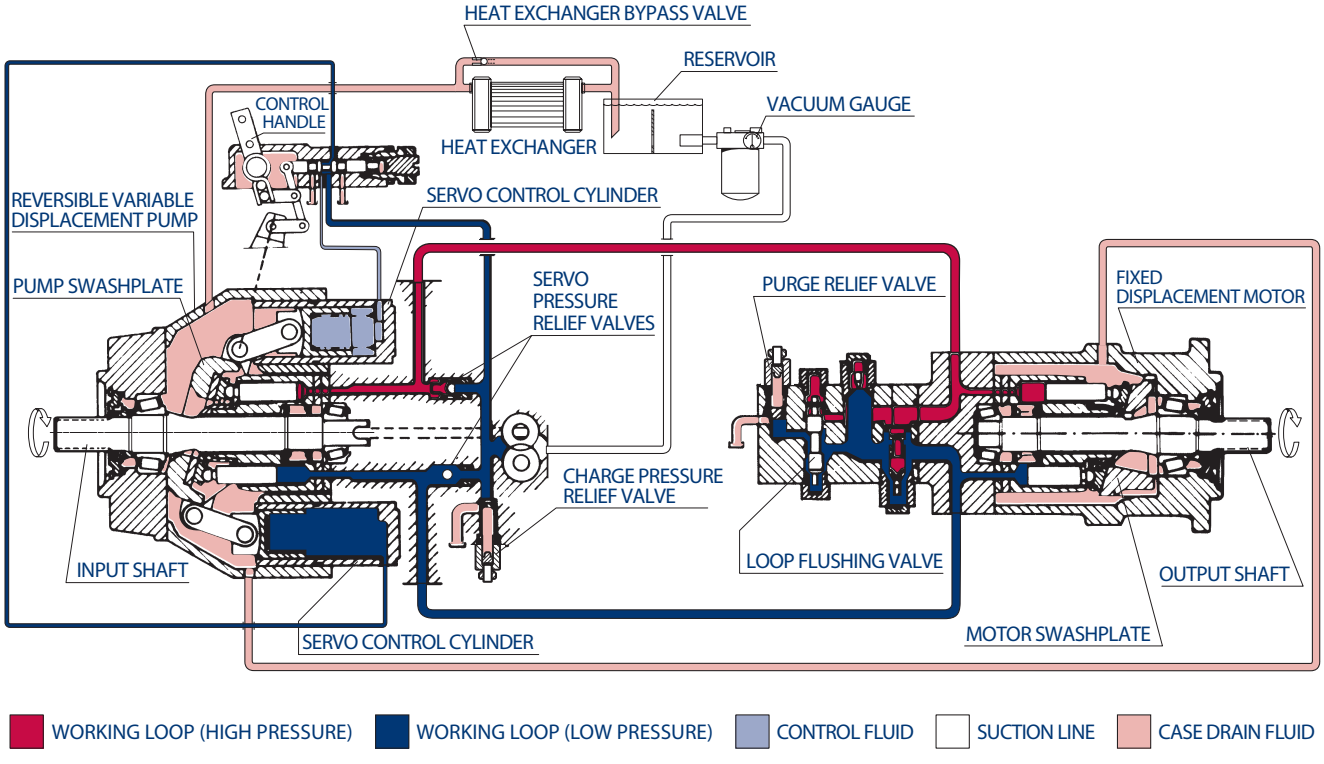
AXIAL PISTON FIXED DISPLACEMENT MOTOR



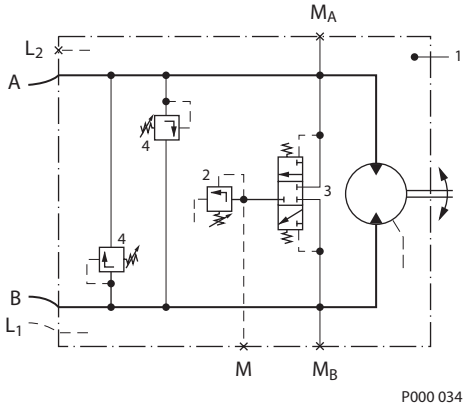
PUMP AND MOTOR CIRCUIT DESCRIPTION



P000 027E

Above figure shows schematically the function of a hydrostatic transmission using an axial piston variable displacement pump and a fixed displacement motor.

MOTOR CIRCUIT SCHEMATIC



P000 034

Designation:

1	=	Fixed displacement motor
2	=	Purge relief valve
3	=	Shuttle valve
4	=	High pressure relief valve

Ports:

A, B	=	Main pressure ports (working loop)
L_1, L_2	=	Drain ports
M_A	=	Gauge port for port **A**
M_B	=	Gauge port for port **B**
M	=	Gauge port - charge pressure

TECHNICAL PARAMETERS

Design
Axial piston motor with fixed displacement and swash plate design.

Type of mounting
SAE four bolt flanges.

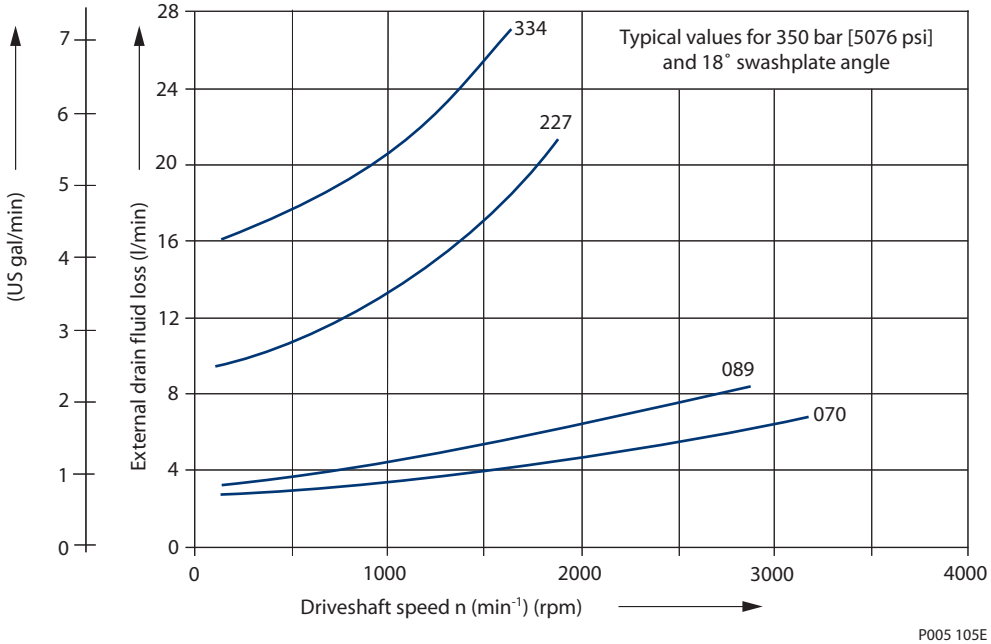
Pipe connections
Main pressure ports: SAE split flange
Remaining ports: SAE O-ring boss

Direction of rotation and flow
Clockwise or counterclockwise (viewing from the output shaft).

Direction of rotation	Port **A**	Port **B**
Clockwise (R)	Output	Input
Counterclockwise (L)	Input	Output

Installation position
Optional; motor housing must be always filled with hydraulic fluid.

External drain fluid loss



P005 105E

HYDRAULIC PARAMETERS

System pressure range, input p_1

Pressure on port A or B:

Max. operating pressure Δp = 420 bar [6092 psi]
Max. high pressure setting Δp = 460 bar[1] [6672 psi]

[1] only with POR-valve

System pressure range, output p_2

Normal setting for configuration MS and MR: 11.0 - 12.5 bar [160 - 181 psi] above case pressure.

Minimum: 8 bar, intermittent only

Case pressure

Max. rated pressure = 2.5 bar [36.3 psi]
Intermittent = 5.0 bar [72.5 psi]

Hydraulic fluid

Refer to Sauer-Danfoss publication Hydraulic Fluids and Lubricants and Experience with Bio Fluids for biodegradable hydraulic fluids.

Hydraulic fluid temperature range

ϑ_{min} = - 40 °C [- 40 °F]
ϑ_{max} = 95 °C [203 °F]

Viscosity range

ν_{min} = 7 mm²/s [49 SUS*]
ν_{max} = 1000 mm²/s [4630 SUS*] (intermittent cold start)
Recommended viscosity range: 12 - 60 mm²/s [66 - 278 SUS*]

*SUS (Saybolt Universal Second)

Filtration

Required cleanliness level: ISO 4406-1999 Code 22/18/13 or better. *Refer to Sauer-Danfoss publication Hydraulic Fluids and Lubricants and Design Guideline for Hydraulic Fluid Cleanliness.*

Shaft load

The pump will accept radial and axial loads on its shaft, the maximum capacity being determined by direction and point of application of the load. Please contact your Sauer-Danfoss representative.

HYDRAULIC PARAMETERS (continued)

Technical data					
	Dimension	Frame size			
		070	089	227	334
Max. displacement	cm^3	69.8	89.0	227.3	333.7
	[in^3]	[4.26]	[5.43]	[13.87]	[20.36]
Rated speed [1]	min^{-1} (rpm)	3200	2900	2100	1900
Theoretical torque	Nm/bar	1.11	1.42	3.62	5.31
	[in lb/1000 psi]	[677]	[867]	[2209]	[3240]
Mass moment of inertia	kg $m^2 \cdot 10^{-3}$	12.34	17.77	86.80	161.40
of rotating group	[lbf•$ft^2 \cdot 10^{-3}$]	[292.8]	[421.7]	[2059.8]	[3830.0]

[1] for higher speeds contact your Sauer-Danfoss representative

Determination of nominal motor size

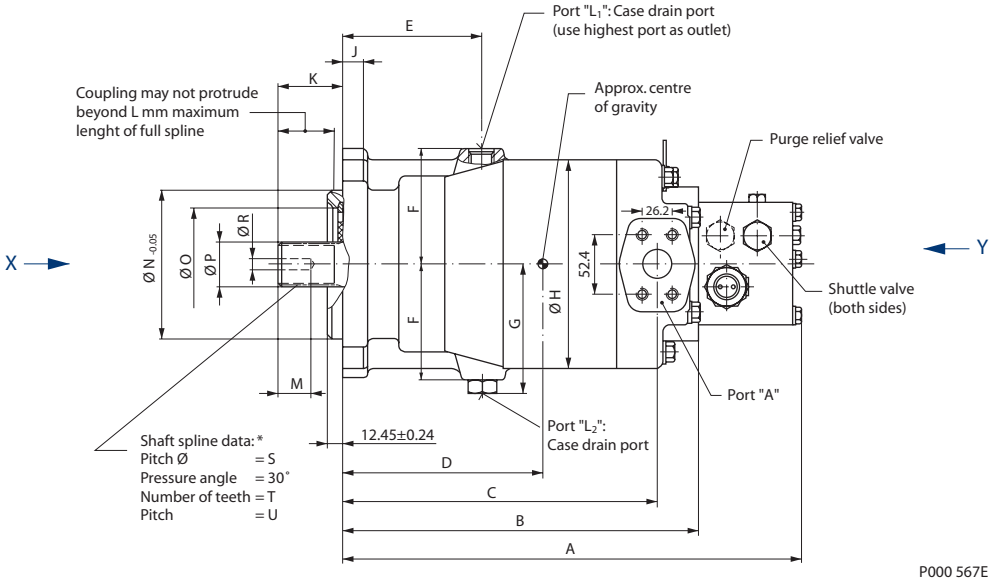
Unit:	Metric System:		Inch System	
Input flow	$Q_e = \frac{V_g \cdot n}{1000 \cdot \eta_v}$	l/min	$Q_e = \frac{V_g \cdot n}{231 \cdot \eta_v}$	[gpm]
Output torque	$M_e = \frac{V_g \cdot \Delta p \cdot \eta_m}{20 \cdot \pi}$	Nm	$M_e = \frac{V_g \cdot \Delta p \cdot \eta_m}{2 \cdot \pi}$	[lbf•in]
Output power	$P_e = \frac{Q_e \cdot \Delta p \cdot \eta_t}{600}$	kW	$P_e = \frac{V_g \cdot n \cdot \Delta p \cdot \eta_t}{396\,000}$	[hp]
Speed	$n = \frac{Q_e \cdot 1000 \cdot \eta_v}{V_g}$	min^{-1}	$n = \frac{Q_e \cdot 231 \cdot \eta_v}{V_g}$	(rpm)

Efficiency characteristic curves available on request.

V_g	=	Moror displacement per revolution	cm^3	[in^3]
n	=	Motor speed	min^{-1}	(rpm)
Δp	=	Hydraulic pressure differential $\Delta p = p_{HD} - p_{ND}$	bar	[psid]
η_v	=	Moror volumetric efficiency		
η_m	=	Moror mechanical efficiency		
η_t	=	Moror total efficiency		
p_{HD}	=	High pressure	bar	[psid]
p_{ND}	=	Low pressure	bar	[psid]

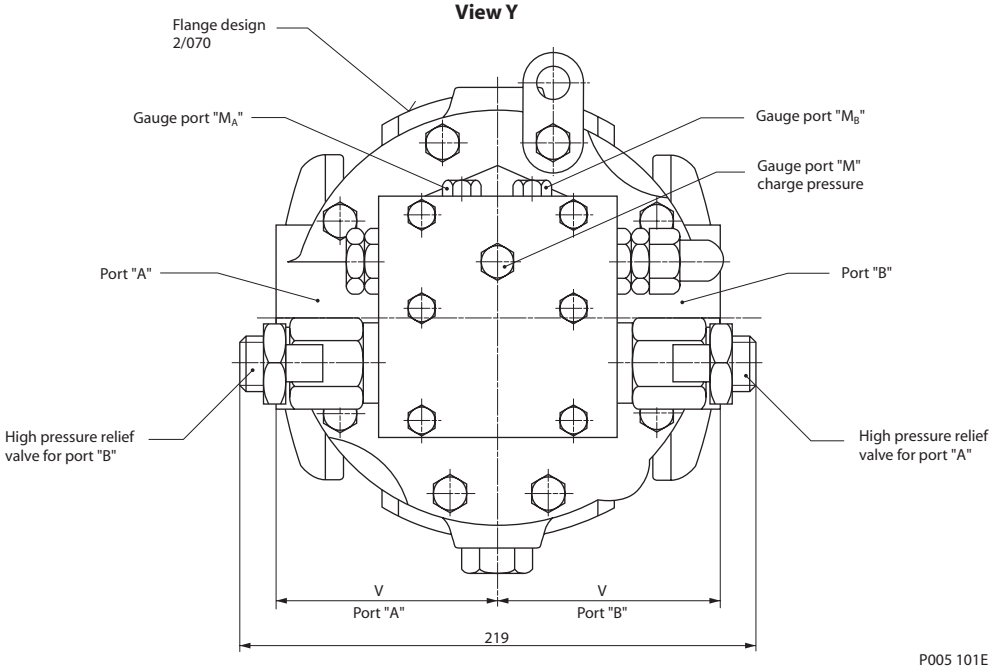
Dimensions – Frame Size 070 and 089 cm³

OUTLINE DRAWING, CONFIGURATION MS



P000 567E

View Y



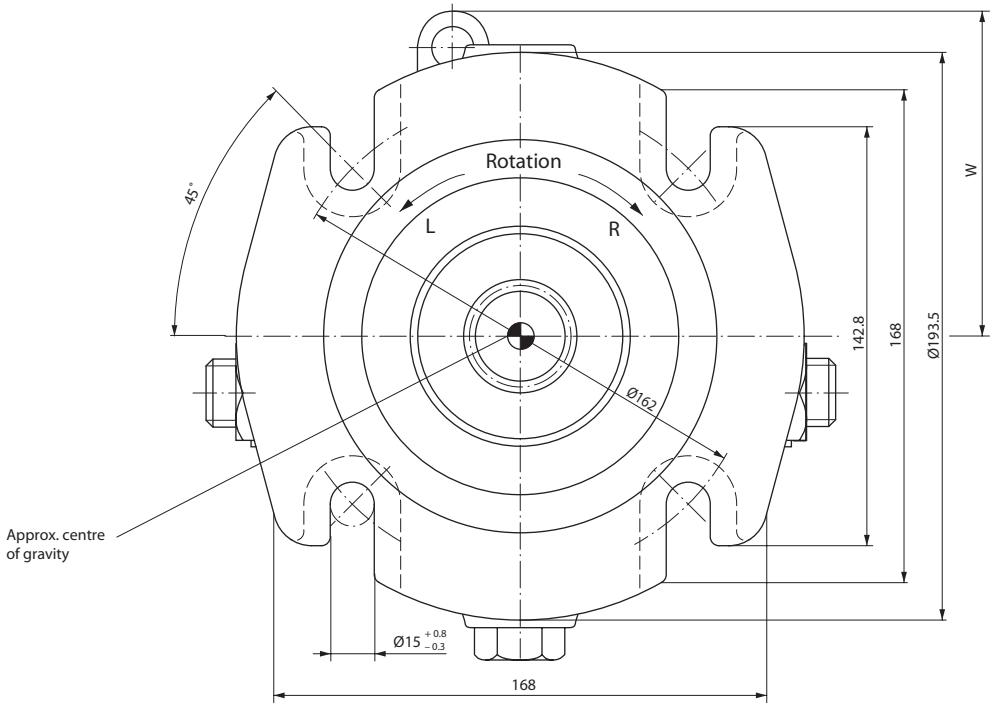
P005 101E

* Shaft spline data: spline shaft with involute spline, according to SAE handbook, 1963, class 1, fillet root side fit.

Frame size	Port **A** and **B**	Port **L_1** and **L_2**	Port **M_A** and **M_B**	Port **M**
070	SAE flange, size 1 SAE split flange boss 5000 psi 4 threads 3/8-16 UNC-2B 18 deep	7/8-14 UNF-2B SAE straight thread O-ring boss	7/16-20 UNF-2B SAE straight thread O-ring boss	
089				

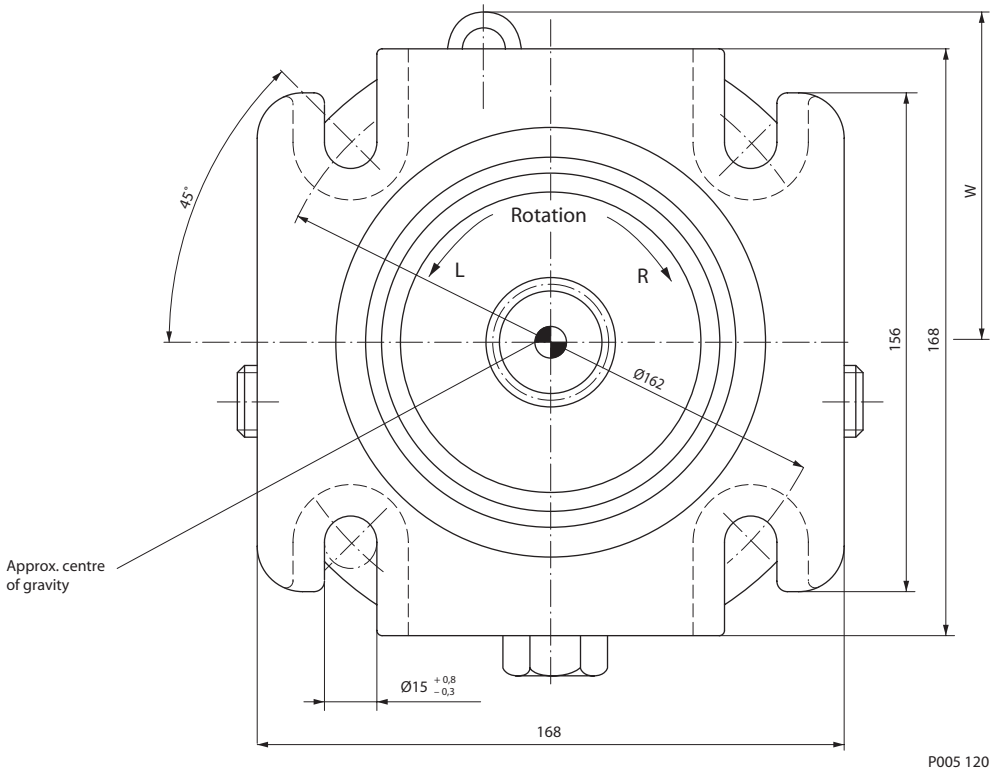
OUTLINE DRAWING, CONFIGURATION MS (continued)

View X (for SMF 2/070 only)



P005 119E

View X (for SMF 2/089 only)

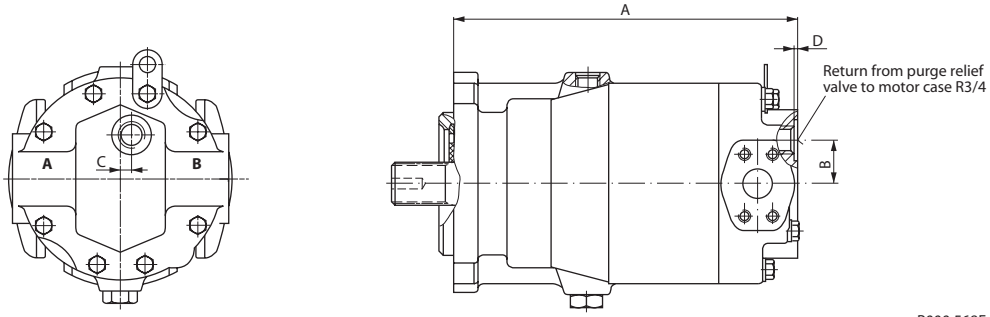


P005 120

OUTLINE DRAWING, CONFIGURATION MS (continued)

Dimensions												
Frame size	**A** mm [in]	**B** mm [in]	**C** mm [in]	**D** mm [in]	**E** mm [in]	**F** mm [in]	**G** mm [in]	∅**H** mm [in]	**J** mm [in]	**K** mm [in]	**L** mm [in]	**M** mm [in]
070	378 [14.882]	290 [11.417]	255 [10.039]	165 [6.496]	108 [4.252]	86.5 [3.406]	98 [3.858]	161 [6.339]	16 [0.630]	56 [2.205]	48 [1.890]	28.4 [1.118]
089	395 [15.551]	307 [12.087]	273 [10.748]	170 [6.693]	118 [4.646]	96.0 [3.780]	107 [4.213]	181 [7.126]	18 [0.709]	56 [2.205]	48 [1.890]	28.4 [1.118]
Frame size	∅**N** mm [in]	∅**O** mm [in]	∅**P** mm [in]	∅**R** mm [in]	∅**S** mm [in]	**T** mm [in]	**U** mm [in]	**V** mm [in]	**W** mm [in]	Diameter for shaft coupling mm [in]		Weight kg [lb]
070	127 [5.000]	84 [3.307]	$34.50^{-0.17}_{-0.0067}$ [1.358]	8.5 [0.335]	33.338 [1.313]	21 [0.827]	16/32	85.8 [3.378]	101 [3.976]	$31.75^{+0.062}$ [1.250 $^{+0.0024}$]		40 [88]
089	127 [5.000]	98 [3.858]	$37.68^{-0.17}_{-0.0067}$ [1.483]	8.5 [0.335]	36.513 [1.438]	23 [0.906]	16/32	95.2 [3.748]	114 [4.488]	$34.95^{+0.062}$ [1.376 $^{+0.0024}$]		47 [104]

OUTLINE DRAWING, BASIC MODEL

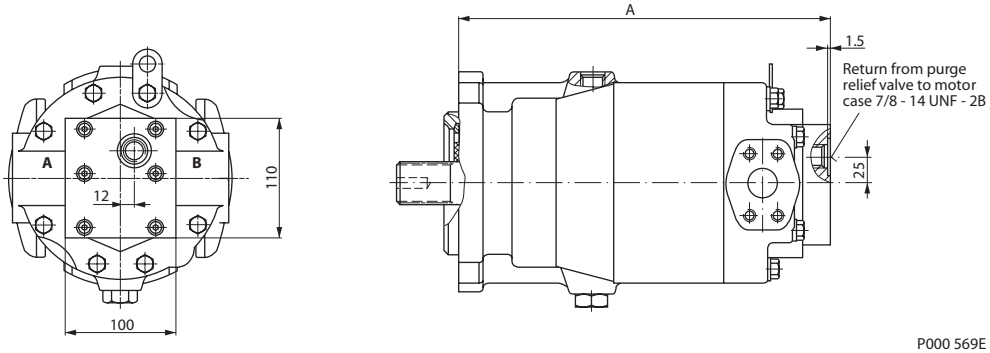


P000 568E

Dimensions					
Frame size	**A** mm [in]	**B** mm [in]	**C** mm [in]	**D** mm [in]	Weight kg [lb]
070	290 [11.417]	30 [1.181]	12 [0.472]	2 [0.079]	34 [75]
089	307 [12.087]	44 [1.732]	6 [0.236]		41 [90]

For further dimensions see previous pages.

OUTLINE DRAWING, MOTOR CONFIGURATION AM 01000



P000 569E

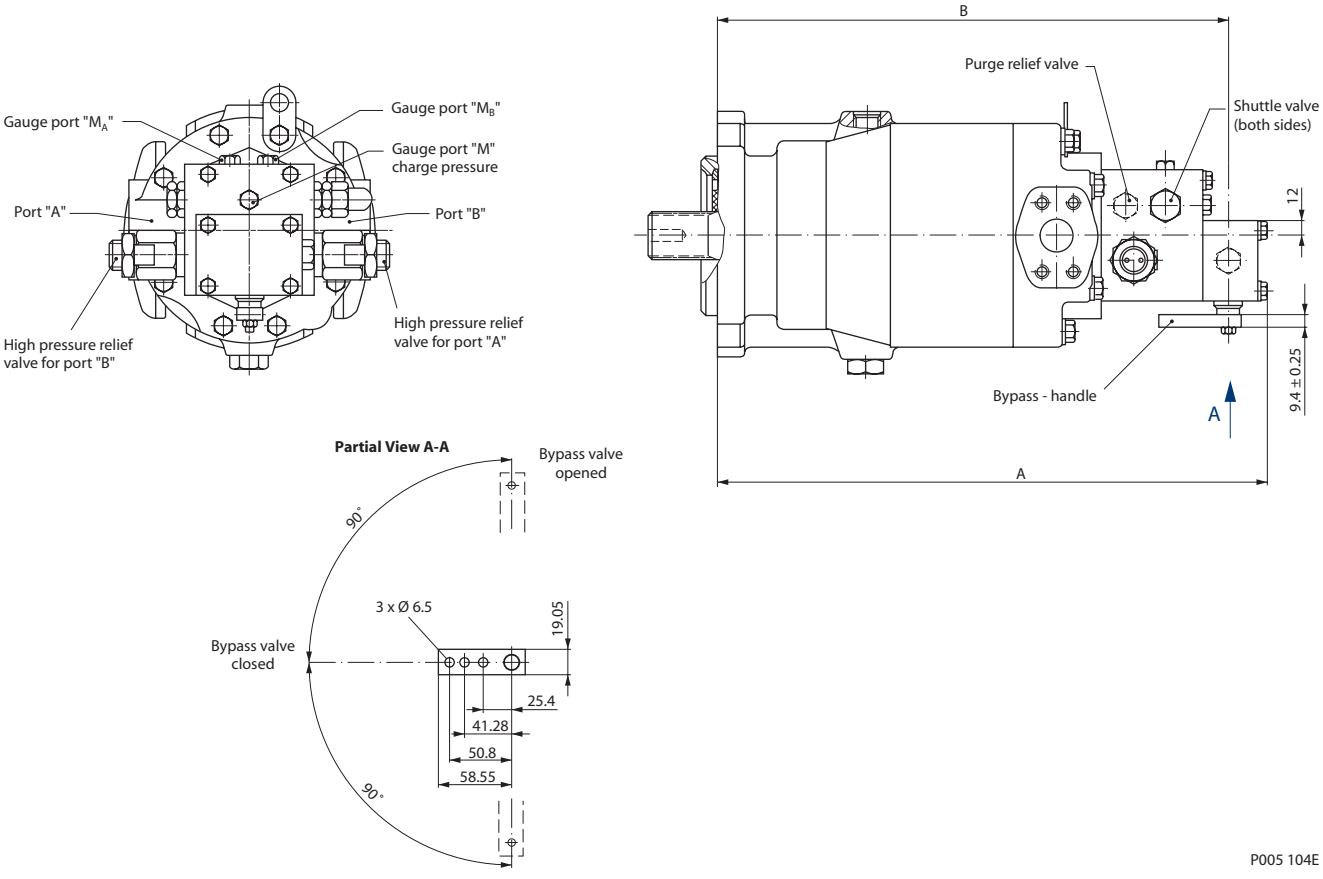
Dimensions		
Frame size	**A** mm [in]	Weight [1] kg [lb]
070	315 [12.402]	36 [79]
089	332 [13.071]	43 [95]

[1] Light weight and short options available on request

For further dimensions see previous pages.

Dimensions – Frame Size 070 and 089 cm³

OUTLINE DRAWING, MOTOR CONFIGURATION MR



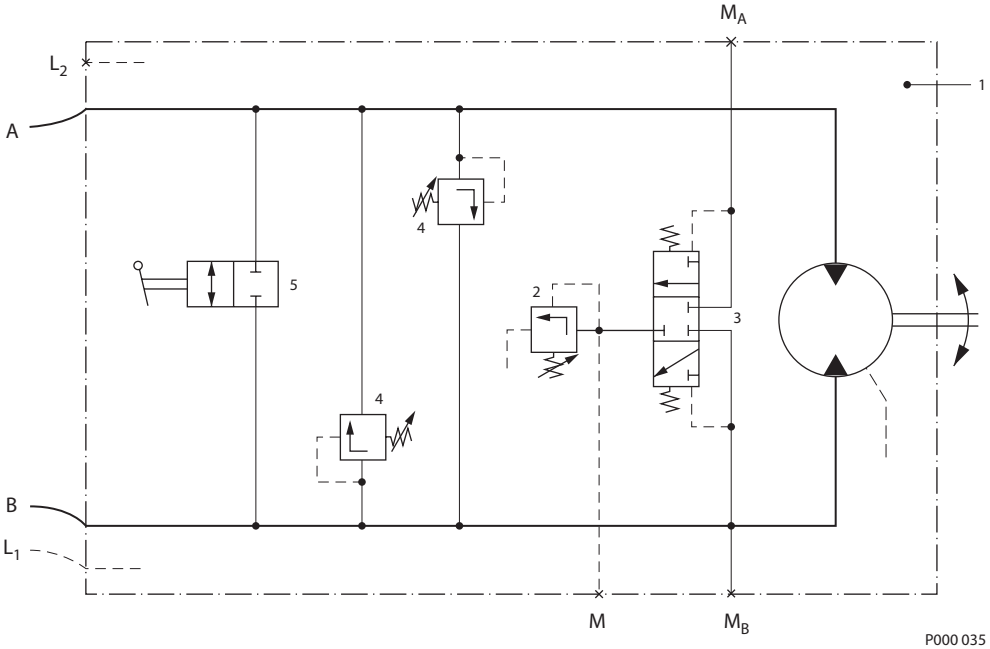
Dimensions					
Frame size	**A** mm [in]	**B** mm [in]	Weight kg [lb]	Port M_A and M_B	Port **M**
070	426 [16.772]	391 [15.394]	42 [93]	7/16-20 UNF-2B SAE straight thread O-ring boss	
089	443 [17.441]	408 [16.063]	49 [108]		

For further dimensions see previous pages.

Dimensions – Frame Size 070 and 089 cm³

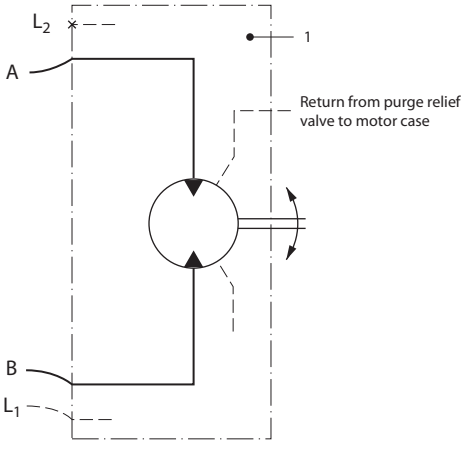
CIRCUIT DIADRAMS

Configuration MR



P000 035

Basic model and motor configuration AM 01000



P000 038E

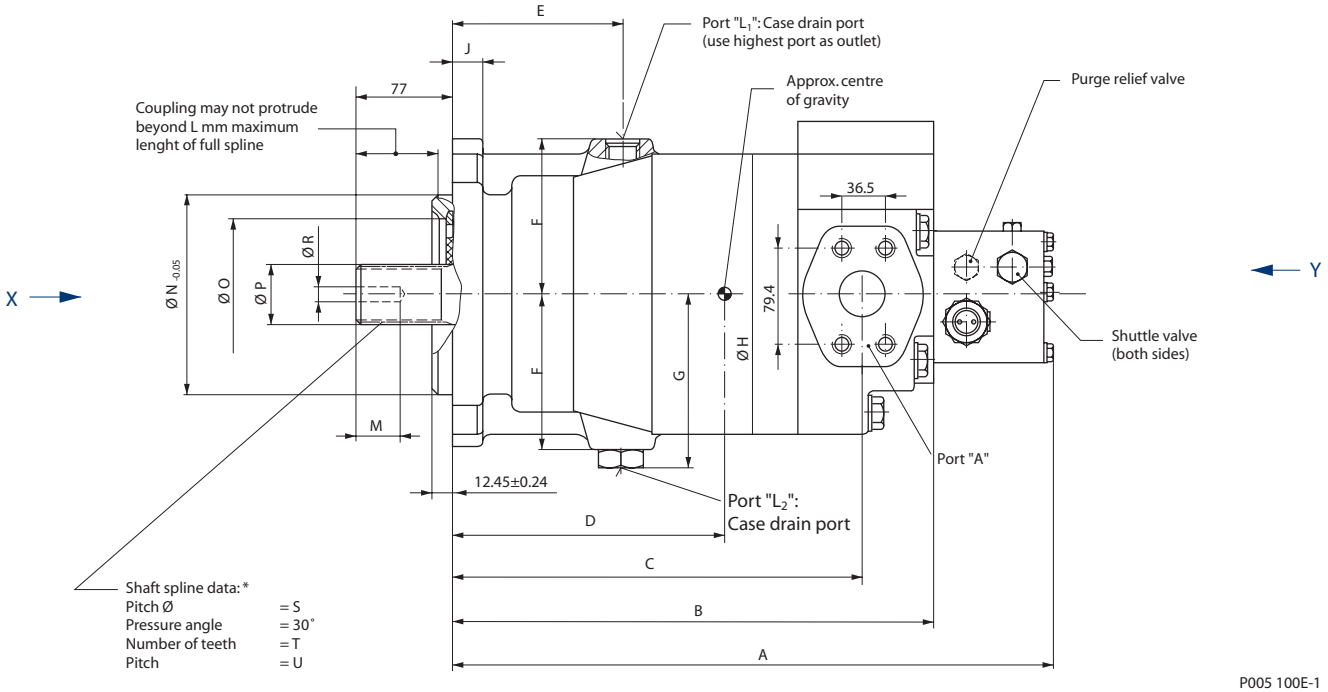
Designation:
1 = Fixed displacement motor
2 = Purge relief valve
3 = Shuttle valve
4 = High pressure relief valve
5 = Bypass valve

Ports:

A,B	=	Main pressure ports (working loop)
L_1, L_2	=	Drain ports
M_A	=	Gauge port for port **A**
M_B	=	Gauge port for port **B**
M	=	Gauge port - charge pressure

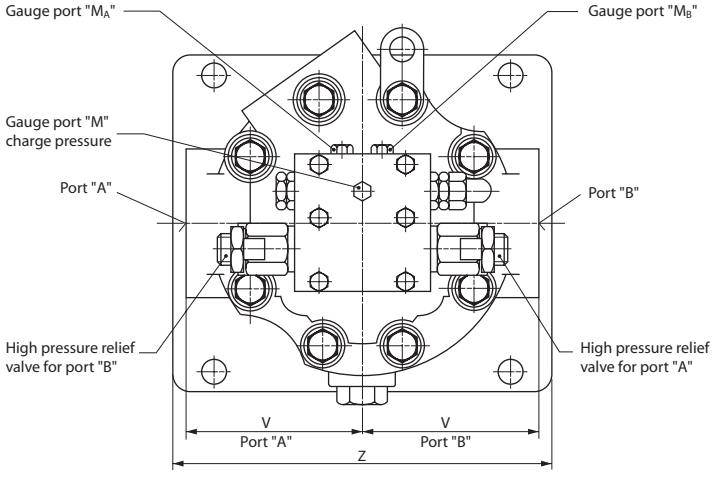
Dimensions – Frame Size 227 and 334 cm³

OUTLINE DRAWING, CONFIGURATION MS

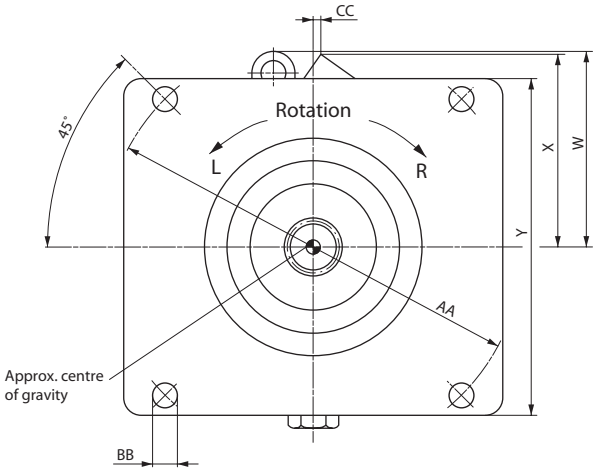


P005 100E-1

View Y



View X



P005 100E-2

* Shaft spline data: spline shaft with involute spline, according to SAE handbook, 1963, class 1, fillet root side fit.

OUTLINE DRAWING, CONFIGURATION MS (continued)

Dimensions									
Frame size	**A** mm [in]	**B** mm [in]	**C** mm [in]	**D** mm [in]	**E** mm [in]	**F** mm [in]	**G** mm [in]	∅ **H** mm [in]	**J** mm [in]
227	498 [19.606]	410 [16.142]	346 [13.622]	228.5 [8.996]	139.7 [5.500]	134.9 [5.311]	152 [5.984]	264 [10.394]	27 [1.063]
334	537 [21.142]	449 [17.677]	389 [15.315]	278 [10.945]	154 [6.063]	143.5 [5.650]	161 [6.339]	292 [11.496]	38 [1.496]
Frame size	**M** mm [in]	∅ **N** mm [in]	∅ **O** mm [in]	∅ **P** mm [in]	∅ **R** mm [in]	∅ **S** mm [in]	**T** mm [in]	**U**	**V** mm [in]
227	38.4 [1.512]	165.1 [6.500]	110 [4.331]	$44.03\ ^{-0.17}$ $[1.733\ ^{-0.0067}]$	11.80 [0.465]	42.863 [1.688]	27 [1.063]	16/32	143.7 [5.657]
334	46.2 [1.819]	177.8 [7.000]	114 [4.488]	$64.66\ ^{-0.16}$ $[2.546\ ^{-0.0063}]$	14.35 [0.565]	63.500 [2.500]	40 [1.575]	16/32	158.7 [6.248]
Frame size	**W** mm [in]	**X** mm [in]	**Y** mm [in]	**Z** mm [in]	**AA** mm [in]	**BB** mm [in]	**CC** mm [in]	Diameter for shaft coupling	Weight kg [lb]
227	156 [6.142]	160 [6.299]	265 [10.433]	265 [10.433]	317.5 [12.500]	20.6 ± 0.4 [0.811 ± 0.0157]	13 [0.512]	$41.28\ ^{+0.062}$ $[1.625\ ^{+0.0024}]$	152 [335]
334	176 [6.929]	174 [6.850]	298 [11.732]	298 [11.732]	350.0 [13.780]	$27.0\ ^{+0.5}_{-0.1}$ $[1.063\ ^{+0.0197}_{-0.0039}]$	18 [0.709]	$61.93\ ^{+0.074}$ $[2.438\ ^{+0.0029}]$	197 [434]

Frame size	Port **A** and **B**	Port L_1 and L_2	Port M_A and M_B	Port **M**
227	SAE flange, size 1 1/2 SAE split flange boss 6000 psi 4 threads 5/8 -11 UNC - 2B 35 deep	1 7/8 -12 UN - 2B SAE straight thread O-ring boss	7/16-20 UNF-2B SAE straight thread O-ring boss	
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SAUER DANFOSS

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Proportional valves

Directional spool valves

Cartridge valves

Hydraulic integrated circuits

Hydrostatic transaxles

Integrated systems

Fan drive systems

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Digital electronics and software

Battery powered inverter

Sensors

DKMH.PN.340.C1.02 **520L0516**

Sauer-Danfoss Hydraulic Power Systems – Market Leaders Worldwide

Sauer-Danfoss is a comprehensive supplier providing complete systems to the global mobile market.

Sauer-Danfoss serves markets such as agriculture, construction, road building, material handling, municipal, forestry, turf care, and many others.

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Sauer-Danfoss (US) Company
2800 East 13th Street
Ames, IA 50010, USA
Phone: +1 515 239-6000, Fax: +1 515 239 6618

Sauer-Danfoss (Neumünster) GmbH & Co. OHG
Postfach 2460, D-24531 Neumünster
Krokamp 35, D-24539 Neumünster, Germany
Phone +49 4321 871-0, Fax: +49 4321 871 122

Sauer-Danfoss (Nordborg) A/S
DK-6430 Nordborg, Denmark
Phone: +45 7488 4444, Fax: +45 7488 4400

www.sauer-danfoss.com