

MAKING MODERN LIVING POSSIBLE

Danfoss

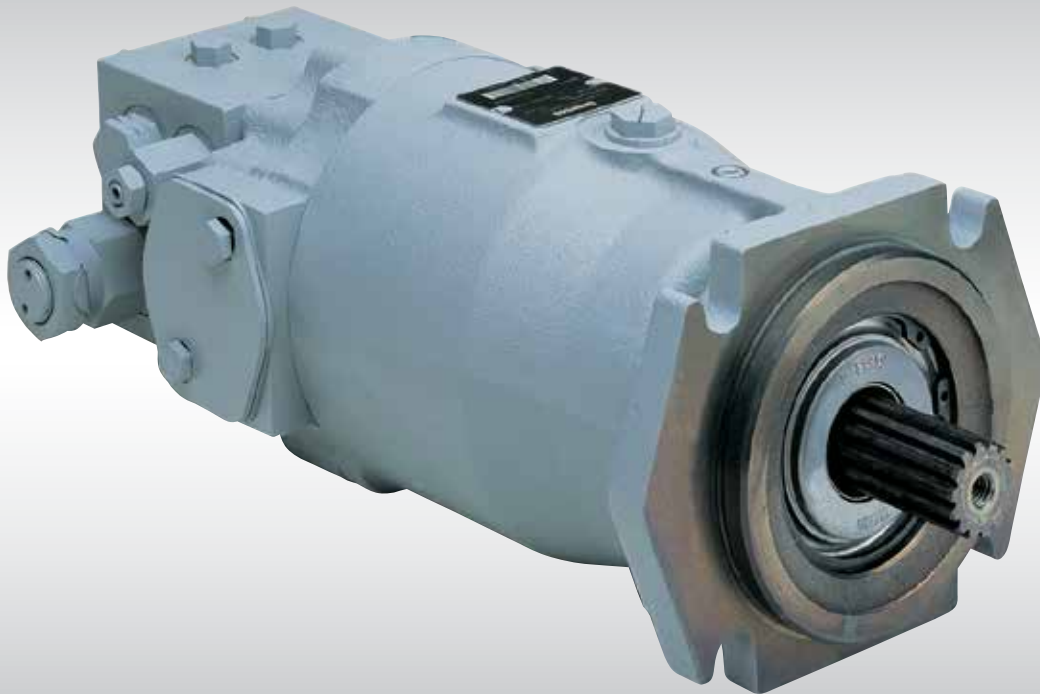
Technical Information

Axial Piston Motors Series 20

Find it at



**PRECISION
FLUID POWER, INC.**
Hydraulic Sales & Repair
800-728-5168 PrecisionFluidPower.com



powersolutions.danfoss.com

General Information**Introduction**

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

Description

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.

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.
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 Danfoss pattern are made by licensed producers worldwide, providing consistent service and fully inter-changeable parts.

Typical markets

- Industrial
- Mining
- Transit Mixer
- Utility Vehicles

Technical Information Axial Piston Motors Series 20

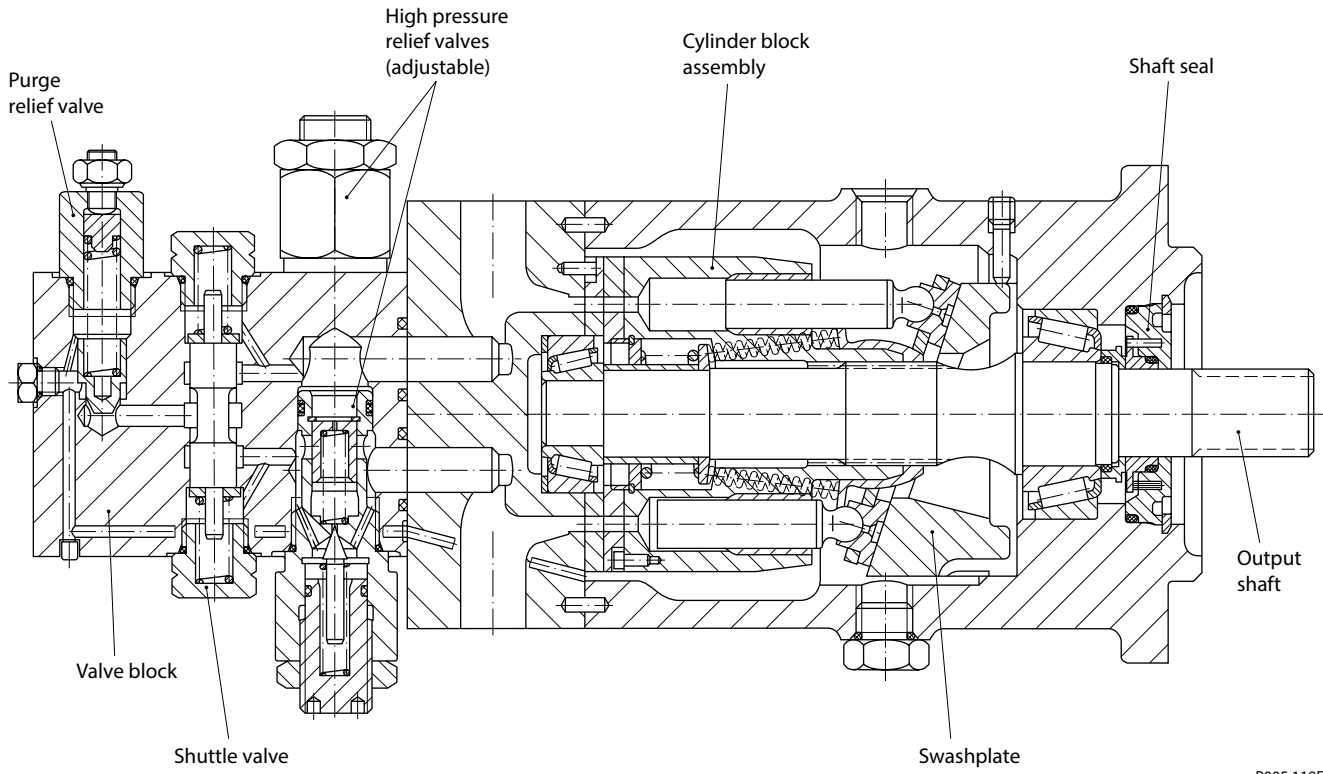
Contents

General Description	Introduction	2
	Description	2
	Typical markets	2
Sectional View	Axial piston fixed displacement motor	4
System Circuit Description	Pump and motor circuit description	5
	Motor circuit schematic	5
Technical Specification	Technical parameters	6
	Design	6
	Type of mounting	6
	Pipe connections.....	6
	Direction of rotation and flow.....	6
	Installation position	6
	External drain fluid loss	6
	Hydraulic parameters	7
	System pressure range, input p_1	7
	System pressure range, output p_2	7
	Case pressure.....	7
	Hydraulic fluid	7
	Hydraulic fluid temperature range.....	7
	Viscosity range.....	7
	Filtration	7
Shaft load	7	
Determination of nominal motor size.....	8	
Dimensions – Frame Size 070 and 089	Outline drawing, configuration ms	9
	Outline drawing, basic model	11
	Outline drawing, motor configuration am 01000.....	11
	Outline drawing, motor configuration mr	12
	Circuit diadrams.....	13
	Configuration MR.....	13
	Basic model and motor configuration AM 01000	13
Dimensions – Frame Size 227 and 334	Outline drawing, configuration ms	14

General Description

Axial piston fixed displacement motor

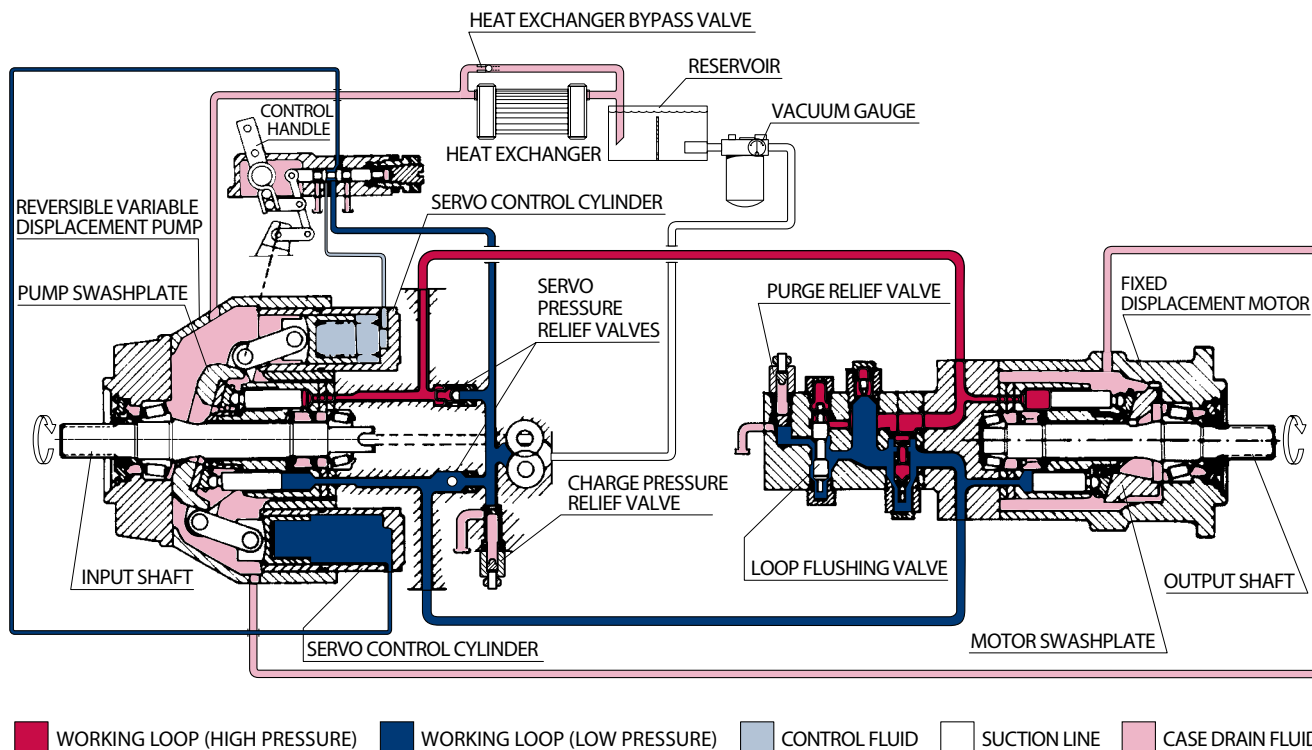
Sectional View



P005 118E

General Description

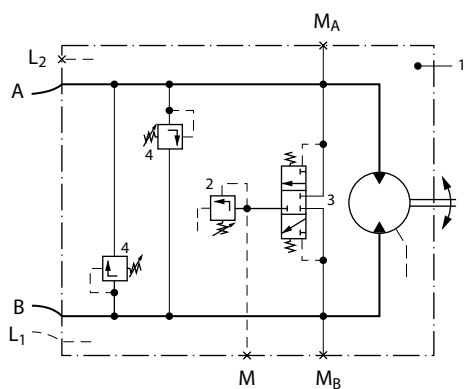
Pump and motor circuit description



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)
- L₁, L₂ = Drain ports
- MA = Gauge port for port A
- MB = Gauge port for port B
- M = Gauge port - charge pressure

Technical Specification

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

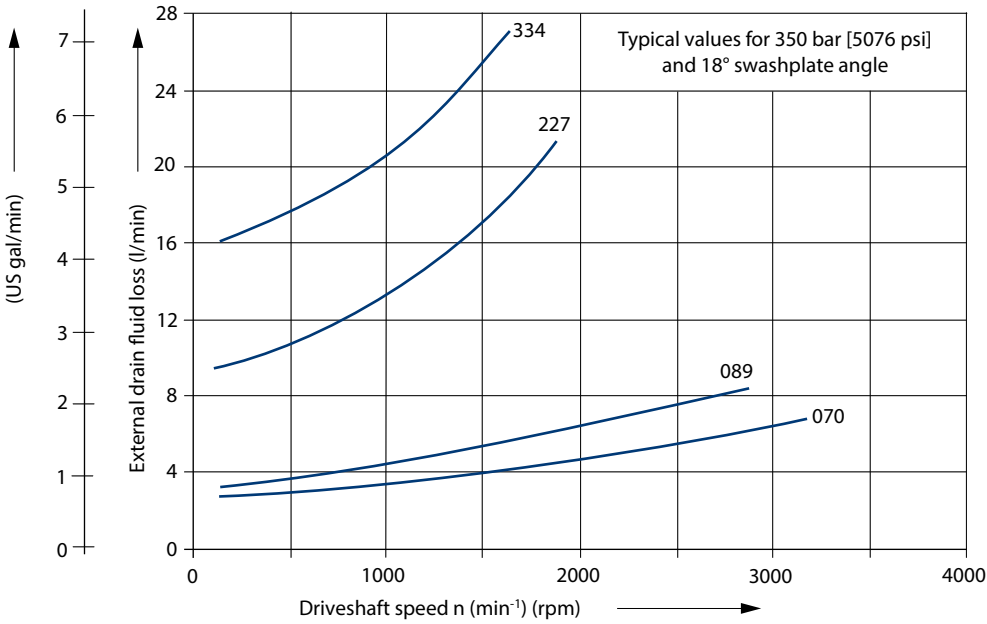
Clockwise or counterclockwise (viewing from the output shaft).

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

Technical Specification**Hydraulic parameters****System pressure range, input p_1**

Pressure on port A or B:

Max. operating pressure $\Delta p = 420 \text{ bar [6092 psi]}$ Max. high pressure setting $\Delta p = 460 \text{ bar}^1 \text{ [6672 psi]}$ ¹only 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 fluidRefer to Danfoss publications [Hydraulic Fluids and Lubricants, 520L0463](#) and [Experience with Biodegradable Hydraulic Fluids, 520L0465](#).**Hydraulic fluid temperature range** $\vartheta_{\min} = -40 \text{ °C [- 40 °F]}$ $\vartheta_{\max} = 95 \text{ °C [203 °F]}$ **Viscosity range** $\nu_{\min} = 7 \text{ mm}^2/\text{s [49 SUS*]}$ $\nu_{\max} = 1000 \text{ mm}^2/\text{s [4630 SUS*]}$ (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 Danfoss publications [Hydraulic Fluids and Lubricants, 520L0463](#) and [Design Guideline for Hydraulic Fluid Cleanliness, 520L0467](#).**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 Danfoss representative.

Technical Specification
**Hydraulic parameters
(continued)**
Technical data

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

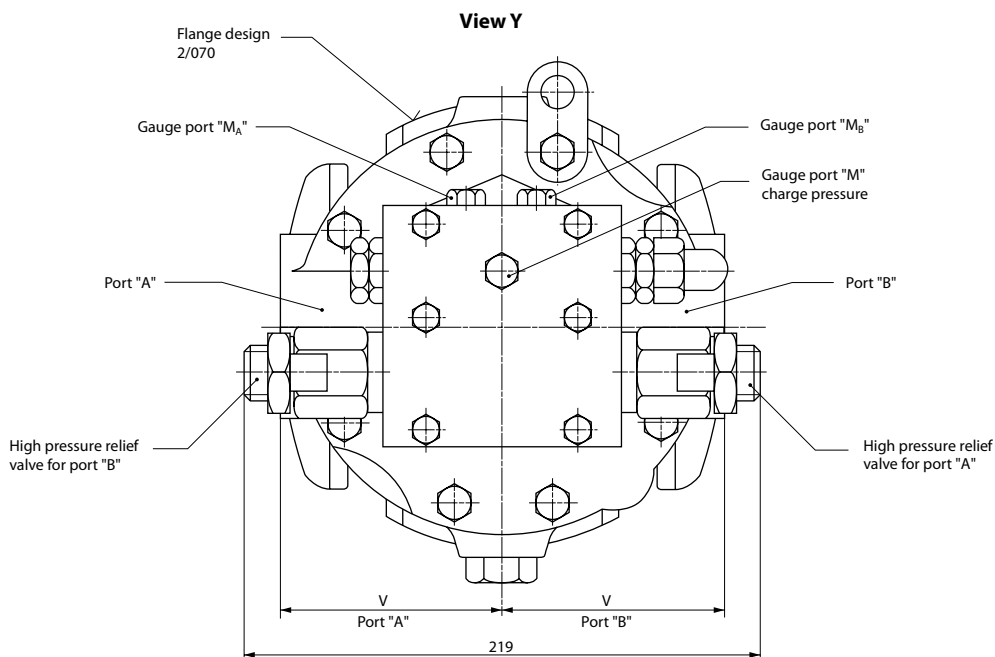
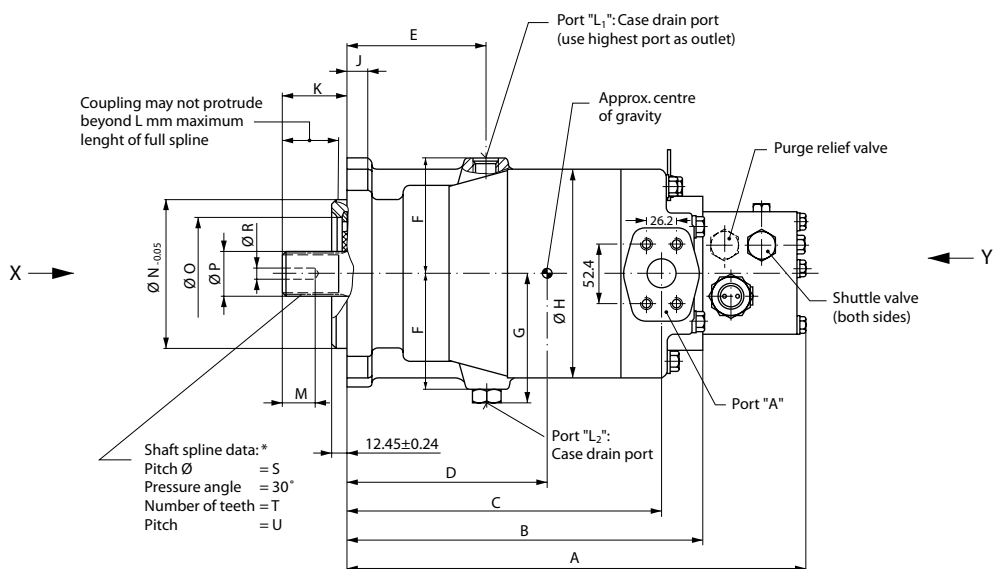
¹ for higher speeds contact your Danfoss representative

Determination of nominal motor size

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

Efficiency characteristic curves available on request.

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


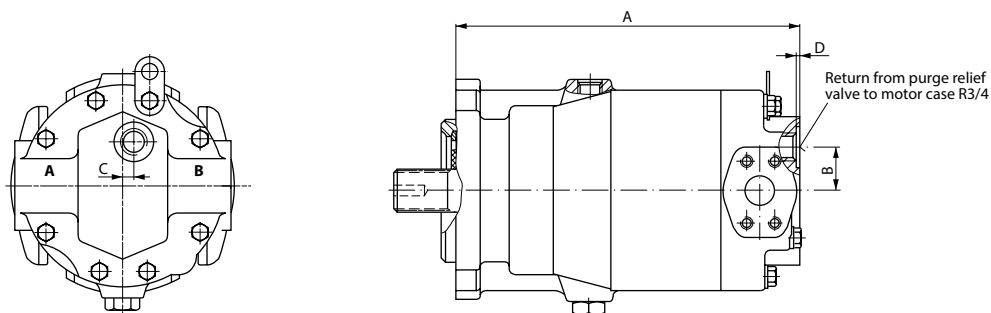
* Shaft spline data: spline shaft with involute spline, according to SAE handbook, 1963, class 1, fillet root side fit.

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	7/8-14 UNF-2B SAE straight thread O-ring boss	7/16-20 UNF-2B SAE straight thread O-ring boss	
089	3/8-16 UNC-2B 18 deep			

Dimensions

 – Frame Size 070 and 089 cm³
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]	Ø 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	Ø N mm [in]	Ø O mm [in]	Ø P mm [in]	Ø R mm [in]	Ø 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} [1.358 ^{-0.0067}]	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} [1.483 ^{-0.0067}]	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]	

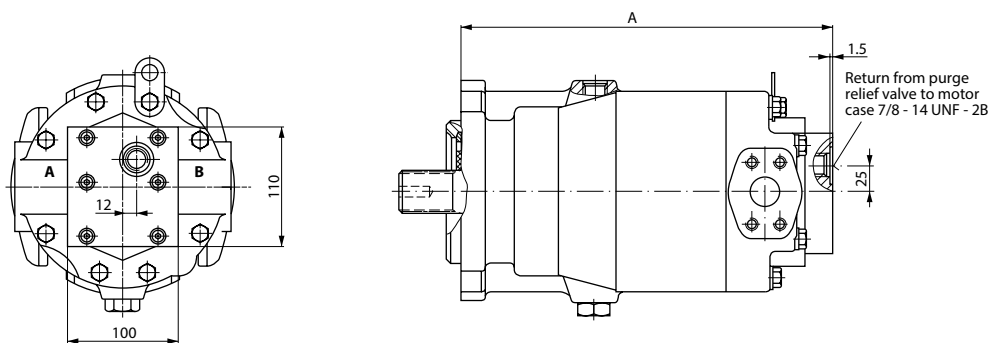
Outline drawing, basic model


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

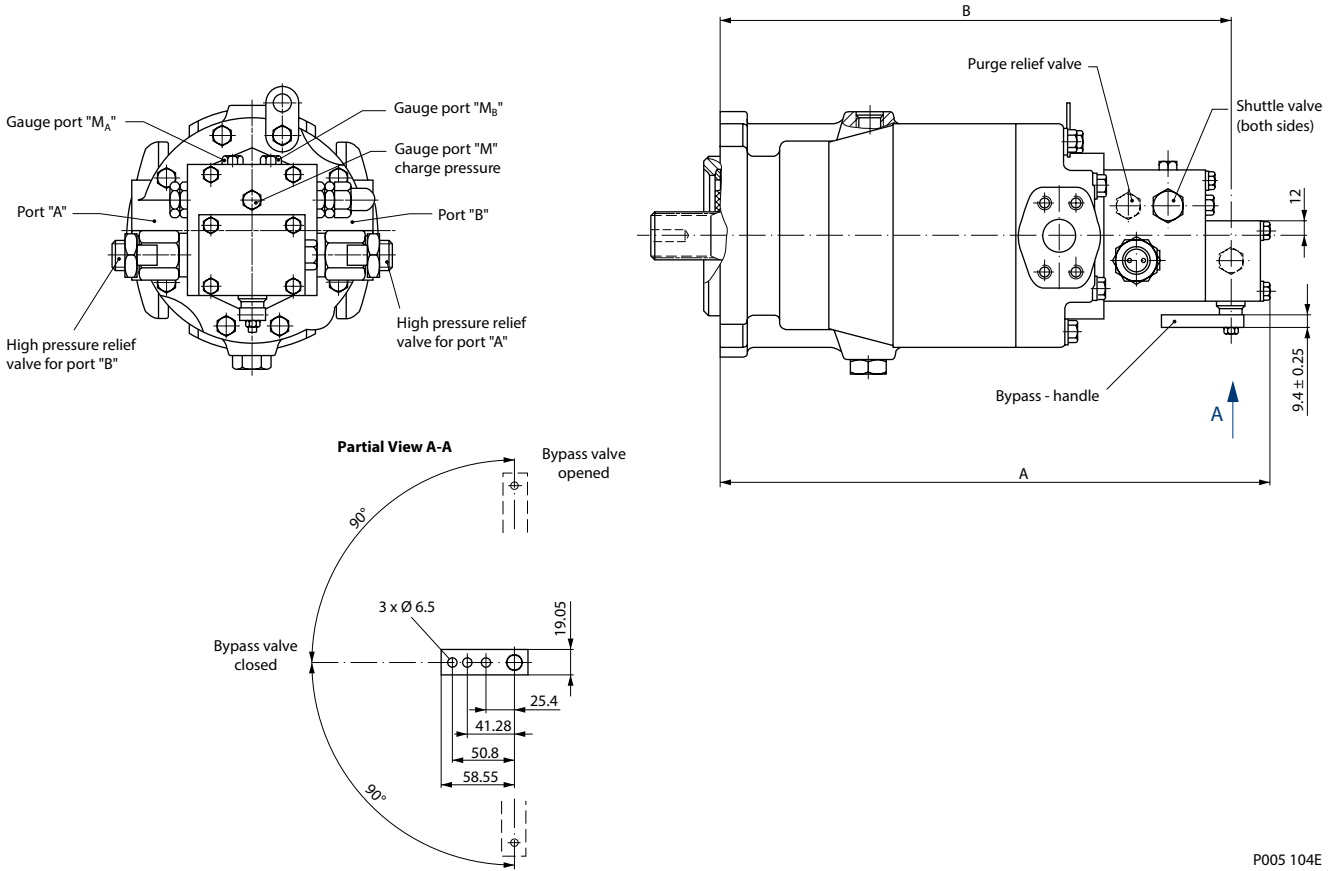
Dimensions

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**



P005 104E

Dimensions

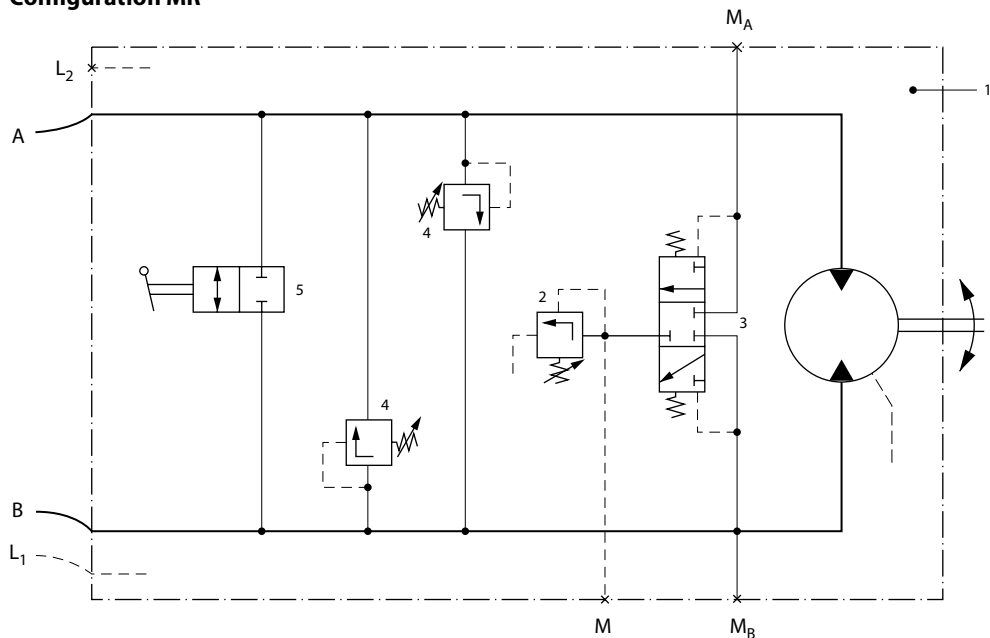
Frame size	A mm [in]	B mm [in]	Weight kg [lb]	Port M _A and M _B	Port M
070	426 [16.772]	391 [15.394]	42 [93]	7/16-20 UNF-2B SAE straight thread O-ring boss	
089	443 [17.441]	408 [16.063]	49 [108]		

For further dimensions see previous pages.

Dimensions
 – Frame Size 070 and 089 cm³

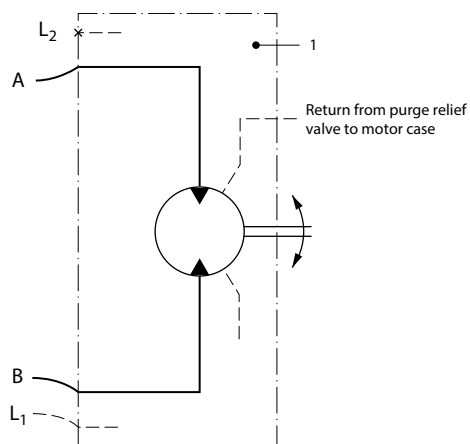
Circuit diagrams

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

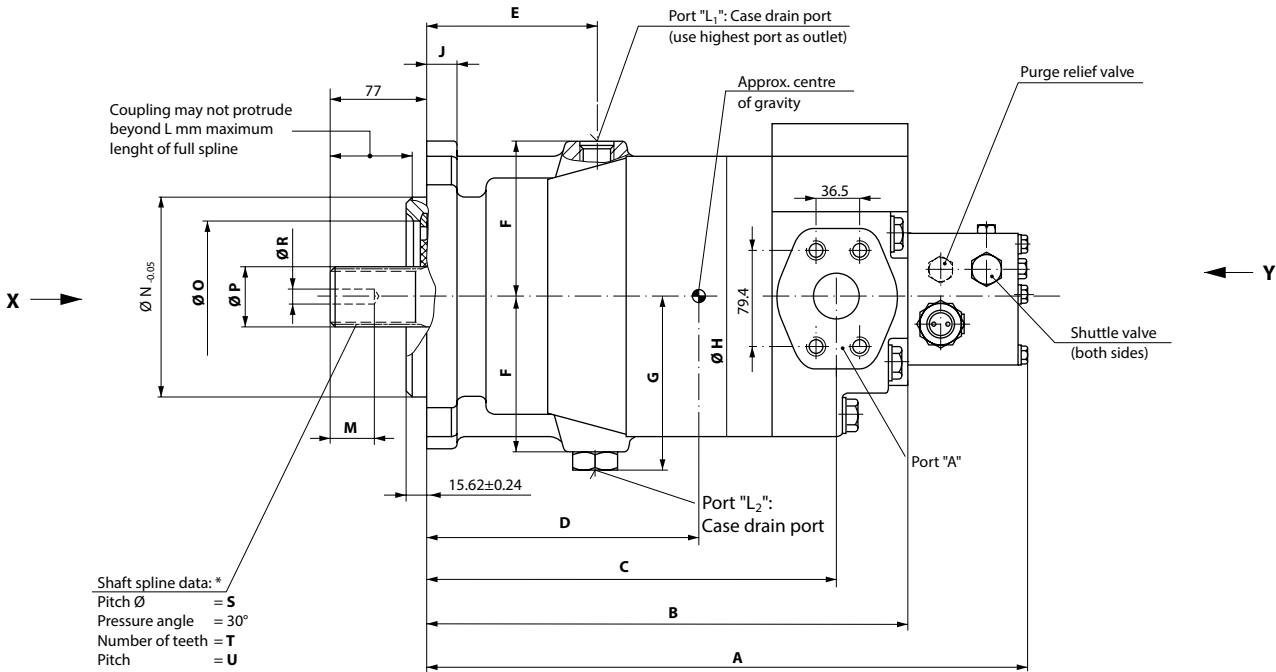
Ports:

- A,B = Main pressure ports (working loop)
- L₁, L₂ = Drain ports
- M_A = Gauge port for port **A**
- M_B = Gauge port for port **B**
- M = Gauge port - charge pressure

Technical Information Axial Piston Motors Series 20

Dimensions – Frame Size 227 and 334 cm³

Outline drawing, configuration MS



Shaft spline data: *
Pitch Ø = S
Pressure angle = 30°
Number of teeth = T
Pitch = U

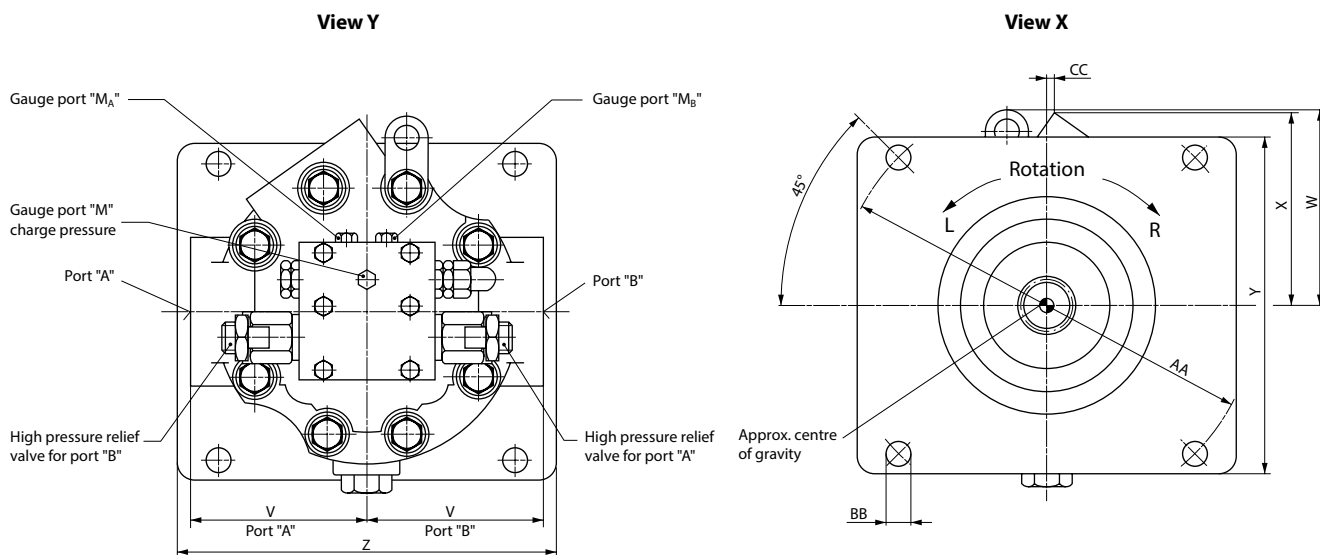
P005 100E-1

Dimensions

Frame size	A mm [in]	B mm [in]	C mm [in]	D mm [in]	E mm [in]	F mm [in]	G mm [in]	Ø 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. [5.650]	161 [6.339]	292 [11.496]	38 [1.496]
Frame size	M mm [in]	Ø N mm [in]	Ø O mm [in]	Ø P mm [in]	Ø R mm [in]	Ø S mm [in]	T mm [in]	U mm [in]	V mm [in]
227	38.4 [1.512]	165.1 [6.500]	110 [4.331]	44.03 [1.733]	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 [2.546]	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 mm [in]	Weight kg [lb]
227	156 [6.142]	160 [6.299]	265 [10.433]	265 [10.433]	317.5 [12.500]	20.6 [0.811]	13 [0.512]	41.28 [1.625]	152 [335]
334	176 [6.929]	174 [6.850]	298 [11.732]	298 [11.732]	350 [13.780]	27.0 [1.063]	18 [0.709]	61.93 [2.438]	197 [434]

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

Dimensions

 – Frame Size 227 and 334 cm³
**Outline drawing,
configuration MS
(continued)**


P005 100E-2

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	1 7/8-12 UNF-2B SAE straight thread O-ring boss	7/16-20 UNF-2B SAE straight thread O-ring boss	
334	5/8-11 UNC-2B 35 mm deep			



Products we offer:

- Bent Axis Motors
- Closed Circuit Axial Piston Pumps and Motors
- Displays
- Electrohydraulic Power Steering
- Electrohydraulics
- Hydraulic Power Steering
- Integrated Systems
- Joysticks and Control Handles
- Microcontrollers and Software
- Open Circuit Axial Piston Pumps
- Orbital Motors
- PLUS+1® GUIDE
- Proportional Valves
- Sensors
- Steering
- Transit Mixer Drives

Danfoss Power Solutions is a global manufacturer and supplier of high-quality hydraulic and electronic components. We specialize in providing state-of-the-art technology and solutions that excel in the harsh operating conditions of the mobile off-highway market. Building on our extensive applications expertise, we work closely with our customers to ensure exceptional performance for a broad range of off-highway vehicles.

We help OEMs around the world speed up system development, reduce costs and bring vehicles to market faster.

Danfoss – Your Strongest Partner in Mobile Hydraulics.

Go to www.powersolutions.danfoss.com for further product information.

Wherever off-highway vehicles are at work, so is Danfoss.

We offer expert worldwide support for our customers, ensuring the best possible solutions for outstanding performance. And with an extensive network of Global Service Partners, we also provide comprehensive global service for all of our components.

Please contact the Danfoss Power Solution representative nearest you.

Comatrol

www.comatrol.com

Schwarzmueller-Inverter

www.schwarzmueller-inverter.com

Turolla

www.turollaocg.com

Valmova

www.valmova.com

Hydro-Gear

www.hydro-gear.com

Daikin-Sauer-Danfoss

www.daikin-sauer-danfoss.com

Local address:

Danfoss Power Solutions (US) Company

2800 East 13th Street
Ames, IA 50010, USA
Phone: +1 515 239 6000

Danfoss Power Solutions GmbH & Co. OHG

Krokamp 35
D-24539 Neumünster, Germany
Phone: +49 4321 871 0

Danfoss Power Solutions ApS

Nordborgvej 81
DK-6430 Nordborg, Denmark
Phone: +45 7488 2222

Danfoss Power Solutions Trading (Shanghai) Co., Ltd.

Building #22, No. 1000 Jin Hai Rd
Jin Qiao, Pudong New District
Shanghai, China 201206
Phone: +86 21 3418 5200

Danfoss can accept no responsibility for possible errors in catalogues, brochures and other printed material. Danfoss reserves the right to alter its products without notice. This also applies to products already on order provided that such alterations can be made without changes being necessary in specifications already agreed. All trademarks in this material are property of the respective companies. Danfoss and the Danfoss logotype are trademarks of Danfoss A/S. All rights reserved.