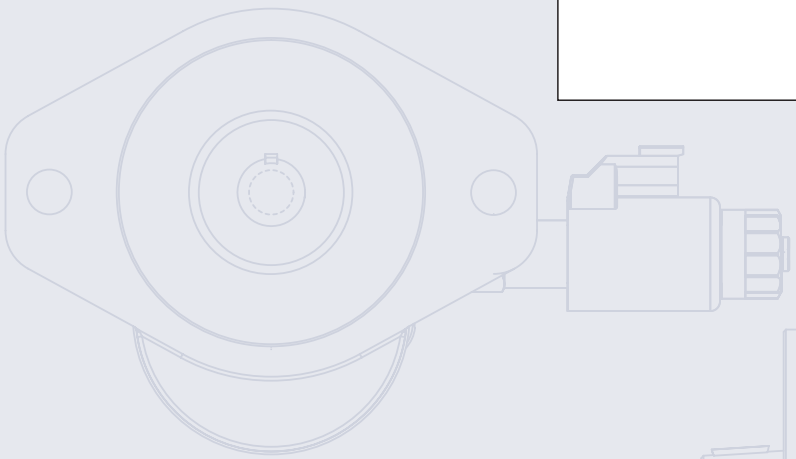
SAUER DANFOSS

D Series
Gear Motors
Including Fan Drive

Technical Information



History of Revisions

Table of Revisions

Date	Page	Changed	Rev.
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Overview

The Sauer-Danfoss D Series fixed displacement gear motor has been specifically designed for demanding mobile equipment applications where maximum performance is required at peak power levels and operating temperatures. The D Series motor is available in displacements of 17cm³ to 45cm³ [1.04 in³ to 2.75 in³]. This motor delivers consistent efficiency across the entire operating range of pressure, speed, and temperature; all in an industry-leading package size that maximizes power density.

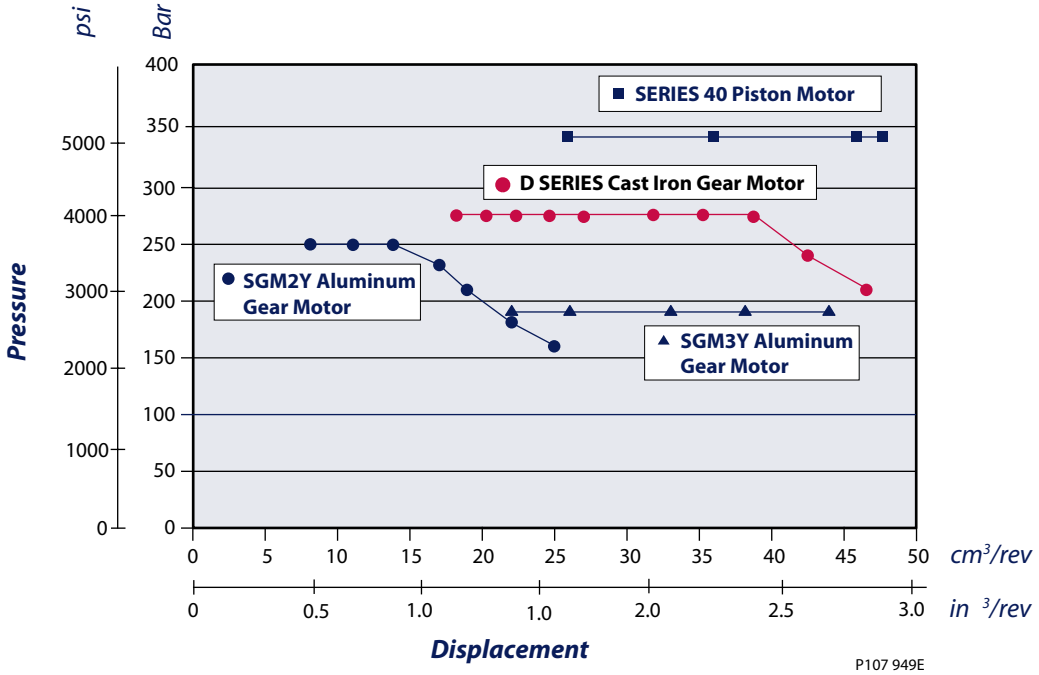
Features and Benefits

- High strength cast iron construction allows consistently efficient performance in continuous operation at 275 bar (4000 psi) and 110°C (230°F).
- Custom engineered shaft bearings and dual pressure-balanced thrust plates optimize internal bearing lubrication, allowing for high starting torque and long life with fluid viscosities as low as 8 mm²/sec (cSt) [36 SUS].
- Compact three-piece design with bearings located in the front flange and rear cover minimizes the overall package length and increases radial load carrying capability.
- Variety of integrated valve options make the D Series motor ideally suited for high performance fan drive applications.

Fan Drive Motors

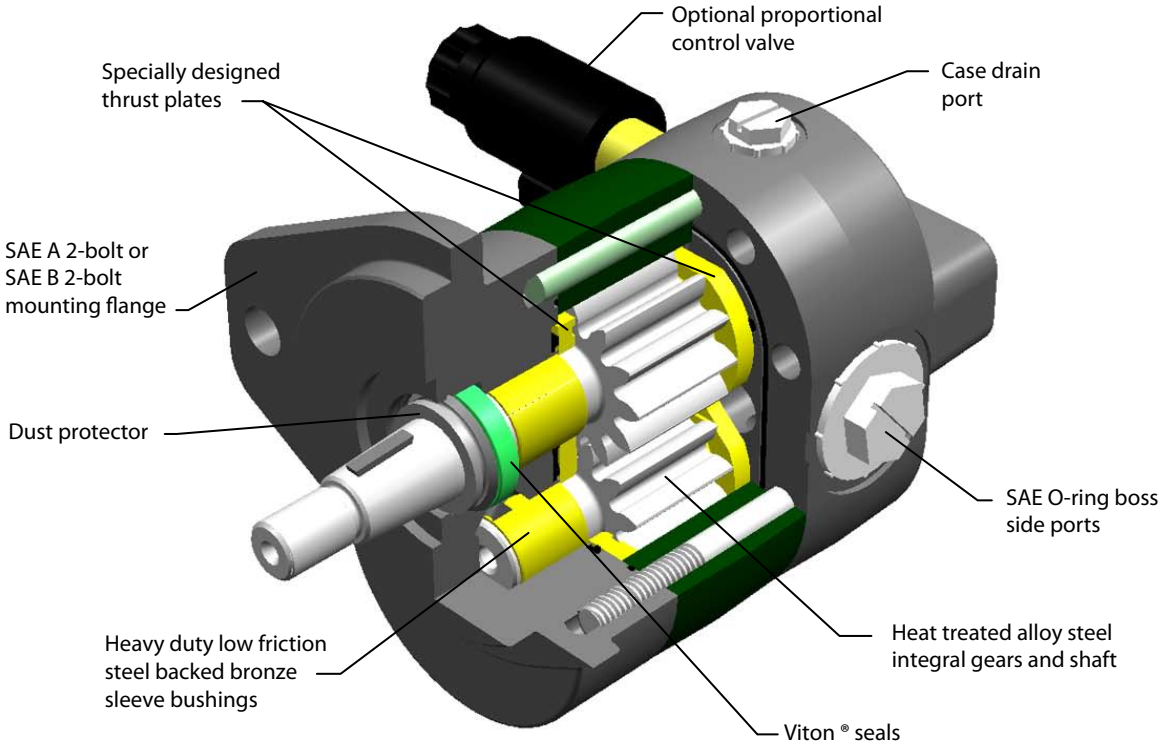
D Series cast iron motors complement the Sauer-Danfoss portfolio of fan drive products. Including aluminum and cast iron pumps and motors, piston pumps and motors, valves and microcontrollers, you can apply the Sauer-Danfoss range in various combinations to create high-performance fan drive systems. D series motors with integrated proportional relief valves are PLUS+1™ compliant for easy plug-and-perform™ installations and offer precise control of fan speed to optimize engine cooling performance.

Quick reference chart - Sauer-Danfoss fan drive motors



Features

Quality components and construction



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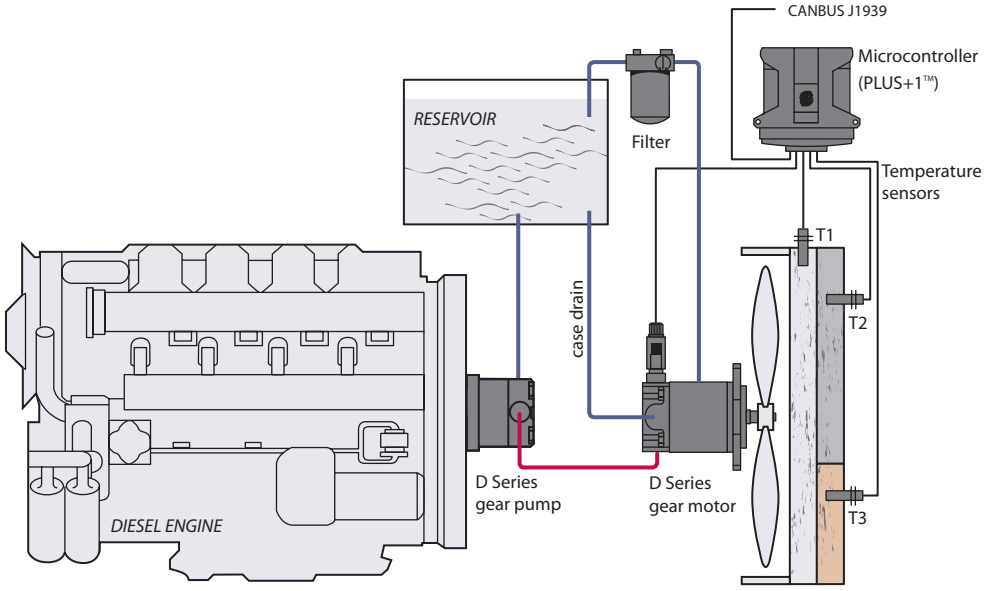
Benefits

- Dual pressure-balanced thrust plates for improved efficiency at extreme pressures and temperatures
- High-temperature seals for today's hotter running machines
- Three-piece ductile iron construction for increased durability, increased power density, with reduced adverse efficiency effects at high temperatures.
- High quality steel backed bronze bearings for maximum pressure handling capacity, located in the front flange, allowing extended radial loading capacity without an external roller bearing.
- Output shaft external dust seal to protect the oil seal from contamination damage
- Available side or rear ports, SAE A or B flange, with a variety of shafts for versatility.
- Integrated, normally-closed electrohydraulic proportional relief valve option for today's high-performing fan systems.

System Schematics

Gear pump/gear motor system with electronic control



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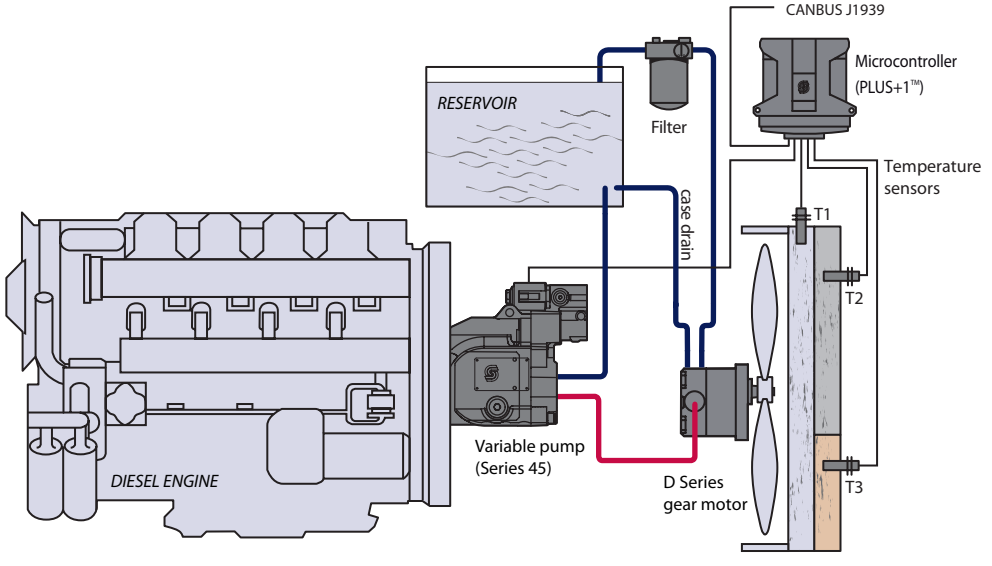
Piston pump/gear motor system with electronic control



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Product Features

Features	Description
Construction	Heavy duty ductile iron 3-piece construction
Displacements	17 to 45 cm³ [1.04 to 2.75 in³/rev]
Continuous Pressure	276 bar [4000 psi] to 38 cm³ [2.32 in³/rev]
Peak Pressure	303 bar [4400 psi] to 38 cm³ [2.32 in³/rev]
Speed	600 to 3400 min^{-1} (rpm) - up to 38cm³
Mounting	SAE A two bolt, SAE B two bolt
Shaft (types)	SAE straight keyed, 1:8 tapered keyed, splined
Fluid viscosity	8 mm²/sec (cSt) [36 SUS] minimum, 1600 mm²/sec (cSt) [7500 SUS] maximum
Filtration requirement	22/18/13 ISO 4406 at motor inlet
Inlet options	SAE O-ring boss, SAE split flange
Fluids	Petroleum/mineral based
Operating temperature	-40°C [-40°F] minimum for cold start 110°C [230°F] normal operating conditions 115°C [239°F] peak intermittent
Integrated valve options	Proportional relief valve, normally closed, 12 Vdc and 24 Vdc Relief valve Anti-cavitation check valve

Technical Specifications

Technical data for D Motors

Ratings	Units	17	19	21	23	25	29	32	36	38	41	45
Displacement	cm^3/rev	17.0	19.0	20.5	22.5	25.4	29.0	31.8	36.1	38.0	41.0	45.0
	in^3/rev	1.04	1.16	1.25	1.37	1.55	1.77	1.94	2.20	2.32	2.50	2.75
Rated pressure	bar	276	276	276	276	276	276	276	276	276	241	210
	psi	4000	4000	4000	4000	4000	4000	4000	4000	4000	3495	3045
Peak pressure	bar	303	303	303	303	303	303	303	303	303	265	231
	psi	4400	4400	4400	4400	4400	4400	4400	4400	4400	3843	3350
Speed at rated pressure	maximum	3400	3400	3400	3400	3400	3400	3400	3400	3400	3000	3000
	minimum*	600	600	600	600	600	600	600	600	600	600	600
Start speed at 1000 PSI	rpm	400	400	400	400	400	400	400	400	400	400	400
Standard Weight	kg	8.53	8.66	8.80	8.94	9.07	9.38	9.53	9.84	9.93	10.16	10.43
	lb	18.8	19.1	19.4	19.7	20.0	20.7	21.0	21.7	21.9	22.4	23.0
Mass moment of inertia of internal rotating components	$x10^{-6}$ kg•m²	127	138	146	156	172	191	206	228	239	255	276
	$x10^{-6}$ slug•ft²	94	102	107	115	127	141	152	168	176	188	204
Theoretical torque at rated pressure	N•m	65.7	73.4	79.2	87.0	98.2	112.1	122.9	139.6	146.9	138.4	132.4
	lbf•ft	48.5	54.2	58.4	64.2	72.4	82.7	90.7	102.9	108.3	102.1	97.6
Theoretical power at rated speed	kW	23.4	26.1	28.2	31.0	35.0	39.9	43.8	49.7	46.1	43.5	41.6
	hp	31.2	34.9	37.6	41.3	46.6	53.2	58.4	66.3	61.1	58.0	55.5
Case drain pressure	bar	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
	psi	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5

* minimum speed at maximum pressure

Fluid Specifications

Ratings are based on operation with premium petroleum-based hydraulic fluids containing oxidation, rust, and foam inhibitors.

Parameter	Unit	Minimum	Continuous	Maximum
Viscosity	mm²/sec (cSt) [SUS]	8 [36]	10 - 100 [50 - 212]	1600 [7500]
Temperature	°C [°F]	-40 [-40]	110 [230]	115 [239]
Cleanliness		ISO 4406 Class 22/18/13 or better		
Filtration efficiency	charge filtration	$\beta_{15\text{-}20}=75(\beta_{10}\geq 10)$		

Sizing Equations

Use these formulas to determine the nominal motor size for a specific application.

	Based on SI units	Based on US units
Input flow	$Q = \frac{V_g \cdot n}{1000 \cdot \eta_v}$ (l/min)	$Q = \frac{V_g \cdot n}{231 \cdot \eta_v}$ (US gal/min)
Output torque	$M = \frac{V_g \cdot \Delta p \cdot \eta_m}{20 \cdot \pi}$ (N•m)	$M = \frac{V_g \cdot \Delta p \cdot \eta_m}{2 \cdot \pi}$ (lbf•in)
Output power	$P = \frac{M \cdot n}{9550} = \frac{Q \cdot \Delta p \cdot \eta_t}{600}$ (kW)	$P = \frac{Q \cdot \Delta p \cdot \eta_t}{1714} = \frac{M \cdot n}{63\,025}$ (hp)
Motor speed	$n = \frac{Q \cdot 1000 \cdot \eta_v}{V_g}$ (min^{-1}(rpm))	$n = \frac{Q \cdot 231 \cdot \eta_v}{V_g}$ (min^{-1}(rpm))

Variables SI units [US units]

V_g	=	Displacement per revolution	cm^3/rev [in^3/rev]
p_O	=	Outlet pressure	bar [psi]
p_i	=	Inlet pressure	bar [psi]
Δp	=	$p_O - p_i$ (system pressure)	bar [psi]
n	=	Speed	min^{-1} (rpm)
η_v	=	Volumetric efficiency	
η_m	=	Mechanical efficiency	
η_t	=	Overall efficiency ($\eta_v \cdot \eta_m$)	

Operating Parameters

Overview

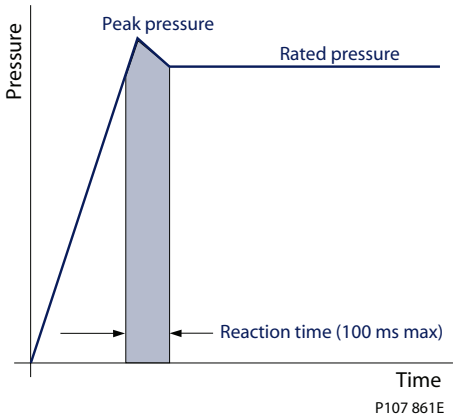
Definitions of the D Series operating parameters appear below. Consult your Sauer-Danfoss representative for applications running outside of these parameters.

Pressure

Peak Pressure

Peak pressure is the highest intermittent pressure allowed. The relief valve overshoot (reaction time) determines peak pressure. It is assumed to occur for less than 100 ms. The illustration to the right shows peak pressure in relation to rated pressure and reaction time (100 ms maximum).

Pressure vs. time



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Rated Pressure

Rated pressure is the average, regularly occurring operating inlet pressure that should yield satisfactory product life. The maximum machine load at the motor shaft determines rated pressure.

System Pressure

System pressure is the differential between the inlet and outlet ports. It is a dominant operating variable affecting hydraulic unit life. High system pressure, resulting from high load at the motor shaft, reduces expected life. System pressure must remain at, or below, rated pressure during normal operation to achieve expected life.

Back Pressure

The hydraulic load downstream of the motor determines the back pressure. The D Series motor can work with back pressure up to 100% of the maximum rated inlet pressure.

Case Drain Pressure

Case drain pressure is the pressure in the case drain line. Route case drain plumbing directly to the reservoir to keep the case drain pressure as low as possible. Maximum continuous case drain pressure allowed is 5 bar [72.5 psi].

Temperature and Viscosity

Temperature and viscosity requirements must be concurrently satisfied.

Temperature

High temperature limits apply at the inlet port of the motor. Ensure the motor runs at or below the maximum continuous temperature.

Cold oil, generally, does not affect the durability of motor components. It may affect the ability of oil to flow and transmit power. For this reason, keep the temperature at 16°C [60 °F] above the pour point of the hydraulic fluid.

Minimum (cold start) **temperature** relates to the physical properties of component materials.

Continuous temperature is the temperature at or below which you may expect normal motor life.

Maximum temperature is the highest temperature that is tolerable by the machine for a transient/limited time. (Duty cycle 1% or less)

Viscosity

Minimum viscosity occurs only during brief occasions of maximum fluid temperature and severe duty cycle operation. It's the minimum acceptable viscosity to guarantee the motor life. (Duty cycle 1% or less)

Maximum viscosity occurs only during cold start at very low temperatures. It is the upper limit of viscosity that allows the motor to start.

Continuous viscosity: The viscosity range at which you may expect normal motor.

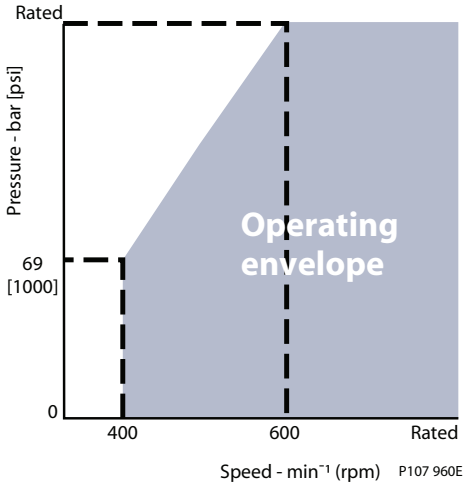
Speed

Maximum speed is the limit for a particular gear motor when operating at rated pressure. It is the highest speed at which you may expect normal life.

The lower limit of operating speed is the **minimum speed**.

Minimum speed increases as operating system pressure increases. When operating under higher pressures, a higher minimum speed must be maintained, as shown.

Speed versus pressure



Hydraulic Fluid

Ratings and data for gear motors are based on operation with premium hydraulic fluids containing oxidation, rust, and foam inhibitors. These fluids must possess good thermal and hydrolytic stability to prevent wear, and corrosion of internal components. Use petroleum/mineral-based fluids. Ensure only clean fluid enters the hydraulic system.

Caution

Never mix hydraulic fluids.

For more information on hydraulic fluid selection, see Sauer-Danfoss publications **520L0463** *Hydraulic Fluids and Lubricants, Technical Information*, and **520L0465** *Experience with Biodegradable Hydraulic Fluids, Technical Information*.

Filtration

Filters

Use a filter that conforms to Class 22/18/13 of ISO 4406 (or better). It may be on the motor outlet (discharge filtration) or inlet (pressure filtration).

Selecting a Filter

When selecting a filter, please consider:

- Contaminant ingression rate (determined by factors such as the number of actuators used in the system)
- Generation of contaminants in the system
- Required fluid cleanliness
- Desired maintenance interval
- Filtration requirements of other system components

Measure filter efficiency with a Beta ratio (β_x). βx ratio is a measure of filter efficiency defined by ISO 4572. It is the ratio of the number of particles greater than a given diameter (in microns) upstream of the filter to the number of these particles downstream of the filter.

- For discharge filtration with controlled reservoir ingression, use a $\beta_{35\text{-}45} = 75$ filter
- For pressure filtration, use a filtration with an efficiency of $\beta_{10} = 75$

Every system is unique. Only a thorough testing and evaluation program can fully validate the filtration system. For more information, see Sauer-Danfoss publication **520L0467** *Design Guidelines for Hydraulic Fluid Cleanliness*.

Fluid cleanliness level and β_x ratio

Fluid cleanliness level (per ISO 4406)	Class 22/18/13 or better
β_x ratio (discharge filtration)	$\beta_{35\text{-}45} = 75$ and $\beta_{10} = 2$
$\beta_{35\text{-}45} = 75$ and $\beta_{10} = 2$	$\beta_{10} = 75$
Recommended inlet screen size	100 – 125 µm [0.0039 – 0.0049 in]

Reservoir

The reservoir provides clean fluid, dissipates heat, removes entrained air, and allows for fluid volume changes associated with fluid expansion. A correctly sized reservoir accommodates maximum volume changes during all system operating modes. It promotes de-aeration of the fluid as it passes through, and accommodates a fluid dwell-time between 60 and 180 seconds, allowing entrained air to escape.

Minimum reservoir capacity depends on the volume required to cool and hold the fluid, allowing for expansion due to temperature changes. A fluid volume of one to three times the motor output flow (per minute) is satisfactory. The minimum recommended reservoir capacity is 125% of the fluid volume.

Put the return-line below the lowest expected fluid level to allow discharge into the reservoir for maximum dwell and efficient de-aeration. A baffle (or baffles) between the return and suction ports promotes de-aeration and accommodates fluid surges.

Line Sizing

Choose pipe sizes that accommodate minimum fluid viscosity to reduce system noise, pressure drops and overheating in order to maximize system life and performance. Line velocity should not exceed 5.0 m/s [16.4 ft/s]. Route case drain line direct to tank.

Most systems use hydraulic oil containing 10% dissolved air by volume. Over-areation, or entrained air is the result of flow line restrictions, where the dissolved air comes out of solution, or when air is allowed to leak into the hydraulic circuit. These include inadequate pipe sizes, sharp bends, or elbow fittings, causing reduction of flow-line cross-sectional area. This problem will not occur if these circuit recommendations are followed, rated speed requirements are maintained, and reservoir size and location are adequate.

Motor Life

Motor life is a function of speed, system pressure, and other system parameters (such as fluid quality and cleanliness).

All Sauer-Danfoss gear motors use hydrodynamic journal bearings that rely on an oil film between the gear shaft and bearing surfaces at all times. You can expect long life when this film is sustained through proper system maintenance and operating within recommended limits.

A B_{10} bearing life expectancy number is generally associated with rolling element bearings. It does not exist for hydrodynamic bearings.

High pressure impacts motor life. When submitting an application for review, provide machine duty cycle data that includes percentages of time at various loads and speeds. We strongly recommend a prototype testing program to verify operating parameters and their impact on life expectancy before finalizing any system design.

Motor Shaft Connection

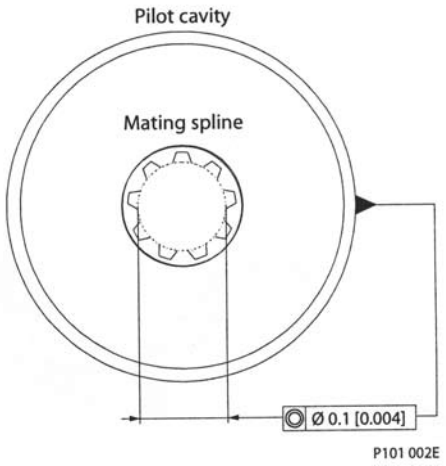
Shaft options for gear motors include tapered, splined, and parallel shafts.

Plug-in drives, with a splined shaft, can impose severe radial loads when the mating spline is rigidly supported. Increasing spline clearance does not alleviate this condition.

Use plug-in drives only if the concentricity between the mating spline and pilot diameter is within 0.1 mm [0.004 in]. Lubricate the drive by flooding with oil. A three-piece coupling minimizes radial or thrust shaft loads.

To avoid spline shaft damage, use carburized and hardened steel couplings with 80-82 HRA surface hardness.

Motor shaft connection



Radial and Axial Loading

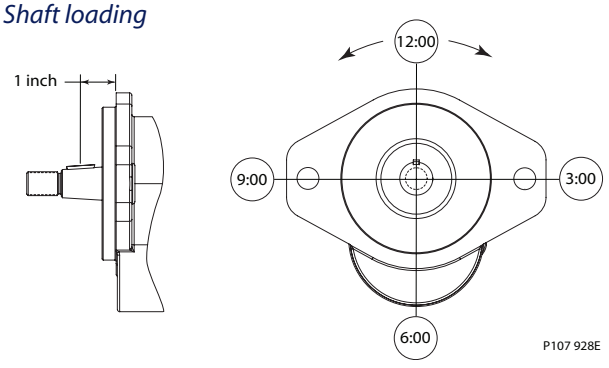
Allowable radial shaft loads are a function of the load position, load orientation, and operating pressure. All external shaft loads have an effect on bearing life, and may affect motor performance.

In applications where external shaft loads cannot be avoided, minimize the impact on the motor by optimizing the orientation and magnitude of the load. Avoid thrust loads in either direction. The table below shows the preferred orientation for radial loads assuming maximum pressure. For assistance concerning shaft loading, contact your Sauer-Danfoss representative.

Shaft axial and radial load ratings

Ratings	Units	17	19	21	23	25	29	32	36	38	41	45
Max. radial load at 12:00 +	lbf	1430	1360	1300	1210	1070	870	700	420	270	450	620
	N	6361	5943	1783	5382	4760	3870	3114	1868	1201	2002	2758
Push/Pull axial load	lbf	350	350	350	350	350	350	350	350	350	350	350
	N	1557	1557	1557	1557	1557	1557	1557	1557	1557	1557	1557

Shaft loading



- All values measured 1 inch from the mounting flange
- For other angles and distances, higher radial loads at lower pressures or axial loading inquiries contact your Sauer-Danfoss representative

Order Code

Order Code Example:

Fan drive motor:
A *Right hand rotation,* **B** *17 cm³, 1:8 taper shaft,* **C** *SAE A two bolt mounting,* **D** *7/8-14 ports, idler side drain,* **E** *12 Vdc proportional relief valve, 25 US gal/min or less at 172 bar curve,* **F** *anti-cavitation valve.*

A	B1	B2	C	D1	D2	E1	E2	F	G	J	K
DEMR–	17	TY	–AA–	B	107	–P	1AB	–A000	–N000	–AN	–NNN

Order code

A	B1	B2	C	D1	D2	E1	E2	F	G	J	K
DEM□–	■■	■■	–■■–	■	■■■	–■	■■■	–■■■■	–■■■■	–■■	–■■■

A: Rotation

Code	Description
B	Bidirectional rotation
L	Left hand rotation (CCW)
R	Right hand rotation (CW)

Model Code

Order Code (continued)

B1: Displacement

Code	Description, cm³/rev
17	17.0 [1.04]
19	19.0 [1.16]
21	20.5 [1.25]
23	22.5 [1.37]
25	25.4 [1.55]
29	29.0 [1.77]

Code	Description, cm³/rev
32	31.8 [1.94]
36	36.1 [2.20]
38	38.0 [2.32]
41	41.0 [2.50]
45	45.1 [2.75]

B2: Input shaft

Code	Description, input shaft
PB	SAE 22mm [7/8in] diameter x 41mm [1.62in] Extension, 1/4in key, with key
TY	SAE 1:8 taper, 22mm [7/8 in] diameter x 59mm [2.34 in] Extension, 5/8-18 x 21mm [.81 in] external thread with #8 Woodruff key
TK*	1:8 taper, 22mm [7/8 in] diameter.. x 35mm [1.38in] Extension, 3/8-24 x 19mm [.75in] Internal thread
SM*	11 tooth, 19 mm [3/4 in] diameter , 48 mm [1.89 in] extension, 30 mm [1.20 in] effective spline

B: Availability chart

Option key

Symbol	Availability
●	Available
—	Not available

	B2 - Input shaft			
B1	**PB**	**TY**	**TK***	**SM***
17	●	●	—	—
19	●	●	—	—
21	●	●	—	—
23	●	●	—	—
25	●	●	●	—
29	●	●	—	—
32	●	●	●	—
36	●	●	—	—
38	●	●	●	—
41	●	●	●	●
45	●	●	—	—

** Other shafts available on request - contact your Sauer-Danfoss representative*

C: Mounting

Code	Mounting
AA	SAE A, 2 bolt
BB	SAE B, 2 Bolt

Order Code (continued)

A B1 B2 C D1 D2 E F G J K

D1: Rear cover/valve options

Code	D1 cover options
A	Anti-cavitation check valve
B	Cover for proportional or relief valve w/anti-cav. check valve less than 95 l/min [25 US gal/min]
C	Cover for proportional or relief valve w/anti-cav. check valve less than 195 l/min [50 US gal/min]

(continued)

Code	D1 cover options
N	No valve, standard cover
P	SAE 12-2 Empty cavity w/anti-cav check valve
S	SAE 10-2 Empty cavity w/anti-cav check valve

Use code **B** and **S** for 25 cm³ and below, code **C** and **P** for 29 cm³ and above

Motors with axial ports [5XX] are available with only A & N cover options.

D2: Rear cover/port options (choose radial or axial ports)

Code		D2 port options	
Radial	Axial	Inlet/Outlet	Drain port
105	505	3/4-16 SAE O-ring boss	Radial 9/16-18 SAE (idler side*)
106	506	3/4-16 SAE O-ring boss	Radial 9/16-18 SAE (drive side*)
107	507	7/8-14 SAE O-ring boss	Radial 9/16-18 SAE (idler side*)
108	508	7/8-14 SAE O-ring boss	Radial 9/16-18 SAE (drive side*)
109	509	1 1/16-12 SAE O-ring boss	Radial 9/16-18 SAE (idler side*)
110	510	1 1/16-12 SAE O-ring boss	Radial 9/16-18 SAE (drive side*)
111	N/A	1 5/16-12 SAE O-ring boss	Radial 9/16-18 SAE (idler side*)
112	N/A	1 5/16-12 SAE O-ring boss	Radial 9/16-18 SAE (drive side*)
330	N/A	1inch SAE Split flange	Radial 9/16-18 SAE (idler side*)
331	N/A	1inch SAE Split flange	Radial 9/16-18 SAE (drive side*)
332	N/A	1-1/4 SAE Split flange	Radial 9/16-18 SAE (idler side*)
333	N/A	1-1/4 SAE Split flange	Radial 9/16-18 SAE (drive side*)

Split flange ports [3XX] are only available with A & N cover options.

** See dimension drawings for explanation of drive and idler side.*

Option key

Symbol	Availability
●	Available
—	Not available

D: Availability chart

D2 - Port options	D1 - Rear cover/valve option					
	A	B	C	N	P	S
105	●	—	—	●	—	—
106	●	—	—	●	—	—
107	●	●	●	●	●	●
108	●	●	●	●	●	●
109	●	●	●	●	●	●
110	●	●	●	●	●	●
111	●	●	●	●	●	●
112	●	●	●	●	●	●
330/331	●	—	—	●	—	—
332/333	●	—	—	●	—	—
505	●	—	—	●	—	—
506	●	—	—	●	—	—
507	●	—	—	●	—	—
508	●	—	——	●	—	—
509	●	—	—	●	—	—
510	●	—	—	●	—	—

Order Code (continued)

A B1 B2 C D1 D2 E F G J K

■■■■–■■■■–■■–■■■■–□□□□–■■■■–■■■■–■■–■■■

E: Relief valve availability chart

			Compatible with D1 - Rear cover option					
Description	**Pressure bar [psi]**	**E - Valve option**	**A**	**B**	**C**	**N**	**P**	**S**
Relief valve internally drained - applications with 95 l/min [26 US gal/min] or less	138 [2000]	**F138**		●				
	172 [2500]	**F172**		●				
	207 [3000]	**F207**		●				
	241 [3500]	**F241**		●				
	276 [4000]	**F276**		●				
Relief valve internally drained - applications with 96-190 l/min[25-50 US gal/min]	138 [2000]	**G138**			●			
	172 [2500]	**G172**			●			
	207 [3000]	**G207**			●			
	241 [3500]	**G241**			●			
	276 [4000]	**G276**			●			
No relief valve	276 [4000]	**N000**	●			●	●	●
12 Vdc Proportional relief valve internally drained - applications with 95 l/min [25 US gal/min] or less	138 [2000]	**P1AA**		●				
	172 [2500]	**P1AB**		●				
	207 [3000]	**P1AC**		●				
	241 [3500]	**P1AD**		●				
	276 [4000]	**P1AF**		●				
12 Vdc Proportional relief valve internally drained - applications with 96-190 l/min[26-50 US gal/min]	138 [2000]	**P2BA**			●			
	172 [2500]	**P2BB**			●			
	207 [3000]	**P2BC**			●			
	241 [3500]	**P2BD**			●			
	276 [4000]	**P2BF**			●			
24 Vdc Proportional relief valve internally drained -applications with 95 l/min [25 US gal/min] or less	138 [2000]	**P3AA**		●				
	172 [2500]	**P3AB**		●				
	207 [3000]	**P3AC**		●				
	241 [3500]	**P3AD**		●				
	276 [4000]	**P3AF**		●				
24 Vdc Proportional relief valve internally drained -applications with 96-190 l/min[26-50 US gal/min]	138 [2000]	**P4BA**			●			
	172 [2500]	**P4BB**			●			
	207 [3000]	**P4BC**			●			
	241 [3500]	**P4BD**			●			
	276 [4000]	**P4BF**			●			

F valve option for 90 l/min [25 US gal/min] flow and 25 cm³ [1.55 in³] and below displacement.
G valve option for 190 l/min [50 US gal/min] flow and 29 cm³ [1.77 in³] and above displacement.
P1, P3 valve option for 90 l/min [25 US gal/min] flow and 25 cm³ [1.55 in³] and below displacement.
P2, P4 valve option for 190 l/min [50 US gal/min] flow and 29 cm³ [1.77 in³] and above displacement.

Order Code (continued)

A B1 B2 C D1 D2 E F G J K

■■■■–■■■■–■■–■■■■–■■■■–□□□–N000–□□–□□□

F: Anti-cavitation valve

		Compatible with D1 - Rear cover option					
	F	**A**	**B**	**C**	**N**	**P**	**S**
Anti-cavitation valve	**A000**	●	●	●		●	●
No anti-cavitation valve	**N000**				●		

G: N000 = Standard

Code	
N000	Standard

J: Name plate

Code	
AN	Standard nameplate, radial ports
BN	Standard label, axial ports

K: Special features

Code	
NNN	No special features, standard black paint

Dimension Drawings

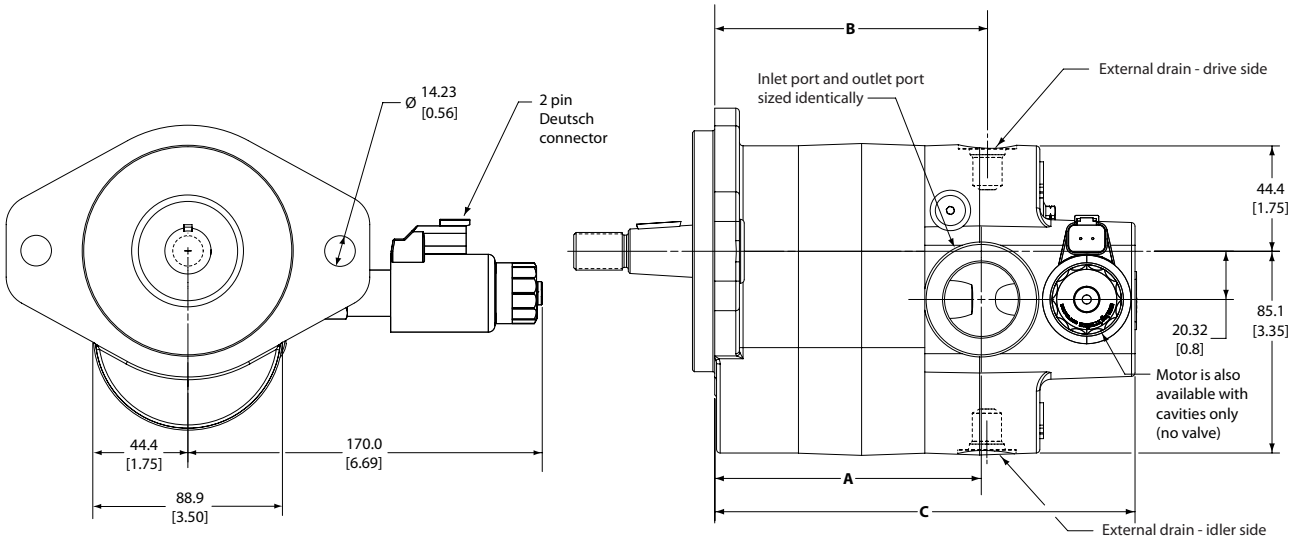
Fan Drive Motor

Fan Drive Motor Example:

Fan drive motor:
A *Right hand rotation,* **B** *17 cm³, 1:8 taper shaft,* **C** *SAE A two bolt mounting,*
D *7/8-14 ports, idler side drain,* **E** *12 Vdc proportional relief valve, 25 GPM or less at 172 bar curve,* **F** *anti-cavitation valve.*

A	B1	B2	C	D1	D2	E1	E2	F	G	J	K
DEMR-	17	TY-	AA-	B	107	P	1AB-	A000-	N000-	AN-	NNN

D motor dimensions; SAE-B two bolt fan drive motor shown



CW motor shown. For CCW motor, valve is on the opposite side.

P107 882E

Dimensions mm [in]

Dimensions	Units	17	19	21	23	25	29	32	36	38	41	45
Dimension A	mm	88.9	90.9	92.5	94.2	97.3	100.8	103.6	107.7	109.7	112.8	117.1
	in	3.50	3.58	3.64	3.71	3.83	3.97	4.08	4.24	4.32	4.44	4.61
Dimension B	mm	91.7	93.8	95.3	97.0	100.1	103.6	106.4	110.7	112.5	115.6	119.9
	in	3.61	3.69	3.75	3.82	3.94	4.08	4.19	4.36	4.43	4.55	4.72
Dimension C	mm	154.4	156.5	158.0	160.0	162.8	166.4	169.2	173.5	175.5	178.6	182.6
	in	6.08	6.18	6.22	6.30	6.41	6.55	6.66	6.83	6.91	7.03	7.19

Dimensions in table are maximum dimensions.

Dimension Drawings

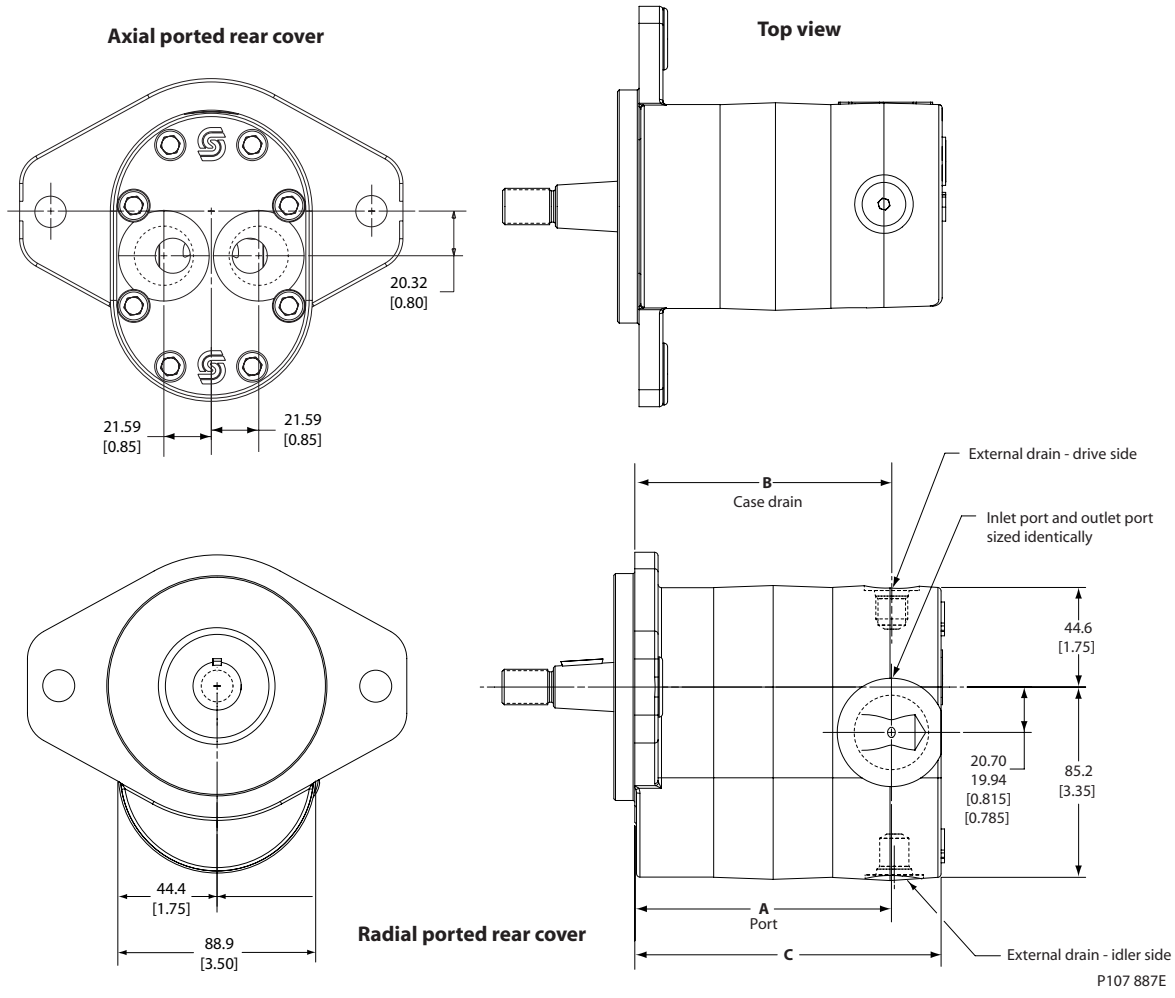
Standard Motor

Standard Motor Example:

A *Right hand rotation,* **B** *17 cm³, 1:8 taper shaft,* **C** *SAE A two bolt mounting,*
D *7/8-14 ports, idler side drain,* **E** *no relief valve.*

A	B1	B2	C	D1	D2	E	F	G	J	K
DEMR–	17	TY–	AA–	N	107	–N000	–N000	–N000	–AN–	NNN

Standard D motor dimensions, SAE-B two bolt motor shown



Dimensions	Units	17	19	21	23	25	29	32	36	38	41	45
Dimension A	mm	91.2	93.2	94.7	96.8	99.6	103.1	105.1	110.2	112.3	115.3	119.4
	in	3.59	3.67	3.73	3.81	3.92	4.06	4.17	4.34	4.42	4.54	4.70
Dimension B	mm	91.7	93.8	95.3	97.0	100.1	103.6	106.4	110.7	112.5	115.6	119.9
	in	3.61	3.69	3.75	3.82	3.94	4.08	4.19	4.36	4.43	4.55	4.72
Dimension C	mm	113.8	115.8	117.4	119.4	122.2	125.7	128.5	132.8	134.9	137.9	139.5
	in	4.48	4.56	4.62	4.70	4.81	4.95	5.06	5.23	5.31	5.43	5.49

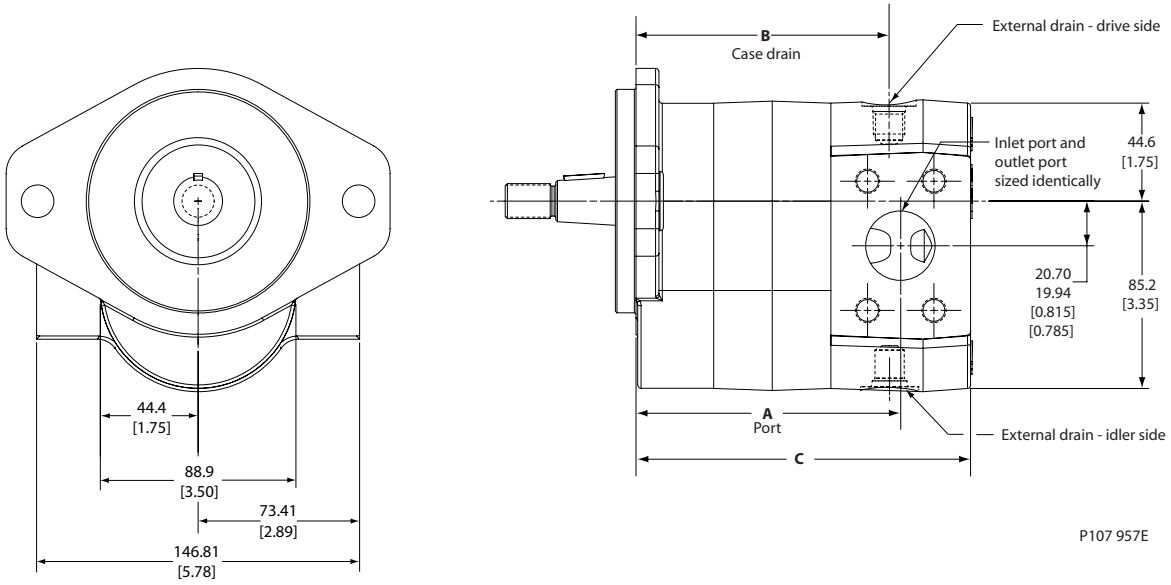
Dimensions in table are maximum dimensions.

Standard Motor with Split Flange Ports

Standard Motor with Split Flange Ports Example:
A *Right hand rotation,* **B** *17 cm³, 1:8 taper shaft,* **C** *SAE A two bolt mounting,*
D *Split flange ports, drive side drain,* **E** *No valve.*

A	B1	B2	C	D1	D2	E	F	G	J	K
DEMR–	1	7	TY–	AA–	N	331	–N000	–N000	–N000	–AN–	NNN

Standard D motor dimensions, SAE-B two bolt motor shown with split flange ports

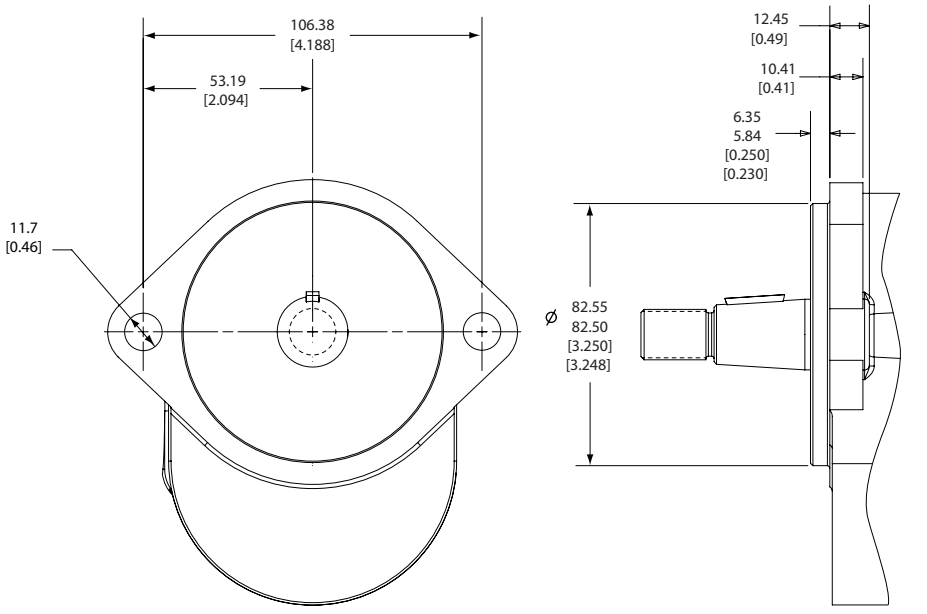


Dimensions	Units	17	19	21	23	25	29	32	36	38	41	45
Dimension A	mm	96.8	98.8	100.3	102.1	105.2	108.7	111.5	115.8	117.6	120.6	125.0
	in	3.81	3.89	3.95	4.02	4.14	4.28	4.39	4.56	4.63	4.75	4.92
Dimension B	mm	91.7	93.8	95.3	97.0	100.1	103.6	106.4	110.7	112.5	115.6	119.9
	in	3.61	3.69	3.75	3.82	3.94	4.08	4.19	4.36	4.43	4.55	4.72
Dimension C	mm	128.8	130.8	132.3	134.4	137.2	140.7	143.5	147.8	149.9	152.9	157.0
	in	5.07	5.15	5.21	5.29	5.40	5.54	5.65	5.82	5.90	6.02	6.18

Dimensions shown are maximum dimensions.

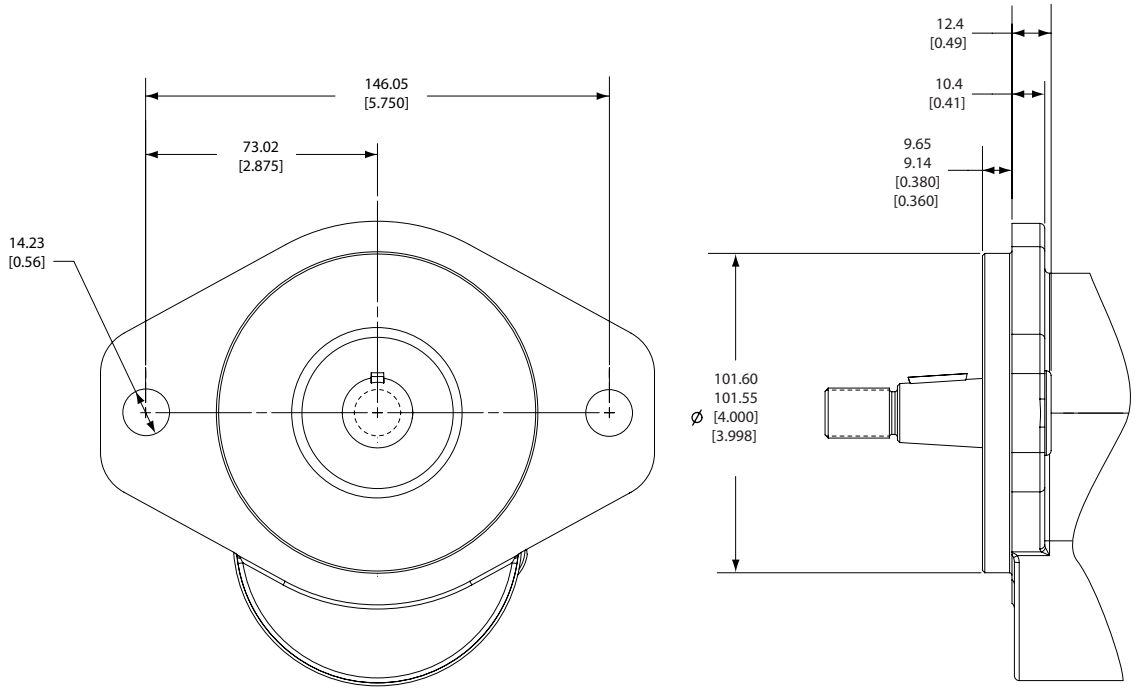
Mounting Flanges

SAE-A 2-bolt flange (AA)



P107 926E

SAE-B 2-bolt flange (BB)

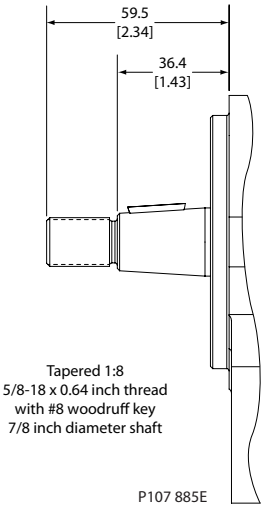


P107 927E

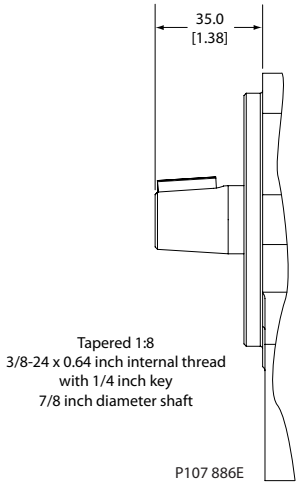
Dimensions mm [in]

Shaft Options

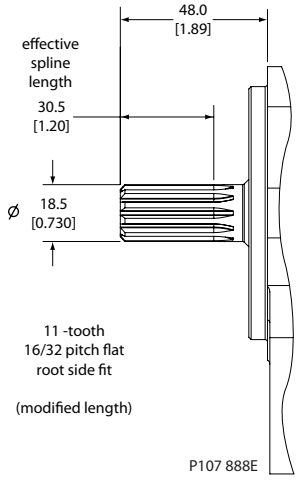
TY shaft option



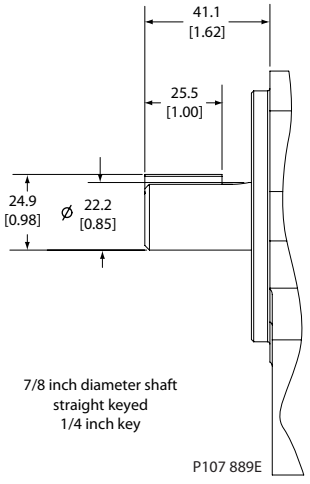
TK shaft option



SM shaft option



PB shaft option



Dimensions mm [in]

Shaft Torque Limits

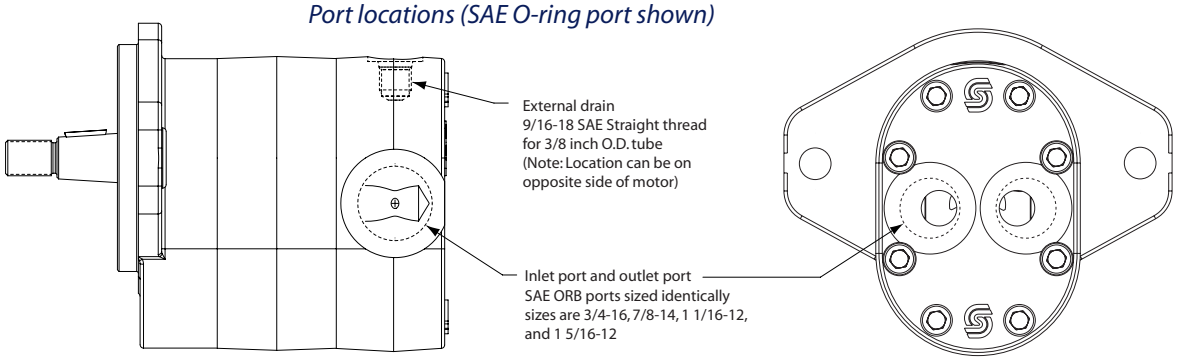
Code	Type	Diameter mm [in]	Length mm [in]	Description	Allowable shaft torque N•m [lbf•in]
SM	Spline	19.1 [0.75]	38.1 [1.50]	11 tooth, 16/32 pitch, modified length	176.3 [1560]
PB	Straight key	22.2 [0.875]	41.2 [1.62]	7/8 inch diameter straight key, SAE-B, includes 1/4 inch key	248.6 [2200]
TY	Tapered	22.2 [0.875]	49.6 [1.95]	Tapered 1:8 with number 6 woodruff key, 7/8 inch diameter, 5/8-18 x 0.64 inch thread	225.9 [2000]
TK	Tapered	22.2 [0.875]	49.3 [1.94]	Tapered 1:8 without key, 7/8 inch diameter, 9/16-18 x 0.56 inch thread	225.9 [2000]

Port Options

SAE O-Ring Boss

Code		SAE O-ring boss ports - No valves		
Radial	**Axial**	**Inlet**	**Outlet**	**Drain port**
N105	N505	3/4-16 SAE	3/4-16 SAE	Radial 9/16-18 SAE (on idler side)
N106	N506	3/4-16 SAE	3/4-16 SAE	Radial 9/16-18 SAE (on drive side)
N107	N507	7/8-14 SAE	7/8-14 SAE	Radial 9/16-18 SAE (on idler side)
N108	N508	7/8-14 SAE	7/8-14 SAE	Radial 9/16-18 SAE (on drive side)
N109	N509	1 1/16-12 SAE	1 1/16-12 SAE	Radial 9/16-18 SAE (on idler side)
N110	N510	1 1/16-12 SAE	1 1/16-12 SAE	Radial 9/16-18 SAE (on drive side)
N111	N/A	1 5/16-12 SAE	1 5/16-12 SAE	Radial 9/16-18 SAE (on idler side)
N112	N/A	1 5/16-12 SAE	1 5/16-12 SAE	Radial 9/16-18 SAE (on drive side)

Port locations (SAE O-ring port shown)



Radial ports

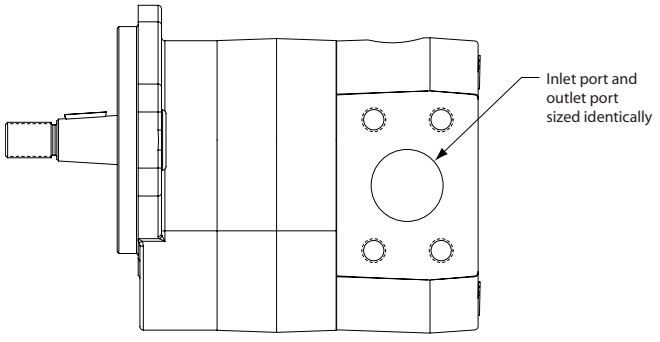
Axial ports

P107 904E

SAE Split Flange Ports

Code	SAE Split flange ports - No valves		
Radial	**Inlet**	**Outlet**	**Drain port**
N330	1 inch Split flange	1 inch Split flange	Radial 9/16-18 SAE (on idler side)
N331	1 inch Split flange	1 inch Split flange	Radial 9/16-18 SAE (on drive side)
N332	1-1/4 Split flange	1-1/4 Split flange	Radial 9/16-18 SAE (on idler side)
N333	1-1/4 Split flange	1-1/4 Split flange	Radial 9/16-18 SAE (on drive side)

Split flange ports



Selecting Port Options

Use the following tables for selecting port options. Recommendations assume maximum rated speed. Applications running at lower speeds may use smaller port sizes. Contact your Sauer-Danfoss representative.

Recommended part size by displacement

Displacement code	Recommended port size
17	1 - 5/16
19	1 - 5/16
21	1 - 5/16
23	1 - 5/16
25	1 - 5/16
29	1 - 5/16
32	1 inch Split flange
36	1 inch Split flange
38	1 inch Split flange
41	1 inch Split flange
45	1 inch Split flange

Maximum flow by port size

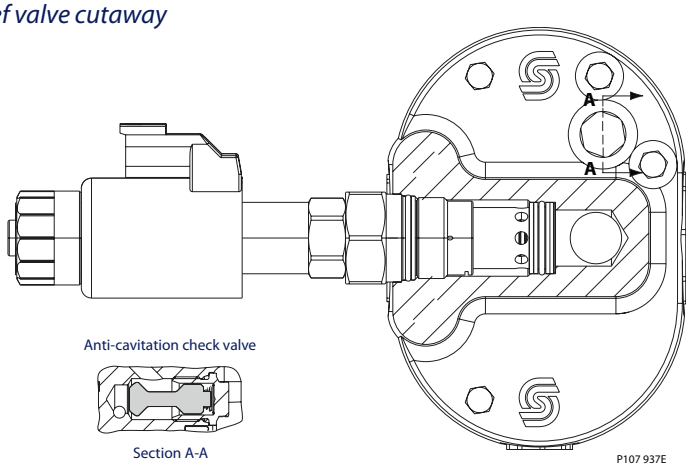
Port size	Maximum flow l/min [US gal/min]
3/4 -16 SAE ORB	19 [5]
7/8-14 SAE ORB	30 [8]
1 1/16-12 SAE ORB	49 [13]
1 5/16-12 SAE ORB	91 [24]
1 inch Split flange	151 [40]
1 1/4 Split flange	204 [54]

Proportional Relief Valve with Anti-cavitation Valve

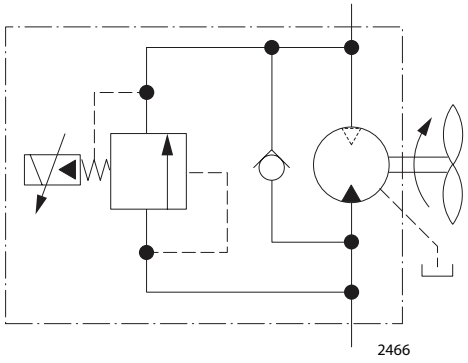
The D Series motor may be equipped with a normally closed proportional relief valve, which modulates the fan speed for on demand cooling in fan drive applications. This valve can also trim maximum fan speed at a pre-set pressure.

Mount the motor so the relief valve is below the reservoir oil level. Keep the relief valve in a horizontal position. Be sure to bleed the system to remove entrained air.

Relief valve cutaway



Schematic - Motor with proportional relief valve and anti-cavitation check valve



Technical data

Capacity	95 l/min [25 US gal/min] or 96-190 l/min [25-50 US gal/min]	
Electrical connector	Deutsch ® DT-04-2P (protection rate IP 69K DIN 40050)	
Electrical supply	0 -1.1 A at 12 Vdc with	coil resistance of 6.4 Ohms at 20° C [68° F]
		Minimum voltage 10.8 Vdc
		Maximum voltage 13.2 Vdc
	0 -0.55 A at 24 Vdc with	coil resistance of 26.2 Ohms at 20° C [68° F]
		Minimum voltage 21.6 Vdc
		Maximum voltage 26.4 Vdc
PWM frequency	100 - 250 Hz	

Proportional Relief Valve (continued)

Select proportional relief valve setting using the pressure vs. bypass flow graphs.

Any modification to the valve to change the factory setting will void product warranty.

Valve option	Pressure setting bar [psi]
AF	276 [4000]
AD	241 [3500]
AC	207 [3000]
AB	172 [2500]
AA	138 [2000]

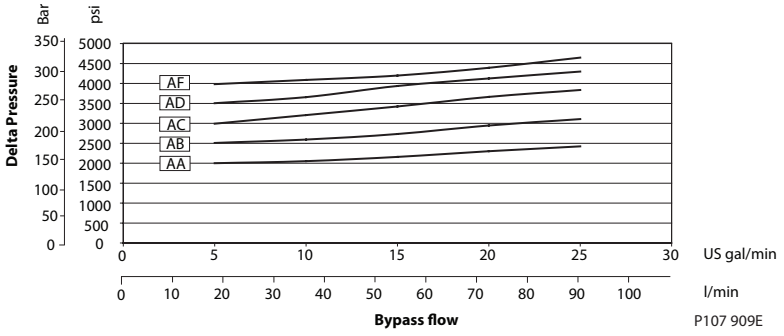
Valve option	Pressure setting bar [psi]
BF	276 [4000]
BD	241 [3500]
BC	207 [3000]
BB	172 [2500]
BA	138 [2000]

Relief pressure vs flow T_{oil}=51.7°C [125°F], viscosity=30 mm²/sec (cSt) [121 SUS] set at 19 l/min [5 US gal/min] and zero current

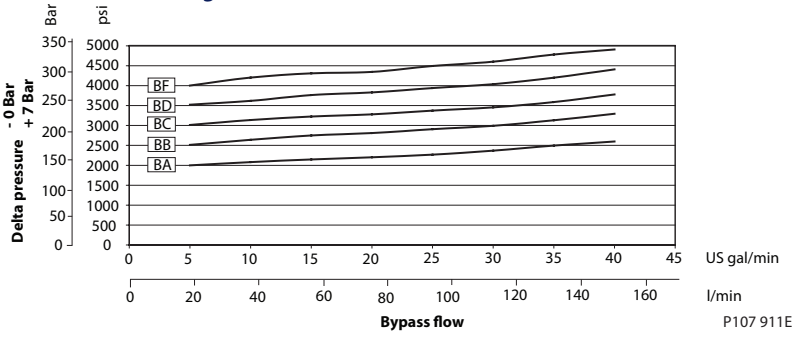
Valve Settings

Code	
P1	12 Vdc Proportional relief valve internally drained - with 95 l/min [25 US gal/min] or less flow (25cc displacement and less)
P2	12 Vdc Proportional relief valve internally drained - with 96-190 l/min[26-50 US gal/min] flow (29cc displacement and greater)
P3	24 Vdc Proportional relief valve internally drained - with 95 l/min [25 US gal/min] or less flow (25cc displacement and less)
P4	24 Vdc Proportional relief valve internally drained - with 96-190 l/min[26-50 US gal/min] flow (29cc displacement and greater)

P1 and P3 valve settings

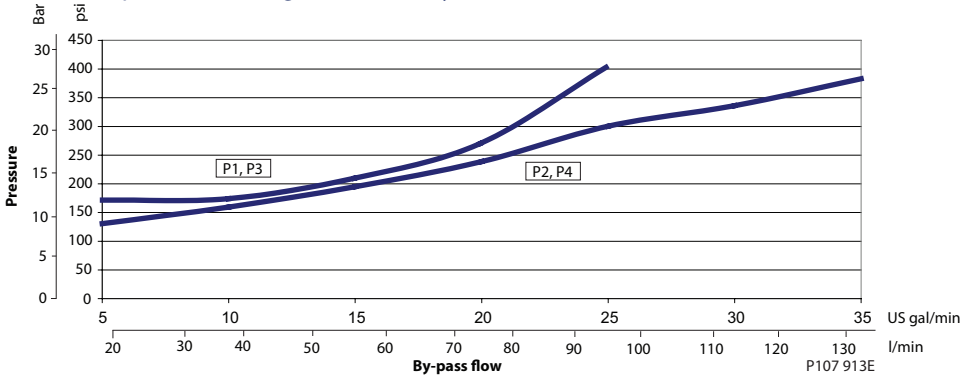


P2 and P4 valve settings



Performance Graphs

Pressure drop with coil energized, valve only



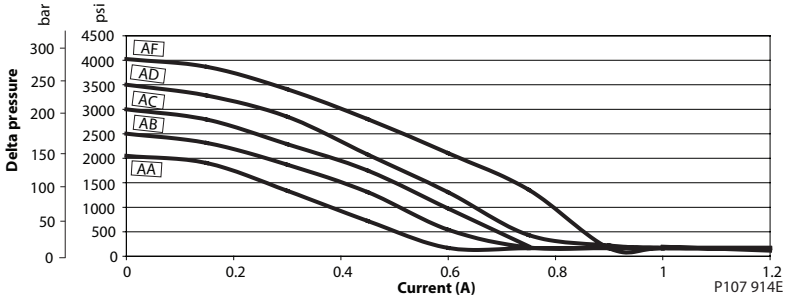
Proportional Relief Valve (continued)

Valve Settings

Code	
P1	12 Vdc Proportional relief valve internally drained - with 95 l/min [25 US gal/min] or less flow
P2	12 Vdc Proportional relief valve internally drained - with 96-190 l/min[26-50 US gal/min] flow
P3	24 Vdc Proportional relief valve internally drained - with 95 l/min [25 US gal/min] or less flow
P4	24 Vdc Proportional relief valve internally drained - with 96-190 l/min[26-50 US gal/min] flow

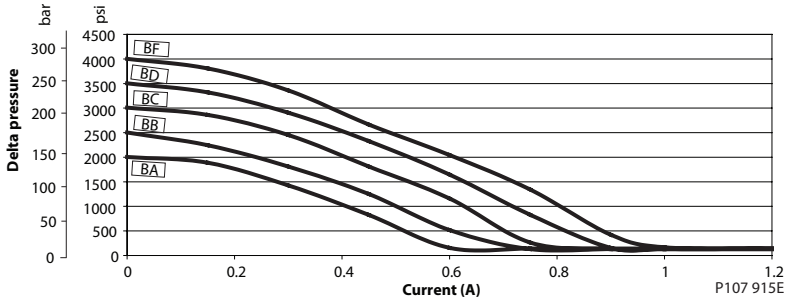
Relief pressure vs flow T_{oil}=51.7°C [125°F], viscosity=30 mm²/sec (cSt) [121 SUS] set at 19 l/min [5 US gal/min] and zero current

***P1**, Relief pressure vs. current*

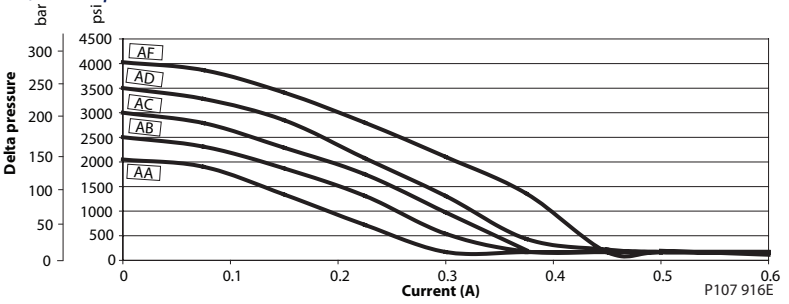


Any modification to the valve to change the factory setting will void product warranty.

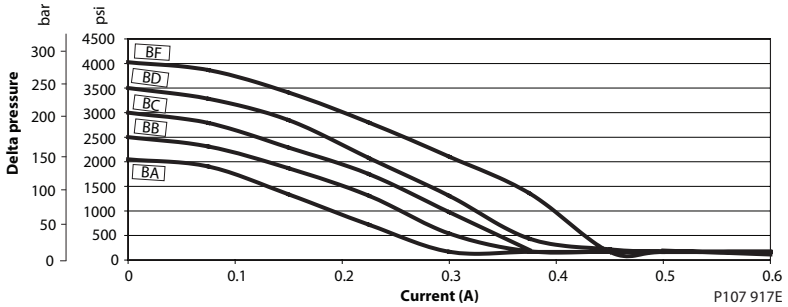
***P2**, Relief pressure vs. current*



***P3**, Relief pressure vs. current*



***P4**, Relief pressure vs. current*

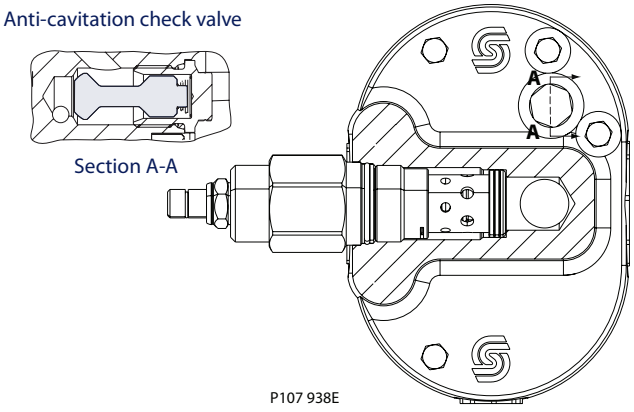


Standard Relief Valve

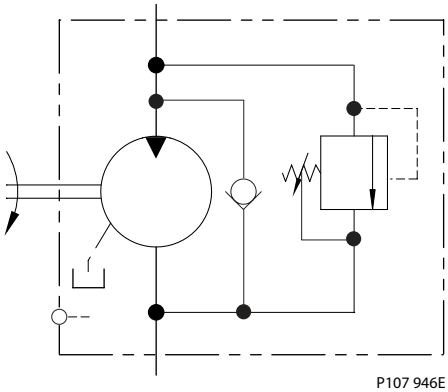
The fixed-setting pressure relief valve limits maximum fan speed and protects the motor from over-pressurization.

Mount the motor so the relief valve is below the reservoir oil level. Keep the relief valve in a horizontal position. Be sure to bleed the system to remove entrained air.

Standard relief valve



Schematic - Motor with standard relief valve with optional anti-cavitation valve



Relief valve codes

Code	Desctiption
F	Relief valve internally drained - applications with 95 l/min [26 US gal/min] or less flow
G	Relief valve internally drained - applications with 96-190 l/min[26-50 US gal/min] flow

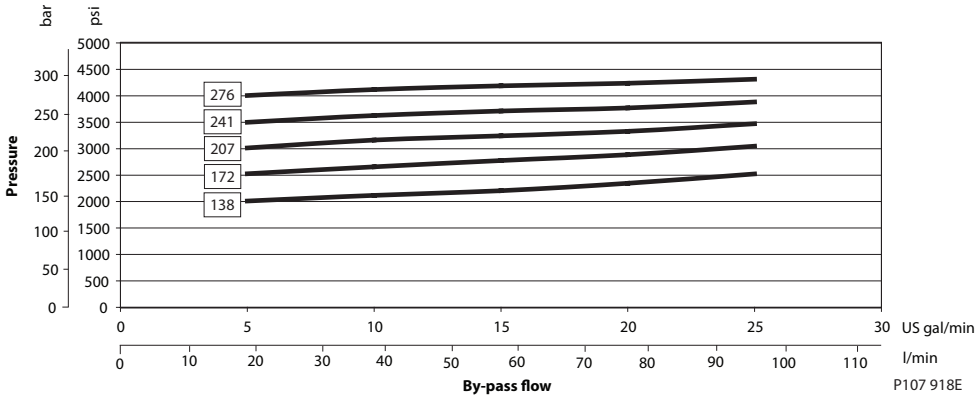
Any modification to the valve to change the factory setting will void product warranty.

Standard Relief Valve (continued)

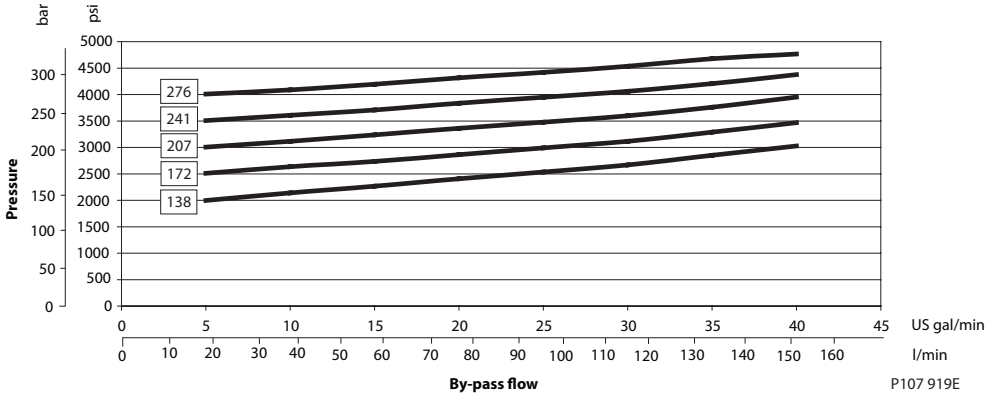
Valve option	Pressure setting bar [psi]
276	276 [4000]
241	241 [3500]
207	207 [3000]
172	172 [2500]
138	138 [2000]

Valve Settings

F *Valve settings*



G *Valve settings*

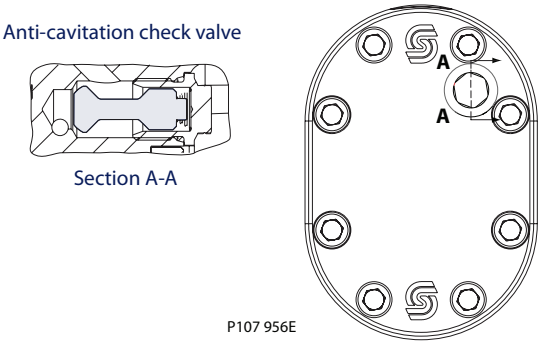


Relief pressure vs flow
T_{oil}=51.7°C [125°F], viscosity=30 mm²/sec (cSt) [121 SUS] set at 19 l/min [5 US gal/min]

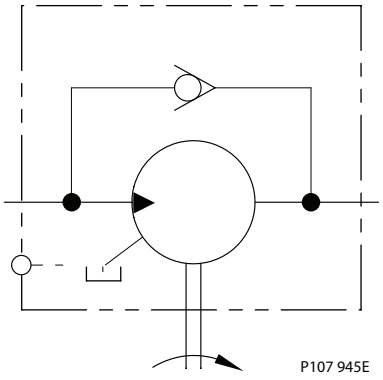
Anti Cavitation Check Valve

D motors are available with an optional anti-cavitation check valve. The valve is integrated into the rear cover. The anti-cavitation check valve protects the motor from cavitation in overrunning conditions.

Standard rear cover with anti-cavitation valve



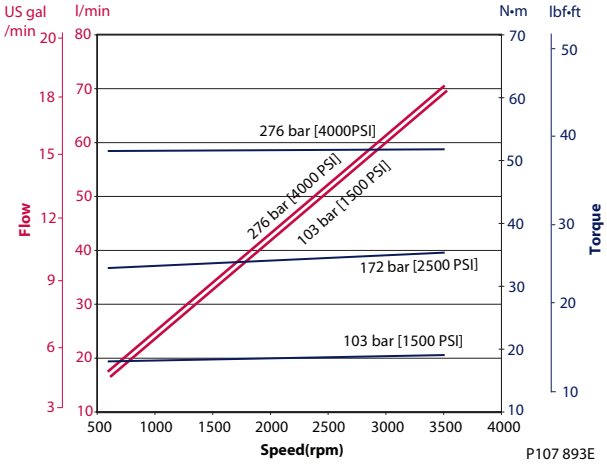
Schematic - Motor with anti-cavitation check valve



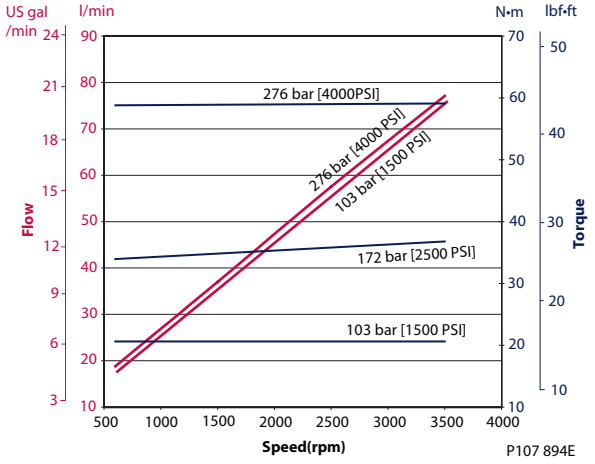
Motor Performance Graphs

The graphs show typical inlet flow and output power for the D series motors at various working pressures as a function of speed. Data were taken using hydraulic fluid conforming to ISO VG46 at 50°C [120° F] with viscosity at 28 mm²/sec (cSt) [132 SUS].

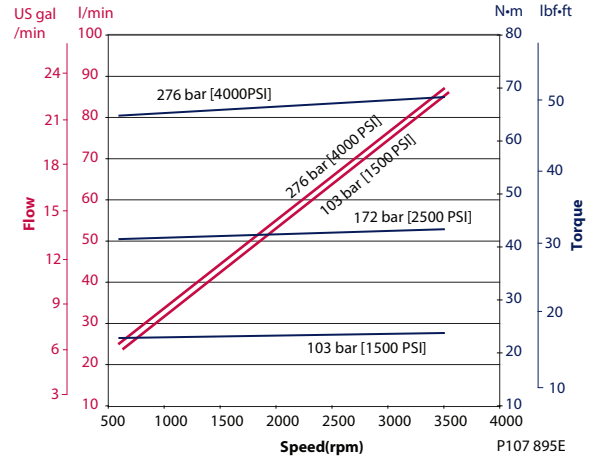
17 cm³ [1.04 in³]



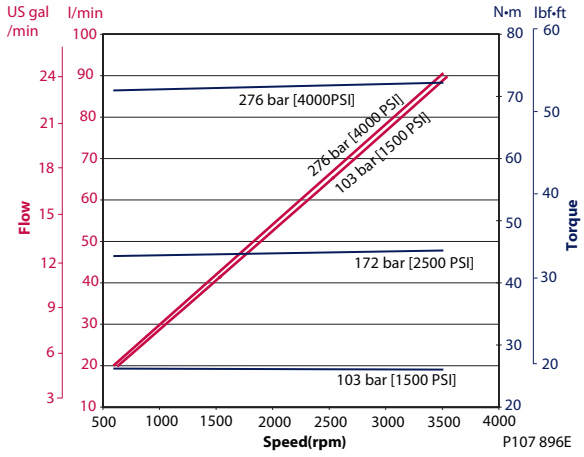
19 cm³ [1.16 in³]



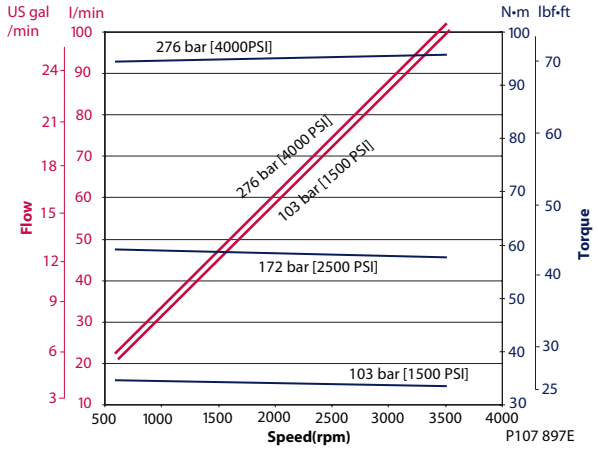
21 cm³ [1.25 in³]



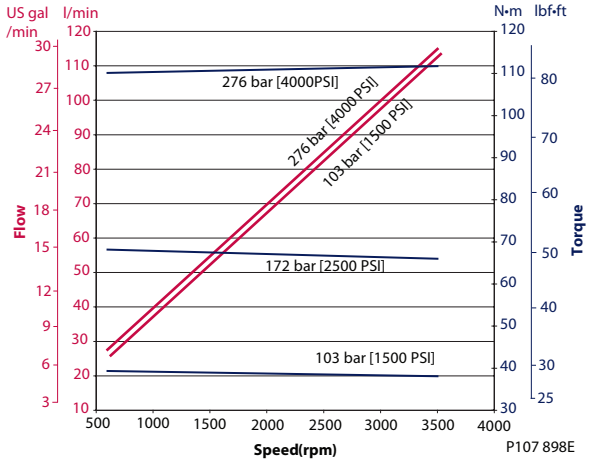
23 cm³ [1.37 in³]



25 cm³ [1.55 in³]

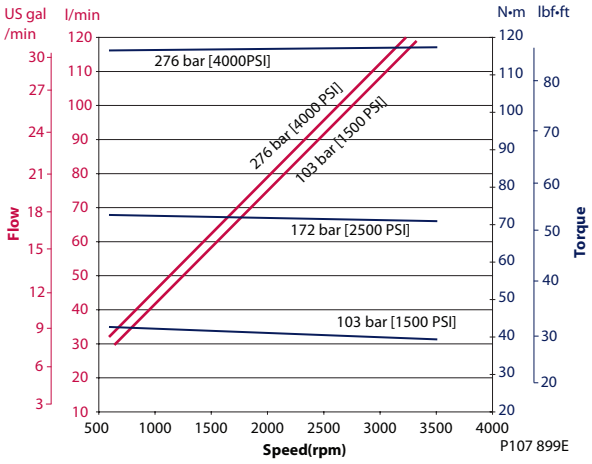


29 cm³ [1.77 in³]

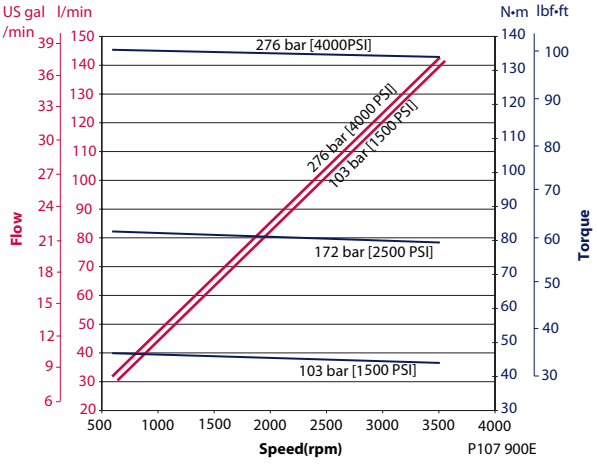


Motor Performance Graphs (continued)

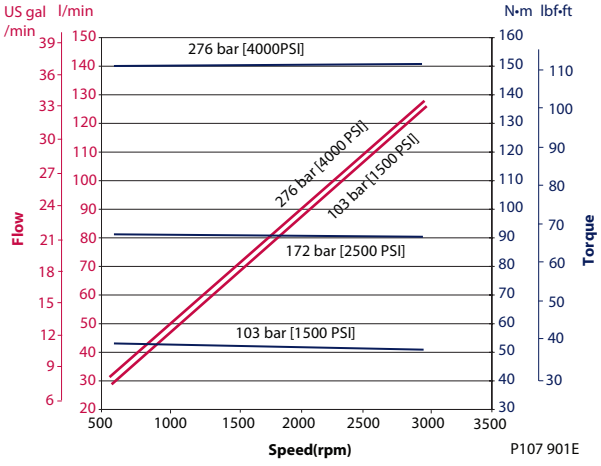
32 cm³ [1.94 in³]



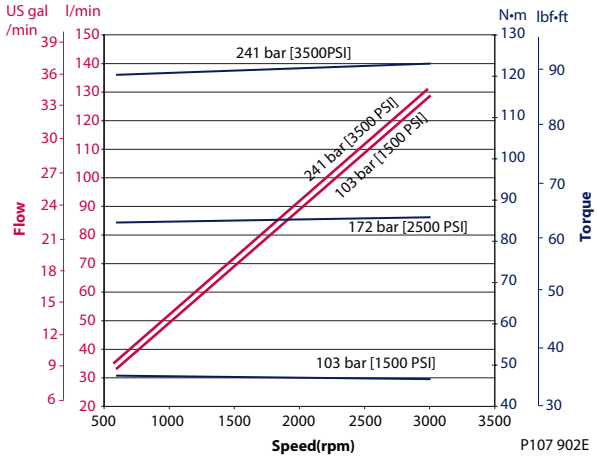
36 cm³ [2.20 in³]



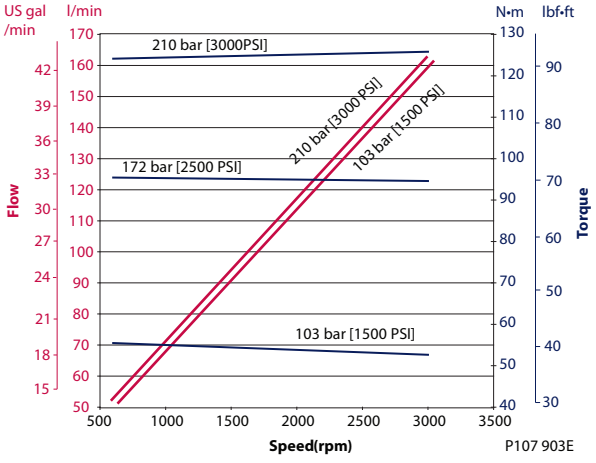
38 cm³ [2.32 in³]



41 cm³ [2.50 in³]



45 cm³ [2.75 in³]



Sauer-Danfoss Fan Drive Related Literature

Software
- *SX Microcontroller Fan Drive Personality* **11023458**

Fan Drive Controls
- *Fan Drive Control Technical Information* **11005336**
- *Fan Drive Control Assembly Technical Information* **11005337**
- *Fan Drive Control Temperature Sensors* **BLN-95-9063**
- *PLUS+1 compliant Heavy-Duty Pressure Transmitter Datasheet* **520L0801**
- *PLUS+1 compliant Heavy-Duty Pressure Transmitter - SAE Thread Version Datasheet* **11005336**
- *PLUS+1 MC088 015-00000-Controller Datasheet* **11006645**

Valves
- *Proportional Solenoid Valves Tech Note* **11022746**
- *Solenoid Valves Product Electrical Installation Tech Note* **11022768**

Motors
- *Aluminium Gear Motors Group2 Technical Information* **520L0560**
- *Aluminium Gear Motors Group3 Technical Information* **520L0569**

Aluminum motors
- *Fan Drive Gear Motors Group2 and Group3 Technical Information* **11040345**

Pumps
- *Series D Hydraulic Gear Pumps Technical Information* **520L0781**
- *Gear Pumps and Gear Motors Technical Information* **520L0557**
- *Series 45 Open Circuit Pumps Technical Information* **520L0519**

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