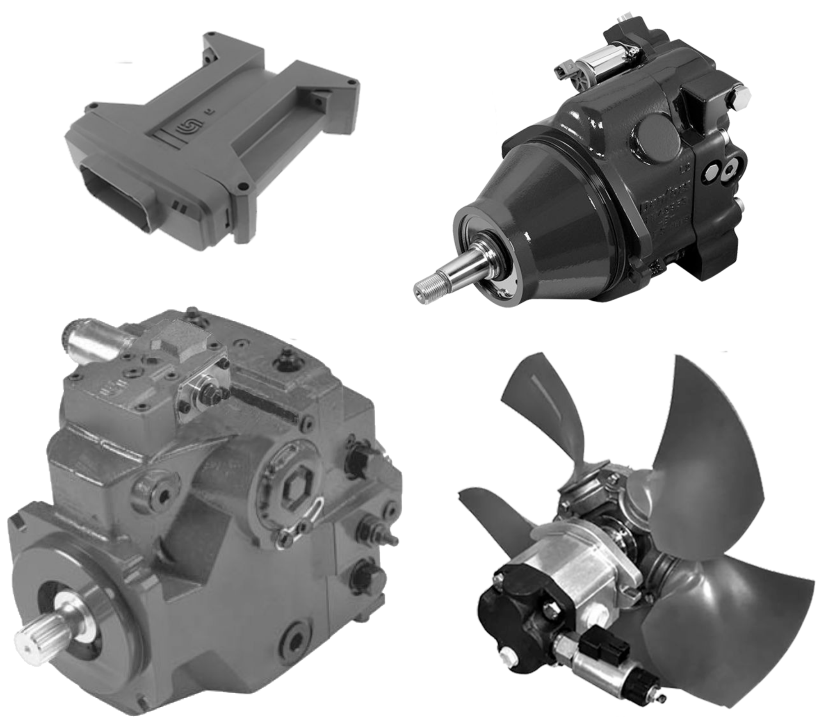
ENGINEERING TOMORROW

Technical Information

Hydraulic Fan Drive Systems



www.danfoss.com

Revision history

Table of revisions

Date	Changed	Rev
Sept 2018	Rebrand to Engineering Tomorrow	0403
June 2015	Danfoss layout - update product information	DA
November 2010	new back page	CC
February 2010	Fix Osaka address	CB
July 2009	updated manual adding new products	CA
June 2008	deletions and illustration modifications	BA
April 2008	added special tools part numbers	AC
March 2008	minor edits and corrections	AB
	First edition	AA

Contents

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General Information

Market Leading Experience

Over a number of years, Danfoss has built up a wealth of experience with fan drive applications for vehicles and machines operating on and off the highway. This knowledge has been gained by providing system solutions which integrate our market leading hydraulic pumps, motors, valves and electro-hydraulic controllers.

Danfoss Hydraulic Fan Drive Systems Provide:

- On-Off and fully modulating controls
- Increased engine reliability
- Decreased fan noise
- Flexible cooling pack positioning
- Vehicle fuel savings
- Design flexibility with multiple inputs for the electro-hydraulic controllers plus CAN bus per SAEJ 1939
- Integrated systems
- Lower operating costs
- Ability to downsize the engine while maintaining system productivity
- Ability to provide engine anti-stall and overspeed protection

Typical Applications

Due to the versatility, flexibility and reliability of Danfoss fan drive systems, they may be applied in numerous applications, including the following.

Agriculture Machinery

- On-Off and fully modulating controls
- Increased engine reliability
- Automatic or On-demand reversing

Construction Machinery

- Backhoe loaders
- Crawler dozer - Crawler loader
- Wheel loaders
- Dump trucks - Haulers
- Excavators
- Skid steer loaders

Material Handling Vehicles

- Fork lift trucks
- Rough terrain trucks
- Telehandlers

Road Building Vehicles

- Pavers
- Graders
- Road rollers
- Crawlers

General Information

Forestry Machinery

- Feller bunchers
- Forwarders
- Harvesters
- Log skidders

On Highway Vehicles

- Buses
- RV motorhomes
- Garbage trucks
- Sweepers

High Power Specialty Vehicles

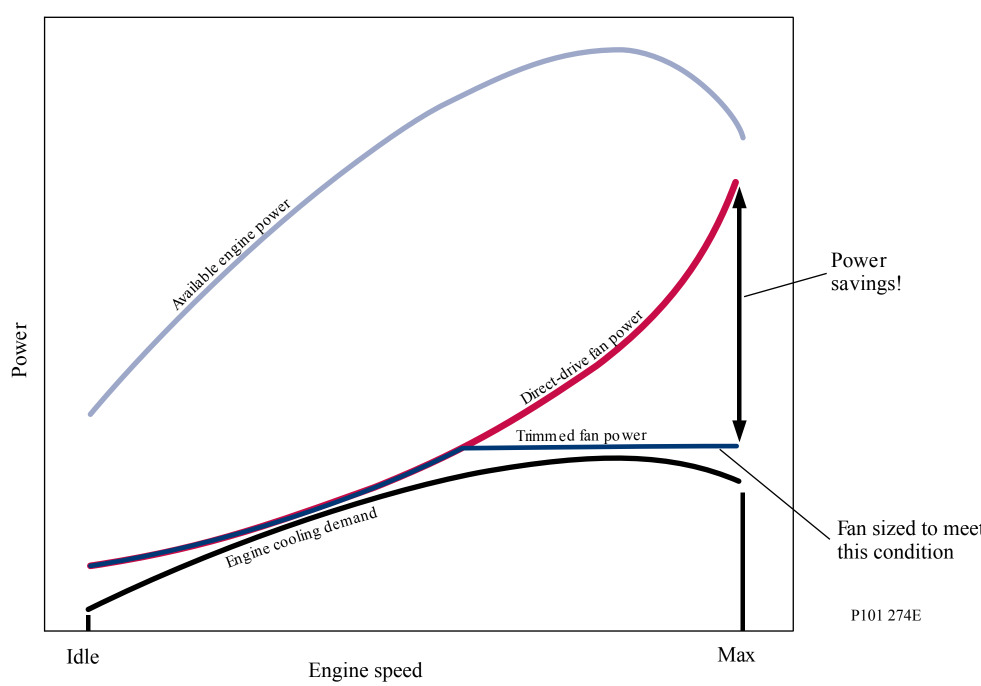
- Marine
- Oil and Gas drilling/Fracking
- Mining

Reduced Power Consumption

Danfoss hydraulic fan drive systems allow cooling fan power consumption to be tailored to cooling requirements. Our systems provide a precise, modulated cooling flow for a given set of monitored conditions.

The power to drive a cooling fan rises as a cubic function of fan speed (doubling the fan speed requires an eight-fold increase of input power). However, engine power and cooling demand decrease at higher speeds. Because of this inverse relationship, a direct drive cooling fan must be sized to meet cooling requirement at a relatively low engine speed and is therefore significantly oversized for cooling requirements at higher speeds. Hydraulic fan drive systems allow fan speed to be trimmed so the fan can be properly sized at low engine speeds without drawing excessive power at high speeds.

Power vs Engine Speed Curve



Fan systems are sized to provide required air flow at all engine speeds and operating conditions. Direct-drive fans consume a great deal of power at higher engine speeds, without any advantage.

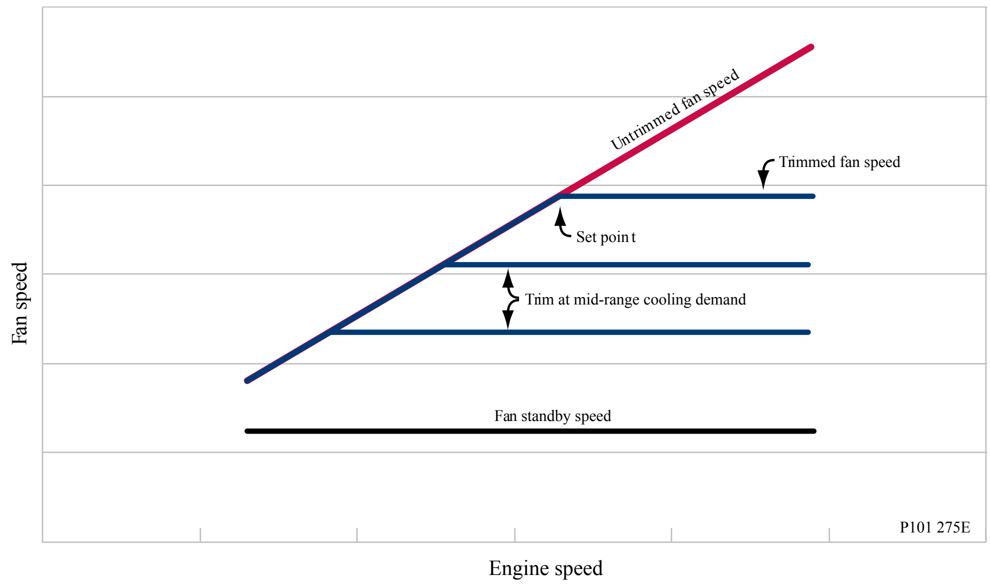
General Information

Trimmed and Standby Fan Speed

Under full cooling demand, maximum fan speed increases with engine speed, up to the *set point* of the fan drive system (the point where further increase in speed yields no further gain). Beyond this point fan speed does not increase, allowing greatly reduced power consumption compared to an untrimmed fan.

Under minimum cooling demand, standby fan speed can be set to provide very low, or minimal air flow.

Fan Speed vs Engine Speed



The upper curves represent maximum cooling conditions; maximum fan speed is trimmed at the set point. The lowest curve represents the standby condition; fan speed is maintained at a minimum value.

Flexible Mounting

Hydraulic fan drives make it is possible to mount the radiator and fan just about anywhere on the vehicle. This is advantageous in space conscious designs.

Wide Range of Components

A fan drive system is sized to provide the required fan torque and speed. Danfoss has a wide range of pumps, motors, controls, and sensors to meet your unique fan drive system needs.

Basic Operation

In simplest terms, fan speed is controlled by regulating the amount of hydraulic oil passing through the fan motor. The greater the flow, the greater the fan speed. The amount of flow is regulated based on one or more inputs from the power system. Typically, engine coolant temperature is the main controlling factor. Other system inputs may include hydraulic fluid temperature, charge air temperature and various signals or switches. As inputs indicate a change in cooling demand, the system adjusts flow to the motor.

Intelligent Control

At the core of the Danfoss Fan Drive System is a controller that monitors relevant cooling parameters and adjusts fan speed accordingly.

Fan Drive Controller

The Danfoss fan drive control system monitors cooling parameter inputs and provides an electronic signal to a proportional hydraulic valve. The proportional valve relays a hydraulic signal either to the

General Information

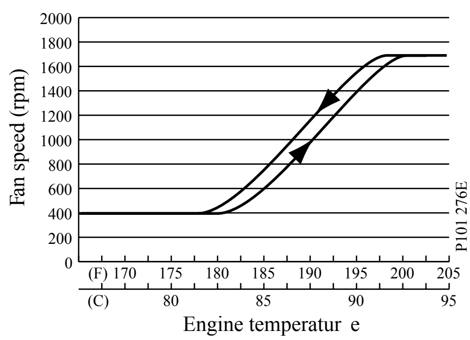
bypass valve on the motor or the displacement control of a variable displacement pump. Possible inputs to the fan drive control system include engine coolant temperature, charge air temperature, engine or transmission oil temperature, compartment temperature, ambient temperature, and various other signals and switches. Also, many engine control systems provide a fan controlling signal or CAN message which can serve as a cooling parameter input.

Balanced Fan Speed and Heat Generation

When an input, such as engine coolant temperature, rises above a predetermined level, signalling an increase in cooling demand; fan speed is gradually increased. Coolant temperature and fan speed continue to rise until heat generation and cooling are balanced. Under most conditions, this balance occurs at a level below the maximum capability of the system.

Maximum fan speed is reached only under simultaneous conditions of maximum ambient temperature and maximum engine load. These parameters are set as part of the cooling system design criteria.

Fan Speed Vs. Engine Temperature



Fan speed is increased as monitored temperature increases until balance is reached.

Fan Drive Systems

Modulating Fan Drive Systems

Monitoring various cooling system parameters enables the Danfoss modulating fan drive systems to increase fan speed as required. As a modulating system, it ramps fan speed only to the level required, providing only as much air flow as needed to maintain balance between heat generation and cooling.

Gear Pump with Gear Motor and PLUS+1™ Fan Drive Controller

The pump receives oil directly from the reservoir through the inlet line. The output of the pump is directed to a gear motor with an integral proportional relief valve.

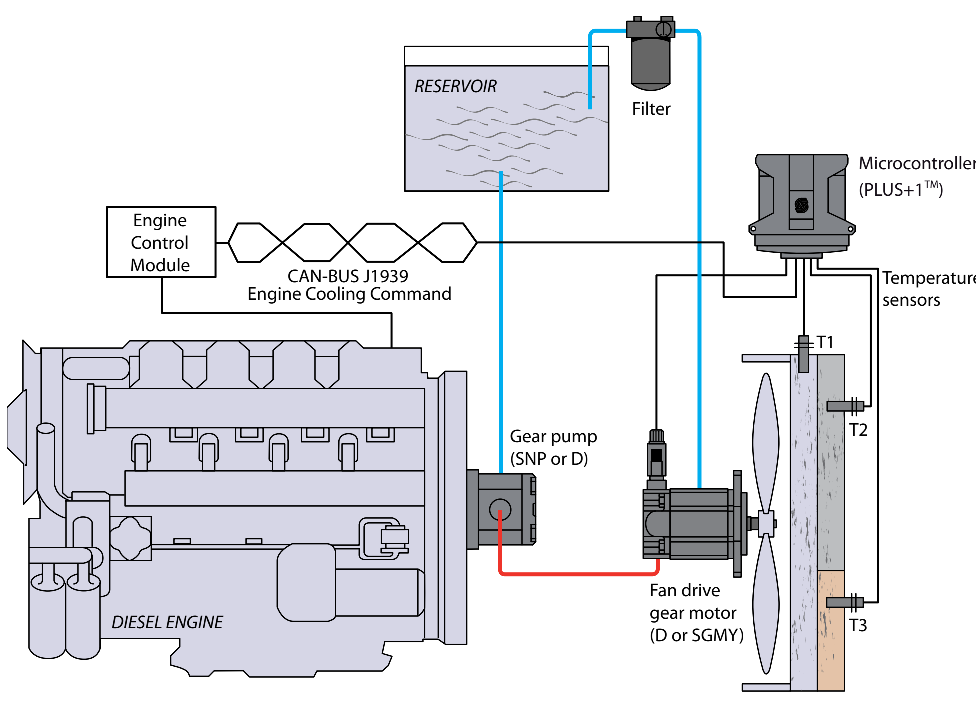
The setting of the valve determines the maximum pressure in the system by bypassing oil (around the motor's gear set) directly to the return port of the motor. The proportional valve is normally closed and requires the application of a PWM signal to reduce the bypass pressure. In a hydraulic fan drive system, the pre-determined maximum pressure setting determines the maximum pressure to the motor, and the maximum trim speed of the fan.

Applying a PWM signal to the valve allows the fan to run at speeds below its maximum trim speed, regardless of the flow supplied by the pump.

Oil exiting the motor is directed back to the reservoir through a filter and a heat exchanger. Oil returning to the reservoir must enter the reservoir well below the fluid level so air will not be entrained in the fluid. The oil is diffused as it enters the reservoir to decelerate it to an acceptable level, to mix it with the fluid in the reservoir, and to prevent the oil from flowing immediately back to the pump inlet. The return oil should remain in the reservoir long enough to allow any entrained air in the fluid to rise to the surface and dissipate back into the atmosphere. An anti-cavitation check valve prevents damage to the fan motor in case of overrun. Fan overrun can occur when fan speed exceeds the speed commanded by the system due to the fan windmilling in the vehicle's air stream.

Gear Pump with PLUS+1™ Controller

PLUS+1™ System Illustration

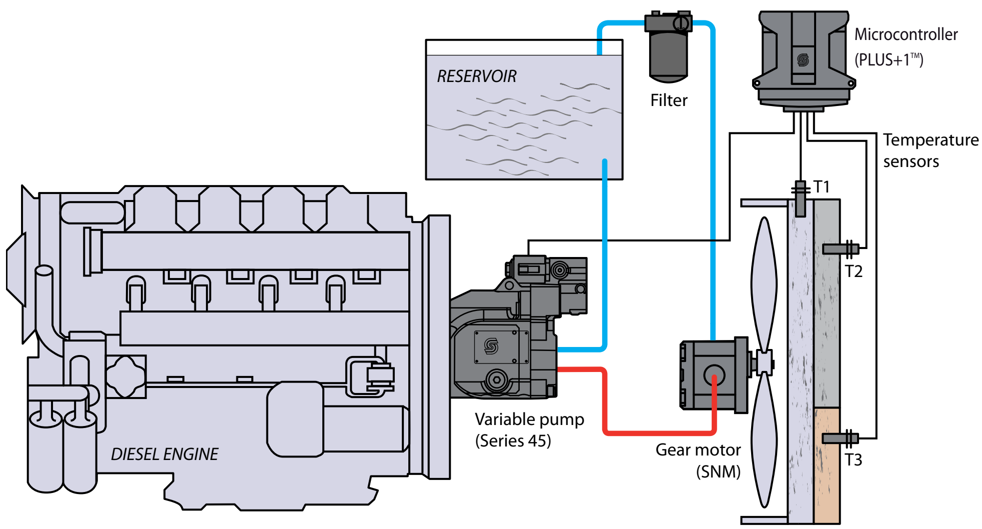


Fan Drive Systems

Variable Displacement Pump with Fan Drive Control

The variable displacement pump sends flow to the fan motor. Based on sensor and other inputs, the microcontroller adjusts the proportional relief valve to regulate the pressure in the pilot port of the pump's load sensing control. Higher pressure in the pilot line results in increased flow to the fan motor. The control has a pressure compensator feature which can be used to limit the fan's trim speed. Trim speed can also be set by software in the microcontroller.

Fan Drive Control System Illustration



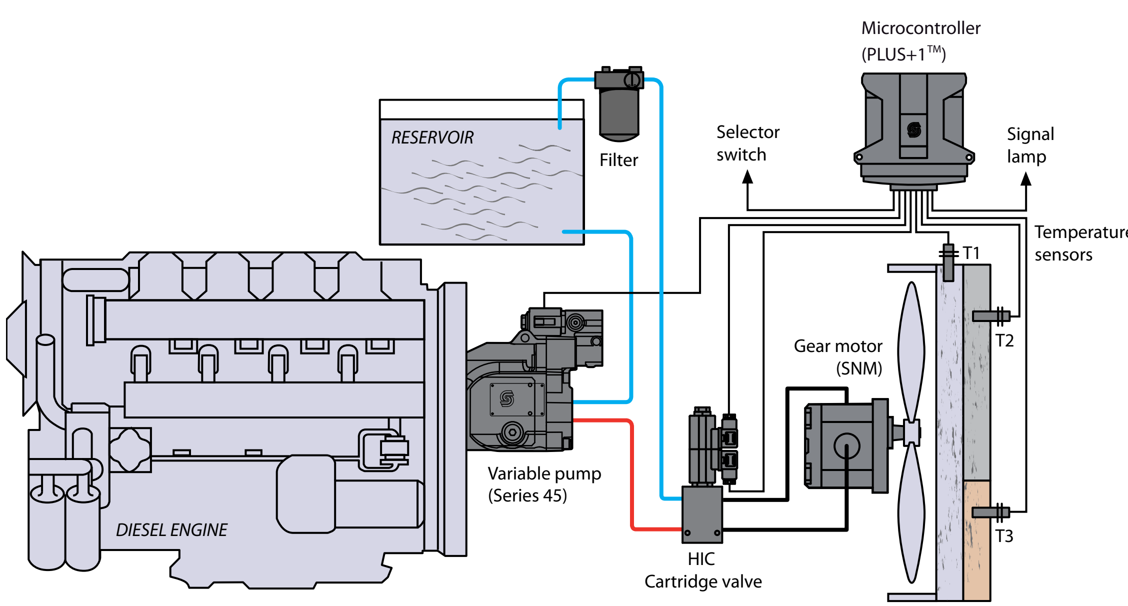
P107 984E

Variable Displacement Pump and HIC Cartridge Valve

The system shown below is the same as the previous system with the addition of an electronically controlled HIC cartridge valve between the pump and motor.

The HIC cartridge valve reverses the hydraulic flow to the motor, thus reversing the rotation of the fan. This feature is commonly used to clean out the radiator if it becomes clogged with debris.

Variable Pump with HIC Cartridge Valve



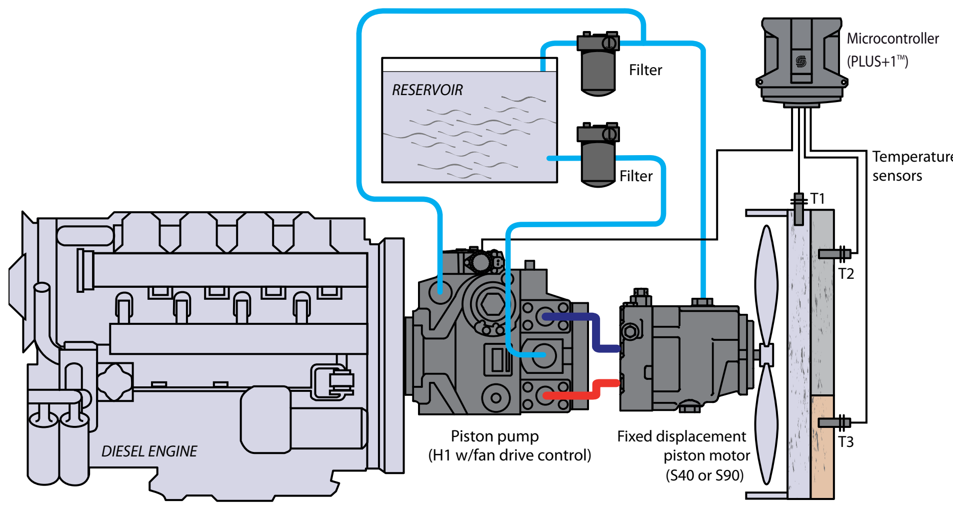
P107 985E

Fan Drive Systems

Closed Circuit System with Microcontroller

The variable displacement axial piston pump sends flow to the fixed displacement piston fan motor. Based on temperature sensor and other inputs, the microcontroller regulates the displacement of the axial piston pump. Higher coolant temperature results in increased flow to the fan motor. The pumps displacement control has a pressure compensator feature which can be used to limit the maximum fan trim speed in either direction. Trim speed can also be set by software in the microcontroller. The nature of the closed-loop system prevents fan overrun. Zero fan speed is available on demand.

Variable Pump with Fixed Piston Motor



System Components

Gear Pumps

Danfoss offers gear pumps in a variety of models, sizes, capacities, and configurations. Integral priority flow dividers are available which supply a constant flow for power assisted steering with the remainder driving the fan drive motor.

Model Sizes and Capacities

Danfoss gear pumps are available in the following models and sizes.

Aluminum construction

- Group 2

  4 to 25 cm3/rev [0.24 to 1.53 in3/rev] displacement
- Group 3

  22 to 90 cm3/rev [1.34 to 5.49 in3/rev]

Cast iron construction

- Group 2.5 (D Series)

  7 to 45 cm3/rev [0.43 to 2.75 in3/rev]

Configurations

- Single pump
- Single pump with priority flow divider for power steering assist
- Tandem pumps
- Tandem pumps with priority flow divider for power steering assist
- Multiple pumps (triple, quadruple, etc.)
- Quadra-Flow pumps (digital displacement)

D Series pumps (single and tandem) are available with load sense and discrete flow options.

Group 2 aluminum gear pump

System Components

Group 2.5 D Series gear pump

Quadra-Flow gear pump

System Components

Series 45 Variable Displacement Axial Piston Pumps

Danfoss offers a complete family of variable displacement, open circuit, axial piston pumps. The Series 45 family offers a wide range of shafts, flanges, and porting options. Through drives are also available for auxiliary pump drives. Load sensing (LS), pressure compensating (PC), remote pressure compensating (RPC) and electro-proportional fan drive controls are available.

Frame K/L

- 25, 30, 38 and 45 cm3/rev [1.53, 1.83, 2.32, 2.75 in3/rev]
- Operating pressures up to 260 bar [3770 psi]
- Speeds to 3200 min-1(rpm)

Frame J

- 45, 51, 60, 65 and 75 cm3/rev [2.75 3.11, 3.66, 3.97, and 4.57 in3/rev]
- Operating pressures to 310 bar [4495 psi]
- Speeds to 2800 min-1(rpm)

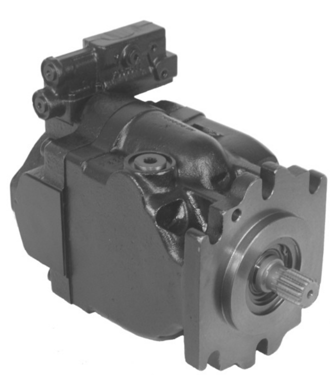
Frame F

- 74 and 90 cm3/rev [4.52 and 5.49 in3/rev]
- Operating pressures to 310 bar [4495 psi]
- Speeds to 2400 min-1(rpm)

Frame E

- 100, 130, and 147 cm3/rev [6.10, 7.93 and 8.97 in3/rev]
- Operating pressures to 310 bar [4495 psi]
- Speeds to 2450 min-1(rpm)

Frame J



System Components

Frame K/L

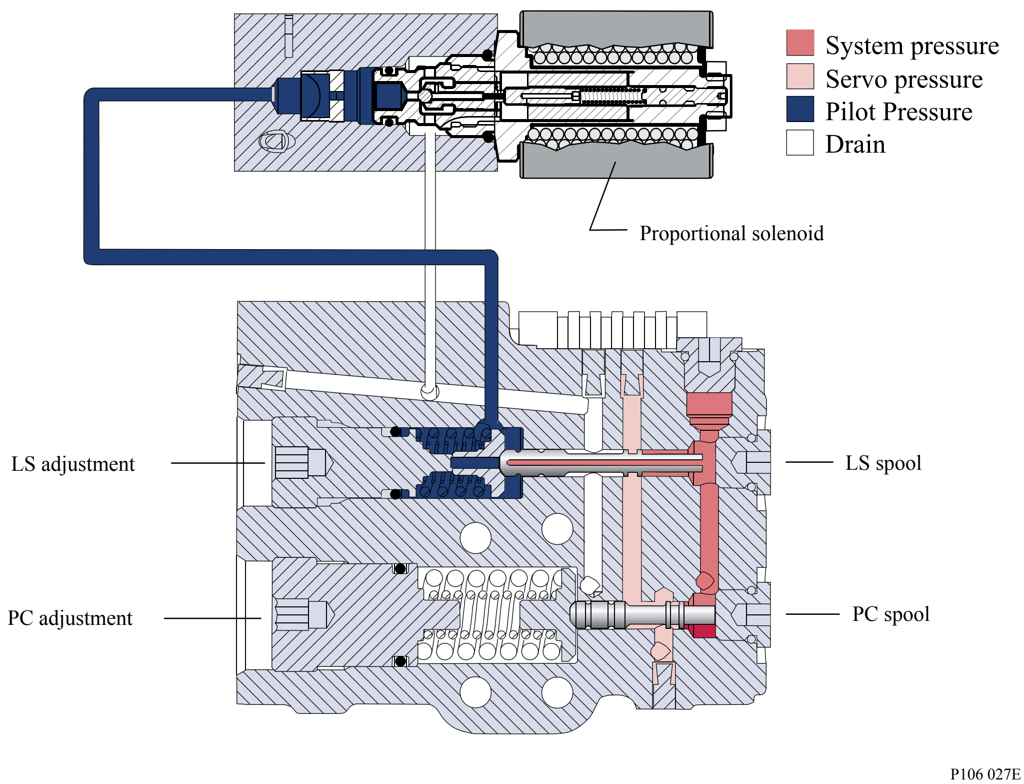
Series 45 Fan Drive Control

The Series 45 fan drive control is an electric proportional control for Series 45 pumps. It controls the pump based on various machine operating parameters. In a fan drive system, coolant temperature forms the basis for pump control.

When the solenoid is de-energized, the pump operates in the high pressure standby (pressure compensation) mode; when the solenoid is fully energized, the pump returns to the low pressure standby mode of operation. This allows the system to minimize energy loss when the cooling system does not require cooling fan operation, potentially using existing system control components (temperature sensor or micro-controller).

The control is proportional. As the current applied to the solenoid increases, the regulated system pressure gradually decreases until the full current is applied, achieving low standby pressure.

System Components



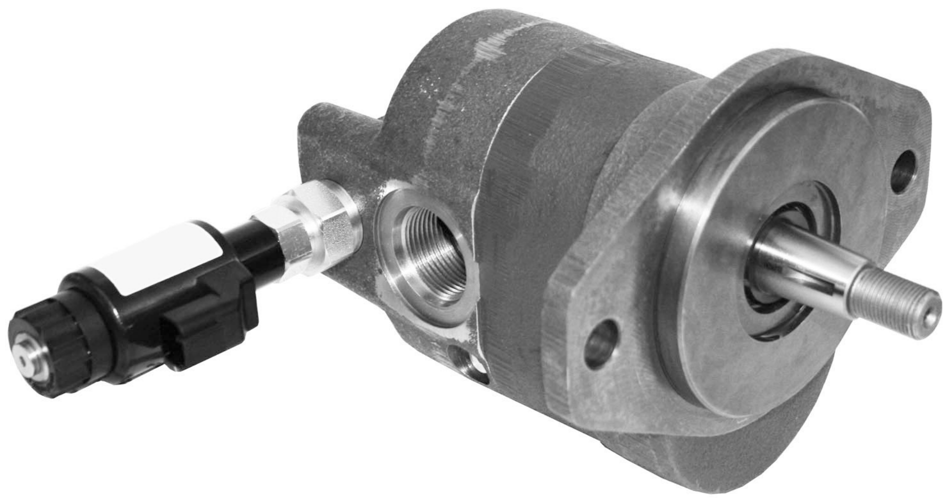
D Series Motor

D series fan drive motors are available in displacements from 17 cm^3/rev [1.04 in^3/rev]to 45 cm^3/rev [2.75 in^3/rev].

D series fan motors are PLUS+1 compliant.

System Components

D Series Motor



D Series Motor Technical Data

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
Minimum shaft speed at 69 bar [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•m^2	127	138	146	156	172	191	206	228	239	255	276
	$x10^{-6}$ slug•ft^2	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

System Components

D Series Motor Technical Data (continued)

Ratings	Units	17	19	21	23	25	29	32	36	38	41	45
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

SGM2Y Motor

Group 2 fan drive motors are available in displacements from 8.4 cm^3/rev [0.51 in^3/rev]to 25 cm^3/rev [1.54 in^3/rev].

Configurations include European and SAE flanges; taper 1:8, 1:5, and straight shafts Ø15.875 mm [0.62 in].

Group 2 fan drive motors are PLUS+1 compliant.

SGM2Y Motor

F005216

SGM2Y technical data

	Units	Frame size						
		8.0	011	014	017	019	022	025
Displacement	cm^3/rev [in^3/rev]	8.4 [0.51]	10.8 [0.66]	14.4 [0.88]	16.8 [1.03]	19.2 [1.17]	22.8 [1.39]	25.2 [1.54]
Peak pressure	bar [psi]	270 [3916]	270 [3916]	270 [3916]	250 [3626]	230 [3336]	200 [2900]	180 [2610]
Rated pressure		250 [3626]	250 [3626]	250 [3626]	230 [3336]	210 [3046]	180 [2610]	160 [2320]
Back pressure		150 [2176]	150 [2176]	150 [2176]	150 [2176]	130 [1885]	100 [1450]	100 [1450]
Maximum speed	min-1 [rpm]	3500	3500	3500	3500	3500	3500	3500
Weight	kg [lb]	4.73 [10.43]	4.83 [10.65]	5.03 [11.1]	5.18 [11.42]	5.23 [11.53]	5.33 [11.75]	5.53 [12.2]
Moment of inertia of rotating components	x 10-6 kg•m^2 [x 10-6 lbf•ft^2]	32.4 [796]	38.4 [911]	47.3 [1122]	53.3 [1265]	59.2 [1405]	68.1 [1616]	74.1 [1758]
Electrical connector	model	Deutsch DT 04-2P connectors (Protection rate IP 69K DIN 400050)						
Electrical current signal	A	0 to 1.1 A @ 12VDC, with coil resistance of 7.2 ohms @ 20°C [68°F]						
		0 to 0.55 A @ 24VDC, with coil resistance of 28.8 ohms @ 20°C [68°F]						
PWM frequency	Hz	from 100 to 200						

SGM3Y Motor

Group 3 fan drive motor available in displacements from 22.1 cm^3/rev [1.34 in^3/rev]to 44.1 cm^3/rev [2.69 in^3/rev].

Group 3 fan drive motors are PLUS+1 compliant.

System Components

SGM3Y Motor

SGM3Y technical data

	Units	Frame size				
		022	026	033	038	044
Displacement	cm^3/rev [in^3/rev]	22.1 [1.34]	26.2 [1.60]	33.1 [2.02]	37.9 [2.31]	44.1 [2.69]
Peak pressure	bar [psi]	210 [3046]	210 [3046]	210 [3046]	210 [3046]	210 [3046]
Rated pressure		190 [2756]	190 [2756]	190 [2756]	190 [2756]	190 [2756]
Back pressure		120 [1740]	120 [1740]	120 [1740]	120 [1740]	120 [1740]
Maximum speed	min^{-1} [rpm]	3500	2500	2500	2500	2500
Weight	kg [lb]	9.12 [20.11]	9.22 [20.33]	9.32 [20.55]	9.38 [20.68]	9.52 [21.0]
Moment of inertia of rotating components	x 10^{-6} kg•m^2 [x 10^{-6} lbf•ft^2]	198 [4699]	216 [5126]	246 [5838]	267.2 [6341]	294.2 [6981]
Electrical connector	model	Deutsch DT 04-2P connectors (Protection rate IP 69K DIN 400050)				
Electrical current signal	A	0 to 1.1 A @ 12VDC, with coil resistance of 7.2 ohms @ 20°C [68°F]				
		0 to 0.55 A @ 24VDC, with coil resistance of 28.8 ohms @ 20°C [68°F]				
PWM frequency	Hz	from 100 to 200				

L/K Frame Axial Piston Motors

For higher power applications, Danfoss offers the L and K frame two position, axial piston motor. The KV and LV motors can operate at two different displacements. Minimum displacement can be used when high fan speed is required at low engine speed and maximum displacement can be used at high engine speed. The K and L frame motors can also be used as single displacement motors.

This short, compact motor is configured ideally for installations requiring compact packaging and optimized plumbing. All hydraulic ports are on one face of the motor. Axial or radial configurations are available.

Mounting

- SAE B-2 bolt and Danfoss cartridge

Shaft

- SAE 0.875 diameter cylindrical and 1:8 taper keyed shafts

System Ports

System Components

- SAE O-ring boss, axial or twin radial locations

Specifications
- 25, 30, 38 and 45 cm3/rev [1.52, 1.83, 2.14, 2.32 and 2.75 in^3/rev] maximum displacements
- Operating pressure up to 415 bar [6000 psi]
- Speeds up to 5500 min-1(rpm)

Control
- Direct acting single line hydraulic displacement control
- 10 to 241 bar [150 to 3500 psi] shift pressure
- Reverse Displacement Control (electric or hydraulic)

Options
- Speed sensor
- Maximum displacement limiter
- Integral over-pressure and anti-cavitation protection

LV Motor

System Components

LC Motor

PLUS+1^{TM} Controllers

12 Pin Microcontroller

System Components

24 Pin Microcontroller

PLUS+1™ controllers and input/output expansion modules are designed to provide flexible, expandable, powerful, and cost effective total machine management systems for off-highway vehicles. These modules communicate with one another and other intelligent systems over a machine CAN (Controller Area Network) data bus. PLUS+1™ hardware products are designed to be equally effective in a distributed CAN network system, with intelligence in every node, or as stand-alone control for smaller machine systems. PLUS+1™ systems are incrementally expandable: Additional modules can be easily added to the machine CAN network to increase system capabilities or computational power.

Inputs

Each input pin allows one or more of these functional types. For pins with multiple functions, input parameters are user programmable using PLUS+1™ GUIDE templates.

- Digital (DIN)
- Digital or Analog (DIN/AIN)
- Digital or Analog or Frequency (DIN/AIN/FreqIN)
- Analog or Temperature or Rheostat (AIN/Temp/Rheo)
- Fixed Range Analog or CAN shield (AIN/CAN shield)

Outputs

PLUS+1™ control modules feature user-configurable universal output circuits. Output parameters are configured using PLUS+1™ GUIDE templates. Refer to product data sheets for maximum current ratings of individual modules. The following output types are supported:

- Digital (DOUT)
- PWM (PWMOUT)
- Analog voltage suitable for driving Danfoss PVG valves (PVEOUT)

CAN Ports

All PLUS+1™ modules have CAN ports that conform to CAN 2.0b specifications, including CAN shield.

Temperature Sensors

The Danfoss family of analog temperature sensors is designed to operate in conjunction with Danfoss Fan Drive Controls. The PLUS+1™ compliant sensors are thermistor-type temperature sensors.

System Components

Temperature sensors

Models

Two models are available: An air sensor typically used to measure engine charge air temperature, and a liquid sensor typically used to measure engine coolant or oil temperature.

Features

- Integrated connector and sensor body
- Brass body construction
- Anti-fouling air temperature sensor design
- 50° C to 125° C operating temperature
- range, FDC software configurable

For proper operation, the air temperature sensor must be mounted at the top of the manifold pipe with the sensor tip facing down.

Temperature versus resistance limits

Measured Temp, ° C [°F]	Resistance, Ohms	
	Nominal	Tolerance
50 [122]	810.9	±5%
80 [176]	283.0	±5%
100 [212]	152.9	±8%
125 [257]	76.9	±8%

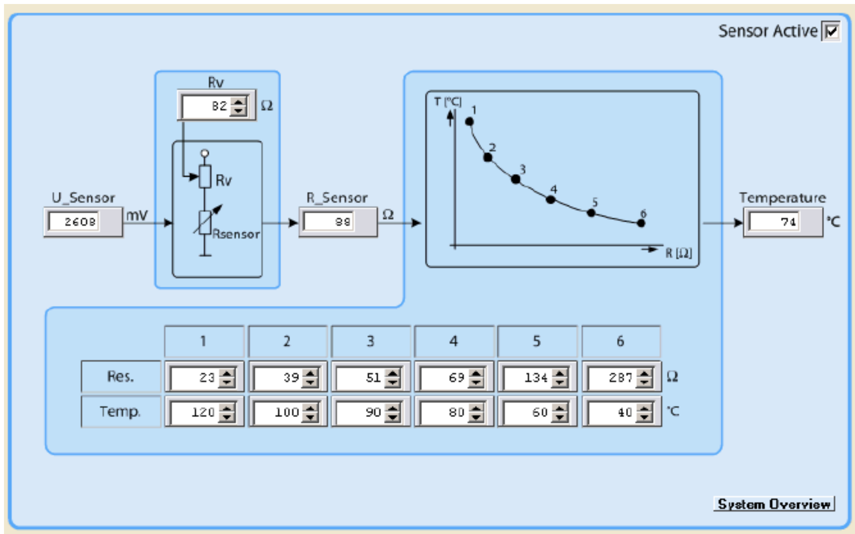
PLUS+1 TM Compliance

The Danfoss temperature sensors are compliant with the larger microprocessors (for example the MC050). The MC050 microprocessor has internal resistance in its four temperature inputs.

If you are using the Danfoss temperature sensors with the smaller microprocessors (for example the MC012 and MC024), you will need to connect the sensors in series with an external resistor (Rv) as shown in the following illustration.

System Components

Analog sensor voltage



For assistance in configuring the temperature sensors contact your Danfoss representative.

System Design Parameters

Sizing Equations

Equations

Pumps

Based on SI units

Output flow $Q = \frac{V_g \cdot n \cdot \eta_v}{1000}$ (l/min)

Input torque $M = \frac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_m}$ (N•m)

Input power $P = \frac{V_g \cdot n \cdot \Delta p}{600\,000 \cdot \eta_m}$ (kW)

Based on English units

Output flow $Q = \frac{V_g \cdot n \cdot \eta_v}{231}$ (US gal/min)

Input torque $M = \frac{V_g \cdot \Delta p}{2 \cdot \pi \cdot \eta_m}$ (lbf•in)

Input power $P = \frac{V_g \cdot n \cdot \Delta p}{396\,000 \cdot \eta_m}$ (hp)

Motors

Based on SI units

Output torque $M = \frac{V_g \cdot \Delta p \cdot \eta_m}{20 \cdot \pi}$ (N•m)

Output power $P = \frac{Q \cdot \Delta p \cdot \eta_t}{600}$ (kW)

Based on English units

Output torque $M = \frac{V_g \cdot \Delta p \cdot \eta_m}{2 \cdot \pi}$ (lbf•in)

Output power $P = \frac{Q \cdot \Delta p \cdot \eta_t}{1714}$ (hp)

Variables

SI units [English 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 = pO - pi (system pressure) bar [psi]

n = Speed min-1 (rpm)

η_v = Volumetric efficiency

η_m = Mechanical efficiency

η_t = Overall efficiency ($\eta_v \cdot \eta_m$)

SI unit formulas are based on cm^3, bar, N, N•m, W.
English formulas are based on in^3, psi, lbf•in, hp.

System Design Parameters

System Design Data Form

Print this form. Fill in all the fields and check the appropriate check boxes. Fax the filled out form to your Danfoss Power Solutions Technical Sales Representative.

Engine details

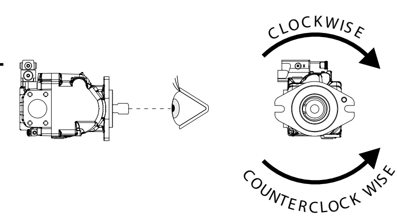
Manufacturer ________________ Model or Series ____________________

Pump Drive
- Engine PTO ☐
- Belt Drive ☐

Ratio ________ :1 (engine to pump)

Input torque limit: ________

Pump Rotation
- Clockwise, Right hand ☐
- Counterclockwise, Anti-clockwise, Left hand ☐



Speeds
- Low Idle ____________ RPM (rated)
- Governed ____________ RPM (rated)
- High Idle ____________ RPM (max speed)

P106110

Power steering

(if applicable)

Controlled Flow Requirement ________________ US gal/min ☐ l/min ☐

Steering Pressure (maximum) ________________________ psi ☐ bar ☐

P104 376E

System Design Parameters

Fan information

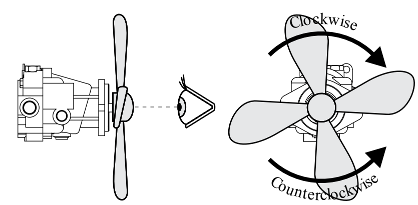
Manufacturer ____________________ Model or Series ____________________

Fan Diameter ____________________ in ☐ mm ☐

Fan Input Power ____________________ HP ☐ kW ☐ At speed __________ rpm

Fan Rotation
(viewed on motor shaft, see illustration)

Clockwise ☐
Counterclockwise ☐



Fan Trim Speed ______________ rpm

Set Point at Fan Trim Speed ______________ rpm
(engine speed where max heat load occurs)

Coolant Temperature at Fan Trim Speed ____________ **°F** ________ **°C**
(coolant temp where max fan speed is required)

Note: To properly size and specify a fan drive system, fan power requirements must be stated as accurately as possible. Fan power requirements can be determined from fan curves supplied by the manufacturer. Radiator and cooler manufacturers will supply air flow requirements based on heat loads. Air flow information must include accurate air flow and static pressure to determine correct fan power requirements.

P101 344E

Control preference

	Electro-Hydraulic Modulating	**Electro-Hydraulic ON/OFF**
Single Input	☐	☐
Multiple Inputs	☐	☐

P104 377E

Reservoir

Reservoir Capacity ______________ US gal ☐ liter ☐

P104 378E

System Design Parameters

Fluid

Hydraulic Fluid Type ____________________

Viscosity ______________________ at 40° C [104°F] ☐ cSt ☐ SUS

______________________ at 100° C [212°F]

Maximum Fluid Temperature ______________________ °C ________ °F

P104 379E

Filtration

Filter Position

Inlet Line ☐

Pressure Line ☐

Return Line (recommended) ☐

Filter Flow

Full Flow ☐

Partial Flow ☐

Filter Rating ________________ micron __________ x ratio

Note: Do not locate the filter cartridge inside the reservoir. This reduces the reservoir capacity and reduces the dwell time (the time the oil spends in the resrevoir). It also increases the potential for damage to the hydraulic components due to aeration of the oil.

P104 380E

Installation Guidelines

Pumps

Pump Drives

Where possible, avoid radial and axial loads on the pump drive.

For in-line drives, place a suitable drive coupling between the prime mover (e.g. engine) and the pump input shaft to remove radial and axial load potential. For belt driven pump applications an outrigger bearing may be required to relieve the pump of radial loads. Outrigger bearings are available with ball or roller bearing support for such applications. For Power Take Off (PTO) drives (where an external gear is assembled to the pump), and for belt driven pump applications, consult your Danfoss representative.

In many applications the limiting factor for driving a pump is available torque. Pump drive shafts have a torque limit based on material, design and system pressure. Likewise, pump drives such as air compressors with PTOs also have torque limits. When planning to drive a pump on the back of an air compressor, first check with the compressor supplier to understand their product torque limitations. Most compressors do not have a constant torque capability across their speed range. Typically, the torque capability of a compressor is lower at low engine speeds and increases to a speed where the capability remains constant.

A number of pump drive shafts are generally available across the Danfoss product range. Consider driveshaft selection carefully.

Pump Inlet

When designing the inlet portion of the hydraulic circuit, it is important to keep the pump inlet pressure within published limits. To reduce the chances of inlet cavitation problems, observe the following guidelines:

- Position reservoir outlet above the pump inlet level whenever possible.
- Make the inlet line (hose and fittings) as straight and as short as possible without inducing bending or stress loads onto the inlet port.
- Size the inlet line to keep fluid velocities and inlet pressure within the limits published in the individual product literature.
- To reduce the chances of port fitting leakage, we recommend using SAE split flange or O-ring boss ports whenever possible.

Pump Outlet

- Make the outlet line (hose and fittings) as straight and as short as possible without inducing bending or stress loads onto the outlet port.
- Ensure the outlet line is sized to keep fluid velocities within the limits published in the individual product literature.
- To reduce the chances of port-fitting leakage we recommend using SAE split flange or O-ring boss ports whenever possible.

Motors

SGM2YN and SGM3YN Fan Drive Motors

SGM2Y and SGM3Y fan drive motors have the proportional solenoid bypass relief valve built into the rear cover. Electrical connector is Deutsch DT 04-2P. Mount the motor so the relief valve is below the reservoir oil level. Keep the relief valve in a horizontal position.

D Series Fan Drive Motors

D series fan drive motors are available with an integrated proportional or standard relief valve. Mount the motor so the relief valve is below the reservoir oil level. Keep the relief valve in a horizontal position.

Installation Guidelines

L and K Variable Motors

L and K variable motors do not have over-pressure protection or an anti-cavitation valve integrated into the motor. Both valve functions need to be provided externally.

L and K variable motors may be applied in open circuit systems without external back-pressure valves, as long as the motor case pressure does not exceed the outlet pressure by more than 0.5 bar [7 psi].

Typically the motor's maximum displacement is used when the system is sized for maximum cooling when the engine is at Full Load High Idle speed. The motor's minimum displacement is selected to provide improved cooling when the engine is at its low idle speed.

Reverse Displacement Motors

The Reverse Displacement Motor is a unique design variation of the L and K variable motors.

It has been designed to reverse the direction of fan rotation without using an externally mounted four-way directional control valve.

The motor is switched from maximum displacement in the forward direction to maximum displacement in the reverse direction with an integrated solenoid valve.

Over-pressure protection and an anti-cavitation valve are integrated into the motors endcap.

Series 40 Fixed Displacement Motors

Series 40 motors are available with over-pressure protection and an anti-cavitation valve in a unidirectional open circuit configuration.

They may be applied in open circuit systems without external back-pressure valves as long as the motor case pressure does not exceed the outlet port pressure by more than 0.5 bar [7.0 psi].

Bi-directional open circuit operation is available, provided that a four-way directional control valve is located between the pump and the motor.

Series 90 Fixed Displacement Motors

Series 90 fixed displacement motors are available without over-pressure protection or an anti-cavitation valve in an open circuit configuration.

They may be applied in open circuit systems without external back-pressure valves, but specific axial thrust, case pressure, and maximum shaft speed limits must be respected. (Consult your Danfoss Technical Sales Representative for assistance when specifying a Series 90 fixed displacement motor in an open circuit application.

Installation Guidelines

Controls

PLUS+1™ controller

The Plus+1™ controller is designed to control many different hydraulic devices. Mount the Plus+1™ controller in a convenient, out of the way, location. A diagnostic connector is required to connect to the Plus+1™ controller. Mount the connector in an easily accessible location in the operators cabin. Follow the wiring guidelines found in Plus+1™ module technical literature.

Series 45 Fan Drive Controls

In Danfoss open circuit fan drives, fan speed is regulated by controlling the system pressure differential across the fan motor. In Series 45 pumps, this is provided by using the Electric Proportional Control variation. The Electric Proportional Control consists of a proportional solenoid integrated into the Remote Pressure Compensated control housing. This control provides an output pressure proportional to the current supplied to the solenoid and allows the pump to be operated at any pressure limit between the load sense and pressure compensation settings by varying the current sent to the solenoid. Both Normally Closed and Normally Open control configurations are available. The Normally Closed configuration is usually applied in system cooling fan installations. It is desireable that the fan fail to full speed if there is an interruption of the electrical command to the solenoid, for any reason.

H1 Pump with Fan Drive Control

A fan drive control option is available for the H1 family of high power, closed circuit, variable displacement pumps. The H1 Fan Drive Control is compatible with the PLUS+1™ controller and the fan drive application block. The Fan Drive Control is designed with a single solenoid and uses a single control input to regulate both the fan speed and direction of rotation.

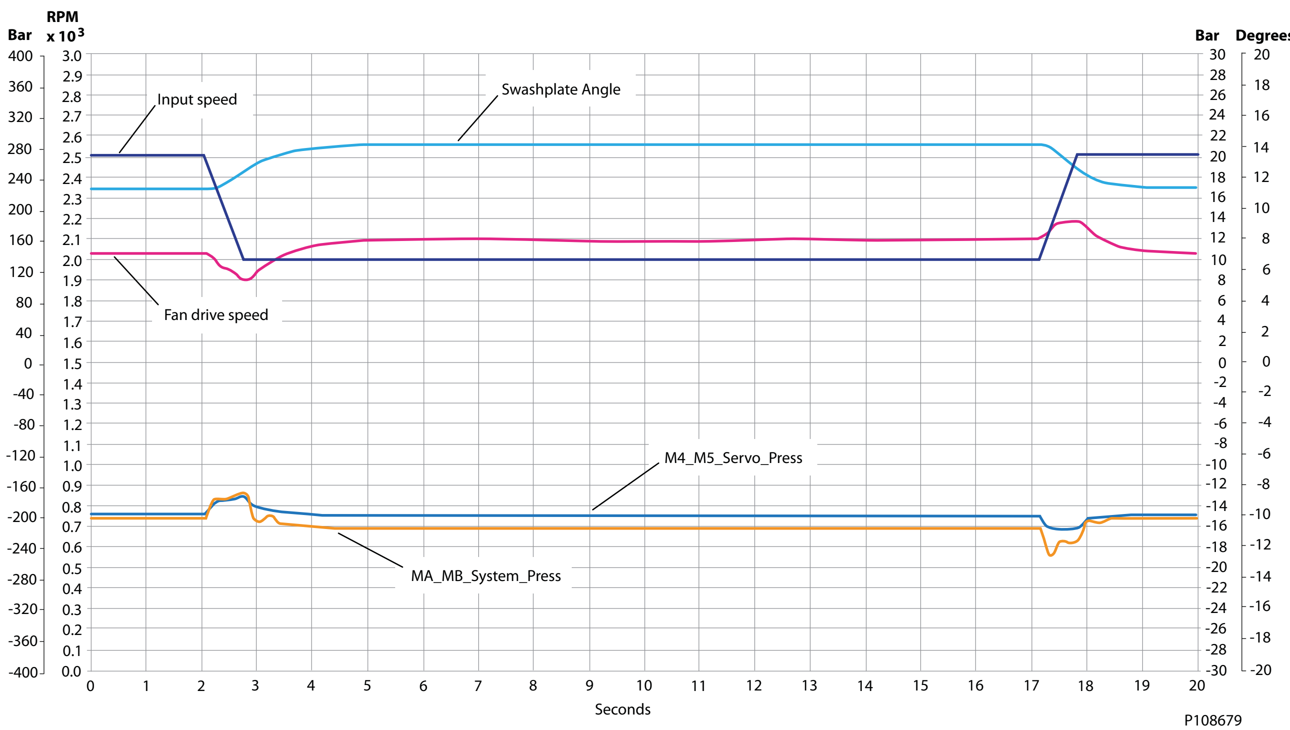
When the pump speed is at the design set point, fan speed required for the desired cooling capacity is determined by the pump's displacement. In many systems, the fan's speed at this condition may be close to its maximum design speed. If the pump speed increases beyond the set point and the pump is commanded to maximum displacement; then the fan speed will increase in proportion to the pump speed ratio and the pressure drop across the fan motor will increase in proportion to the square of the pump speed ratio. To prevent this from happening, the system designer is encouraged to limit the maximum fan speed in each direction of rotation by adjusting the set pressure of the Pressure Limiters for both directions of rotation.

The Fan Drive Control (FDC) has limitations on the maximum servo delta pressure developed, compared to other types of controls, and so there are limitations to the operating conditions which can be achieved in the various frame size H1 pumps. Typical fan drive systems are unusual in that they achieve peak pressure only at high flows, so it is important that FDC equipped pumps not be applied beyond the specified limits. (Refer to *Fan Drive Design Guidelines* **520L0926**, Appendix H, for additional information, or contact your Danfoss Technical Sales Representative for assistance.)

Fan drives are sized with reserve pump capacity so that peak fan speed can be maintained even when engine speed is reduced, as illustrated below. This is a feature that is unique to the Danfoss H1 Fan Drive Control; it allows the system to maintain a nearly constant fan speed without the need for additional control algorithms in the fan drive controller. In this example, representing an engine lugging condition (engine speed change of 20%), there was no significant reduction in fan speed.

Installation Guidelines

Prime Mover Speed Change (2500 - 2000 - 2500 rpm)



System

Filtration

To prevent premature wear, it is imperative that only clean fluid enters the pump and hydraulic circuit. A filter capable of controlling the fluid cleanliness to class 22/18/13 (per ISO 4406-1999) or better, under normal operating conditions, is recommended. At initial start up, the system can be at Class 25/22/17 but should not be run at high speed or pressure until the Class 22/18/13 is achieved through filtration. Since the filter must be changed at regular intervals, the filter housing should be located in an accessible area. Appropriate filter change intervals may be determined by test or by gauges indicating excessive pressure drop across the filter element.

For more information refer to *Design Guideline for Hydraulic Fluid Cleanliness, Technical Information* **520L0467**.

Operating Temperatures

With Buna seals and normal operating conditions, the system temperature should not exceed 82 °C [180 °F] except for short periods to 93 °C [200 °F]. With optional Viton elastomer, the system may be operated at continuous temperatures up to 107°C [225°F] without damage to the hydraulic components.

Caution

Operation in excess of 107 °C [225 °F] may cause external leakage or premature unit failure.

Fluids

A mineral based fluid is recommended that includes additives to resist corrosion, oxidation and foaming. The oil should have a maximum viscosity commensurate with system pressure drop and pump suction pressures. Since the fluid serves as a system lubricant, as well as transmitting power, careful selection of the fluid is important for proper operation and satisfactory life of the hydraulic components. Hydraulic

Installation Guidelines

fluids should be changed at appropriate intervals determined by test, supplier, or by change in color, or odor, of the fluid.

Every 10°C [18°F] rise in continuous reservoir temperature over 80°C [176 °F] decreases the life of the oil by ½.

For additional technical information on hydraulic fluids refer to *Hydraulic Fluids and Lubricants* **520L0463** Technical Information Bulletin and specific product technical bulletins.

For information relating to biodegradable fluids, see Danfoss publication *Experience with Biodegradable Hydraulic Fluids* **520L0465** or consult the Danfoss Technical Services Department.

Installation Drawings

D Series Pumps

D Series pump counterclockwise (CCW) rotation

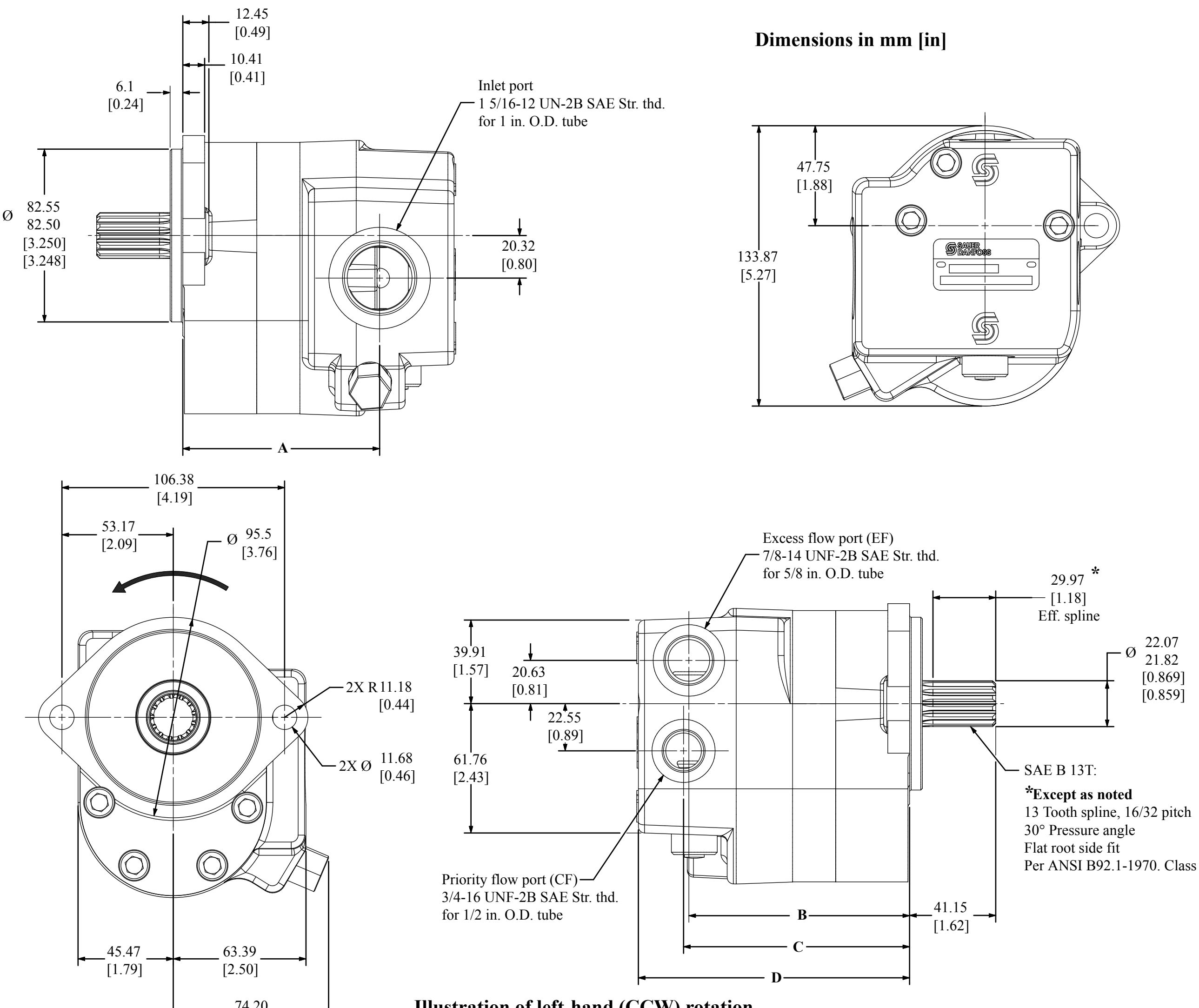


Illustration of left-hand (CCW) rotation
(SAE B mount available)

For specifications and measurements for A, B, C, and D, refer to the folowing table.

Installation Drawings

D Series Pump Clockwise (CW) Rotation

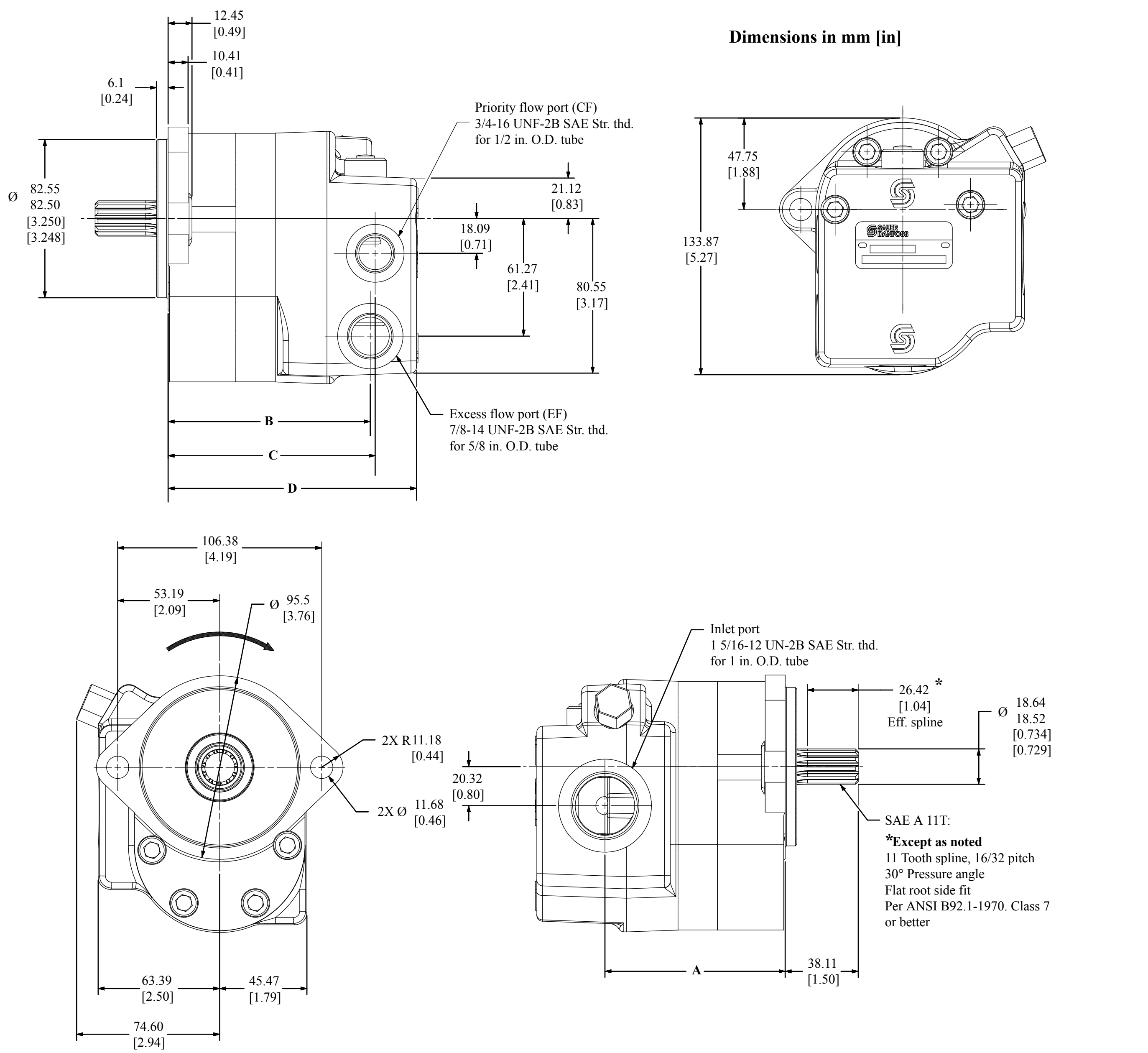


Illustration of right-hand (CW) rotation
(SAE B mount available)

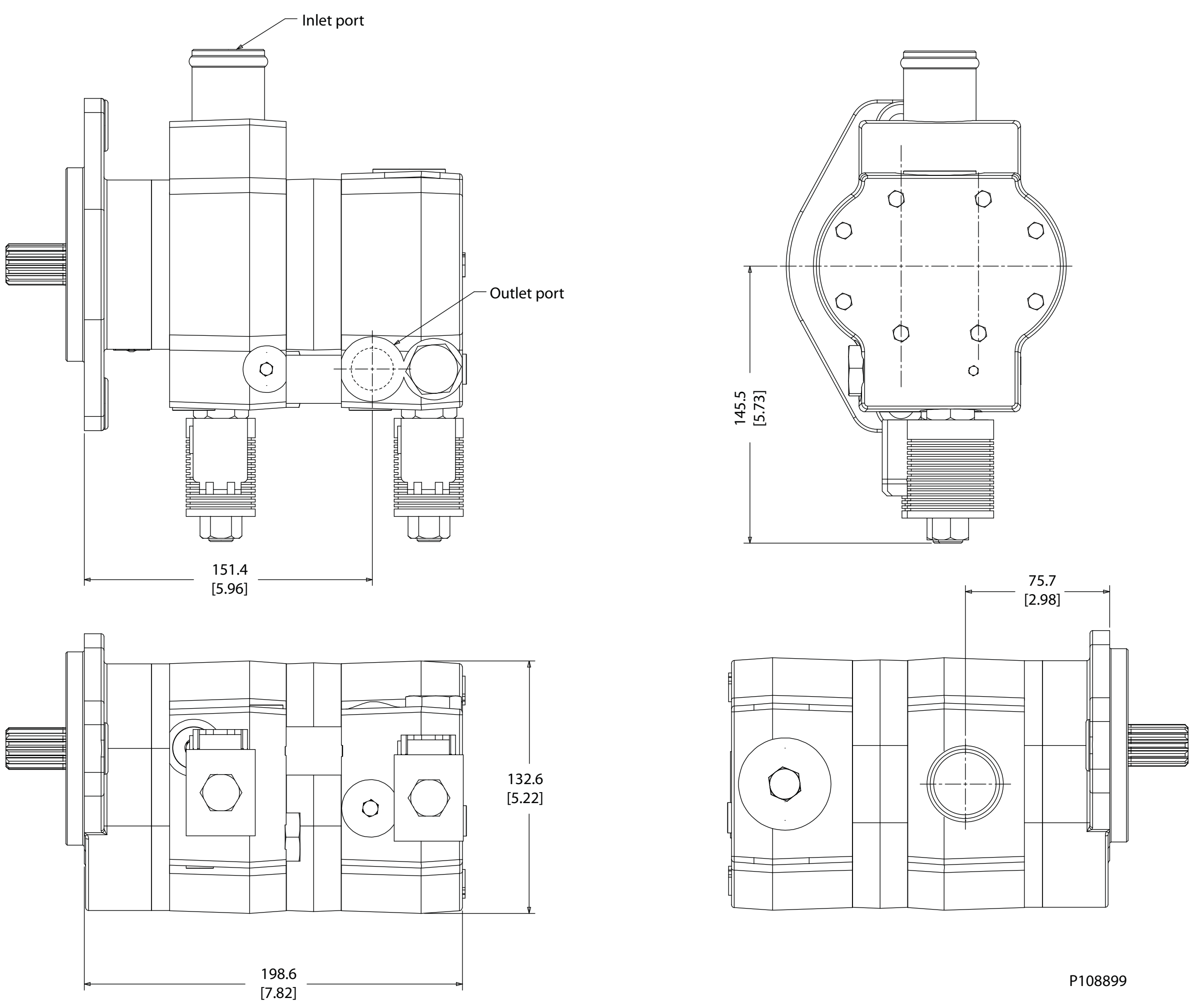
P106 104E

Nominal pump displacement cm³/rev [in³/rev]	Maximum continuous pressure bar [psi]	Maximum pressure bar [psi]	Maximum speed min-1 (rpm)	A mm [in]	B mm [in]	C mm [in]	D mm [in]
7.0 [0.43]	276 [4000]	303 [4400]	3400	80.5 [3.17]	92.0 [3.62]	94.5 [3.72]	116.1 [4.57]
9.5 [0.58]	276 [4000]	303 [4400]	3400	82.9 [3.27]	94.4 [3.72]	96.9 [3.82]	118.5 [4.67]
12.6 [0.77]	276 [4000]	303 [4400]	3400	86.1 [3.39]	97.5 [3.84]	100.1 [3.94]	121.7 [4.79]
14.3 [0.87]	276 [4000]	303 [4400]	3400	87.8 [3.46]	99.2 [3.91]	101.7 [4.01]	123.3 [4.86]
17.0 [1.04]	276 [4000]	303 [4400]	3400	90.4 [3.56]	101.9 [4.01]	104.4 [4.11]	126.0 [4.96]

Installation Drawings

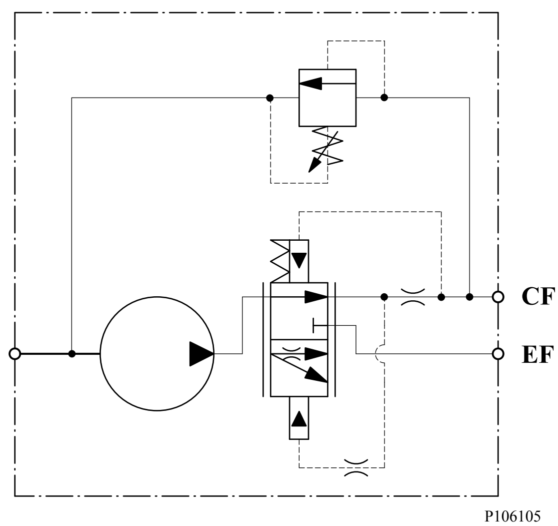
Nominal pump displacement cm^3/rev [in^3/rev]	Maximum continuous pressure bar [psi]	Maximum pressure bar [psi]	Maximum speed min-1 (rpm)	A mm [in]	B mm [in]	C mm [in]	D mm [in]
19.0 [1.16]	276 [4000]	303 [4400]	3400	92.5 [3.64]	103.9 [4.09]	106.4 [4.19]	128.0 [5.04]
20.5 [1.25]	276 [4000]	303 [4400]	3400	94.0 [3.70]	105.4 [4.15]	108.0 [4.25]	129.6 [5.10]
22.5 [1.37]	276 [4000]	303 [4400]	3400	95.8 [3.77]	107.3 [4.22]	109.8 [4.32]	131.4 [5.17]
25.4 [1.55]	276 [4000]	303 [4400]	3400	98.8 [3.89]	110.2 [4.34]	112.8 [4.44]	134.4 [5.29]
29.0 [1.77]	276 [4000]	303 [4400]	3200	102.4 [4.03]	113.8 [4.48]	116.4 [4.58]	138.0 [5.43]
31.8 [1.94]	276 [4000]	303 [4400]	3000	105.2 [4.14]	116.6 [4.59]	119.1 [4.69]	140.7 [5.54]
36.0 [2.20]	241 [3500]	265 [3850]	2750	109.4 [4.31]	120.9 [4.76]	123.4 [4.86]	145.0 [5.71]
38.0 [2.32]	228 [3300]	250 [3630]	2750	111.4 [4.39]	122.8 [4.84]	125.4 [4.94]	147.0 [5.79]
41.0 [2.50]	207 [3000]	228 [3300]	2500	114.4 [4.50]	125.8 [4.95]	128.4 [5.05]	150.0 [5.90]
45.1 [2.75]	190 [2750]	209 [3025]	2500	118.6 [4.67]	130.1 [5.12]	132.6 [5.22]	154.2 [6.07]

Quadra-Flow Pump

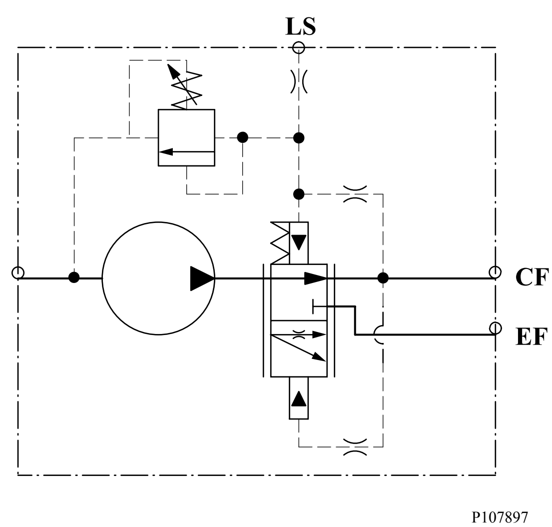


Installation Drawings

D Series Pumps with Priority Flow Schematic

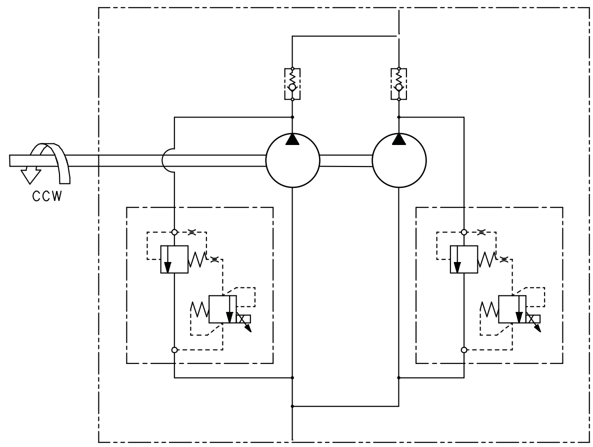


D Series Pump with Load Sensing Schematic



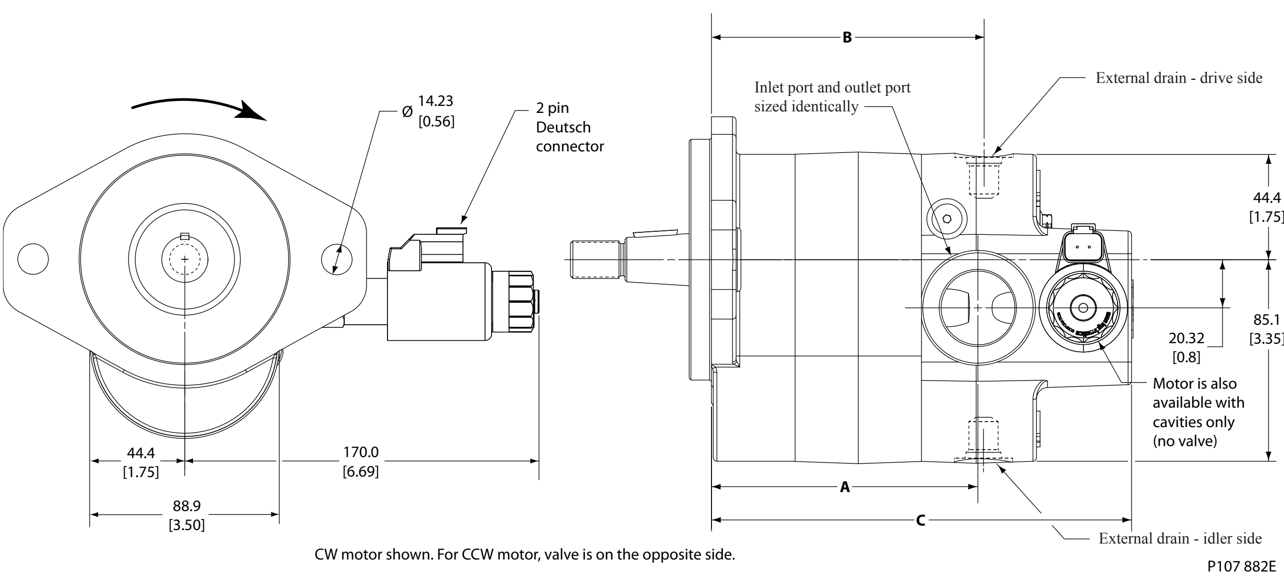
Installation Drawings

Quadra-Flow Schematic



D Series Gear Motor

D Series Motor Dimensions



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

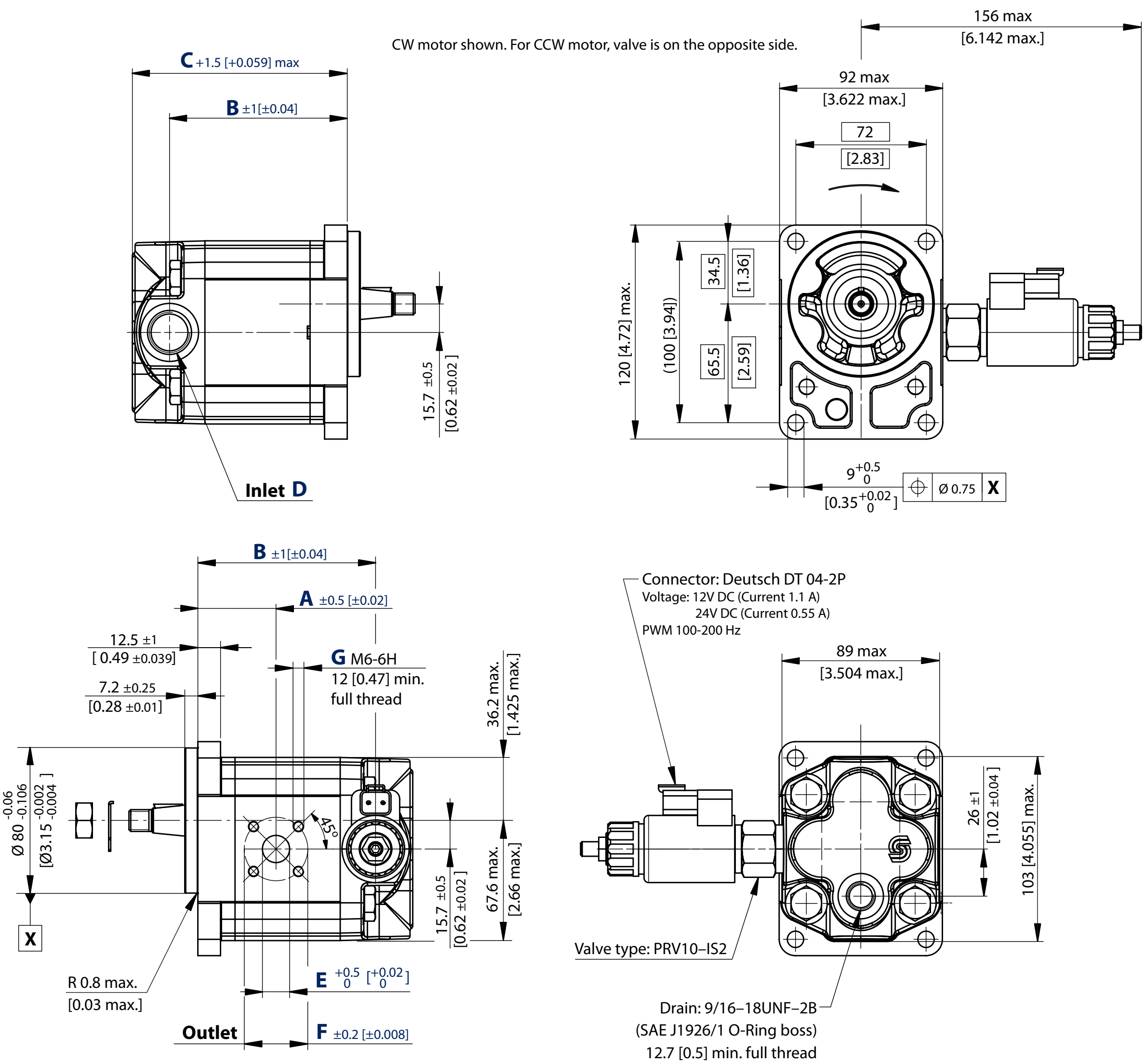
Dimensions	Units	17	19	21	23	25	29	32	36	38	41	45
Dimension A	mm	88.9	90.9	92.5	94.2	97.3	100.8	103.6	107.7	109.7	112.8	117.1
	in	3.50	3.58	3.64	3.71	3.83	3.97	4.08	4.24	4.32	4.44	4.61
Dimension B	mm	91.7	93.8	95.3	97.0	100.1	103.6	106.4	110.7	112.5	115.6	119.9
	in	3.61	3.69	3.75	3.82	3.94	4.08	4.19	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.

Installation Drawings

SGM2YN Gear Motor

02AA



P005 400E

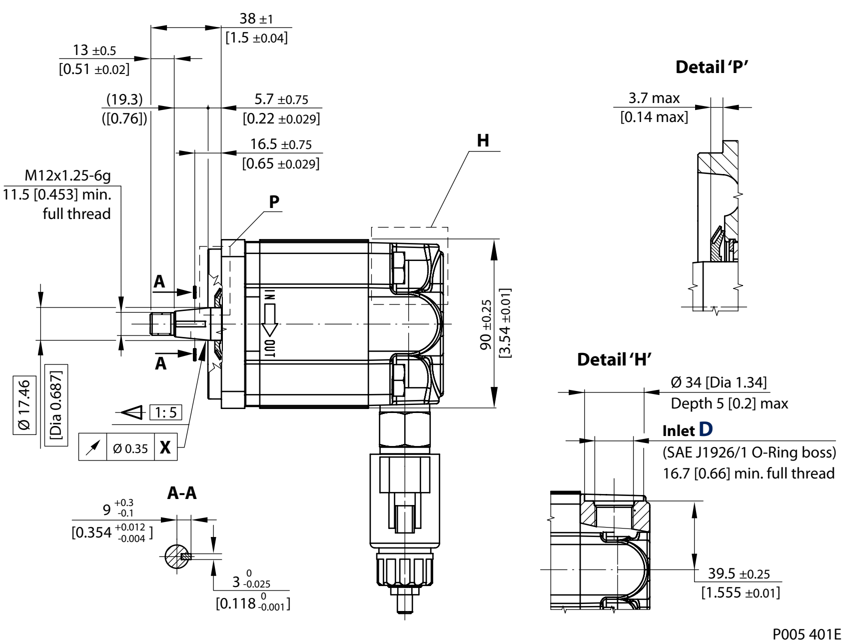
SGM2YN - 02AA dimensions

Frame size		8.0	011 [0.67]	014 [0.95]	017 [1.04]	019 [1.16]	022 [1.34]	025 [1.53]
Dimension mm [in]	A	47 [1.85]	49 [1.93]	52 [2.05]	54 [2.13]	56 [2.17]	59 [2.32]	61 [2.40]
	B	95.5 [3.76]	99.5 [3.91]	105.5 [4.15]	109.5 [4.31]	113.5 [4.47]	119.5 [4.70]	123.5 [4.86]
	C	118.5 [4.66]	122.5 [4.83]	128.5 [5.05]	132.5 [5.22]	136.5 [5.37]	142.5 [5.61]	146.5 [5.77]
Inlet port	D	7/8-14 UNF-2B (SAE J1926/1 O-ring boss); 16.7 [0.66] min. full thread						

Installation Drawings

SGM2YN - 02AA dimensions (continued)

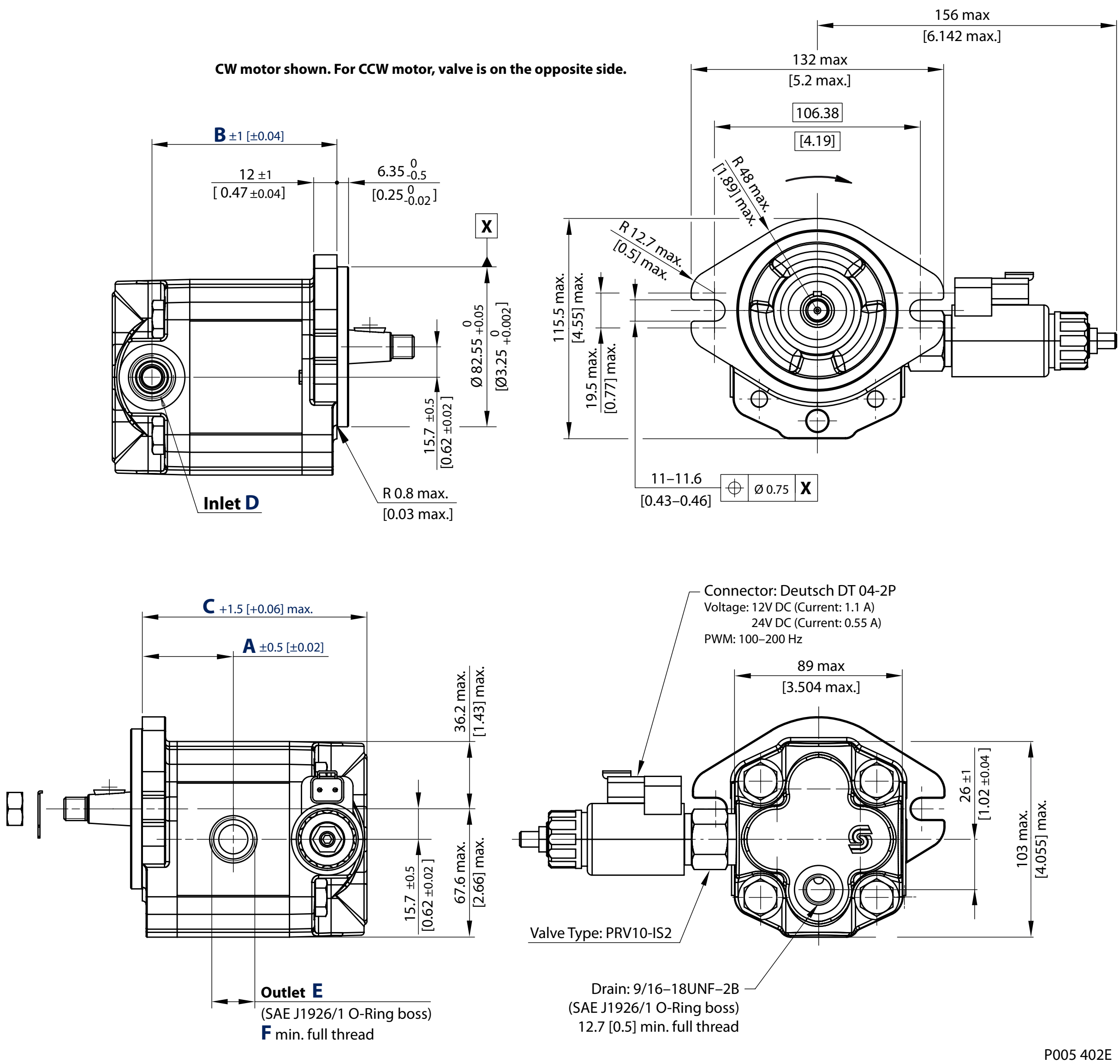
Frame size		8.0	011 [0.67]	014 [0.95]	017 [1.04]	019 [1.16]	022 [1.34]	025 [1.53]
Outlet port	E	15 [0.59]		20 [0.79]				
	F	35 [1.38]		40 [1.57]				
	G	M6-6H; 12[0.47] min. full thread						
Drain port		9/16 18UNF-2B (SAE J1925/1 O-ring boss) 12.7 [0.50] min. full threads						



For more information regarding SGM2Y gear motors, refer to *SGM2Y and SGM3Y Fan Drive Motors Technical Information* **11040345**.

Installation Drawings

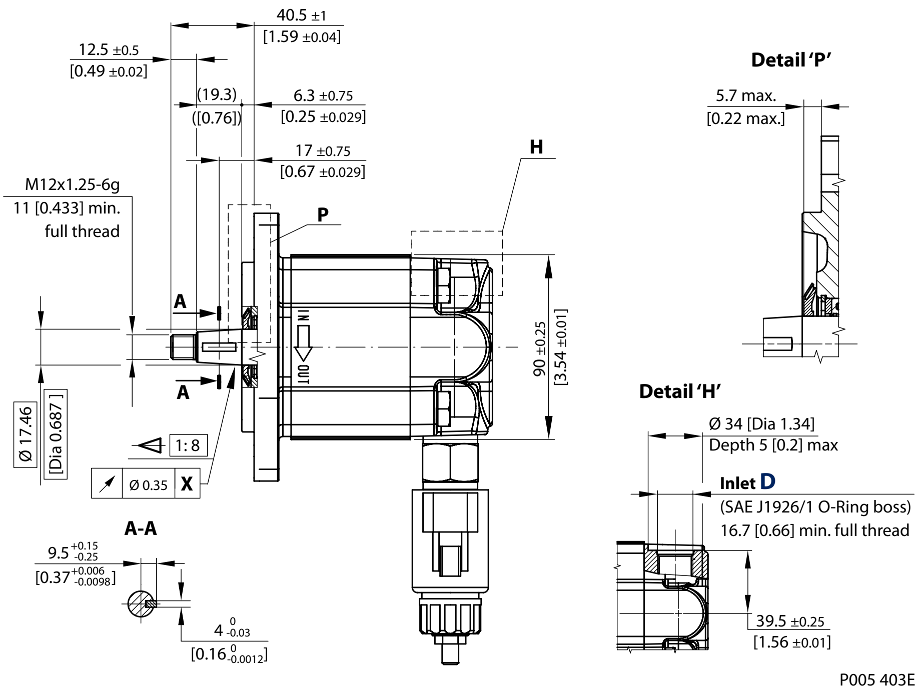
06BA



SGM2Y - 06BA dimensions

Frame size		8.0	011 [0.67]	014 [0.95]	017 [1.04]	019 [1.16]	022 [1.34]	025 [1.53]
Dimension mm [in]	**A**	47 [1.85]	49 [1.93]	52 [2.05]	54 [2.13]	56 [2.17]	59 [2.32]	61 [2.40]
	B	95.5 [3.76]	99.5 [3.91]	105.5 [4.15]	109.5 [4.31]	113.5 [4.47]	119.5 [4.70]	123.5 [4.86]
	C	116 [4.57]	120 [4.72]	126 [4.96]	130 [5.11]	134 [5.28]	140 [5.51]	144 [5.67]
Inlet port	**D**	7/8-14 UNF-2B (SAE J1926/1 O-ring boss); 16.7 [0.66] min. full thread						
Outlet port	**E**	7/8-14 UNF-2B				1 1/16-12 UN-2B		
	F	16.7 [0.66] min. full thread				19 [0.75] min. full thread		
Drain port		9/16 18UNF-2B (SAE J1925/1 O-ring boss) 12.7 [0.50] min. full threads						

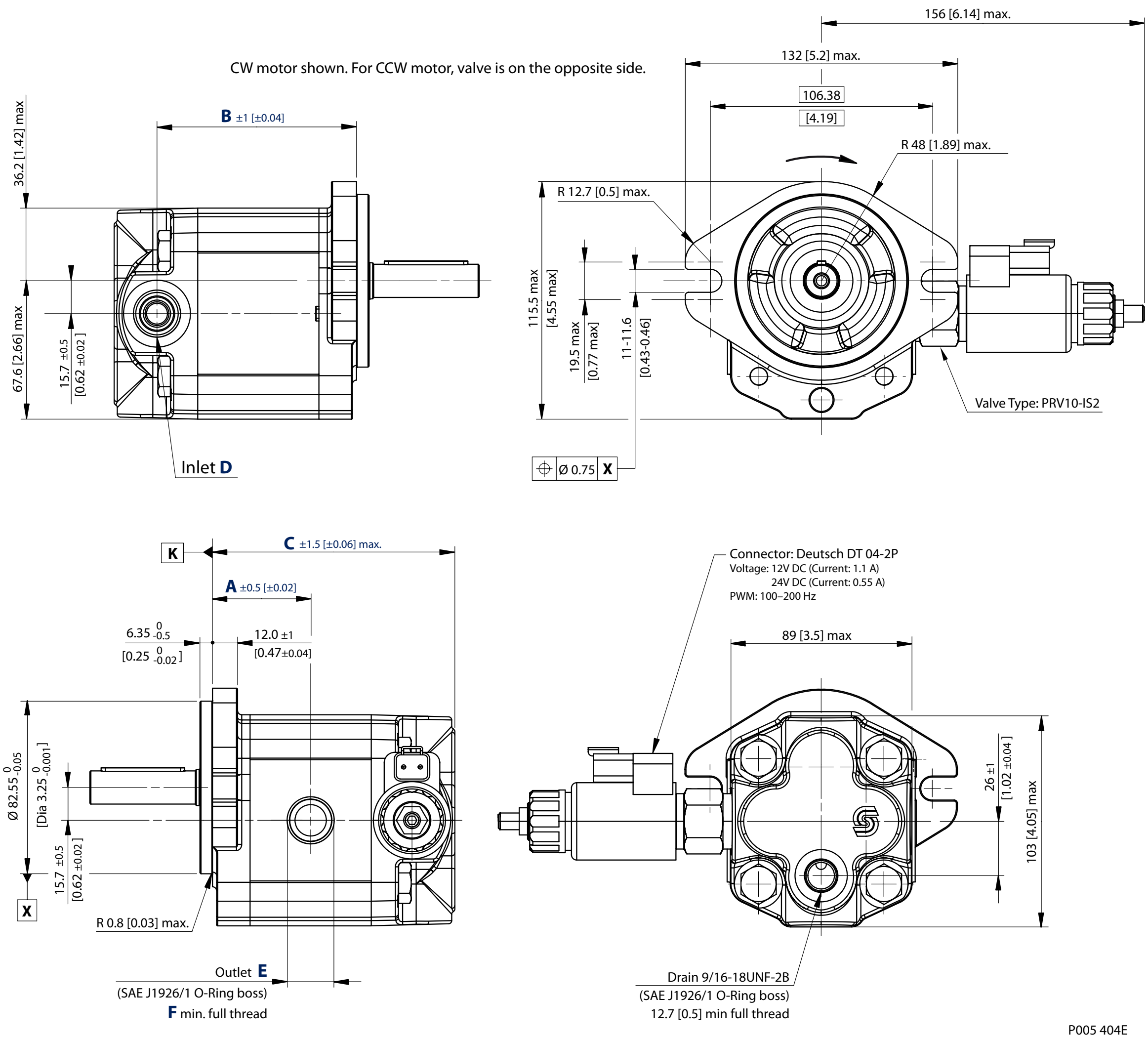
Installation Drawings



For more information regarding SGM2Y gear motors, refer to *SGM2Y and SGM3Y Fan Drive Motors Technical Information* **11040345**.

Installation Drawings

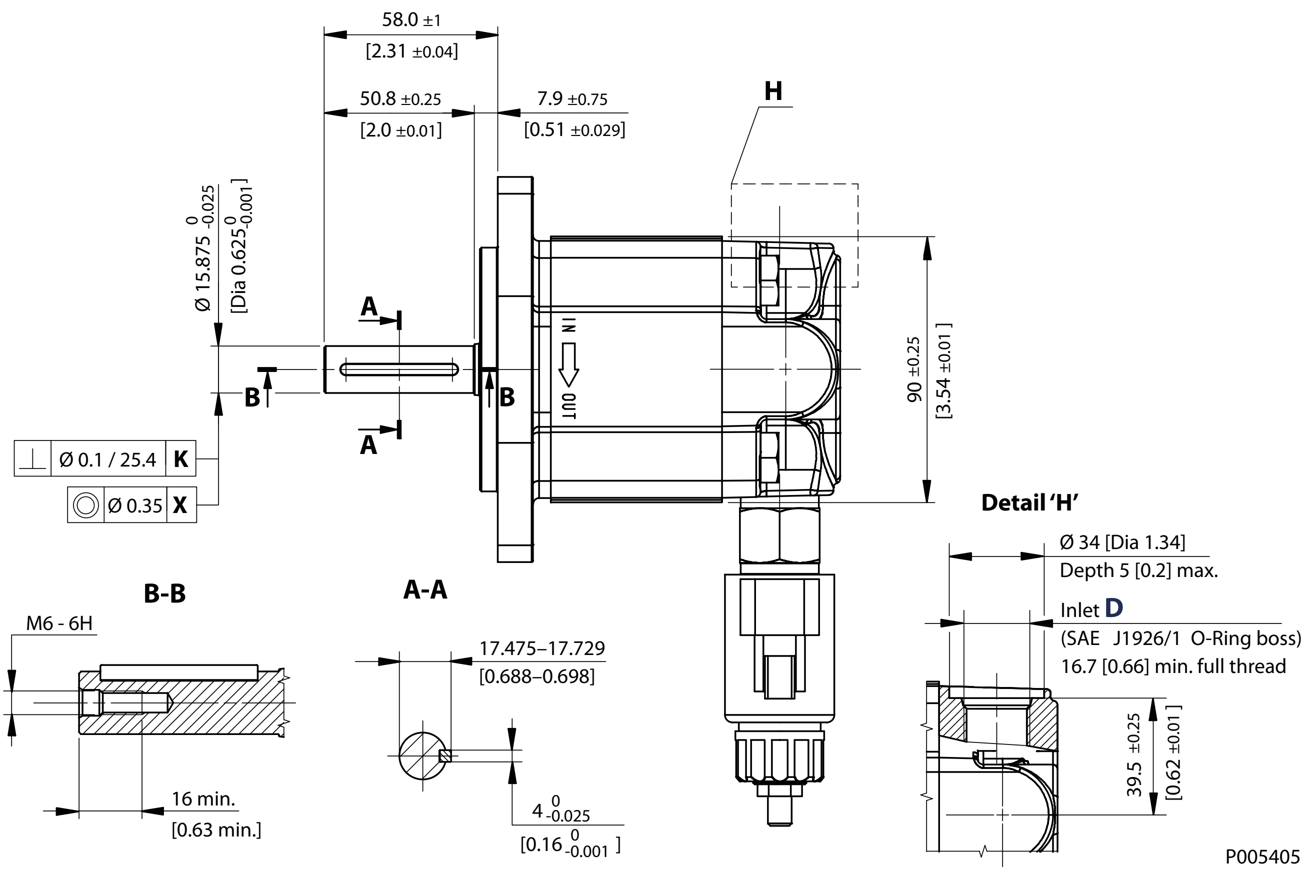
06GB



SGM2YN - 06GB dimensions

Frame size		8.0	011 [0.67]	014 [0.95]	017 [1.04]	019 [1.16]	022 [1.34]	025 [1.53]
Dimension mm [in]	A	47 [1.85]	49 [1.93]	52 [2.05]	54 [2.13]	56 [2.17]	59 [2.32]	61 [2.40]
	B	95.5 [3.76]	99.5 [3.91]	105.5 [4.15]	109.5 [4.31]	113.5 [4.47]	119.5 [4.70]	123.5 [4.86]
	C	116 [4.57]	120 [4.72]	126 [4.96]	130 [5.11]	134 [5.28]	140 [5.51]	144 [5.67]
Inlet port	D	7/8-14 UNF-2B (SAE J1926/1 O-ring boss); 16.7 [0.66] min. full thread						
Outlet port	E	7/8-14 UNF-2B				1 1/16-12-UN-2B		
	F	16.7 [0.66] min. full thread				19 [0.75] min. full thread		
Drain port		9/16 18UNF-2B (SAE J1925/1 O-ring boss) 12.7 [0.50] min. full threads						

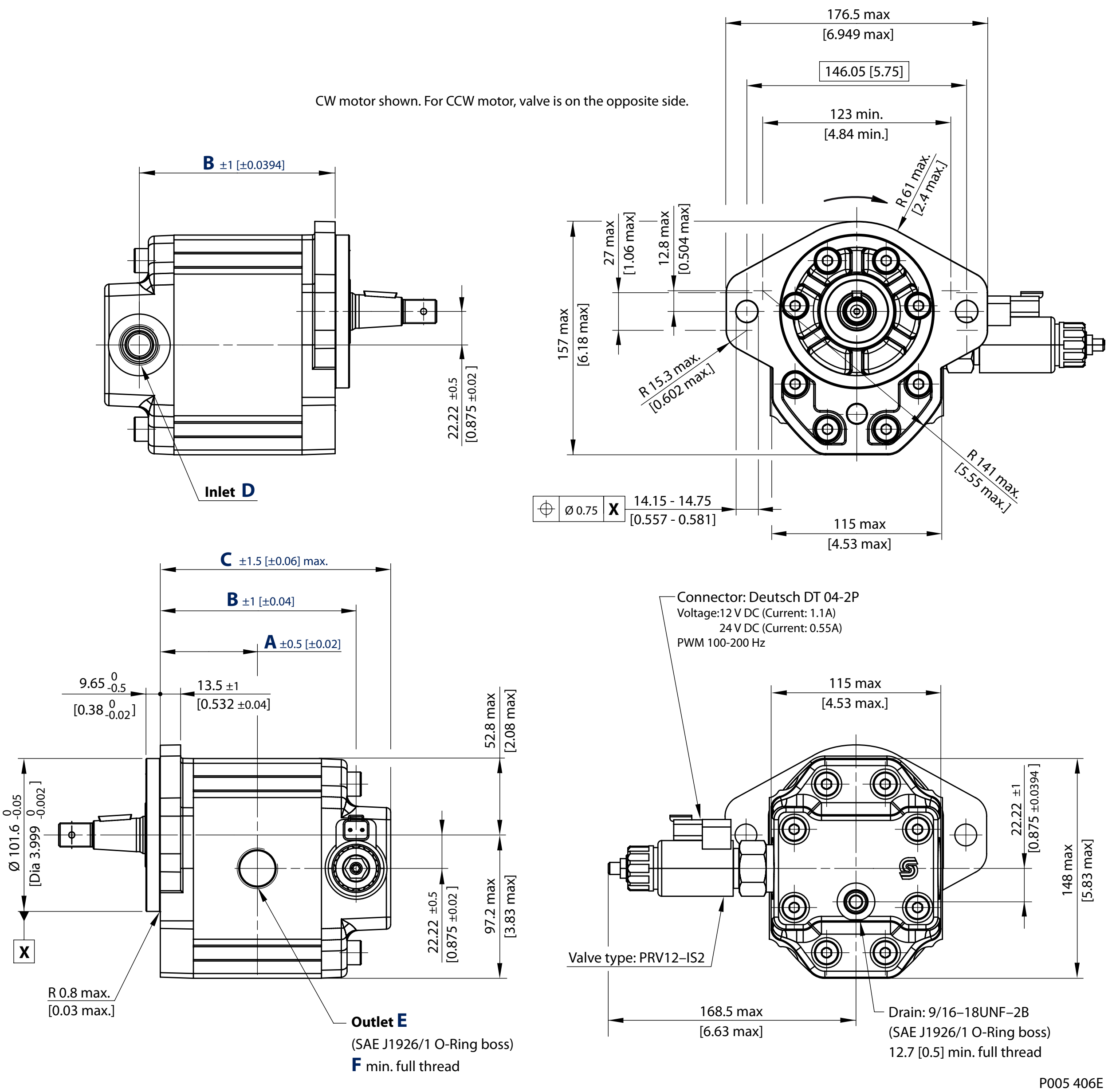
Installation Drawings



For more information regarding SGM2Y gear motors, refer to *SGM2Y and SGM3Y Fan Drive Motors Technical Information* **11040345**.

Installation Drawings

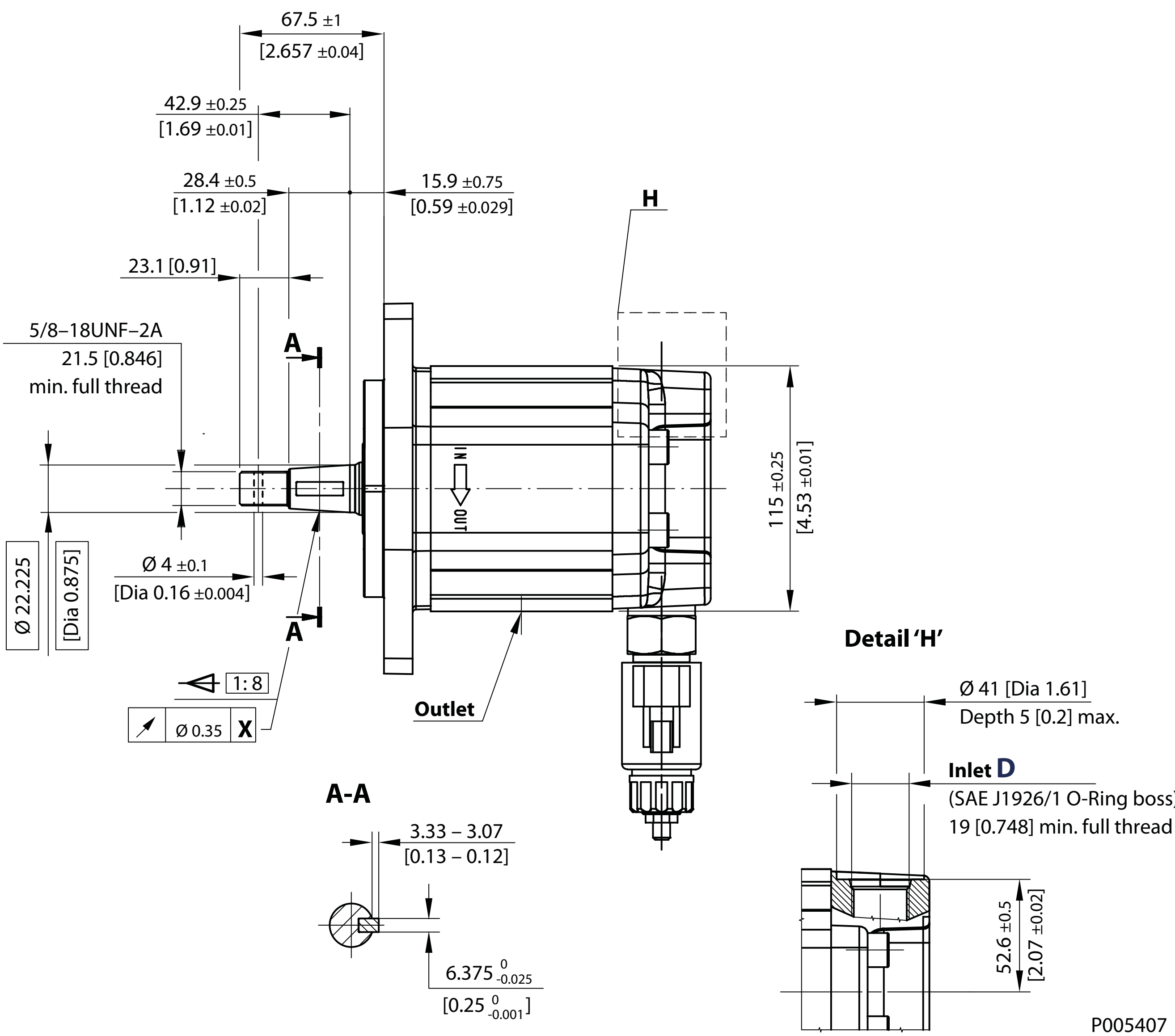
07BC



SGM3YN - 07BC dimensions

Frame size		022	026	033	038	044
Dimension mm [in]	A	63	64.5	67	68.8	71
	B	127.1	130.1	135.1	138.6	143
	C	20 [0.787]	20 [0.787]	27 [1.063]	27 [1.063]	27 [1.063]
Inlet port	D	1-1/16-12UN-2B				
Outlet port	E	1-1/16-12UN-2B				
	F	19 [0.75] min. full thread				
Drain port		9/16 18UNF-2B (SAE J1925/1 O-ring boss) 12.7 [0.50] min. full threads				

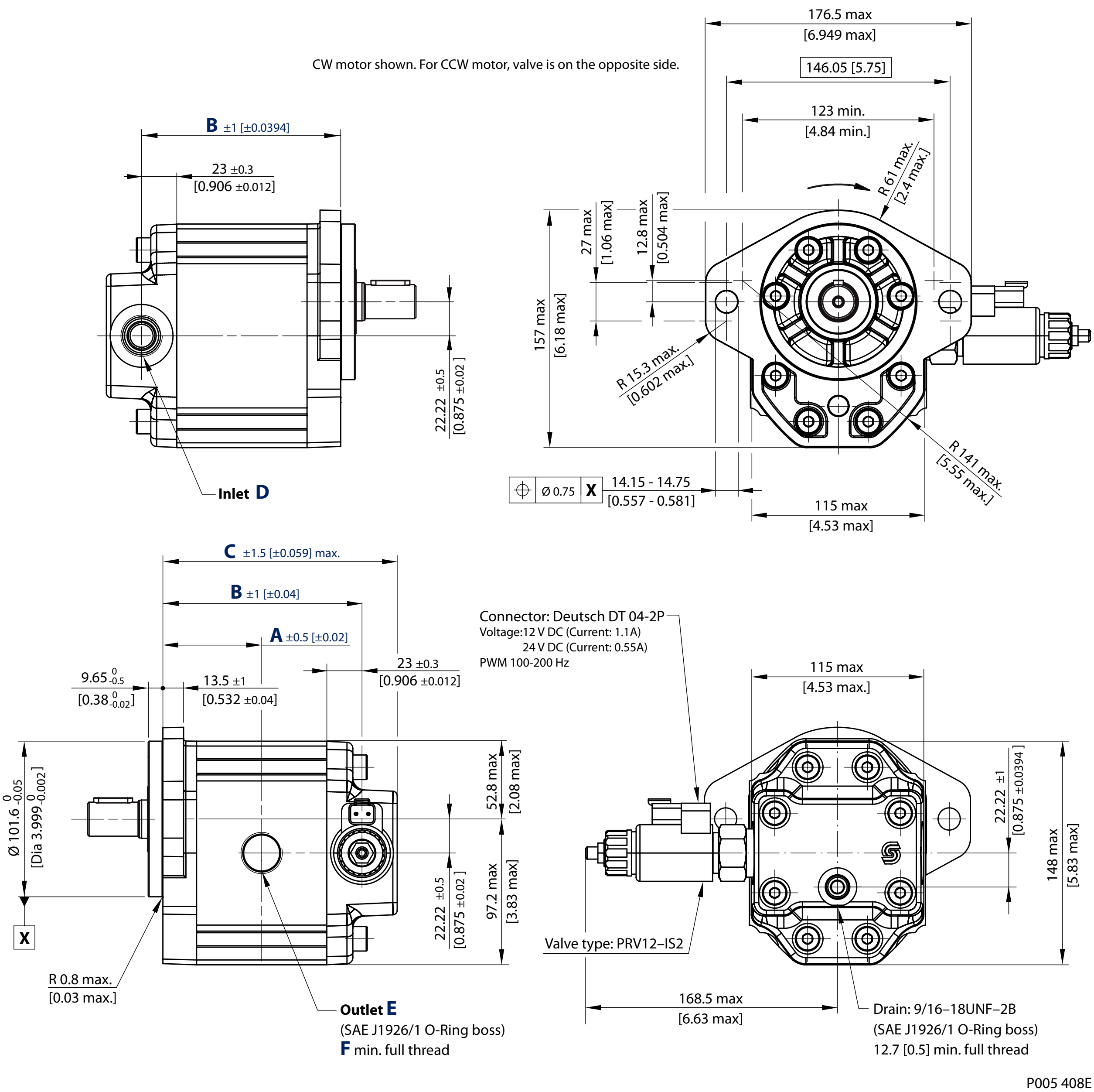
Installation Drawings



For more information regarding SGM3Y gear motors, refer to *SGM2Y and SGM3Y Fan Drive Motors Technical Information* **11040345**.

Installation Drawings

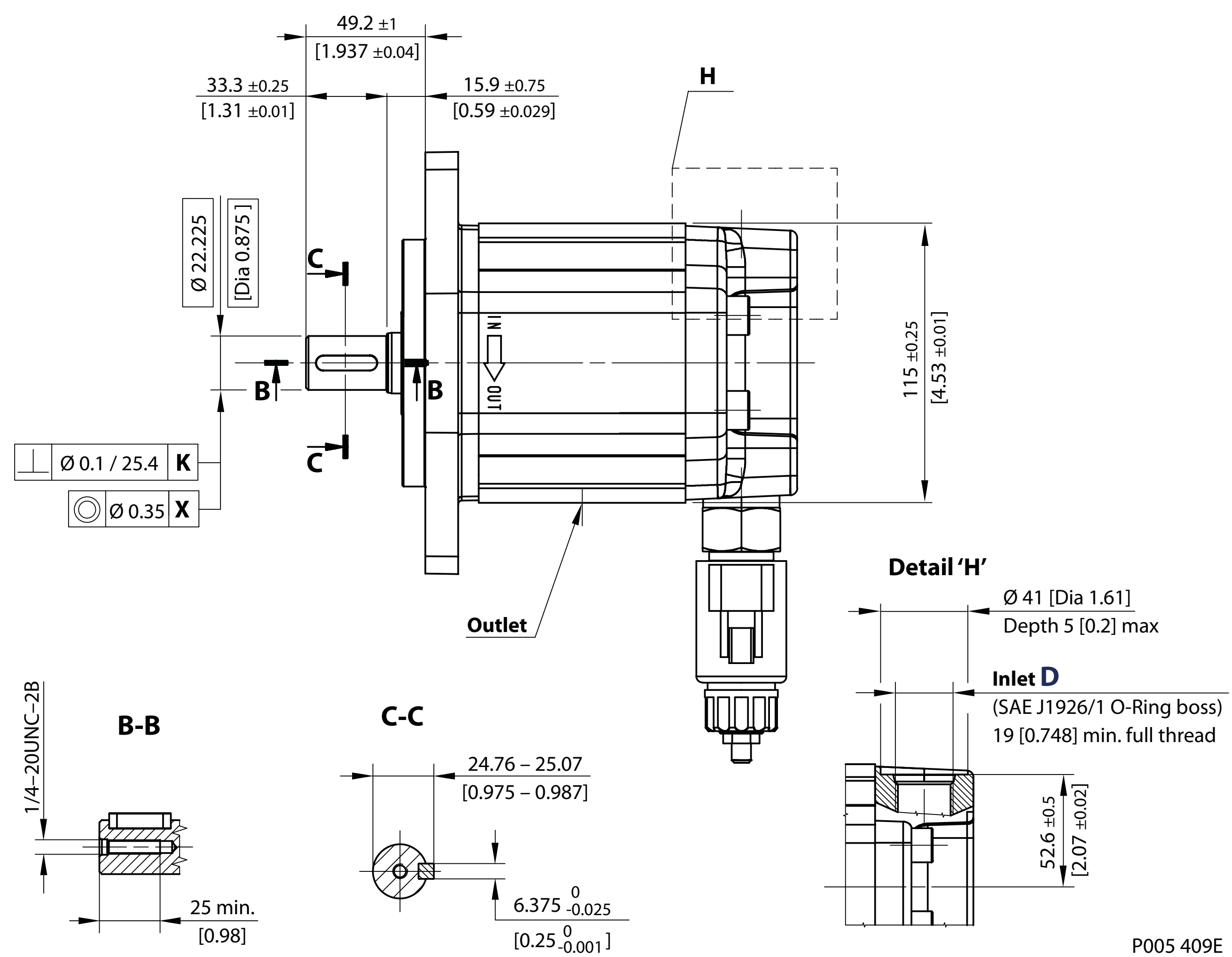
07GB



SGM3YN - 07GB dimensions

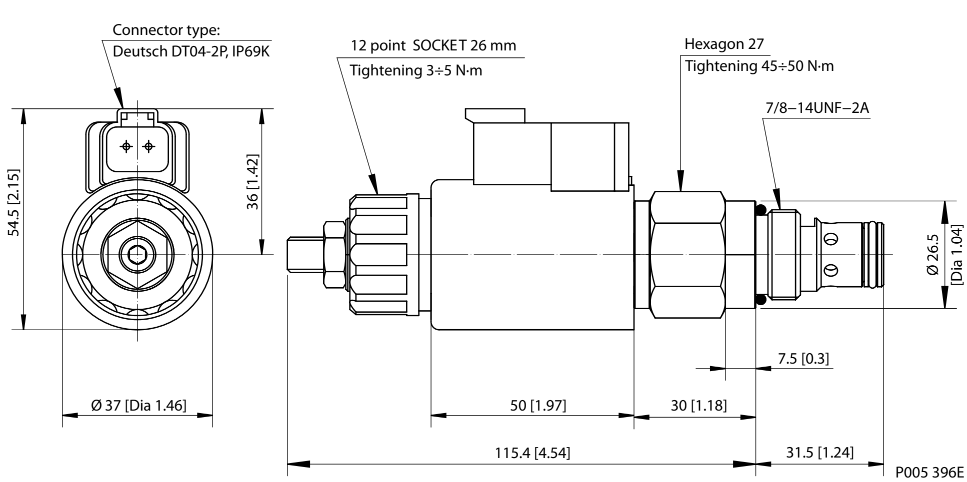
Frame size		022	026	033	038	044
Dimension mm [in]	**A**	61	63	64.5	66.5	69.5
	B	132.5	135.5	140.5	144.0	148.5
	C	20 [0.787]	20 [0.787]	27 [1.063]	27 [1.063]	27 [1.063]
Inlet port	**D**	1 1/16-12UN-2B				
Outlet port	**E**	1 1/16-12UN-2B				
	F	19 [0.748] min. full thread				
Drain port		9/16 18UNF-2B (SAE J1925/1 O-ring boss) 12.7 [0.50] min. full threads				

Installation Drawings



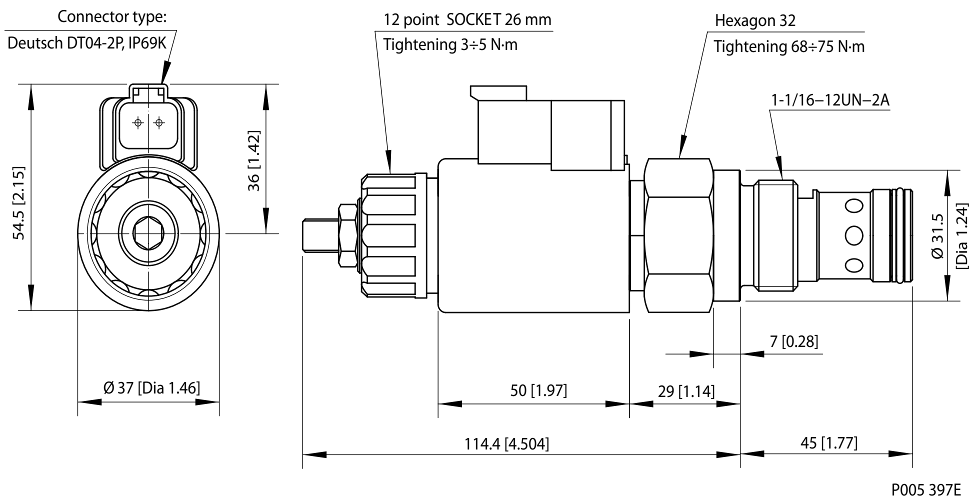
For more information regarding SGM3Y gear motors, refer to *SGM2Y and SGM3Y Fan Drive Motors Technical Information* **11040345**.

PRV10-IS2 Valve for SGM2Y



Installation Drawings

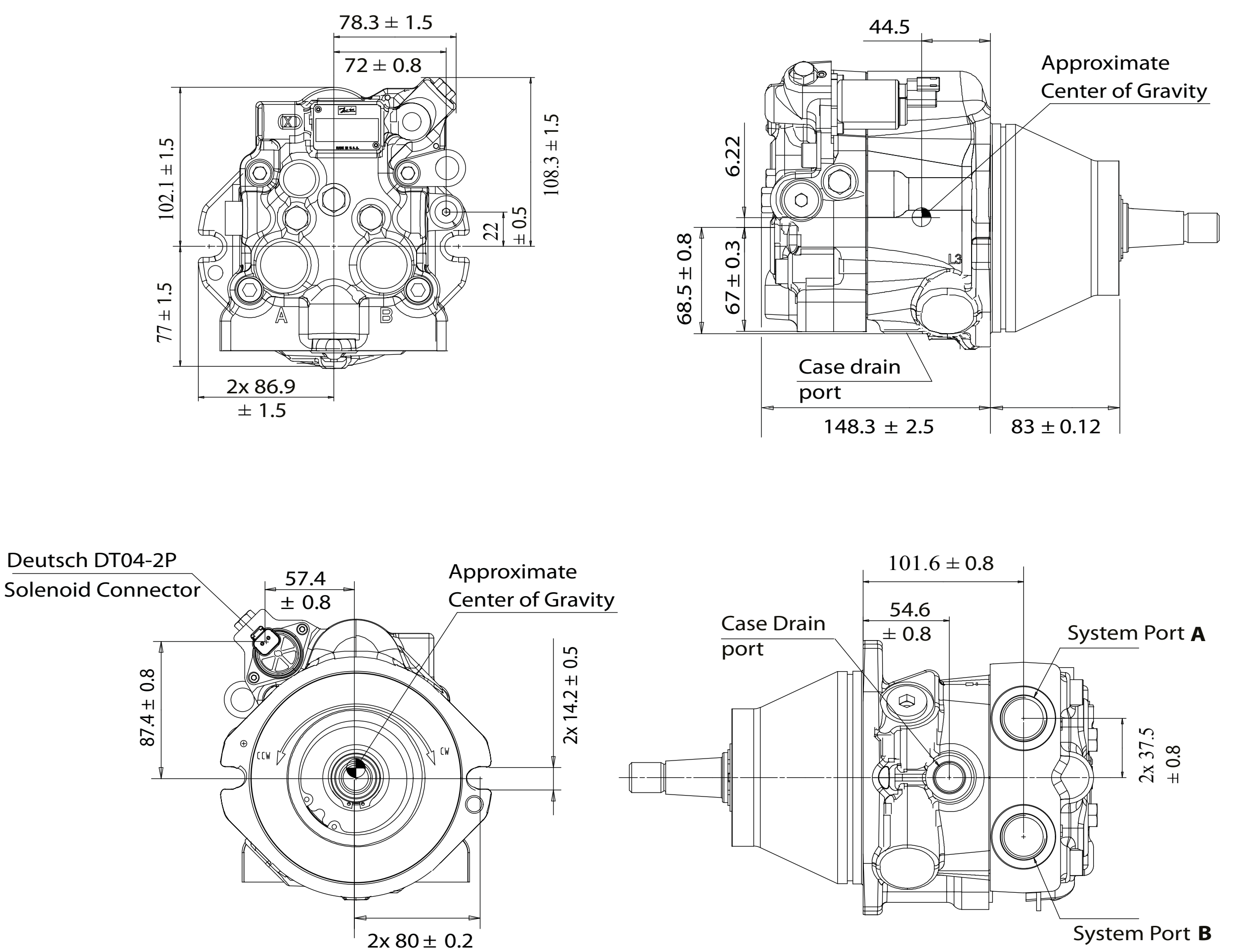
PRV12-IS2 Valve for SGM3Y



Installation Drawings

Reverse Displacement Motors (RDM)

Cartridge Motor



P108915

Recommended mounting hardware

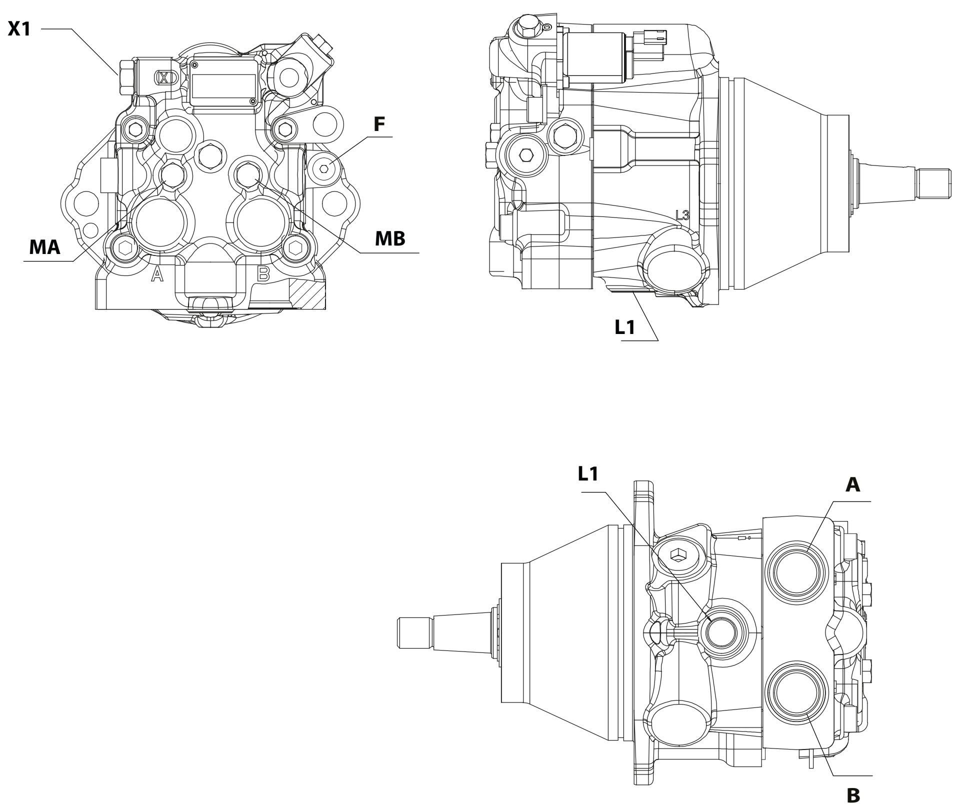
Bolt size	**Grade**	**Torque N•m [lbf•ft]**	**Mounting circle diameter**
1/2 inch	5	86 [64]	160 mm [6.299 in]
	8	122 [90]	
Use hardened washer under each bolt head.			

Installation Drawings

Port locations and gauge installation

Pressure measurements can be obtained by installing tee fittings to the connections at the locations listed in the table below. Recommended gauge sizes are listed.

Twin radial port locations



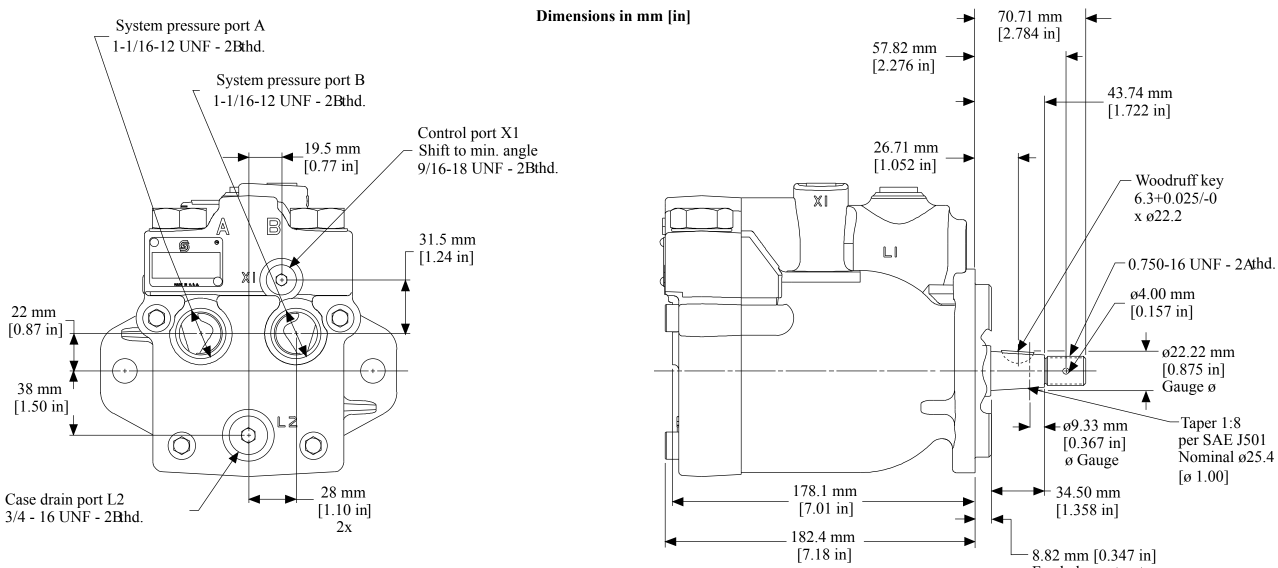
P108844

Port information

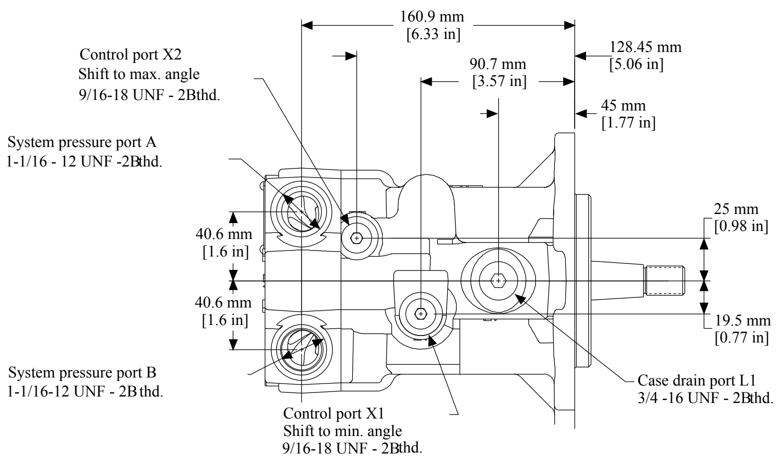
Port identifier	Metric	Inch	Pressure obtained	Gauge size, bar [psi]
X1	ISO 6941-1, M 18x1.5	ISO 11926-1, 3/4-16	Control signal	600 [10 000]
L1	ISO 6941-1, M 14x1.5	ISO 11926-1, 9/16-18	Case drain	10 [100]
A/B	ISO 6941-1, M 27x2	ISO 11926-1, 1-1/16-12	System pressure	600 [10 000]
MA/MB	ISO 11926-1, 7/16 - 20		System gauge port	600 [10,000]
F	ISO 11926-1, 7/16-20		Brake release port	-

Installation Drawings

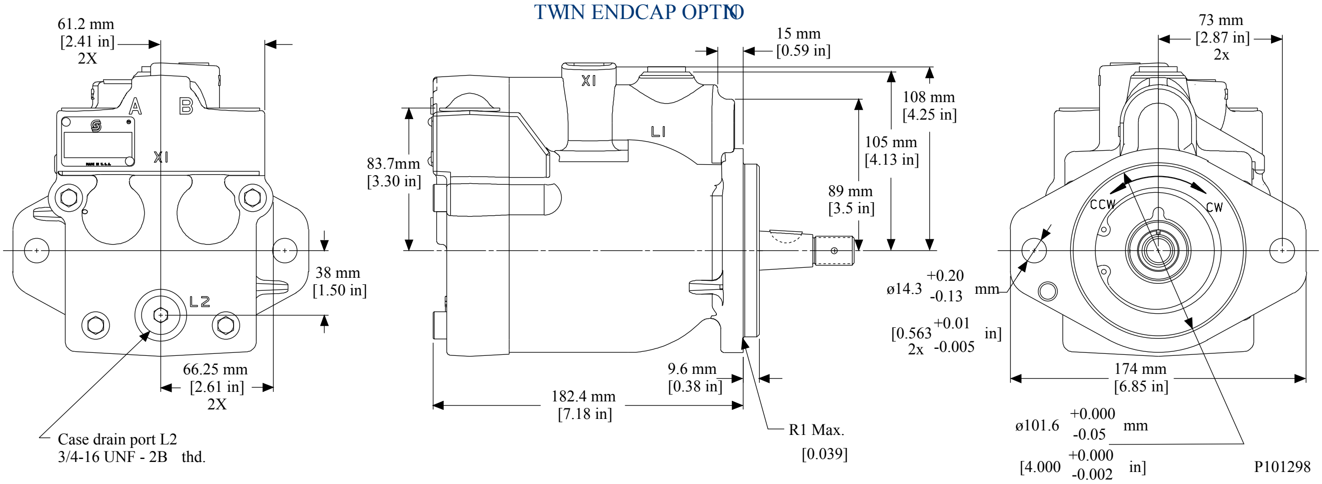
L and K Frame Variable Motor



AXIAL ENDCAP OPTION



TWIN ENDCAP OPTION



Installation Drawings

Motor Rotation

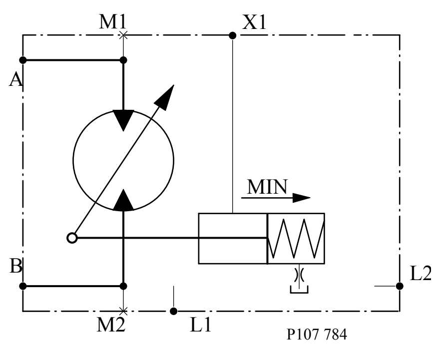
L and K Frame variable motors are fully bidirectional. The table gives the direction of rotation with respect to flow direction through the motor.

Rotation by Flow Direction

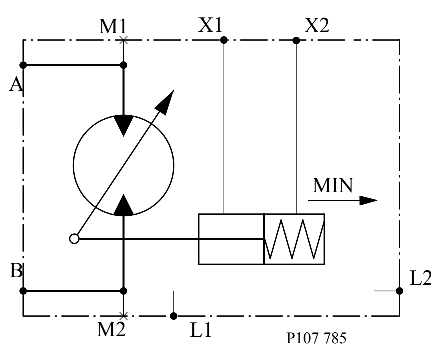
Mount	SAE-B	Cartridge
Flow A→B	CCW	CW
Flow B→A	CW	CCW

Schematics

Motor schematic, single line control



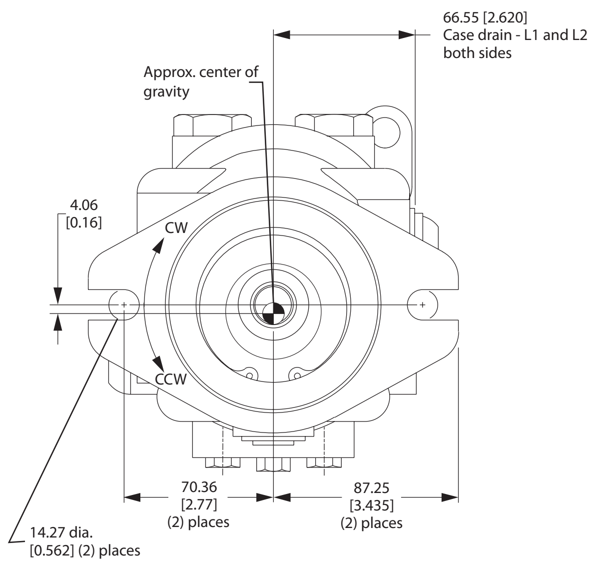
Motor schematic, dual line control



Series 40 Fixed Motors

Installation Drawings

M35/M44 MF: mounting flange



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*All ports are SAE straight thread o-ring ports per SAE J514, unless otherwise specified.

Shaft rotation is determined by viewing motor from output shaft end.

Contact Danfoss Application Engineering for specific installation drawings.

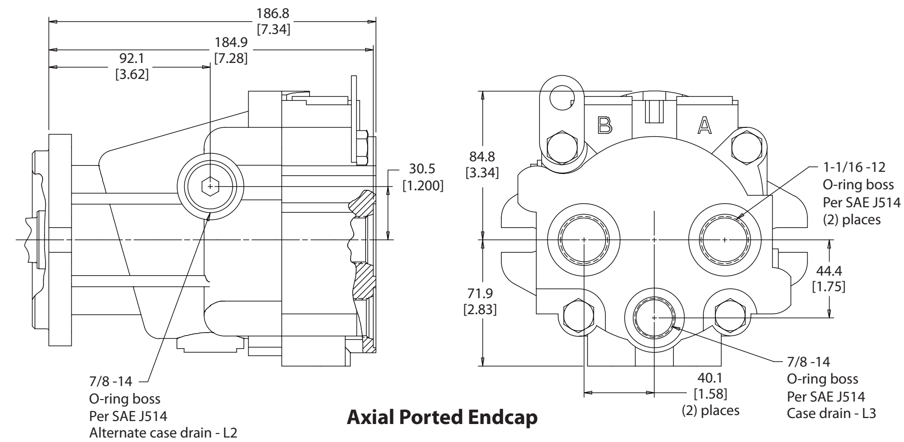
M35/M44 MF: axial ports, twin ports, loop flushing, speed sensor

Flow direction

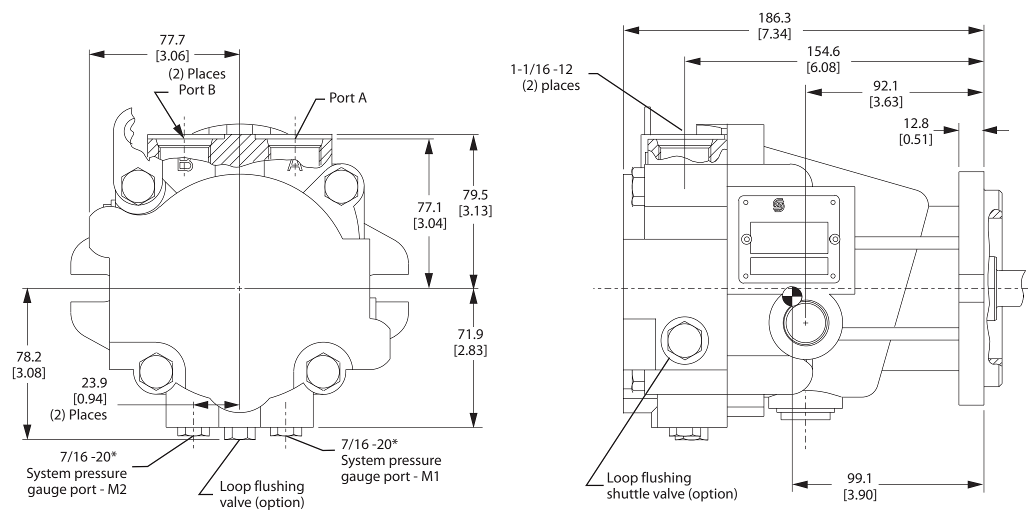
Motor shaft rotation	Port A	Port B
Clockwise	In	Out
Counterclockwise	Out	In

Installation Drawings

M35-M44 MF dimensions



Axial Ported Endcap



Twin Ports

*All ports are SAE straight thread o-ring ports per SAE J514, unless otherwise specified.

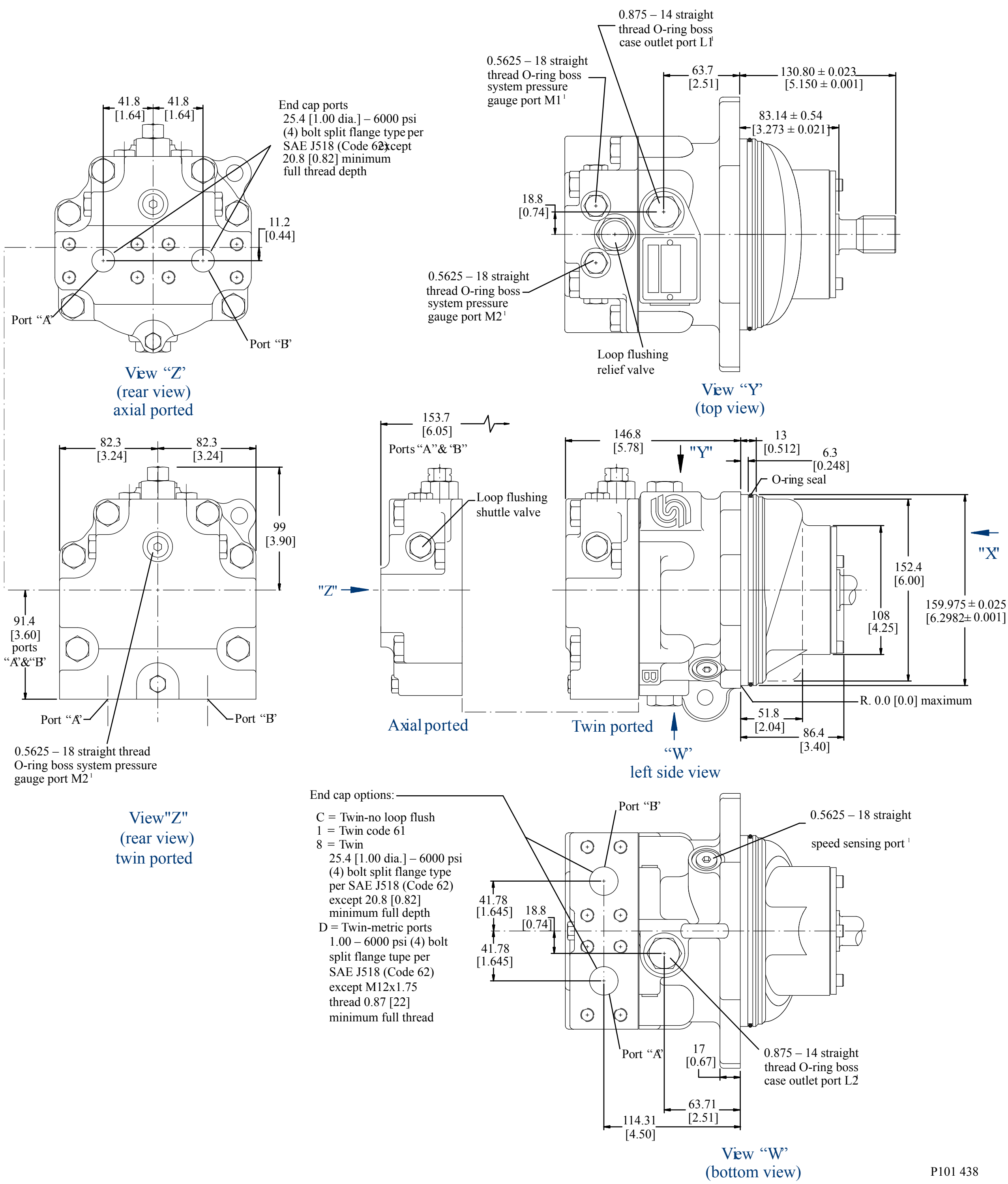
Shaft rotation is determined by viewing motor from output shaft end.

Contact Danfoss Application Engineering for specific installation drawings.

Series 90 Fixed Motors

Installation Drawings

90K55 Fixed Motor Cartridge Mount



All SAE straight thread O-rings ports per SAE J1926 (fittings per SAE 514). Shaft rotation is determined by viewing motor from output shaft end. Contact your Danfoss representative for specific installation drawings

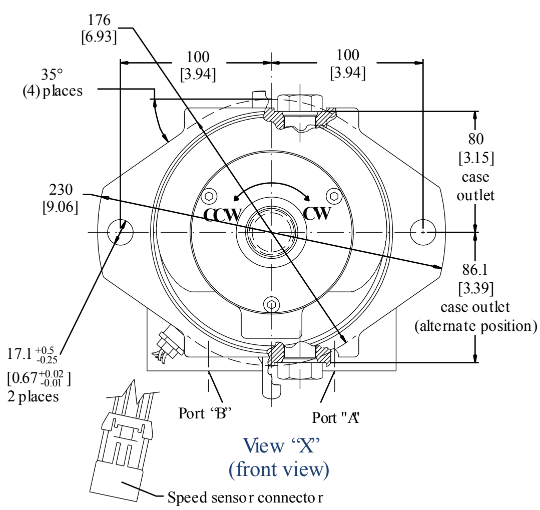
Installation Drawings

Splined output shaft options

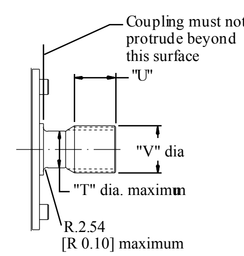
Output shaft option	Shaft diameter T	Full spline length U	Major diameter V	Pitch diameter W	Number of teeth Y	Pitch Z
S1	24.9 [0.98]	27.9 [1.10]	31.13 [1.2258]	29.634 [1.1667]	14	12/24
C6	29 [1.14]	32.5 [1.28]	34.42 [1.3550]	33.338 [1.3125]	21	16/32

Flow direction

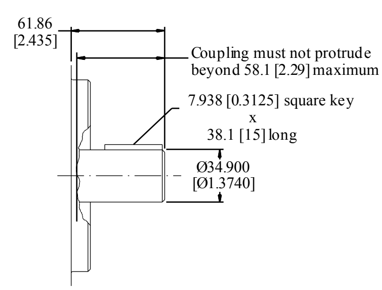
Shaft rotation	Flow direction	
	Port "A"	Port "B"
Clockwise (CW)	Out	In
Counterclockwise (CCW)	In	Out



View "X"
(front view)



Splined shaft option s
(see tables)

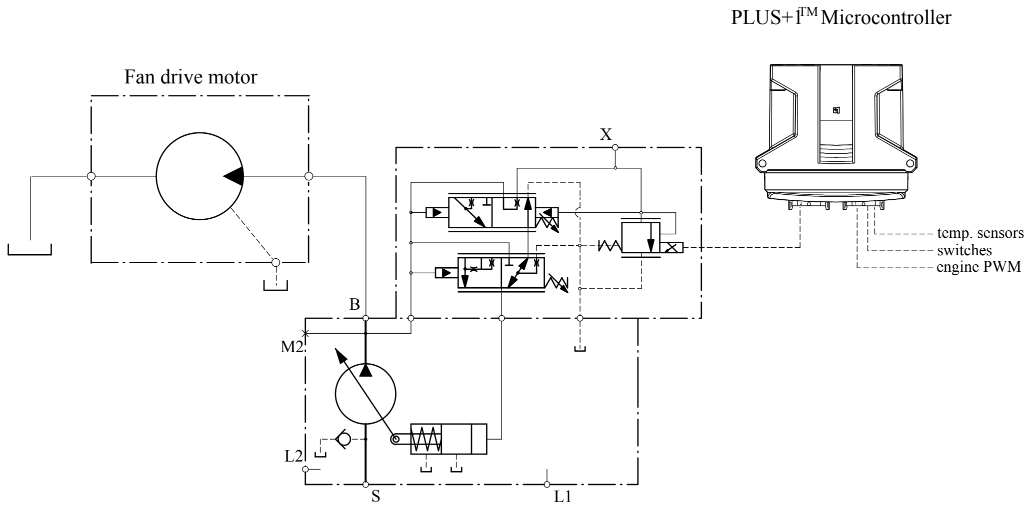


Shaft option K1

P101439

Installation Drawings

Fan Drive Control Schematic

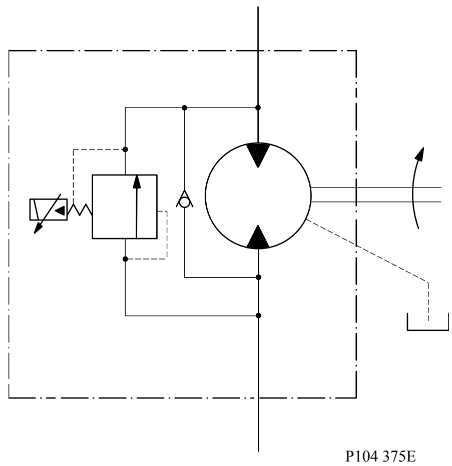


S45 Frame J pump with PRV control

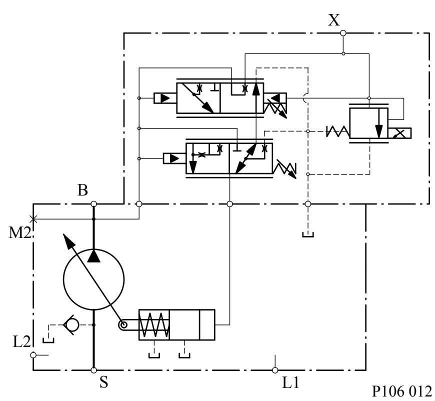
Schematics

Fan Drive System Schematics

Gear Motor (with proportional control) Schematic



S45 Fan Drive Controller Schematic



Fan Drive System Related Literature

Overview

Fan drive systems may consist of a variety of pump, motor, valve and control combinations. The product codes shown on the following pages are for components that have been designed specifically for fan drive systems. Refer to the literature listed below for product code information and specifications for other Danfoss components that may be utilized in a fan drive system.

Gear Pumps

- *SNP 2 (group 2) Gear Pumps* **520L0560**
- *D Series Gear Pumps* **520L0781**
- *Group 1 thru 3 Gear Pumps and Motors* **520L0557**
- *SNP 3 (group 3) Gear Pumps* **520L0569**

Open Circuit Piston Pumps

- *Series 45 Open Circuit Axial Piston Pumps* **520L0519**

Closed Circuit Piston Pumps

- *Series 42 Variable Piston Pumps* **11022637**
- *Series 90 Axial Piston Pumps and Motors* **520L0603**
- *H1 Pumps with Fan Drive Control* - (045-100 cm^3) **11062168**

Gear Motors

- *SGM2Y and SGM3Y Fan Drive Gear Motors* **11040345**
- *D Series Gear Motors Including Fan Drive* **11044656**

Open Circuit Piston Motors

- *L and K Frame Variable Motors* **520L0627**
- *Series 40 Axial Piston Motors* **520L0636**
- *Series 90 Axial Piston Motors* **520L0604**
- *RDM Motors* **L1424445**

Controllers

- *Fan Drive Control Temperature Sensors* **BLN-95-9063**
- *Electronic Fan Drive Controller (FDC)* **11005336**
- *Electronic Fan Drive Controller Assembly* (FDCA) **11005337**
- *PLUS+1™ Controller Family* **520L0719**

System Guidelines

- *Design Guidelines for Hydraulic Fluid Cleanliness* **520L0467**
- *Design Guidelines for Hydraulic Fan Drive Systems* **520L0926**

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