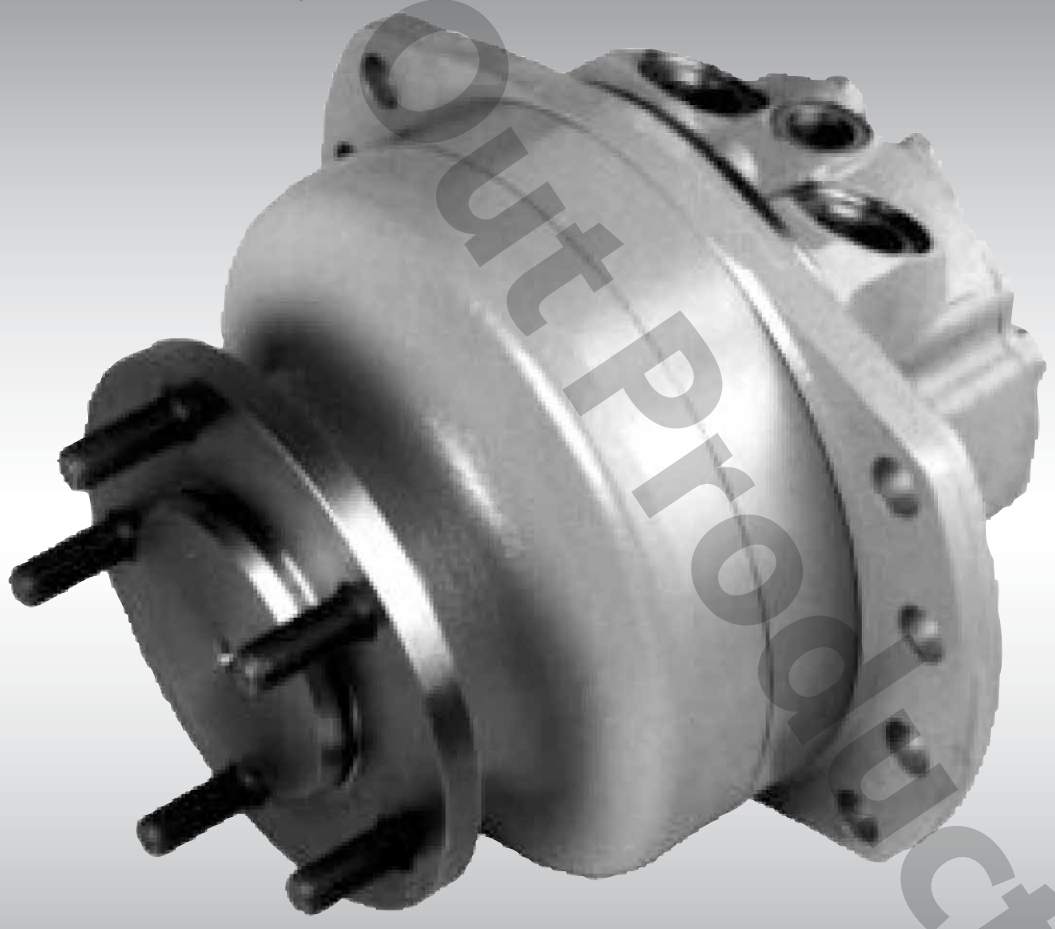
MAKING MODERN LIVING POSSIBLE

Technical Information

Radial Piston Motors
Series 60



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General Description

Series 60 Motors are radial piston motors of the multi cam design in which the pistons are acting against the cam ring supported by a single cylindrical roller. These motors are designed primarily for combination with other products in closed circuit systems to trans-mit and control hydraulic power.
Series 60 Motors meet the most demanding requirements for systems in heavy duty applications. They have high volumetric and mechanical efficiencies under dynamic and stall conditions. Especially designed for wheel drives, they have high radial load capability and are equipped with a robust shaft seal for operations in rough environments.

- 4 Sizes of Radial Piston Motors – Cam Ring Design
- Proven Reliability and Performance
- Optimum Product Configurations
- Compact

A high resolution speed pick-up, which has been especiallly designed for mobile applications, is an option available for all frame sizes.
An integrated loop flushing valve is optional providing optimal cooling and flushing of the closed circuit. Park Brakes are available as well as Two Speed versions.

Front page: Radial Piston Motor 60M0470, Flange Motor Version, without Brake.

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Technical Features

A Complete Family to Meet Market Needs
- Four (4) Frame Sizes
  470 cm3 (28.68 in3/rev) to 1750 cm3 (106.8 in3/rev)
- Choice of five (5) Displacements per Frame Size from 90% to 130% of Basis Volume
- Wide Range of Installation Options
- Closed or Open Circuit Installations

The Latest Technology
- Unique Product Features
- High Power Density
- Designed to Lower Installation Costs
- Design Provides for Reduced Operating Costs

High Performance
- Speeds to 310 rpm
- Pressure to 480 bar (7000 psi)
- High Overall Efficiency
- High Starting Torque Efficiency
- Low Noise Levels

Reliability
- Designed to Rigorous Standards
- Manufactured to Exacting Quality Standards
- Long Service Life
- Output Shaft Bearings provide for High Radial and Axial Loads

World Product
- Designed for Worldwide Markets
- Identical Product Available Worldwide
- Mobile and Industrial Markets

Worldwide Support
- Sales and Technical Support in All Industrialized Countries of the World
- Serviced by a Worldwide Network of Authorized Service Centers

Contents

System Circuit Description

Working loop (low pressure)
Case drain fluid
Working loop (high pressure)
Control fluid
Suction line

Figure 1: System Circuit Diagram • Radial Piston Motor with Axial Piston Pump

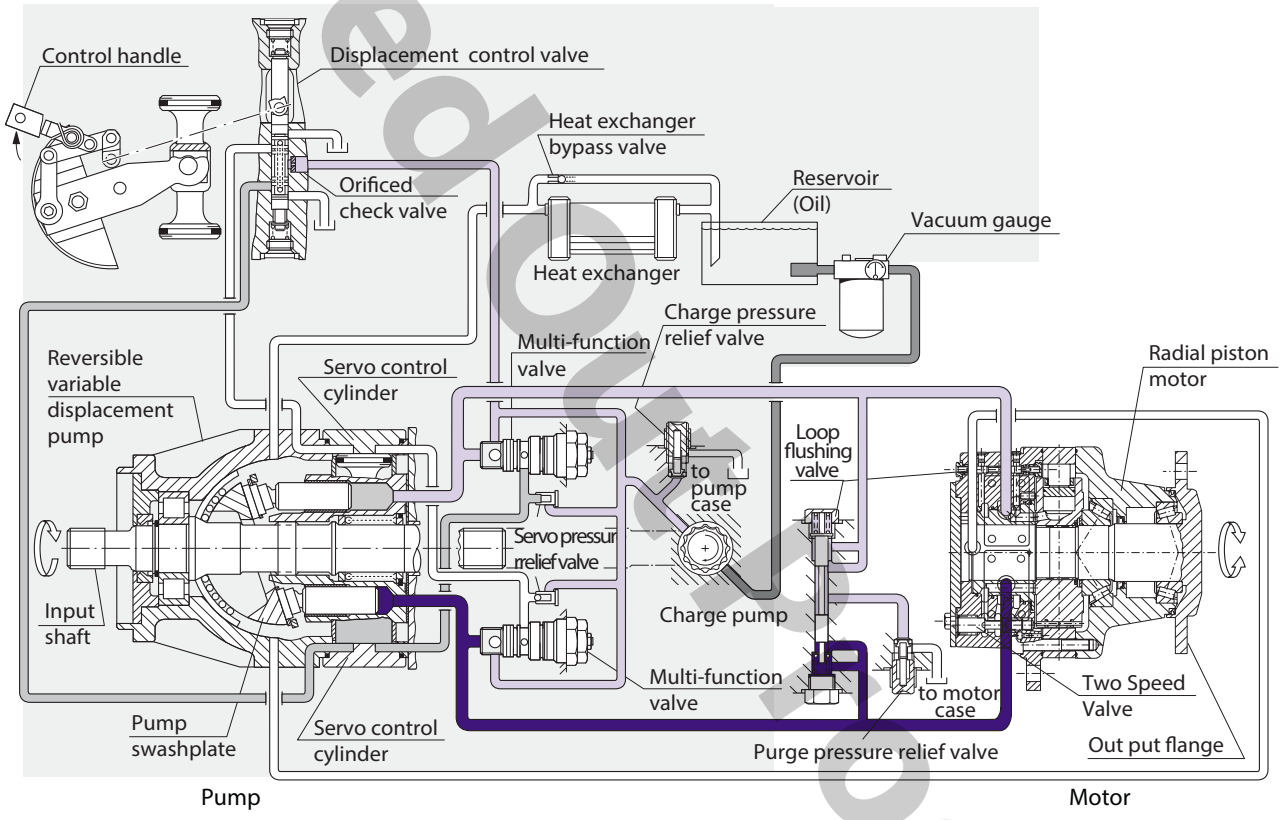

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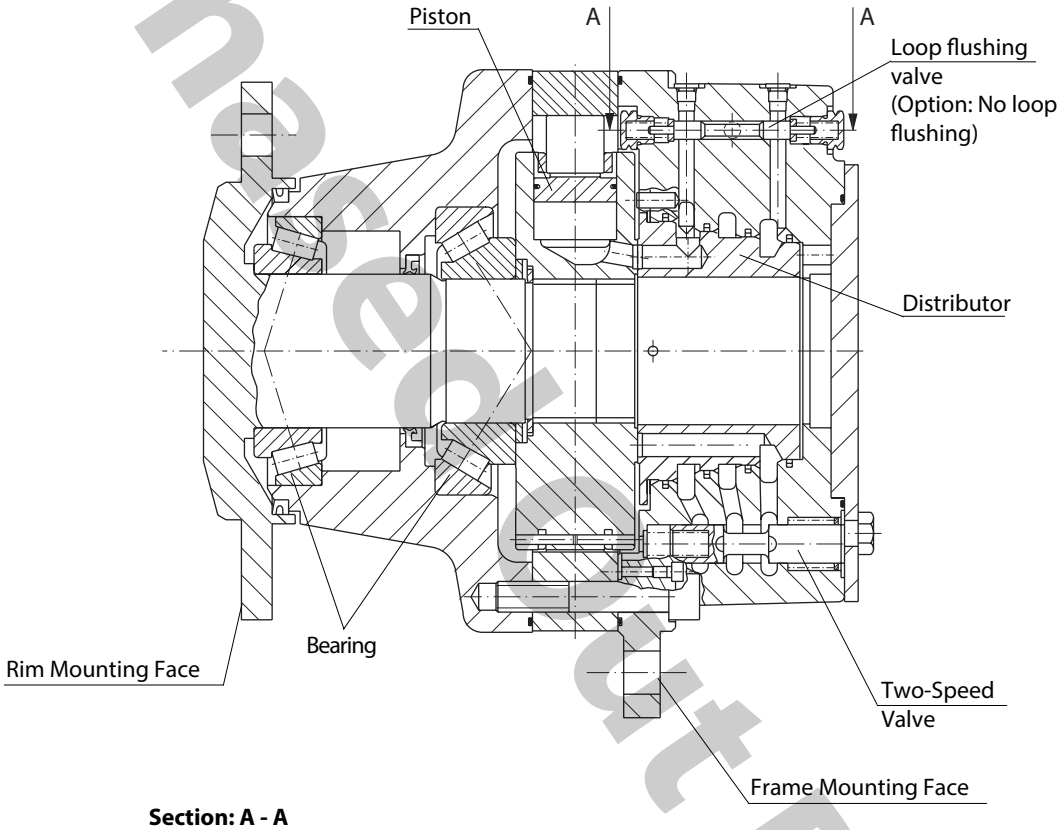
Figure 1 shows a hydrostatic transmission using a Series 90 axial piston variable displacement pump and a Series 60 radial piston motor.

Sectional View

Figure 2: Series 60 Radial Piston Motor



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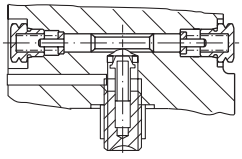
Section: A - A



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Type Designation and Order Code

Frame Size

6	0								N	N		N	N	N			N	N

Series or Product	
60	=Series 60 Radial Piston Motor

Motor Design	
M	=Single Speed
V	=Two Speed

Displacement per Rev.	
Size	
0470	=470 cm³ (28.7 in³)
0780	=780 cm³ (47,6 in³)
1048	=1048cm³ (63,9 in³)
1750	=1750cm³ (106,8 in³)

Displacement-Option		
D090	= 090%	○
D100	= 100%	●
D110	= 110%	○
D120	= 120%	○
D130	= 130%	○

Shaft Configuration		
S1S	= Shaft motor , SAE-Spline	○
W1W	= Wheel Motor	●
W2C	= Flange Motor	○

Distributor Cover Options	
1W	= Single Speed, Wheel-/ Flange Motor
2W	= Two Speed, Wheel-/ Flange Motor
1S	= Single Speed, Shaft Motor
2S	= Two Speed, Shaft Motor

Data sheet	
NN	= Std

Charge Pressure		
00	= None	○
14	= 14 bar	○
18	= 18 bar	○
20	= 20 bar	●
24	= 24 bar	○

Pref Rotation	
N	= None, Single-Spd
R	=CW, Two-Speed
L	=CCW, Two-Speed

Special Hardware		
N N N	= None	●
N N S	= Speed Sensor	○

Brake Type		
N	= Without brake	○
1	= Type 1 (60)	●
3	= Type 3 (90)	○

Brake Options		
N	= None (Single Speed)	○
K	= None (Two Speed)	○
P	= With Brake	●

Control Options	
N N	= None

Port Style	
T	= SAE "O" Ring Boss, (0470 / 0780)
S	= SAE Flange,J518c,C. 62, (1048 / 1750)

Loop Flushing		
L	= With	●
N	= None	○

● = Standard
○ = optional

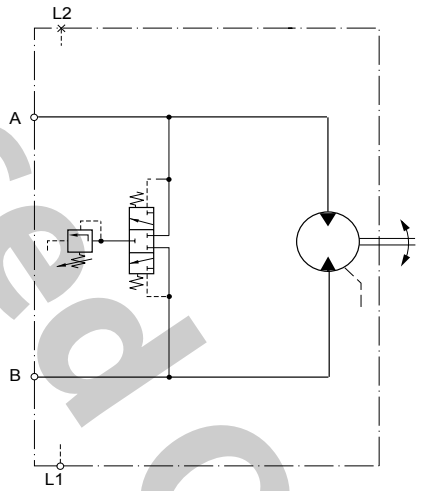
Notes

Technical Specificatons - Radial Piston Motors · Cam Ring Design

Circuit Diagram and Nomenclature

Radial Piston Motor

Figure 3: Circuit diagram · Radial Piston Motor



Ports:
A, B = Main pessure lines
L1, L2 = Drain lines

Design
Radial piston cam ring motor in single and two speed version.

Type of Mounting
Flange mounting with pilot.

Pipe Connections
Main pressure ports:
SAE straight thread O-ring boss, Size 0470 and 0780 SAE flange Code 62, Size 1048 and 1750
Other ports: SAE straight thread O-ring boss
Refer to "Dimensions" section for port sizes.

Direction of Rotation
Clockwise and counter-clockwise (bi-directional).

Installation Position
Installation position as required: The housing must always be filled with hydraulic fluid.

Flow Direction
Refer to "Dimensions section"

Hydraulic Parameters

System Pressure Range, Port A and B
Max. pressure :
480 bar (7000 psi)

Min. pressure :
[450 bar (6500 psi) for 130% Option]
See Diagram, Page 11, Fig. 5

Case Pressure
Max. Continuous : 3 bar (44 psi)
Max. intermittent: 14 bar (200 psi) (cold start)

Pilot Pressure, Two Speed Option
For minimum displacement signal pressure to displacement change port "x1",
Min. pressure : 10 bar (145 psi) (above case pressure)
Max. pressure: 50 bar (725 psi)

Hydraulic Fluid
Refer to Publication, BLN-9887 or 697581.
Refer to ATI-E 9101 for information relating to biodegradeable fluids .

Temperature Range
ϑ min. = -20 °C (-4 °F), intermittent, cold start
ϑ nominal = 80 °C (175 °F), continuous
ϑ max = 85 °C (188 °F), intermittent [1)]

Hydraulic fluid viscosity must be as shown below.
[1)] at the hottest point, normally the case drain line.

Fluid Viscosity Limits
v min = 9 mm^2/s (55 SUS) continuous
v max= 1600 mm^2/s (7400 SUS) intermittent, cold start

Filtration
Required cleanliness level: ISO 4406 Code 18/13 or better.
Refer to publication BLN-9887 or 697581 and ATI-E 9201.

Technical Data – Radial Piston Motors

Table 1

		(Dimension)	Frame Size 0470					0780				
Displacement - Option		%	90	**100**	110	120	130	90	**100**	110	120	130
Displacement	Vg	cm³	**423**	**470**	**517**	**564**	**611**	**702**	**780**	**858**	**936**	**1014**
		in³	25.9	28.7	31.5	34.4	37.3	42.8	47.6	52.4	57.1	61.9
	Vg 0.5	**cm³**	**212**	**235**	**259**	**282**	**306**	**351**	**390**	**429**	**468**	**507**
		in³	12.9	14.3	15.8	17.2	18.7	21.4	23.8	26.2	28.5	30.9
Rated Speed	n	**min⁻¹** (RPM)	**235**					**200**				
Output Speed, max.	n	**min⁻¹** (RPM)	**310**	**295**	**280**	**270**	**260**	**260**	**250**	**240**	**230**	**220**
Theoretical Torque	at Vg	**Nm / bar**	**6,73**	**7,48**	**8,23**	**8,98**	**9,72**	**11,17**	**12,41**	**13,66**	**14,90**	**16,14**
		lbf•in/1000 psi	**4117**	**4576**	**5035**	**5494**	**5946**	**6833**	**7592**	**8357**	**9115**	**9874**
	Vg 0,5	**Nm / bar**	**3,37**	**3,74**	**4,11**	**4,49**	**4,86**	**5,59**	**6,21**	**6,83**	**7,45**	**8,07**
		lbf•in/1000 psi	**2062**	**2288**	**2514**	**2747**	**2973**	**3420**	**3799**	**4178**	**4558**	**4937**
Max. Flow at Vg	Q	**l / min**	**131**	**138**	**145**	**152**	**159**	**183**	**195**	**206**	**215**	**223**
		gal/min (US	34.6	36.6	38.2	40.2	42.0	48.2	51.5	54.4	56.8	58.9
Max. Flow at Vg 0,5	Q	**l / min**	**66**	**69**	**72**	**76**	**79**	**91**	**98**	**103**	**108**	**112**
		gal/min (US	17.3	18.3	19.1	20.1	21.0	24.1	25.7	27.2	28.4	29.4
Output Power												
Single Speed at Vg	P	**kW**	**29**					**41**				
		hp	39					55				
Two Speed, pref Direction, Vg 0,5	P	**kW**	**19**					**27**				
		hp	25					36				
Two Speed, not pref Direction, Vg 0,5	P	**kW**	**14**					**20**				
		hp	19					27				
Weight												
Wheel Motor	m	**kg**	**46**					**74**				
		lb	101					163				
Flange Motor	m	**kg**	**42**					**71**				
		lb	93					157				
Shaft Motor	m	**kg**	**49**					**72**				
		lb	108					159				

Determination of Nominal Motor Size (Metric System)

Input flow $Q_e = \frac{Vg \cdot n}{1000 \cdot \eta_v}$ l/min

Output power $P_e = \frac{M_e \cdot n}{9950} = \frac{Q_e \cdot \Delta p \cdot \eta_t}{600}$ kW

Output torque $M_e = \frac{Vg \cdot \Delta p \cdot \eta_{mh}}{20 \cdot \pi}$ Nm

Speed $n = \frac{Q_e \cdot 1000 \cdot \eta_v}{Vg}$ min^{-1}

Vg = Motor displacement per rev. cm^3
Δp = $p_{HD} - p_{ND}$ bar
η_v = Motor volumetric efficiency
η_{mh} = Motor mechanical – hydraulic (Torque) efficiency

η_v = Motor overall efficiency
p_{HD} = High pessure bar
p_{ND} = Low pressure bar

Technical Data – Radial Piston Motors (cont.)

Table 2

		(Dimension)	Frame Size									
			1048					1750				
Displacement - Option		%	90	**100**	110	120	130	90	**100**	110	120	130
Displacement	Vg	cm^3	**943**	**1048**	**1153**	**1258**	**1362**	**1575**	**1750**	**1925**	**2100**	**2275**
		in^3	57.5	64.0	70.4	76.8	83.1	96.1	107	117.5	128.1	138.8
	Vg 0.5	**cm^3**	**472**	**524**	**576**	**629**	**681**	**788**	**875**	**963**	**1050**	**1138**
		in^3	28.8	32.0	35.1	38.4	41.6	48.1	53.4	58.8	64.1	69.4
Rated Speed	n	**min $^{-1}$** (RPM)	**180**					**150**				
Output Speed, max.	n	**min $^{-1}$** (RPM)	**240**	**230**	**215**	**210**	**200**	**200**	**195**	**185**	**175**	**170**
Theoretical Torque	at Vg	**Nm / bar**	**15,01**	**16,7**	**18,35**	**20,02**	**21,68**	**25,07**	**27,85**	**30,64**	**33,42**	**36,21**
		lbf•in/1000 psi	**9183**	**10217**	**11226**	**12248**	**13263**	**15337**	**17038**	**18745**	**20445**	**22152**
	Vg 0,5	**Nm / bar**	**7,50**	**8,34**	**9,18**	**10,01**	**10,84**	**12,53**	**13,93**	**15,32**	**16,71**	**18,10**
		lbf•in/1000 psi	**4588**	**5102**	**5616**	**6124**	**6632**	**7665**	**8522**	**9372**	**10223**	**11073**
Max. Flow at Vg	Q	**l / min**	**226**	**241**	**248**	**264**	**272**	**315**	**341**	**356**	**368**	**387**
		gal/min (US	60.0	63.6	65.5	69.7	71.8	83.2	90.1	94.0	97.0	102.1
Max. Flow at Vg 0,5	Q	**l / min**	**113**	**121**	**124**	**132**	**136**	**158**	**171**	**178**	**184**	**193**
		gal/min (US	29.9	31.8	32.7	34.9	35.9	41.6	45.0	47.0	48.5	51.1
Output Power												
Single Speed at Vg	P	**kW**	**50**					**70**				
		hp	67					94				
Two Speed, pref Direction, Vg 0,5	P	**kW**	**33**					**47**				
		hp	44					63				
Two Speed, not pref Direction, Vg 0,5	P	**kW**	**25**					**35**				
		hp	34					47				
Weight												
Wheel Motor	m	**kg**	**99**					**149**				
		lb	218					329				
Flange Motor	m	**kg**	**95**					**144**				
		lb	209					318				
Shaft Motor	m	**kg**	**96**					**152**				
		lb	212					335				

Determination of Nominal Motor Size (Inch System)

Input flow $Q_e = \frac{Vg \cdot n}{231 \cdot \eta_v}$ gal/min US

Output power $P_e = \frac{M_e \cdot n}{5252} = \frac{Q_e \cdot \Delta p \cdot \eta_t}{1715}$ HP

Output torque $M_e = \frac{Vg \cdot \Delta p \cdot \eta_{mh}}{24 \cdot \pi}$ lbf. in

Speed $n = \frac{Q_e \cdot 231 \cdot \eta_v}{Vg}$ min^{-1}

Vg = Motor displacement per rev. in^3
Δp = p_{HD} - p_{ND} psi
η_v = Motor volumetric efficiency
η_{mh} = Motor mechanical – hydraulic (Torque) efficiency

η_v = Motor overall efficiency
p_{HD} = High pessure psi
p_{ND} = Low pressure psi

General Technical Specifications

Speed Range

The **Rated Speed** is the max. speed recommended at max. permitted operating power at which normal life can be expected. All other operating conditions (e.g. fluid viscosity and temperature, charge pressure) must be within recom-mended ranges.

Maximum Speed is the max. operating speed permitted and cannot be exceeded without reduction in the life of the product or risking immediate failure and *loss of driveline power* (which may create a safety hazard).

⚠ Braking Warning !
The loss of *hydrostatic driveline power* in any mode (e.g. acceleration, deceleration, or neutral mode of operation) may cause a loss of braking capacity. A braking system which is independent of the hydrostatic transmission must, therefore, be provided which is adequate to stop and hold the system should the condition develop.

System Pressure Range

System pressure is a dominant operating variable affecting hydraulic unit life. High pressure, which results from high load, reduces expected life in a manner similar to many mechanical assemblies such as engines and gearboxes. The maximum pressure is the highest intermittent pres-sure allowed. It is determined by the maximum machine load demand.
Maximum pressure is assumed to occur a small percentage of operating time, usually less than 2% of the total. Maximum pressure is normally the relief valve setting.
It is desirable to have a machine duty cycle with the percentage of time at various loads and speeds. An appro-priate design pressure can be calculated by our application department from this information . This method of selecting operating pressure is recommended whenever duty cycle information is available.

Case Pressure

Under normal operating conditions, the maximum continu-ous case pressure must not exceed 3 bar (44 psi). Maximum allowable intermittent case pressure during cold start must no exceed 14 bar (200 psi).

Hydraulic Fluids

Use only recommended hydraulic fluids in accordance to manual BLN-9887, 697581, and ATI-E 9101.
While fluids containing anti-wear additives are not necessary for the satisfactory performance of the series 60 units, they are often required for associated equipment. These fluids must possess good thermal and hydrolytic stability to prevent wear, erosion and corrosion of internal compo-nents. It is not permissible to mix hydraulic fluids. Fire-resistant fluids are also suitable at modified

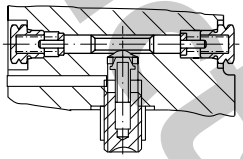
Temperature Limits

Refer to page 7 for maximum allowable temperatures for petroleum based fluids.
These temperature limits apply at the hottest point of the transmission, which is normally the case drain.
Heat exchangers should be sized to keep the fluid within the limits.

Loop Flushing

Series 60 motors incorporate an integral loop flushing valve. Installations that require additional fluid to be removed from the main hydraulic circuit because of fluid cooling requirements, or circuits requiring the removal of excessive contamination from the high pressure circuit, can benefit from loop flushing.
Series 60 motors with an integral loop flushing valve also include a purge pressure relief valve. The setting of the motor charge relief valve affects the function of the flushing circuit. Higher motor purge relief settings reduce the loop flushing flow and increase the flow over the pump charge pressure relief valve when the circuit is operating. Lower motor purge relief settings increase the loop flushing flow and may increase the motor case pressure when the circuit is operating.
An appropriate combination of pump and motor charge pressure settings should be maintained to insure the proper function of the loop flushing circuit. Correct charge pressure must be maintained under all conditions of operation to maintain control performance in closed loop systems.

Figure 4: Loop Flushing Valve



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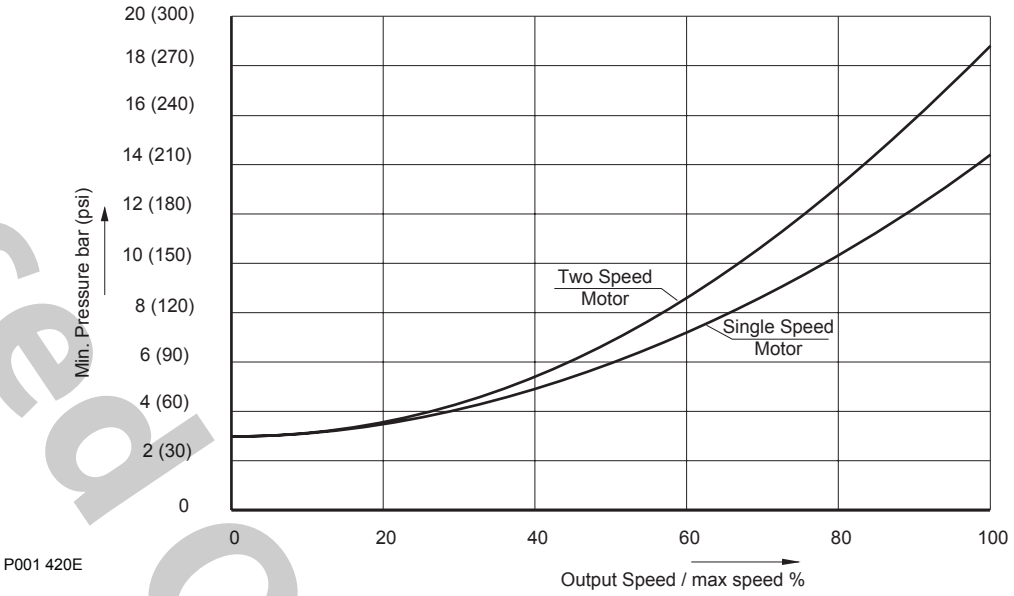
General Technical Specifications (Continued)

Charge Pressure Requirements

Figure 5: Minimum charge pressure (above Case Pressure) , Single Speed and Two Speed Motor



Park Brake Brake Description

The brake is of the multiple-plate type. A belleville spring washer is acting against the piston pressing stationary and rotating discs against each other. When the brake piston is pressurized, the force on the piston overcomes the force of the belleville spring and releases the brake.

To move the vehicle or machine without the availability of brake release pressure, a mechanical release option is available. The torque specified for this brake is only validated under static conditions.

Figure 6: Circuit Diagramm

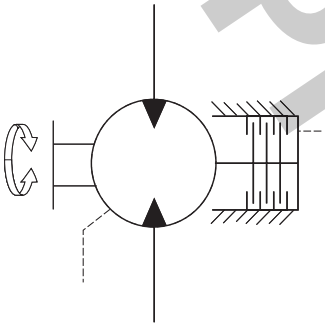


Figure 7: Brake section View

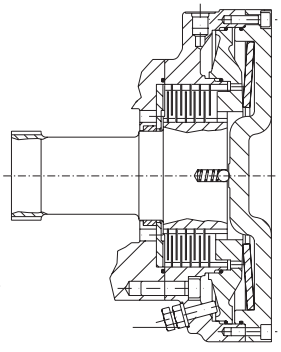


Table 3: Input Brakes

	Dimension	Frame Size			
		0470	0780	1048	1750
Brake Torque, static, permitted (Applies for petroleum based fluid)	Nm	2500	4200	5700	9600
	lb·in	22 100	37 100	50 400	84 900
Brake release pressure, above case pressure	bar	15 min / 30 max			
	psi	218 min / 435 max			

General Technical Specifications (Continued)

Freewheeling Option

Series 60 Motors run in freewheeling mode with almost no losses. The necessary valving needs to be added into the circuit. The schematic below shows a solution closed circuit operation.

The following has to be provided:
- The high pressure ports of the motor are connected to the tank.
- A low pressure is applied to the motor drain port (Fig. 8)

which pushes the pistons into their cylinders (Fig.9), disengaging them from the cam. The necessary case pressure is shown on table 4.

Table 4: Max speeds in freewheeling condition

Case pressure: 1,5 bar (22 psi) above ports A and B	Dimension	Frame Size			
		0470	0780	1048	1750
Freewheeling Output Speed, max.	min^{-1} (RPM)	770	630	560	450

Figure 8: Circuit Diagramm, Freewheeling Option

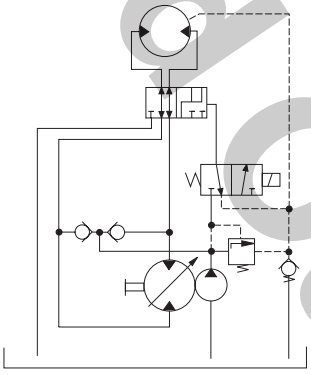


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Figure 9: Motor Section View, Freewheeling mode

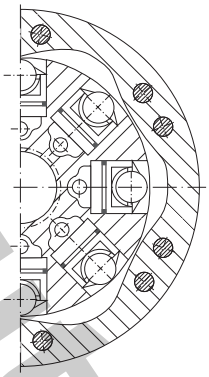

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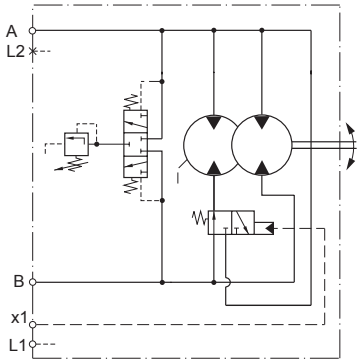
Fig. 10: Circuit Diagramm, Two Speed Option



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Two Speed Option

The Two Speed Option is available on all motor sizes, allowing increased application flexibility. The integral displacement change valve selects half displacement. When the displacement change port "x1" (Fig. 10) is connected to tank or motor case pressure, maximum displacement is selected.

When a signal pressure min 10 bar (145 psi) above case pressure, [max. 50 bar (725 psi)], is connected to "x1", minimum displacement is selected. Motor performance and life is optimal in the preferred direction of rotation (see Dimensions). The displacement should be changed while the motor is stationary. This avoids sudden or unexpected speed changes and possible transmission damage.

Speed Pick-Up

Series 60 Motors speed pick-up (Hall Effect Sensor) is especially designed for rough outdoor, mobile, or heavy industrial applications where speed monitoring, revolution counting, speed limit control or alarm function is required with no physical contact with the sensed motor shaft.

Pin 1: Supply voltage = 4,5 to 16 V dc
Supply current: At 5 V -16 mA
Pin 2: Not used
Pin 3: Output digital, open collector NPN
Pin 4: Ground
For installation and connector details, see Fig. 28, page 23.

Table 5: Pulse Frequency

Motor Frame Size	0470	0780	1048	1750
Pulses per revolution	78	92	101	121

Shock Load

Motors are designed for 20 g external accelleration.

General Technical Specifications (Continued)

Efficiency Graphs and Maps

Figure 11 shows the volumetric, mechanical and overall efficiencies of a typical Series 60 single and two speed motor at full displacement and system pressures of 200 bar (2900 psi) and 400 bar (5800 psi), with a fluid viscosity of 20 mm^2/s (98 SUS) at a temperature of 60 °C (140 °F).

Figure 12 shows the overall efficiency of a typical Series 60 single and two speed motor at full displacement with system pressure up to 480 bar (7000 psi), with a fluid viscosity of 20mm2/s (98 SUS) at a temperature of 60 °C (140 °F).

Figure 11:
Volumetric, Mechanical and Overall Efficiency.

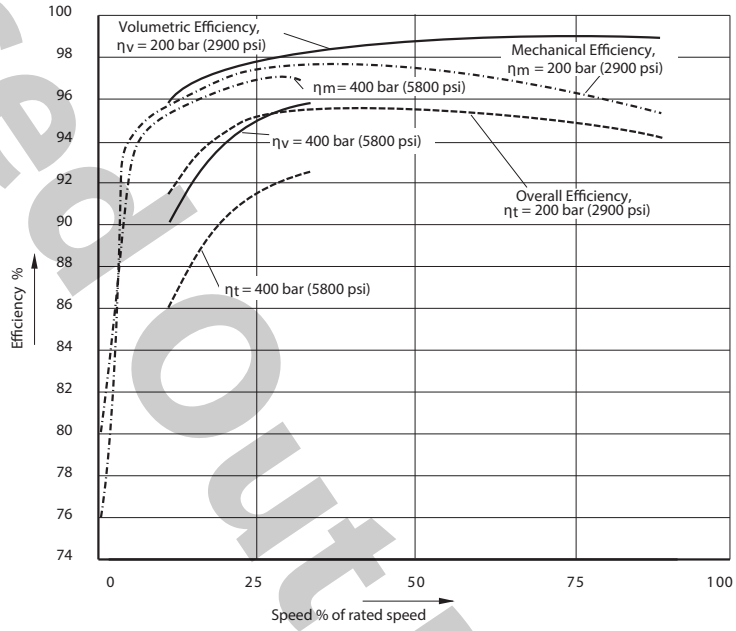

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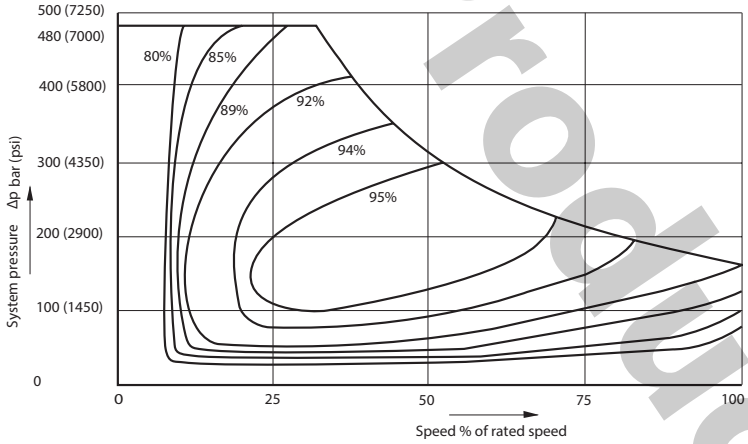
Figure 12: Overall Efficiency



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General Technical Specifications (Continued)

Efficiency Graphs and Maps

Figure 13 shows the volumetric, mechanical and overall efficiencies of a typical Series 60 single and two speed motor at half displacement in the preferred direction, and system pressures of 200 bar (2900 psi) and 400 bar (5800 psi), with a fluid viscosity of 20 mm²/s (98 SUS) at a temperature of 60° C (140° F).

Figure 13: Volumetric, Mechanical and Overall Efficiency at half displacement, in the preferred direction.

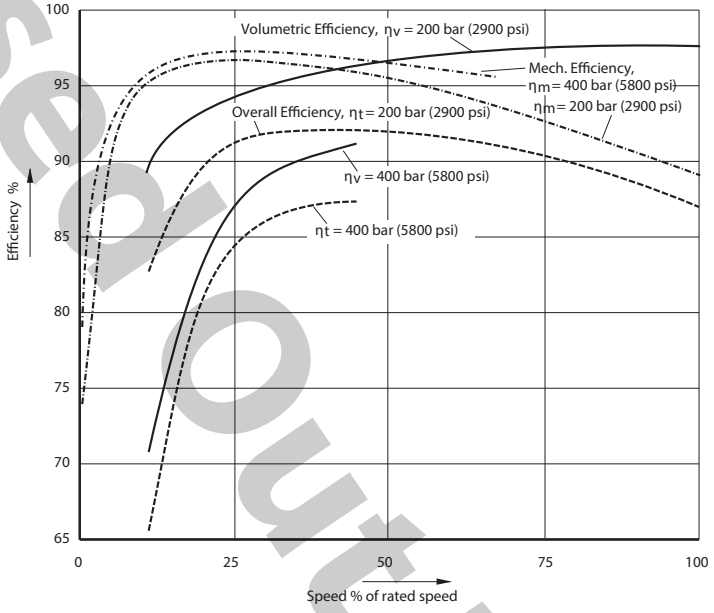

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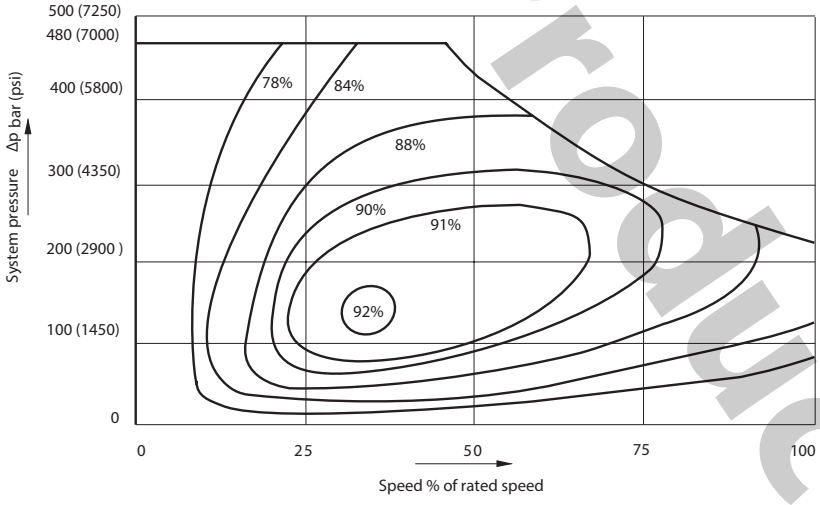
Figure 14: Overall Efficiency at half displacement, in the preferred direction.

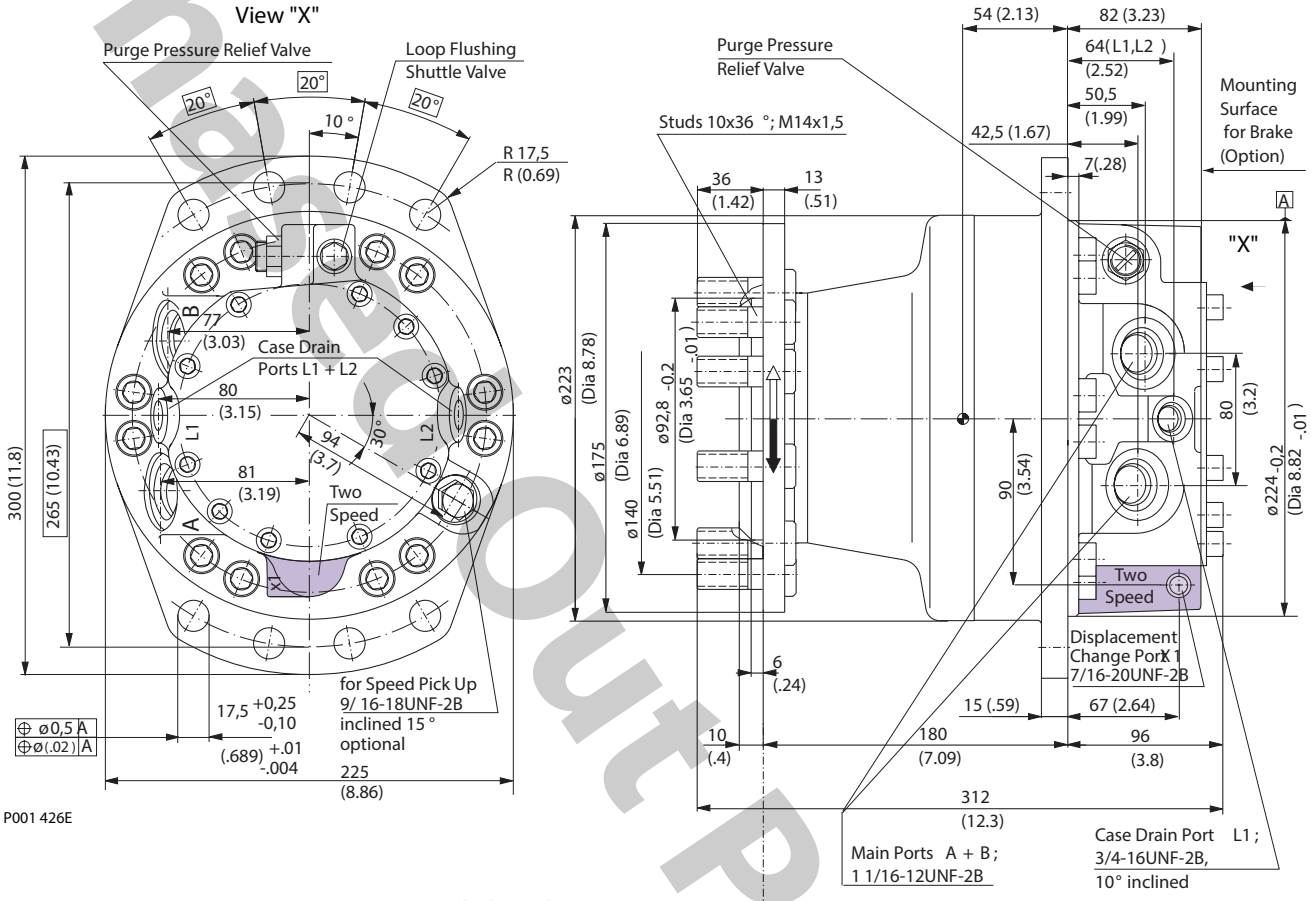
Figure 14 shows the overall efficiency of a typical Series 60 single and two speed motor at half displacement in the preferred direction, and system pressure up to 480 bar (7000) psi), with a fluid viscosity of 20 mm²/s (98 SUS) at a temperature of 60 °C (140 ° F).



P001 402 E

Dimensions 60M0470 / 60V0470

Figure 15:
Wheel Motor 60M0470, Single Speed Version
Wheel Motor 60V0470, Two Speed Version



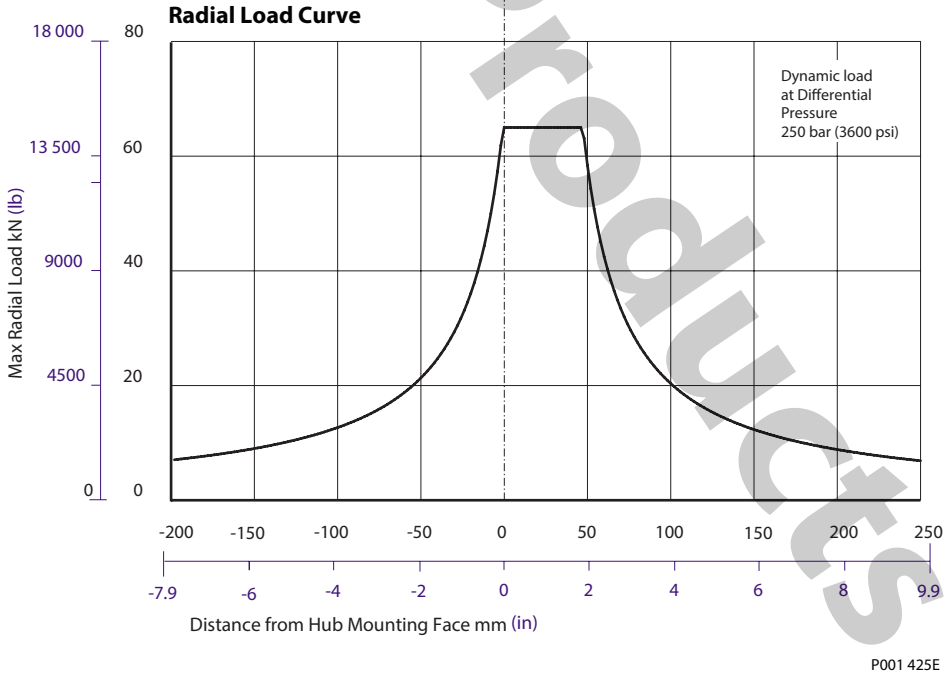
Rotation

Single Speed Motor		
	Port Flow	
Rotation	in	out
LH(CCW)	B	A
RH (CW)	A	B

Two Speed Motor Pref. Rotation: Right		
Rotation	in	out
LH(CCW)	A	B
RH (CW)	B	A

Two Speed Motor Pref. Rotation: Left		
Rotation	in	out
LH(CCW)	B	A
RH (CW)	A	B

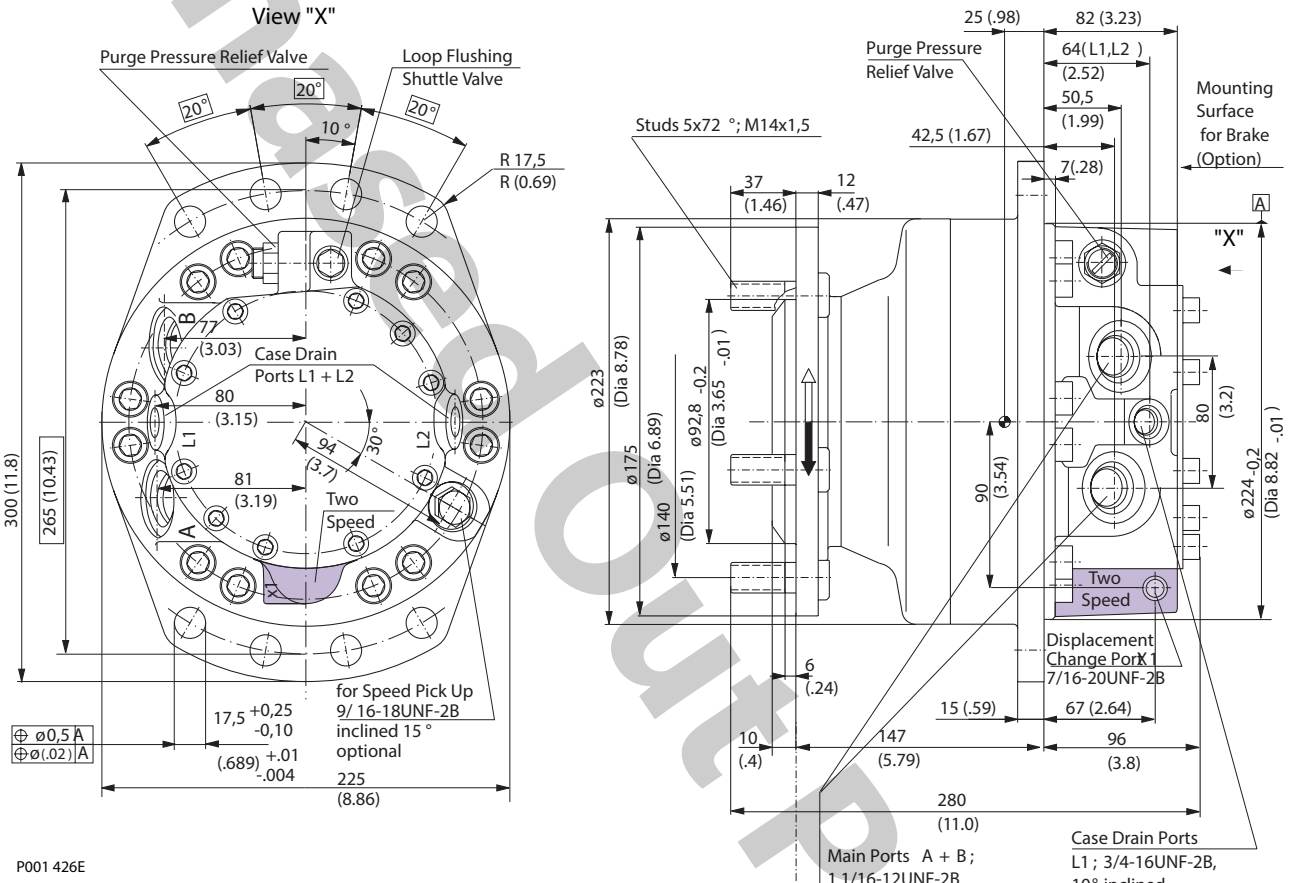
Radial Load Curve



P001 425E

Dimensions 60M0470 / 60V0470

Figure 16:
Flange Motor, 60M0470, Single Speed Version
Flange Motor, 60V0470, Two Speed Version



P001 426E

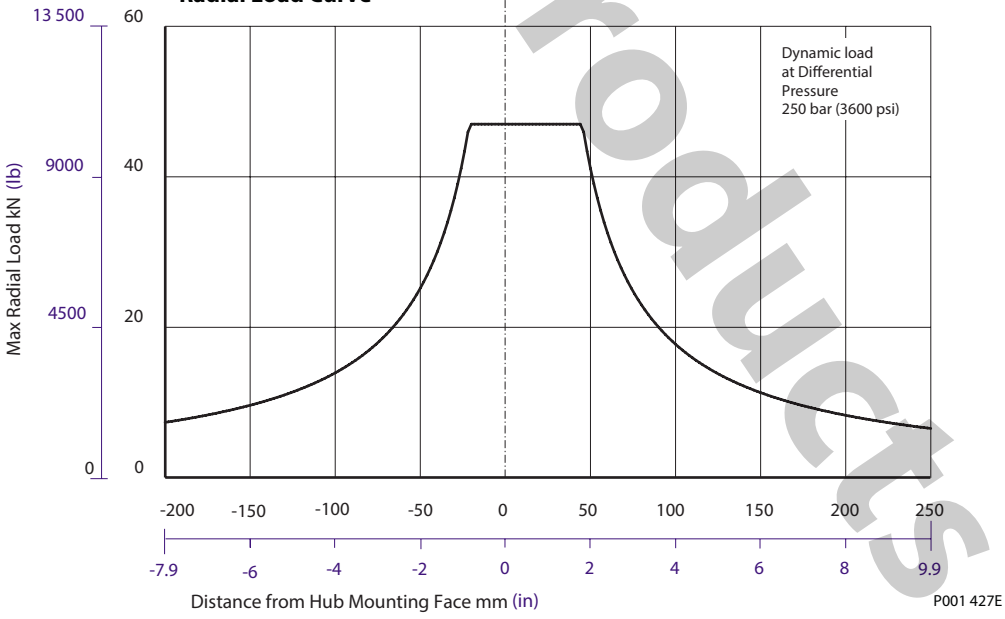
Rotation

Single Speed Motor	Port Flow	
Rotation	in	out
LH(CCW)	**B**	**A**
RH (CW)	**A**	**B**

Two Speed Motor Pref. Rotation: Right		
Rotation	in	out
LH(CCW)	**A**	**B**
RH (CW)	**B**	**A**

Two Speed Motor Pref. Rotation: Left		
Rotation	in	out
LH(CCW)	**B**	**A**
RH (CW)	**A**	**B**

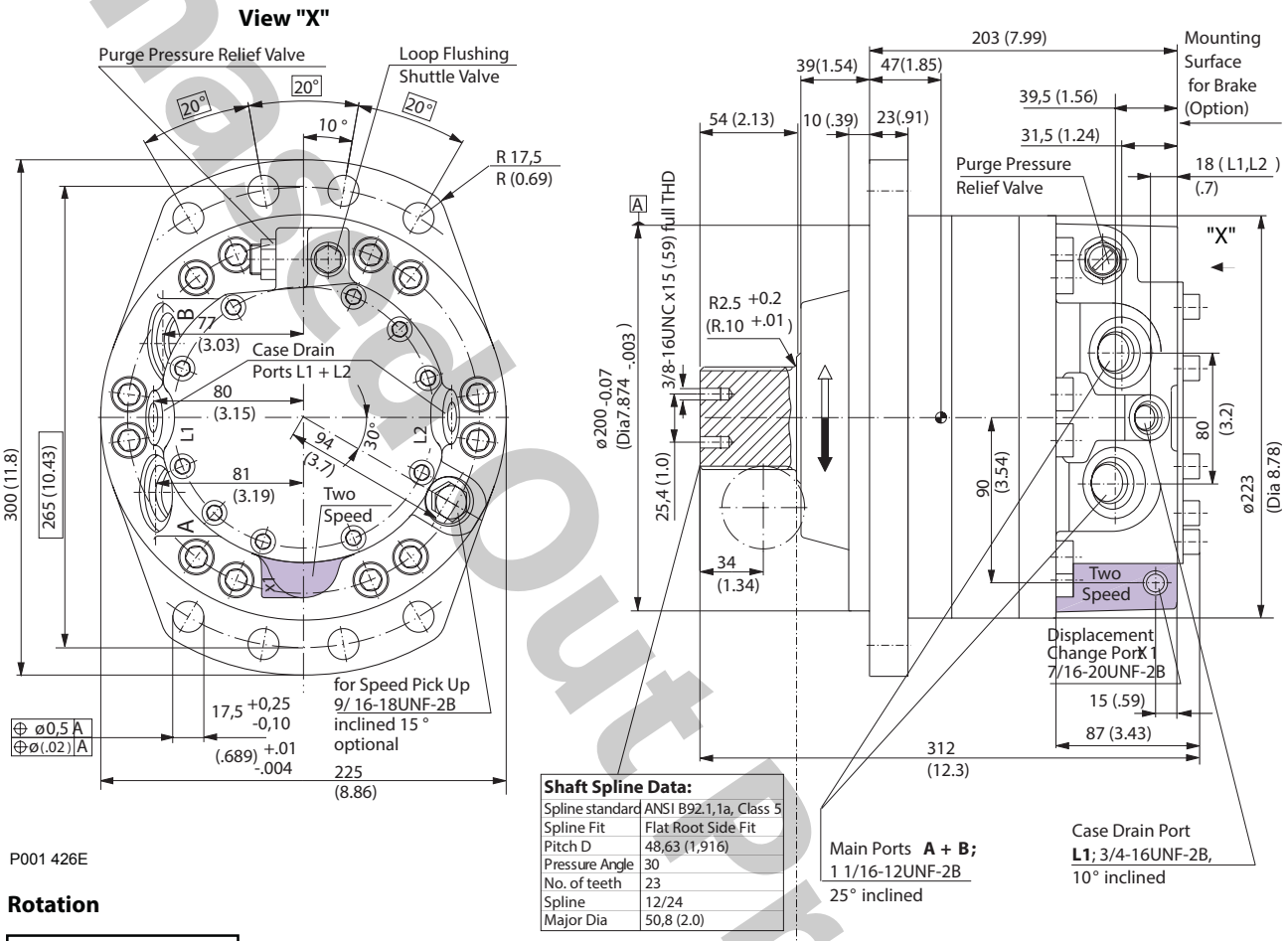
Radial Load Curve



P001 427E

Dimensions 60M0470 / 60V0470

Figure 17:
Shaft Motor 60M0470, Single Speed Version
Shaft Motor 60V0470, Two Speed Version



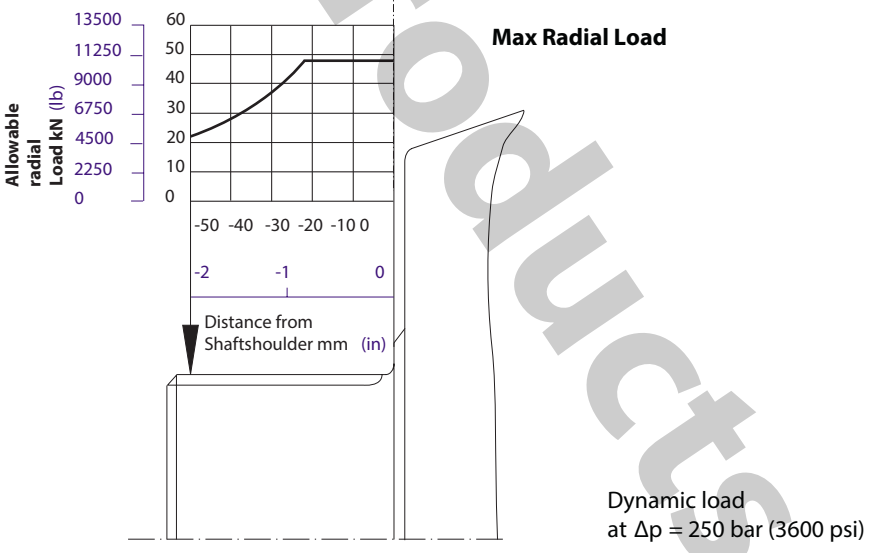
P001 426E

Shaft Spline Data:

Spline standard	ANSI B92.1,1a, Class 5
Spline Fit	Flat Root Side Fit
Pitch D	48,63 (1,916)
Pressure Angle	30
No. of teeth	23
Spline	12/24
Major Dia	50,8 (2.0)

Rotation

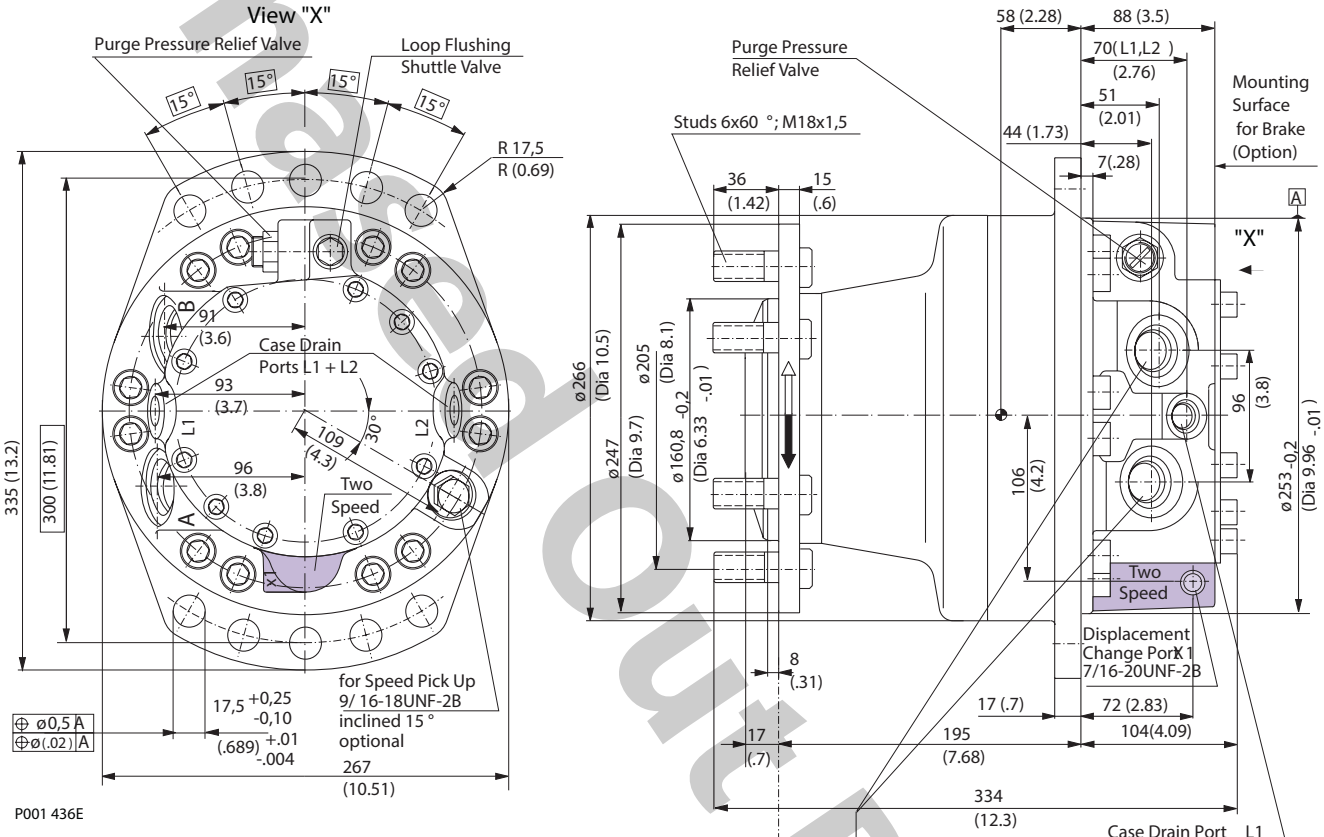
Single Speed Motor	Port Flow	
Rotation	in	out
LH(CCW)	**B**	**A**
RH (CW)	**A**	**B**
Two Speed Motor Pref. Rotation: Right		
Rotation	in	out
LH(CCW)	**A**	**B**
RH (CW)	**B**	**A**
Two Speed Motor Pref. Rotation: Left		
Rotation	in	out
LH(CCW)	**B**	**A**
RH (CW)	**A**	**B**



P001 428E

Dimensions 60M0780 / 60V780

Figure 18:
Wheel Motor 60M0780, Single Speed Version
Wheel Motor 60V0780, TwoSpeed Version



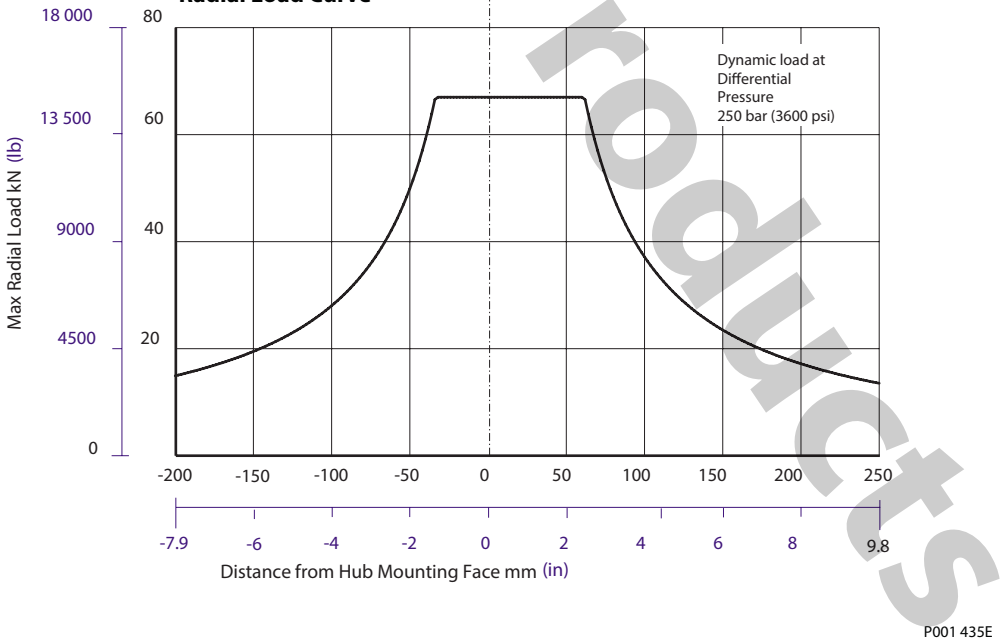
Rotation

Single Speed Motor		
	Port Flow	
Rotation	in	out
LH(CCW)	**B**	**A**
RH (CW)	**A**	**B**

Two Speed Motor Pref. Rotation: Right		
Rotation	in	out
LH(CCW)	**A**	**B**
RH (CW)	**B**	**A**

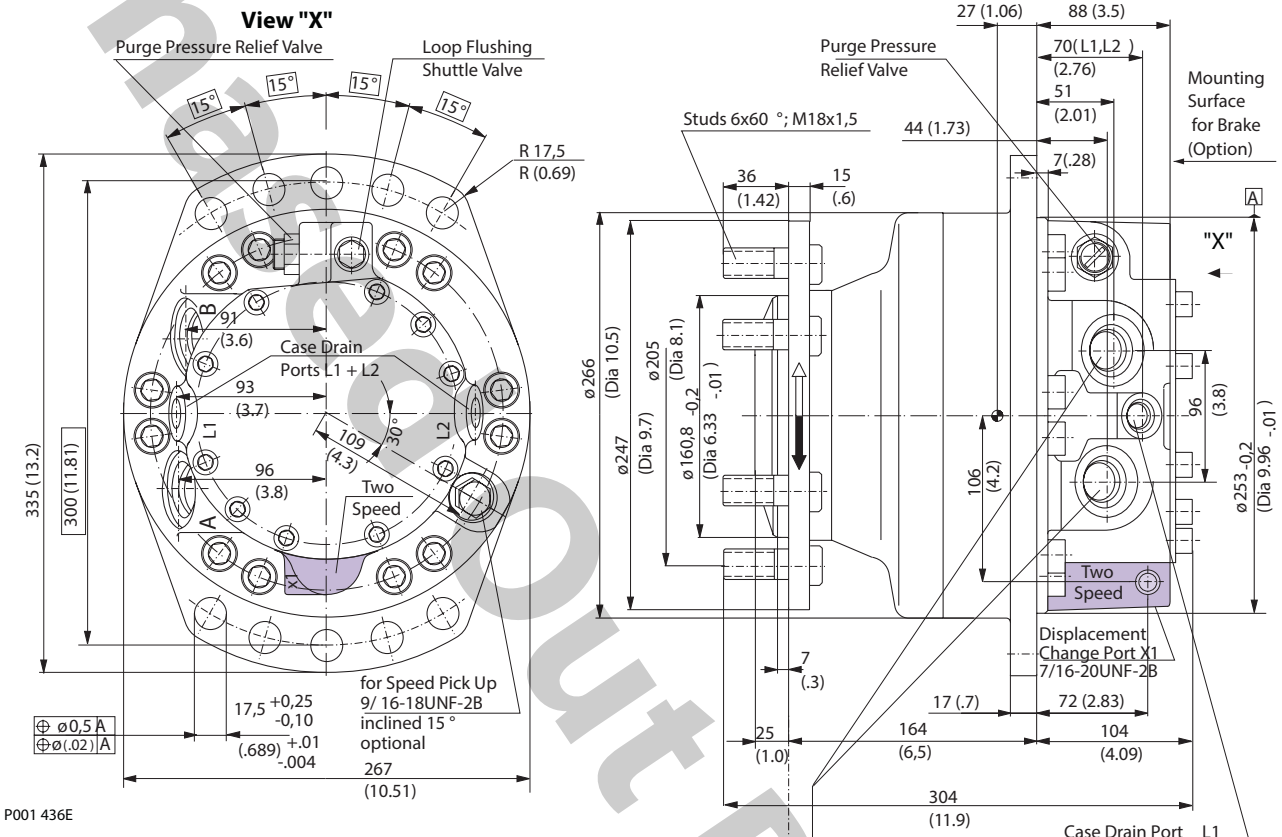
Two Speed Motor Pref. Rotation: Left		
Rotation	in	out
LH(CCW)	**B**	**A**
RH (CW)	**A**	**B**

Radial Load Curve



Dimensions 60M0780 / 60 V780

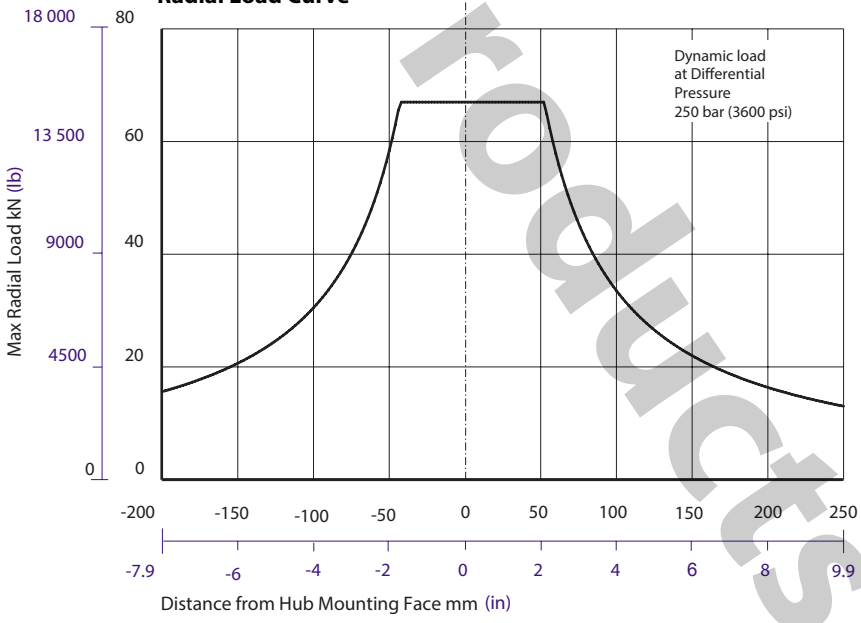
Figure 19:
Flange Motor 60M0780, Single Speed Version
Flange Motor 60V0780, Two Speed Version



Rotation

Single Speed Motor		
	Port Flow	
Rotation	in	out
LH(CCW)	**B**	**A**
RH (CW)	**A**	**B**
Two Speed Motor Pref. Rotation: Right		
Rotation	in	out
LH(CCW)	**A**	**B**
RH (CW)	**B**	**A**
Two Speed Motor Pref. Rotation: Left		
Rotation	in	out
LH(CCW)	**B**	**A**
RH (CW)	**A**	**B**

Radial Load Curve



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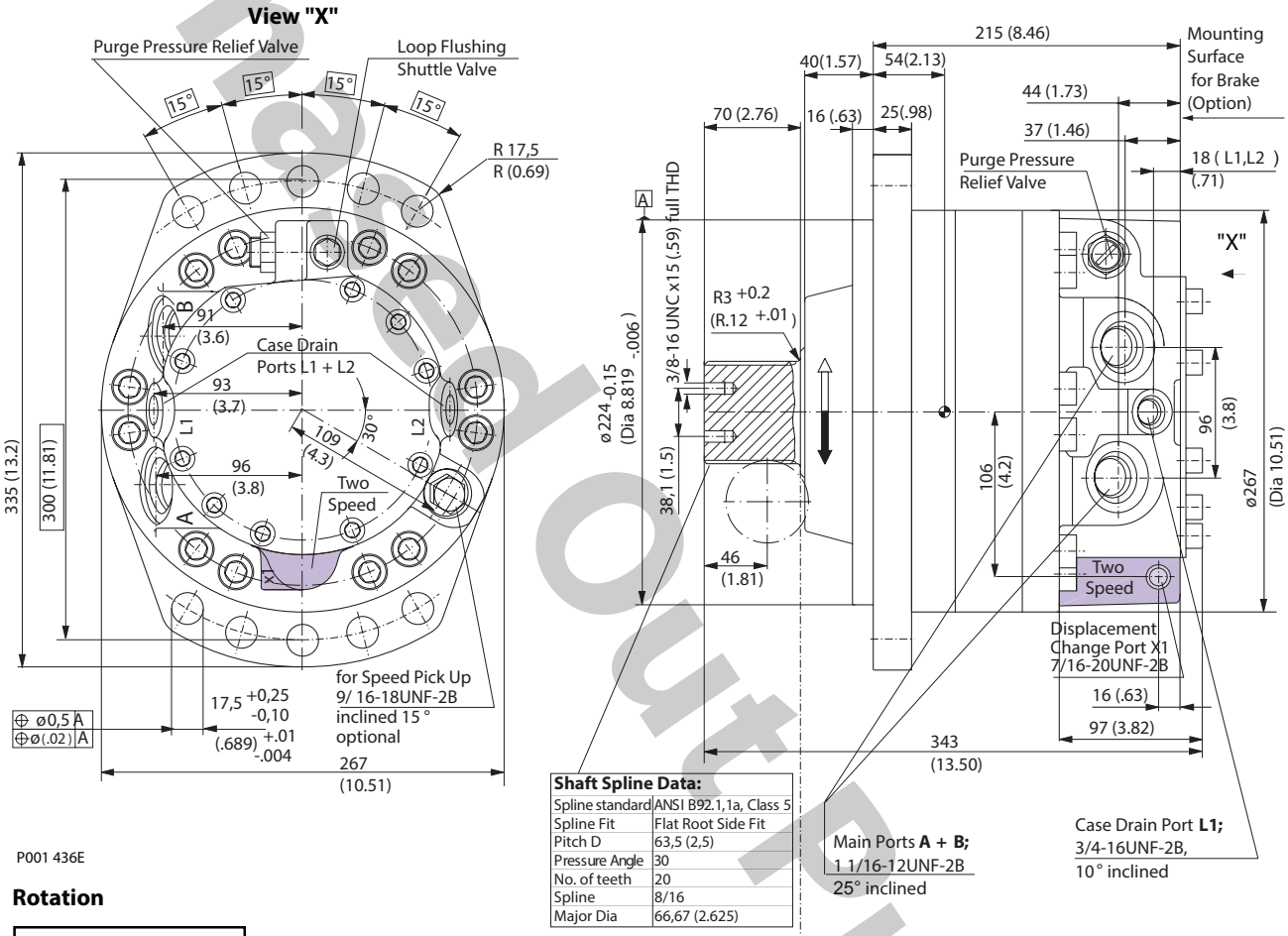
Dimensions 60M0780 / 60V780

Figure 20:
Shaft Motor 60M0780, Single Speed Version
Shaft Motor 60V0780, Two Speed Version

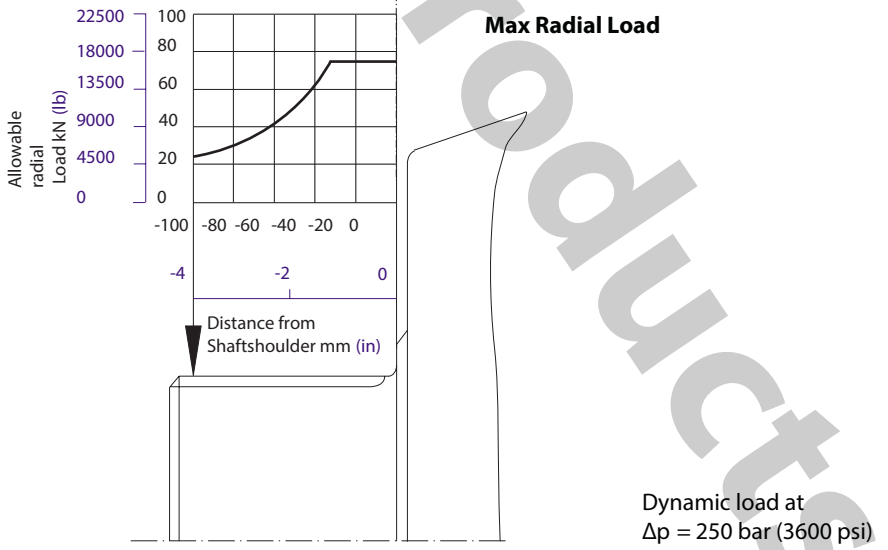


P001 436E

Shaft Spline Data:	
Spline standard	ANSI B92.1,1a, Class 5
Spline Fit	Flat Root Side Fit
Pitch D	63,5 (2,5)
Pressure Angle	30
No. of teeth	20
Spline	8/16
Major Dia	66,67 (2.625)

Rotation

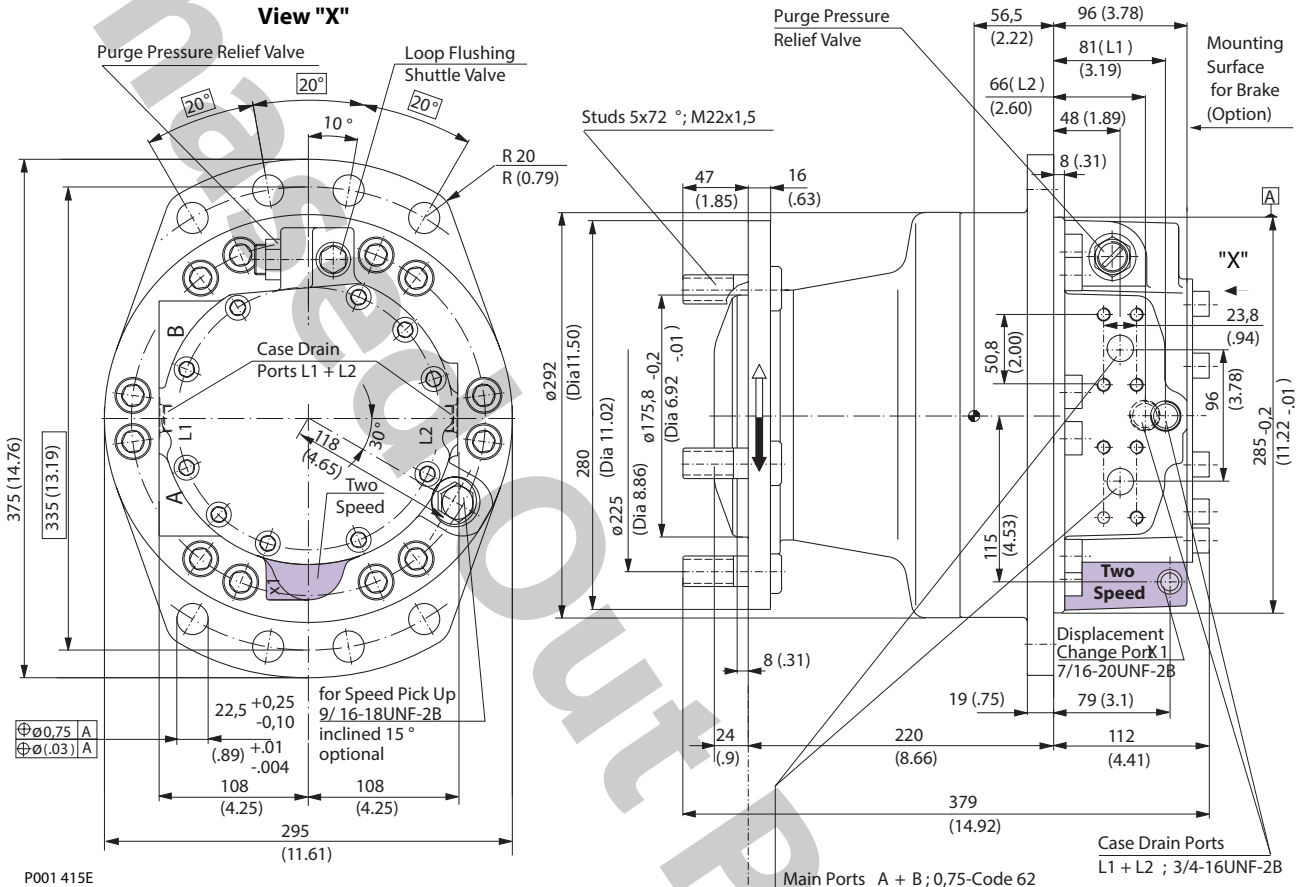
Single Speed Motor		
	Port Flow	
Rotation	in	out
LH(CCW)	**B**	**A**
RH (CW)	**A**	**B**
Two Speed Motor Pref. Rotation: Right		
Rotation	in	out
LH(CCW)	**A**	**B**
RH (CW)	**B**	**A**
Two Speed Motor Pref. Rotation: Left		
Rotation	in	out
LH(CCW)	**B**	**A**
RH (CW)	**A**	**B**



P001 438E

Dimensions 60M1048 / 60V1048

Figure 21:
Wheel Motor, 60M1048, Single Speed Version
Wheel Motor 60V0470, Two Speed Version



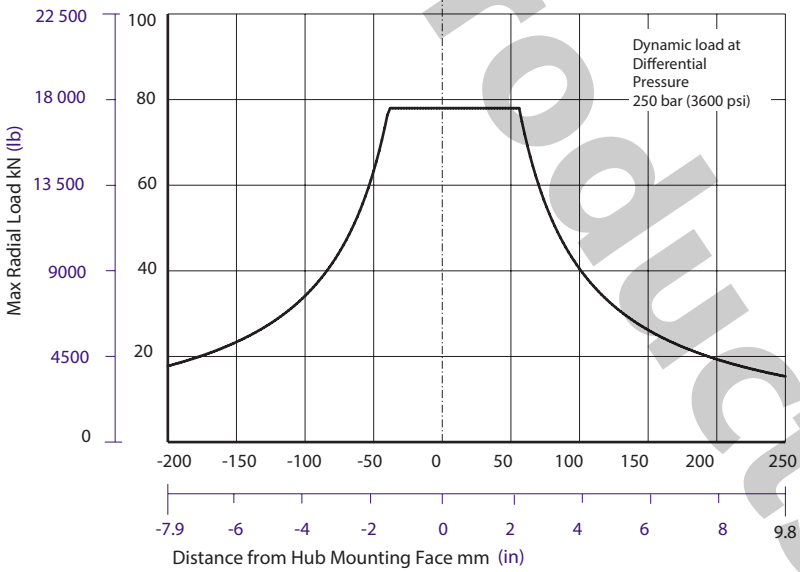
Rotation

Single Speed Motor		
	Port Flow	
Rotation	in	out
LH(CCW)	**B**	**A**
RH (CW)	**A**	**B**

Two Speed Motor Pref. Rotation: Right		
Rotation	in	out
LH(CCW)	**A**	**B**
RH (CW)	**B**	**A**

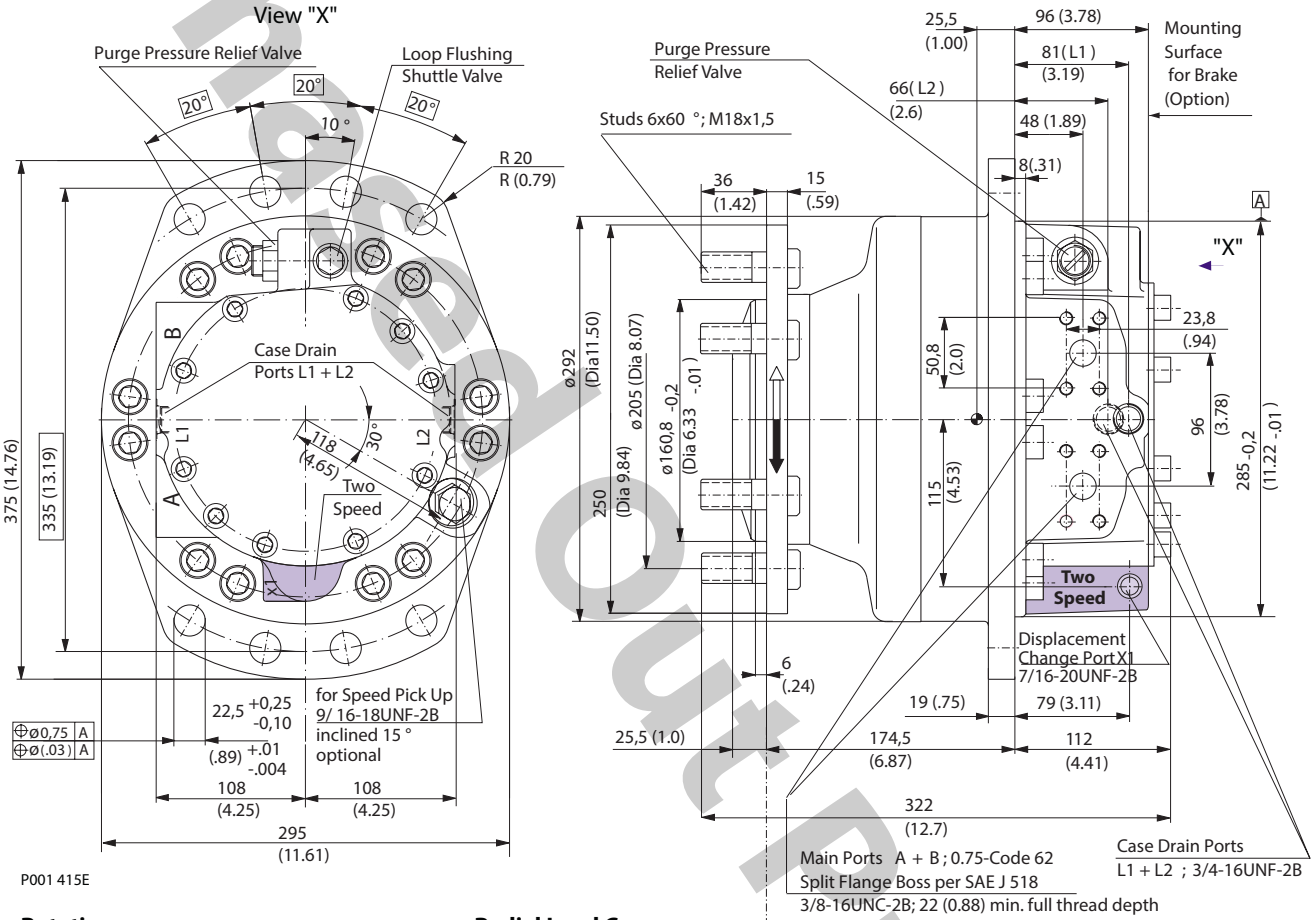
Two Speed Motor Pref. Rotation: Left		
Rotation	in	out
LH(CCW)	**B**	**A**
RH (CW)	**A**	**B**

Radial Load Curve



Dimensions 60M1048 / 60V1048

Figure 22:
Flange Motor, 60M1048, Single Speed Version
Flange Motor, 60V1048, Two Speed Version



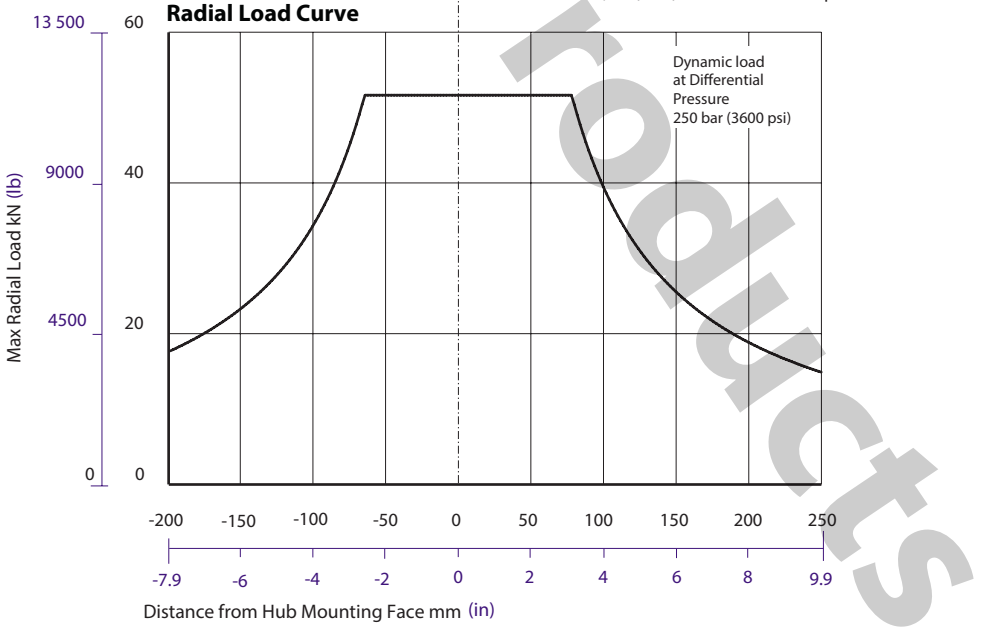
Rotation

Single Speed Motor		
	Port Flow	
Rotation	in	out
LH(CCW)	**B**	**A**
RH (CW)	**A**	**B**

Two Speed Motor Pref. Rotation: Right		
Rotation	in	out
LH(CCW)	**A**	**B**
RH (CW)	**B**	**A**

Two Speed Motor Pref. Rotation: Left		
Rotation	in	out
LH(CCW)	**B**	**A**
RH (CW)	**A**	**B**

Radial Load Curve



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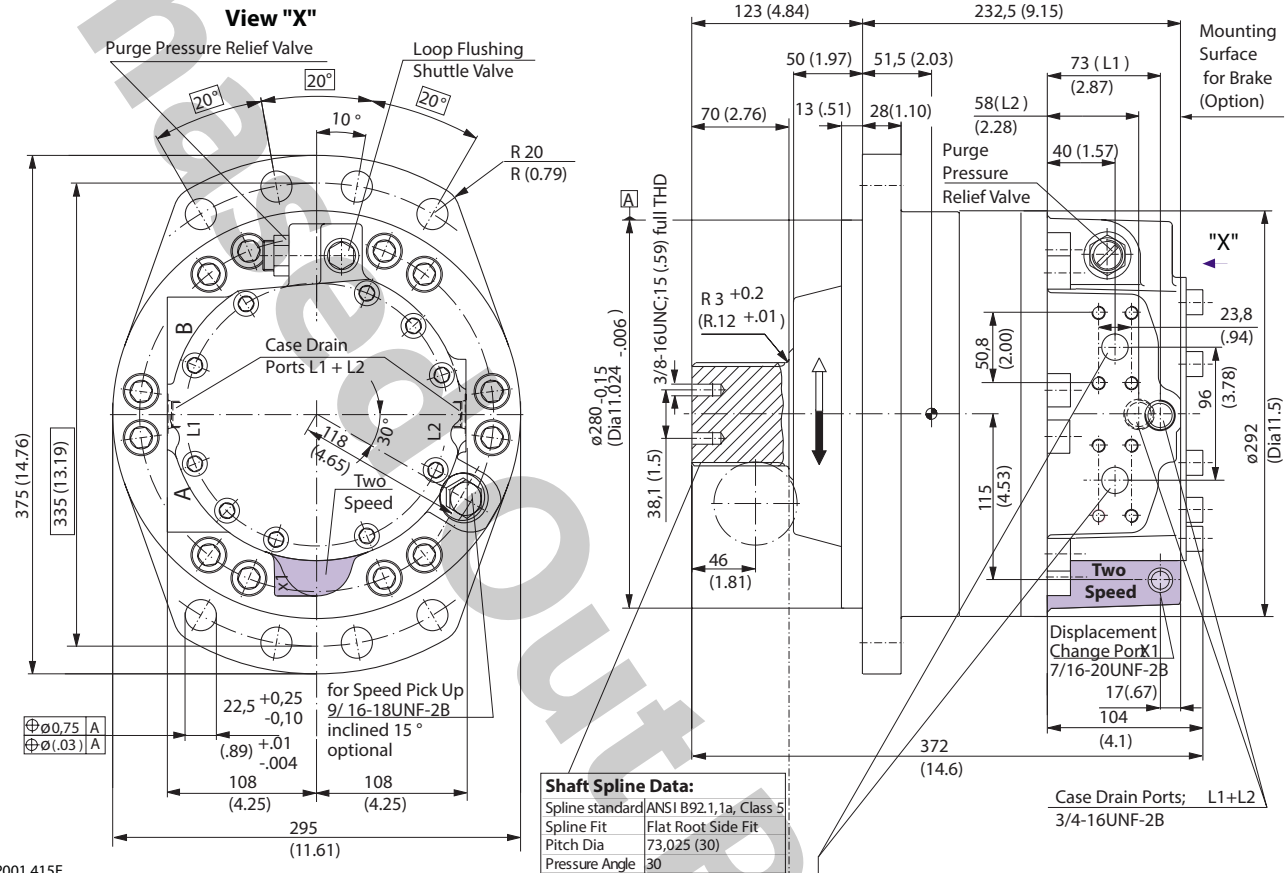
Dimensions 60M1048 / 60V1048

Figure 23:
Shaft Motor, 60M1048, Single Speed Version
Shaft Motor, 60M1048, Two Speed Version



P001 415E

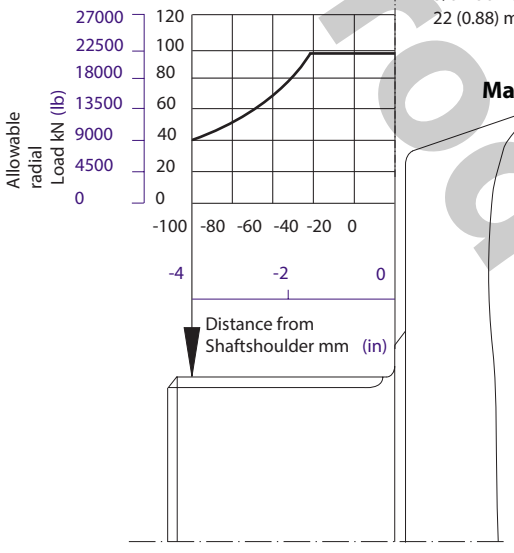
Shaft Spline Data:	
Spline standard	ANSI B92.1,1a, Class 5
Spline Fit	Flat Root Side Fit
Pitch Dia	73,025 (30)
Pressure Angle	30
No. of teeth	23
Spline	8/16
Major Dia	76,2 (3,0)

Rotation

Single Speed Motor	Port Flow	
Rotation	in	out
LH(CCW)	**B**	**A**
RH (CW)	**A**	**B**

Two Speed Motor Pref. Rotation: Right		
Rotation	in	out
LH(CCW)	**A**	**B**
RH (CW)	**B**	**A**

Two Speed Motor Pref. Rotation: Left		
Rotation	in	out
LH(CCW)	**B**	**A**
RH (CW)	**A**	**B**



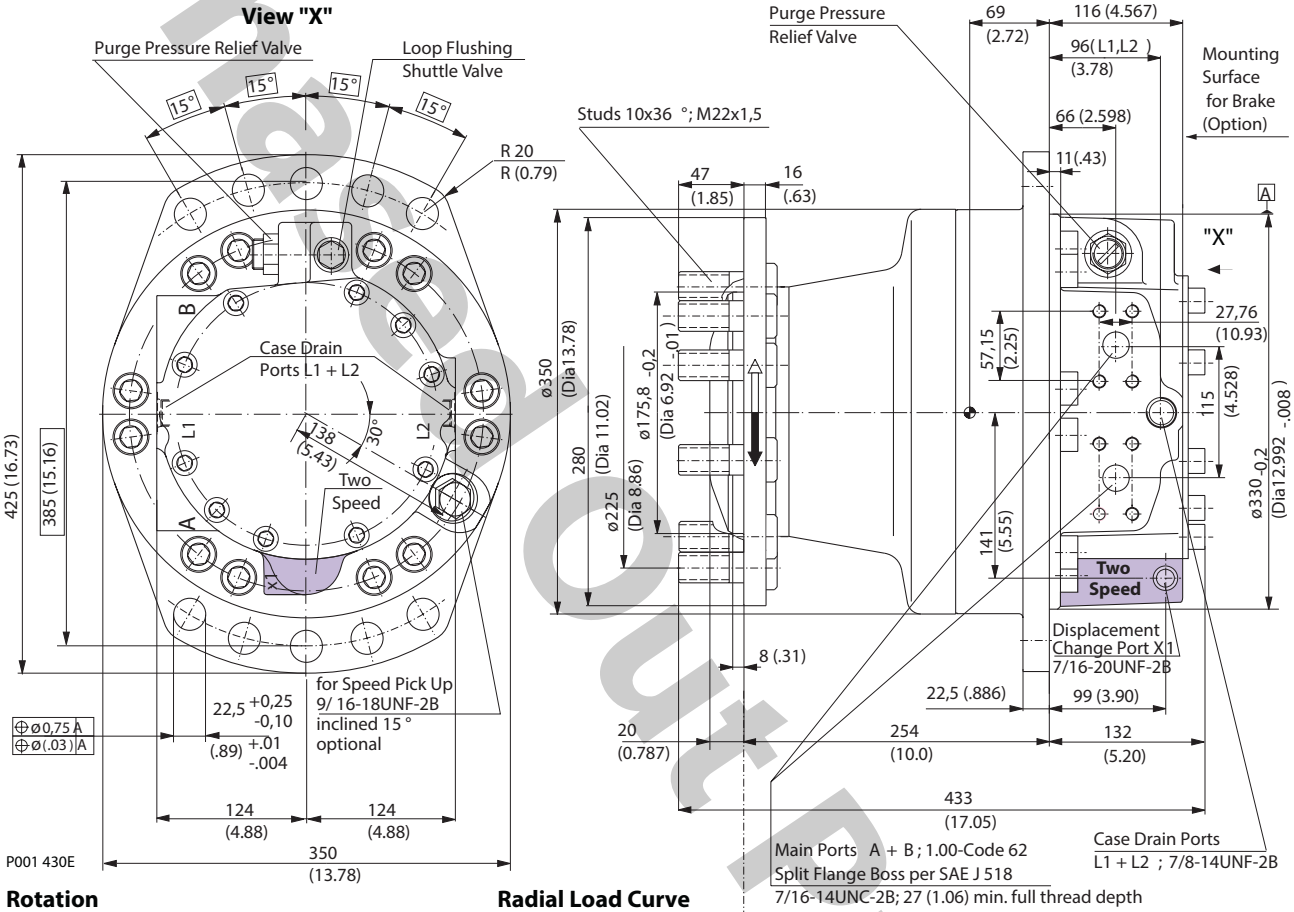
Max Radial Load

Dynamic load at Δp = 250 bar (3600 psi)

P001 417E

Dimensions 60M1750 / 60V1750

Figure 24:
Wheel Motor 60M1750, Single Speed Version
Wheel Motor 60V1750, Two Speed Version



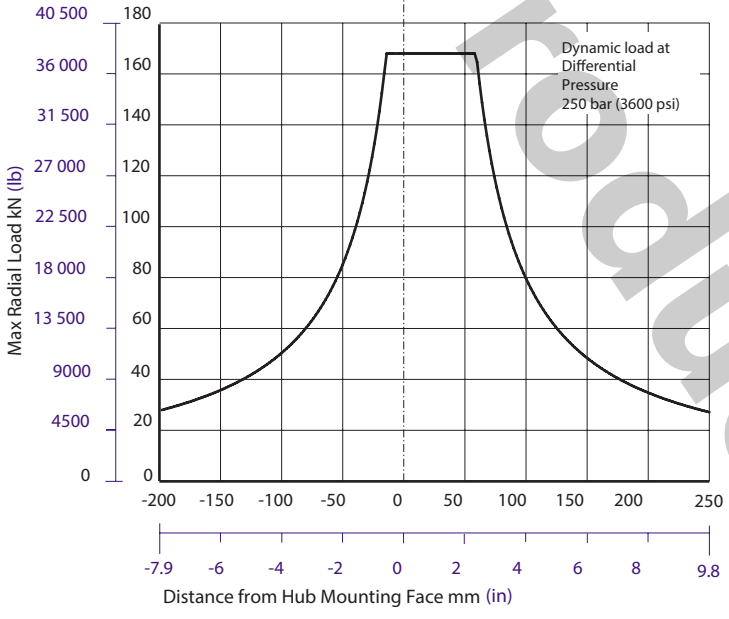
Rotation

Single Speed Motor		
	Port Flow	
Rotation	in	out
LH(CCW)	**B**	**A**
RH (CW)	**A**	**B**

Two Speed Motor Pref. Rotation: Right		
Rotation	in	out
LH(CCW)	**A**	**B**
RH (CW)	**B**	**A**

Two Speed Motor Pref. Rotation: Left		
Rotation	in	out
LH(CCW)	**B**	**A**
RH (CW)	**A**	**B**

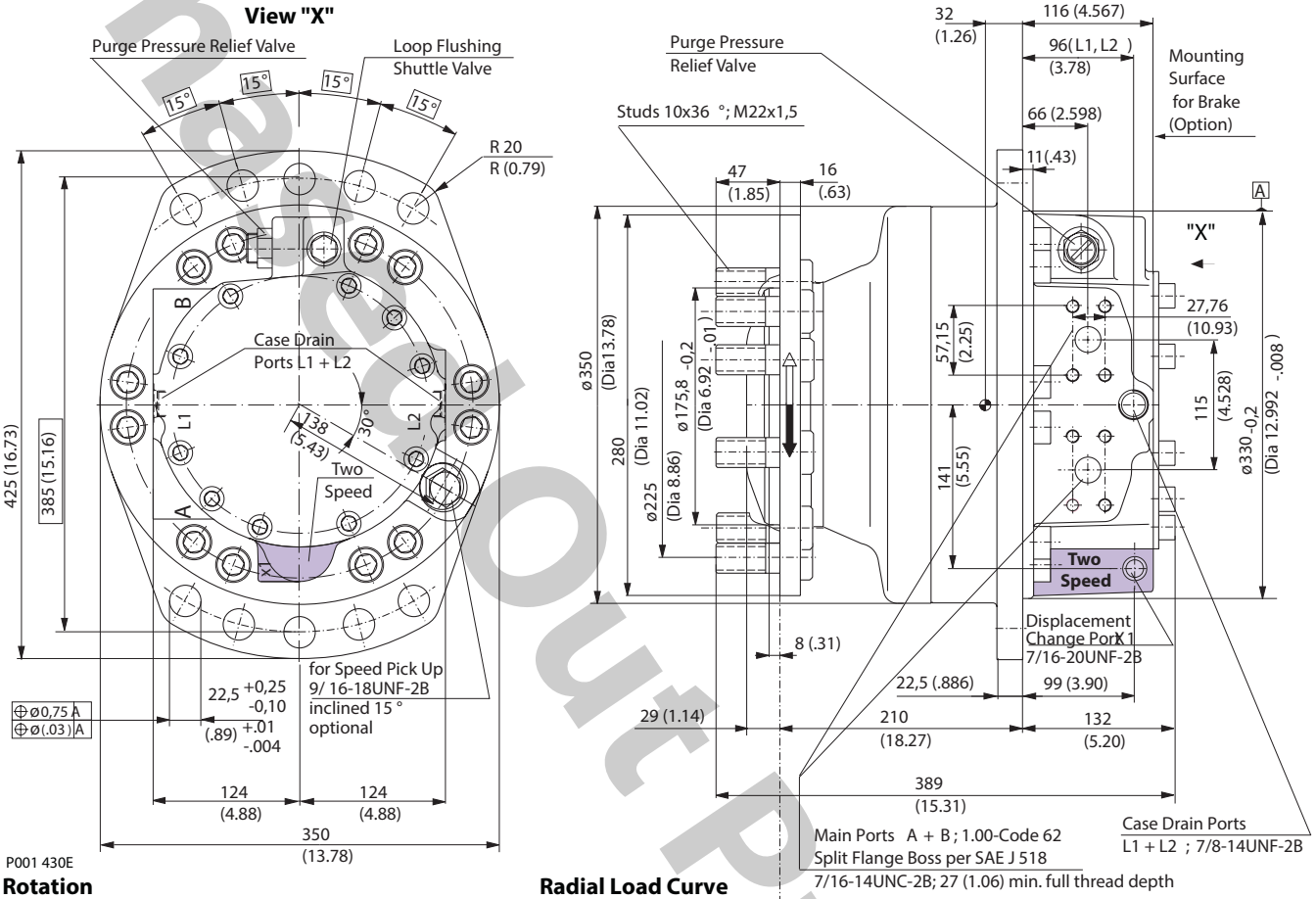
Radial Load Curve



P001 429E

Dimensions 60M1750 / 60V1750

Figure 25:
Flange Motor, 60M1750, Single Speed Version
Flange Motor, 60V1750, Two Speed Version



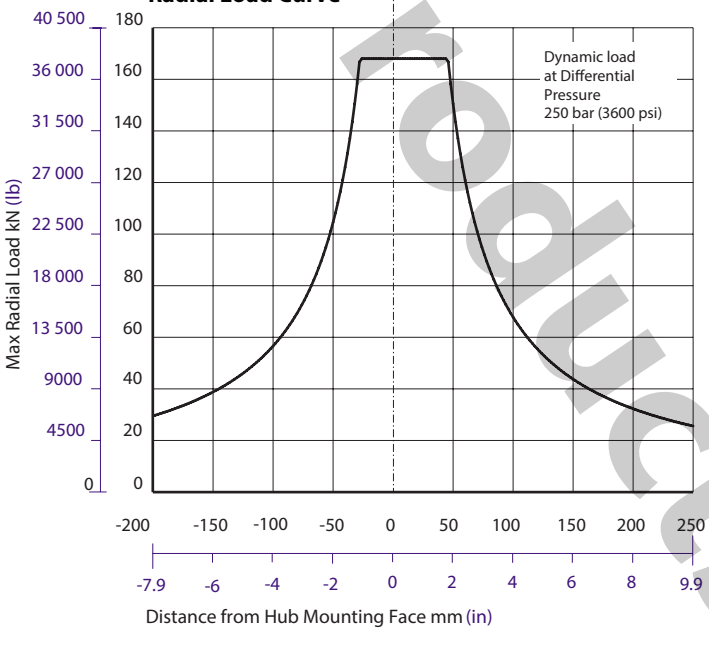
Rotation

Single Speed Motor	Port Flow	
Rotation	in	out
LH(CCW)	**B**	**A**
RH (CW)	**A**	**B**

Two Speed Motor Pref. Rotation: Right		
Rotation	in	out
LH(CCW)	**A**	**B**
RH (CW)	**B**	**A**

Two Speed Motor Pref. Rotation: Left		
Rotation	in	out
LH(CCW)	**B**	**A**
RH (CW)	**A**	**B**

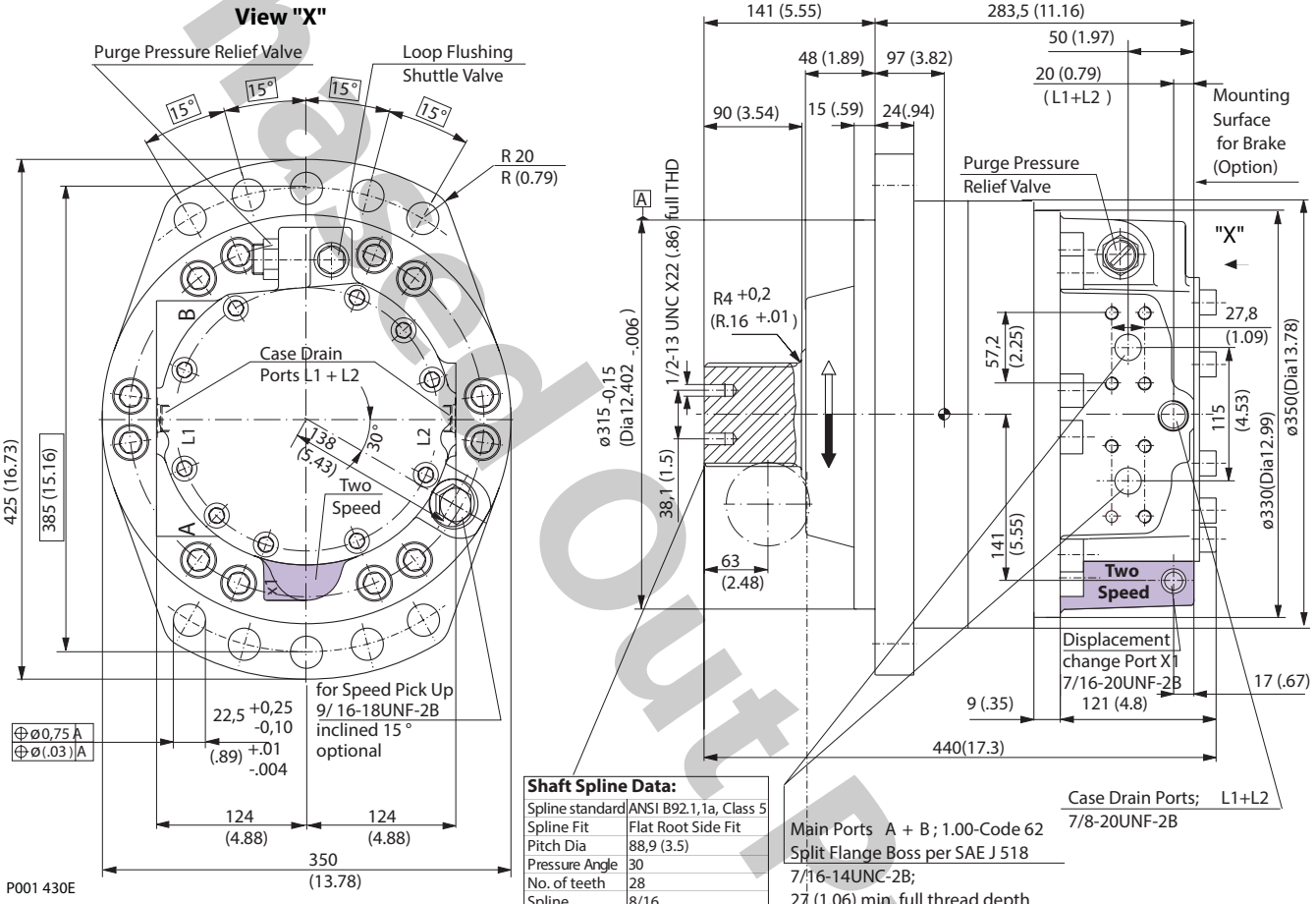
Radial Load Curve



P001 431E

Dimensions 60M1750 /60V1750

Figure 26:
Shaft Motor 60M1750, Single Speed Version
Shaft Motor 60V1750, Two Speed Version



Shaft Spline Data:

Spline standard	ANSI B92.1,1a, Class 5
Spline Fit	Flat Root Side Fit
Pitch Dia	88,9 (3.5)
Pressure Angle	30
No. of teeth	28
Spline	8/16
Major Dia	92.07 (3.625)

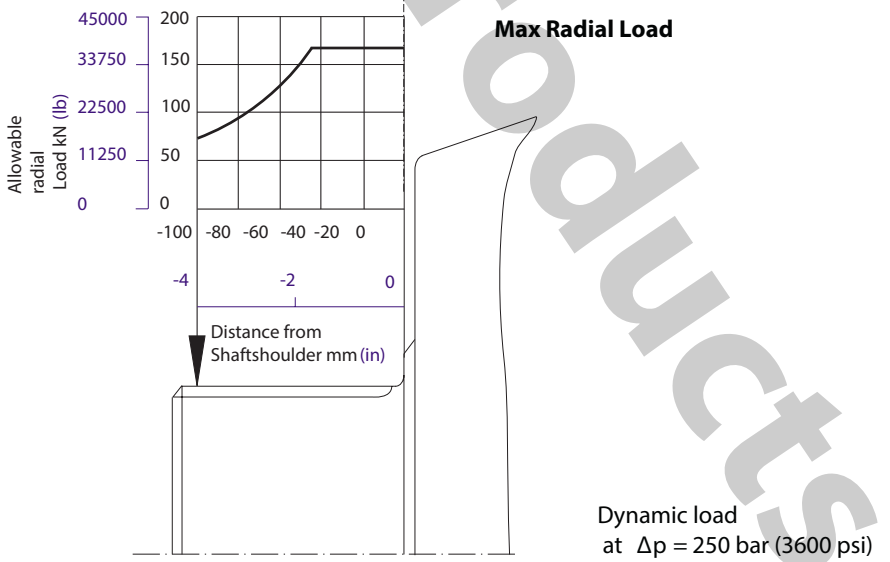
Rotation

Single Speed Motor	Port Flow	
Rotation	in	out
LH(CCW)	**B**	**A**
RH (CW)	**A**	**B**

Two Speed Motor Pref. Rotation: Right		
Rotation	in	out
LH(CCW)	**A**	**B**
RH (CW)	**B**	**A**

Two Speed Motor Pref. Rotation: Left		
Rotation	in	out
LH(CCW)	**B**	**A**
RH (CW)	**A**	**B**

Max Radial Load



Notes

Dimensions Brakes

Figure 27:
Radial Piston Motor with Brake (0ptional)

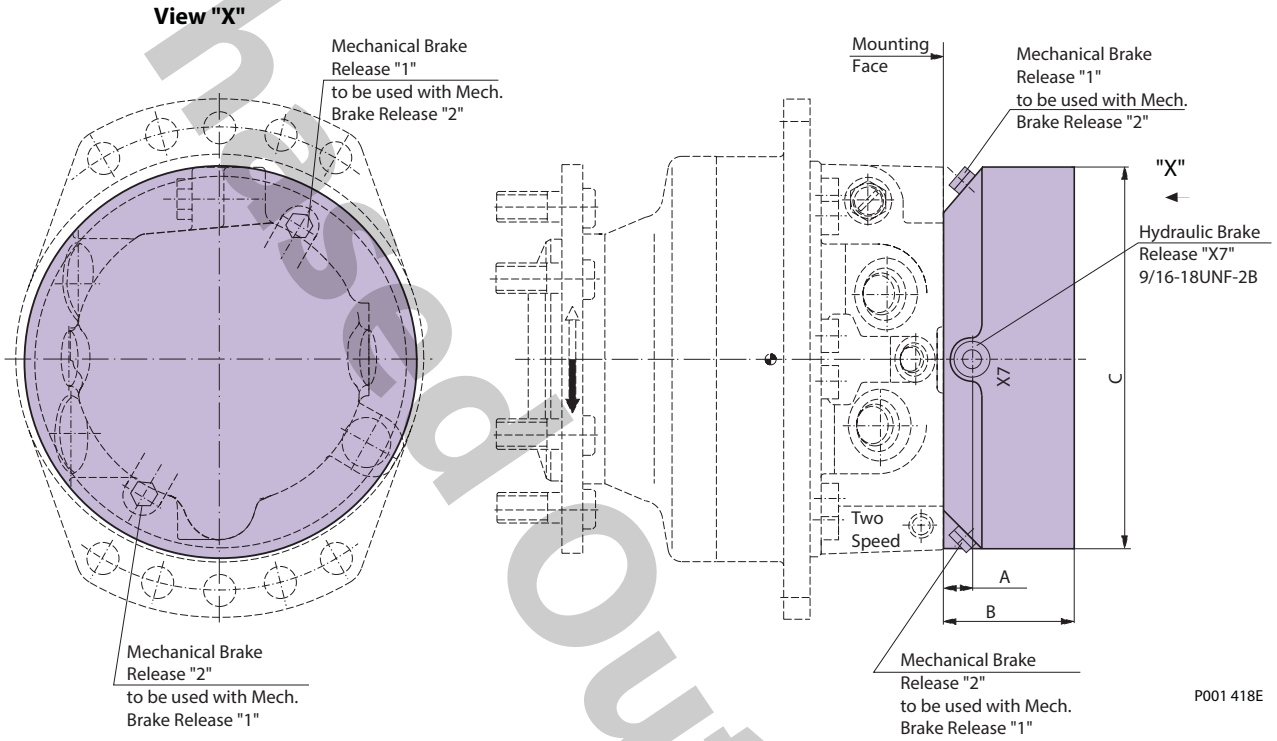
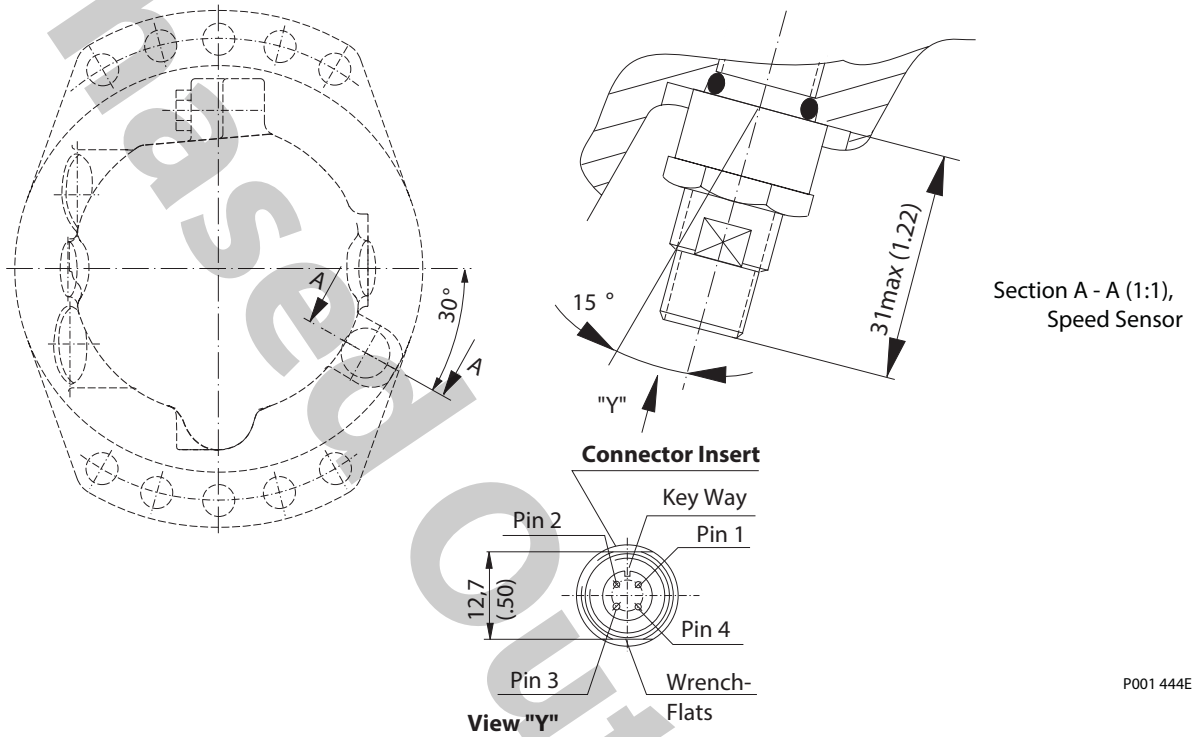


Table 6: Brake Dimensions

Series	Dimension		
	A	**B**	**C**
60M0470	23 (0.90)	74 (2.90)	ø212 (Dia 8.35)
60M0780	42 (1.65)	100 (3.94)	ø245 (Dia 9.65)
60M1048	30 (1.18)	90 (3.54)	ø280 (Dia 11.02)
60M1750	38 (1.47)	107 (4.21)	ø320 (Dia 12.60)

Dimensions Speed Sensor

Figure 28:
Radial Piston Motor with Speed Sensor (0ptional)



Electrical details see page12.

Table 7: Speed Sensor Connector

Connecto	Id.No.
Straight	500724
Right angle	500725

Connector is not supplied with the motor.
Please order separatly using above Id. No.

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