

XJ40

RADIAL PISTON MOTOR



You are at the **centre**
of everything we do



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ABOUT US

Rotary Power specialises in the design, development and manufacture of hydraulic motors and pumps.

With a history dating back over 50 years, we understand the exacting and demanding requirements of today's hydraulic applications.

Operating from 18,000 sq. m. of purpose built manufacturing facilities, based in the North East of England and Bangalore, India, we continue to invest in the latest CNC machinery, automation and testing facilities. We have a clear focus on continuous improvement in lean cellular manufacturing. These facilities, alongside our European and US operations, offer sales, service and production support for the entire Rotary Power product range. A worldwide network of distribution partnerships provide additional support all over the world.

OUR BUSINESS

We recognise the importance of developing partnerships with our customers. That's why we offer flexibility in design, delivery and service to meet our customer's requirements.

Partnerships with our supply chain are key to Rotary Power's success and allow us to deliver excellent service in order to exceed expectations.

OUR PEOPLE

People are at the centre of everything we do. As an innovative engineering and manufacturing business we take recruitment and career development very seriously.

As part of the British Engines Group, we operate a training and development programme that maintains a strong focus on in-house manufacturing and a commitment to local employment. Our apprenticeship and graduate schemes provide the opportunity to develop and nurture engineering talent from an early stage.

OUR FUTURE

Whether in product design or internal processes and systems, our engineers are actively encouraged to develop new ideas within design and manufacturing. This ensures that we are at the forefront of customer and sector led innovation, whilst continuously improving our business.

Our team of in-house design engineers invest time into understanding our customer's application and work with them to deliver value added solutions, customised to their application.



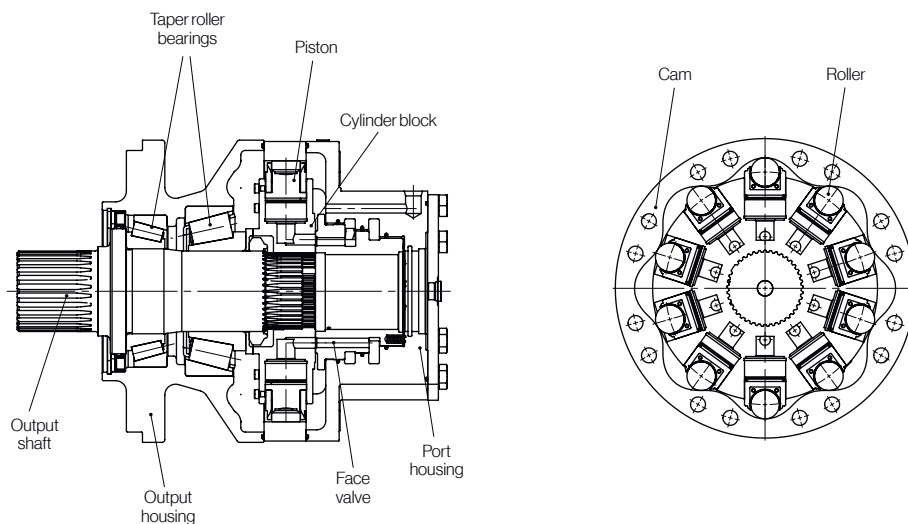
XJ RANGE

The XJ range of hydraulic motors offer displacements from 260 to 5,010 cc/rev. The XJ05 is the smallest of the range with displacements from 260 to 565 cc/rev, complemented by the larger XJ20 and XJ40 motors extending the displacement range to 2,505 and 5,010 cc/rev.

The XJ motor has a range of features and options designed to suit your specific application:

- Radial piston, multi-stroke operation
- Modular design
- Two speed options
- Parking brake options
- Freewheel capability
- Multiple mounting arrangements
- 350 bar continuous pressure
- Fast delivery options

The motor is designed with a rotating cylinder block connected to the drive shaft, which is mounted in taper roller bearings within the motor housing. This offers a high radial and axial load carrying capacity.



The pistons are located radially within the bores of the cylinder block. When oil is fed under pressure through the face valve and into the cylinder block, the pistons attempt to move outwards. The rollers react on the incline of the cam profile and this action produces rotation of the cylinder block.

The rate of flow to the motor will determine the speed at which the piston moves out against the cam ring and consequently the rotational speed of the motor. Once the power stroke is complete, the pistons return into the bore by the action of the reverse cam slope, ready for the next pressure cycle.

With units operating all over the world in a variety of applications including industrial, mobile and marine, the XJ range offers real application options for the future.

PRODUCT FEATURES

Fluids	HL; HLP to DIN 51524 Other specified fluids are possible.
Normal operating viscosity range	20 to 200 cSt
Maximum intermittent viscosity range	10 to 2,000 cSt
Normal operating temperature range	+15° to +70° C [+59°F to +158°F]
Maximum intermittent temperature range	-20° to +80° C [-4°F to +176°F]
Fluid cleanliness	NAS 1638 class 9 / ISO code 18/15

FIRST DISPLACEMENT

Displacement option	A	B	C	D	E
Geometric displacement (cc/rev) [in ³]	3,332 [203.3]	3,768 [229.9]	4,184 [255.3]	4,602 [280.8]	5,010 [305.7]
Specific torque (Nm/bar) [lbf.ft/psi]	53.0 [2.6]	60.0 [3.0]	66.6 [3.4]	73.2 [3.8]	79.8 [4.0]
Max. continuous speed (rpm)	100	90	85	80	70
Max. continuous power (kW) [hp]	110 [147.5]	110 [147.5]	110 [147.5]	110 [147.5]	110 [147.5]
Max. continuous pressure (bar) [psi]	350 [5,076]	350 [5,076]	350 [5,076]	350 [5,076]	350 [5,076]
Max. pressure (bar)* [psi]	450 [6,527]	450 [6,527]	450 [6,527]	450 [6,527]	450 [6,527]

SECOND DISPLACEMENT

Nominal displacement (cc/rev)	A	B	C	D	E
Geometric displacement (cc/rev) [in ³]	1,666 [101.7]	1,884 [115]	2,092 [127.6]	2,301 [140.4]	2,504 [152.8]
Specific torque (Nm/bar) [lbf.ft/psi]	26.5 [1.4]	30 [1.6]	33.3 [1.8]	36.6 [2.0]	39.9 [2.0]
Max. continuous speed (rpm)	125	115	110	100	85
Max. continuous power (kW) preferred direction [hp]	73 [97.9]	73 [97.9]	73 [97.9]	73 [97.9]	73 [97.9]
Max. continuous power (kW) non-preferred direction [hp]	55 [73.8]	55 [73.8]	55 [73.8]	55 [73.8]	55 [73.8]
Max. continuous pressure (bar) [psi]	350 [5,076]	350 [5,076]	350 [5,076]	350 [5,076]	350 [5,076]
Max. pressure (bar)* [psi]	450 [6,527]	450 [6,527]	450 [6,527]	450 [6,527]	450 [6,527]

*Maximum values should only be applied for a small portion of the duty cycle.



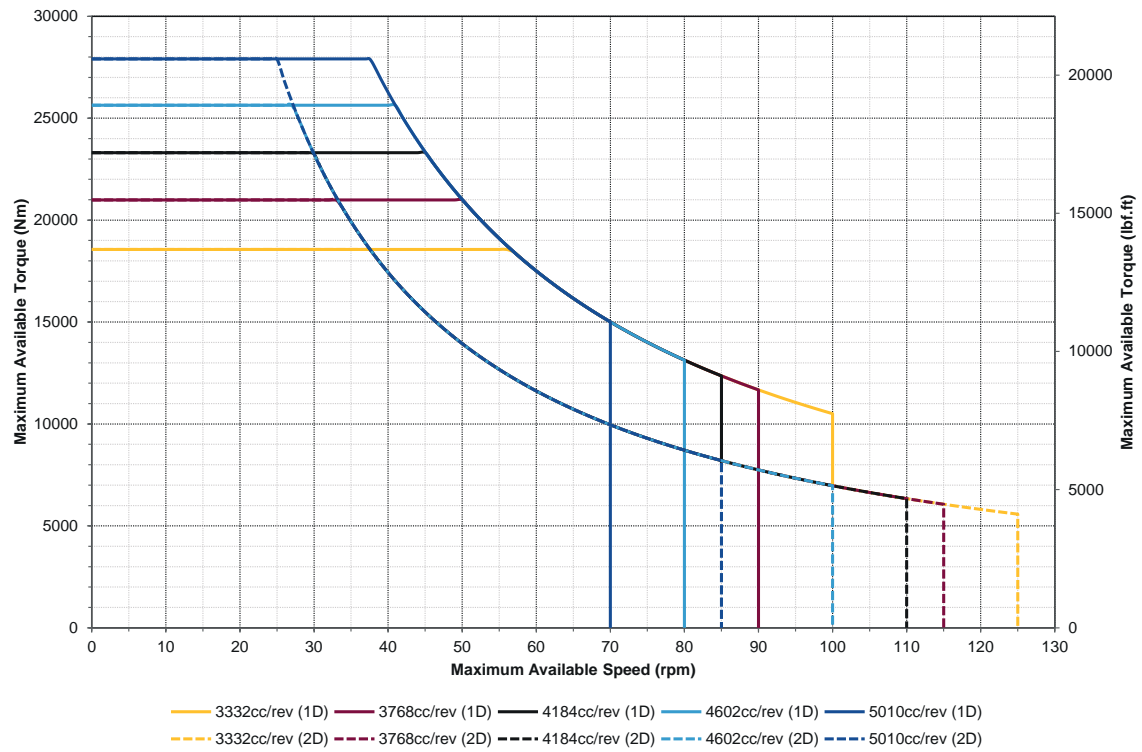
Weight of motor without oil



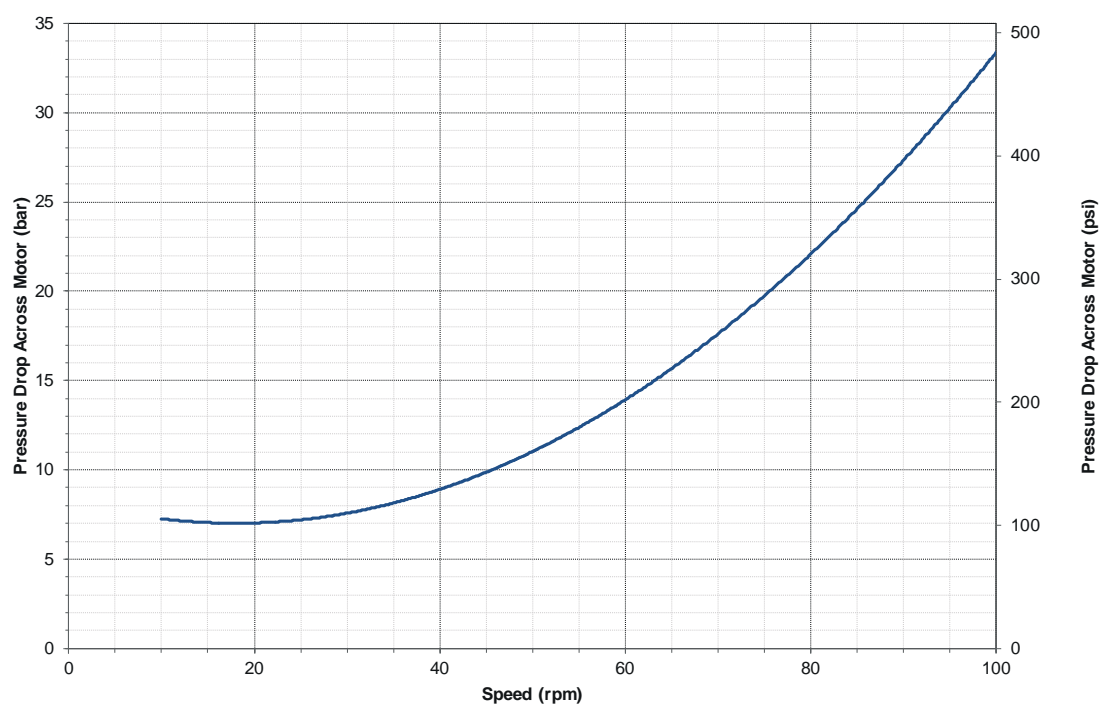
Sizes are listed in mm, inches shown in brackets

QUICK SELECTION DIAGRAM

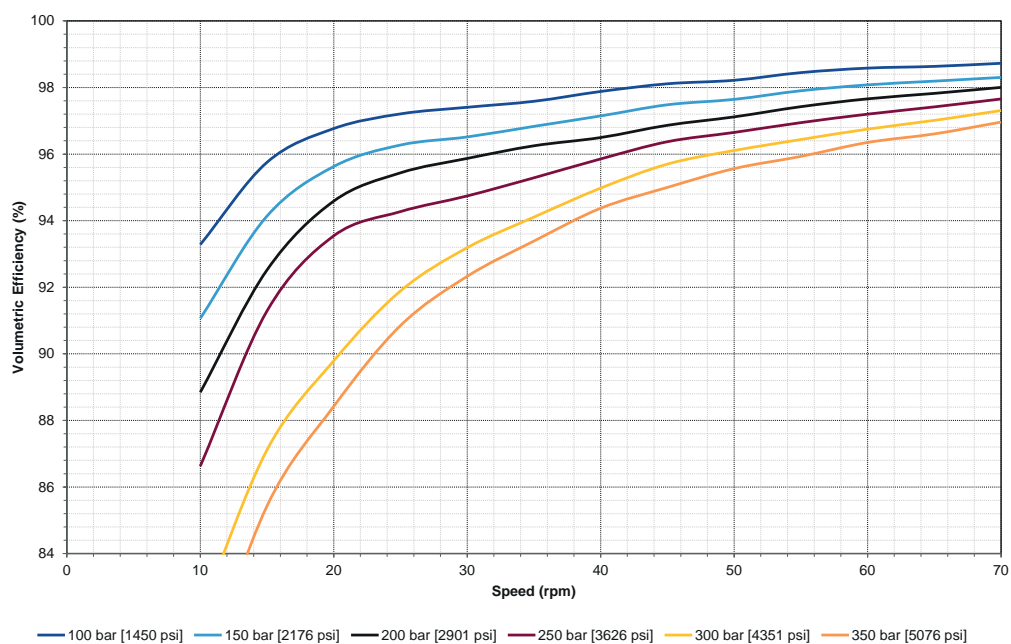
Based on your torque and speed requirements, the diagram below can be used to help determine which cam size best suits your application. Shown for both maximum displacement (1D) and minimum displacement (2D), the diagram outlines the limits of the motor based on its continuous power rating.



NO LOAD PRESSURE DROP

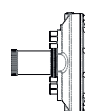
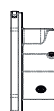
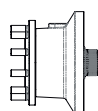


VOLUMETRIC EFFICIENCY



All performance graphs plotted for maximum displacement (5,010 cc/rev) using ISO46 fluid at 50°C.

MOTOR ORDER CODE



PRODUCT
01

CAM
02

FRONT MODULE

03	04	05	06	07

PORT MODULE

08	09	10	11	12

REAR BRAKE

13

OPTIONS

14	15	16

SPECIALS

17
00

DESIGN
18

18
A2

PRODUCT

01	XJ40	Radial piston motor
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CAM - DISPLACEMENT

02	A	3,332 cc/rev
	B	3,768 cc/rev
	C	4,184 cc/rev
	D	4,602 cc/rev
	E	5,010 cc/rev

FRONT MODULE - CASE STYLE

03	T	Torque unit
	S	Shaft motor front case flange
	W	Wheel motor no case flange

FRONT MODULE - OUTPUT SHAFT

04	N	No shaft (torque unit DIN 5480 N85 x 2 x 30 x 41 x 9H spline)
	C	Keyed shaft - Ø100
	E	Splined shaft DIN 5480 - W120 x 5 x 30 x 22 7h
	Q	Wheel output 10 off, Ø335 PCD, Ø280 spigot

FRONT MODULE - OUTPUT FITTINGS








05	N	None (torque unit or shaft motor)
	A	Wheel flange with studs fitted - standard
	B	Wheel flange with studs and nuts fitted
	F	Wheel flange with through holes
	H	Wheel flange with tapped holes

FRONT MODULE - SHAFT SEAL CONFIGURATION

06	1	Standard
	2 (WHEEL MOTORS ONLY)	Mechanical face seal

FRONT MODULE - FRONT BRAKE

07	N	No brake (standard)
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PRODUCT 01	CAM 02	FRONT MODULE 03 04 05 06 07	PORT MODULE 08 09 10 11 12	REAR BRAKE 13	OPTIONS 14 15 16	SPECIALS 17	DESIGN 18
XJ40						00	A2

PORT MODULE - MOUNTING FLANGE

08	N	No flange (torque units and shaft motors)
	L	Lug fixing flange (wheel motors only)

PORT MODULE - SPEED AND ROTATION

09	1R	Single speed - flow port A = CW rotation
	1L	Single speed - flow port A = ACW rotation
	RA	Two speed (Ratio 2:1) - flow port A = CW preferred rotation
	LA	Two speed (Ratio 2:1) - flow port A = ACW preferred rotation

PORT MODULE - HYDRAULIC CONNECTIONS (SEE PAGE 16 FOR PORT DESIGNATIONS)

10	0	No port block
	1 (XJ40 HOUSING ONLY)	ISO 6162 DN 32. All other ports SAE J514 (standard)
	6 (XJ40 HOUSING ONLY)	ISO 6162 DN 25. All other ports ISO 9947-1
	5 (XJ20 HOUSING ONLY)	ISO 6162 DN 32. All other ports SAE J514
	2 (XJ20 HOUSING ONLY)	ISO 6162 DN 19. All other ports ISO 9947-1

PORT MODULE - ADDITIONAL CIRCUIT VALVING

11	N	None
	B	Purge and relief valve with standard orifice (1.5 mm)

PORT MODULE - SPEED SENSOR

12	N	None
	S	Speed sensor port in port housing (M12 X 1.0p)
	T	Speed sensor port in port housing (incl. sensor)
	U	Speed sensor port in port housing (incl. sensor and connector)

REAR BRAKE

13	N	None
	P	"P" parking brake (21 kNm)

OPTIONS

14 15 16	0	None
	A	Strengthened port housing cover with side drain port
	B	Face valve with round porting
	G	Special paint (specify RAL number)
	P	Shaft-up vent port
	V	Viton seal material

SPECIALS

17	00	Specials (Rotary Power specified)
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DESIGN SERIES

18	A2	Design series (Rotary Power specified)
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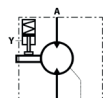
TORQUE UNIT

SINGLE SPEED OPTION

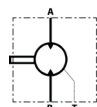
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XJ40		03	04	05	06	07	08	09	10	11	12		14	15	16	00	A2
		T	N	N	1	N	N		1	N	N						

(For models shown below)

 162 kg [357 lb] with P brake



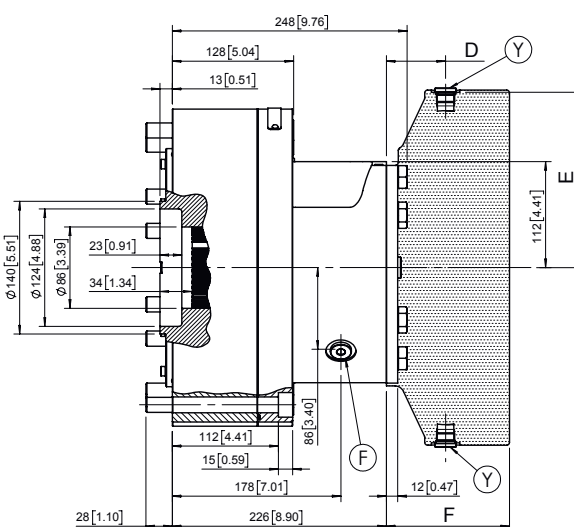
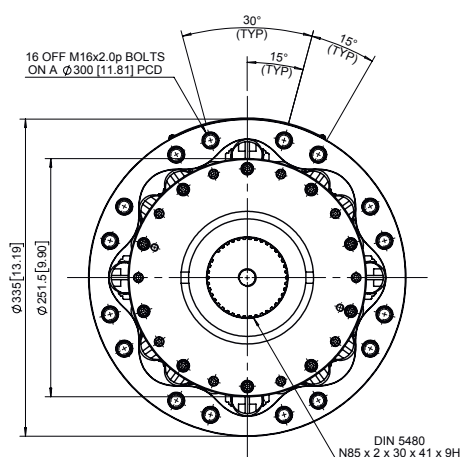
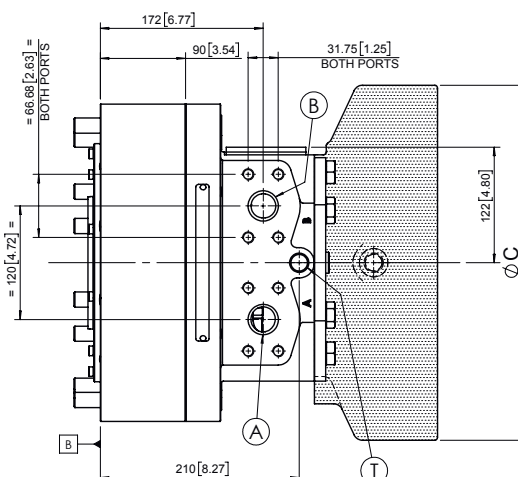
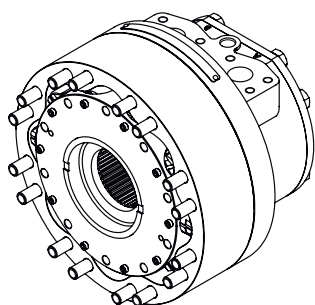
 88 kg [194 lb] without brake



Option	Rated holding torque	C	D	E	F	Weight
P	21 kNm [14,488 lbf.ft]	Ø375 [14.764]	59 [2.323]	185 [7.283]	142 [5.591]	74 kg [163 lb]

Rotor spline
DIN 5480: N85 x 2 x 30 x 41 x 9H

Other spline options available, contact us for more information.
See page 20 for hydraulic connection options.




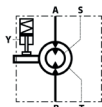
TORQUE UNIT

TWO SPEED OPTION

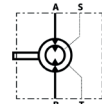
PRODUCT 01	CAM 02	FRONT MODULE 03 04 05 06 07					PORT MODULE 08 09 10 11 12					REAR BRAKE 13	OPTIONS 14 15 16			SPECIALS 17	DESIGN 18
XJ40		T	N	N	1	N	N		1	N	N					00	A2

(For models shown below)

 169 kg [373 lb] with P brake



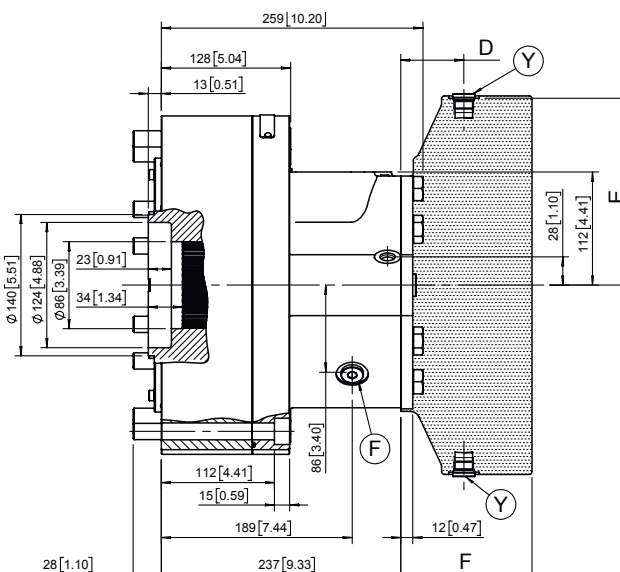
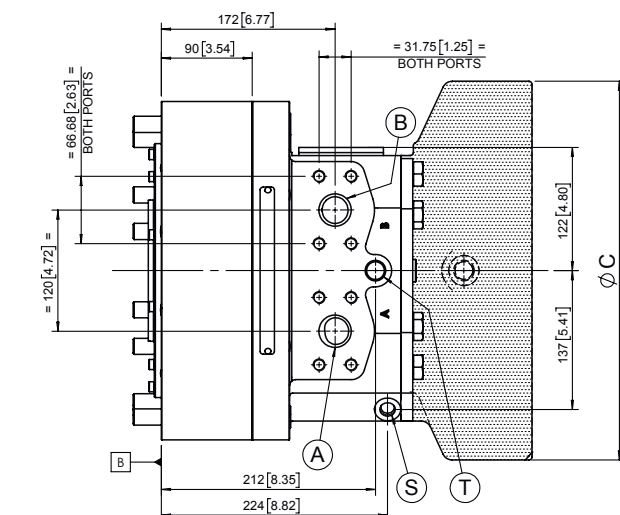
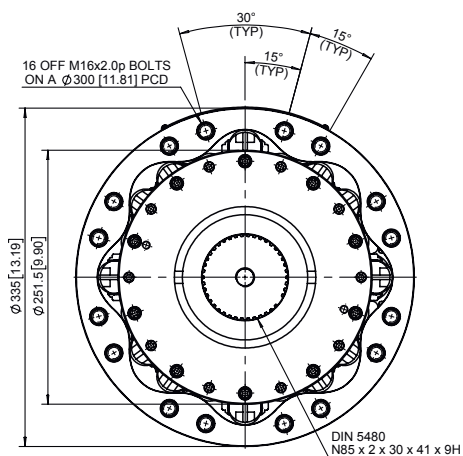
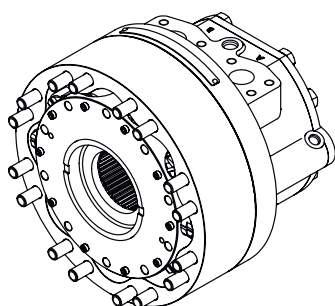
 95 kg [209 lb] without brake



Rotor spline
DIN 5480: N85 x 2 x 30 x 41 x 9H

Other spline options available, contact us for more information.
See page 20 for hydraulic connection options.

Option	Rated holding torque	C	D	E	F	Weight
P	21 kNm [14,488 lbf.ft]	Ø375 [14.764]	59 [2.323]	185 [7.283]	142 [5.591]	74 kg [163 lb]



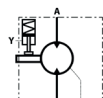
SHAFT MOTOR

SINGLE SPEED WITH SPLINE

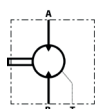
PRODUCT 01	CAM 02	FRONT MODULE					PORT MODULE					REAR BRAKE 13	OPTIONS			SPECIALS 17	DESIGN 18
XJ40		03	04	05	06	07	08	09	10	11	12		14	15	16	00	A2
		S	E	N	1	N	N		1	N	N						

(For models shown below)

 238 kg [525 lb] with P brake

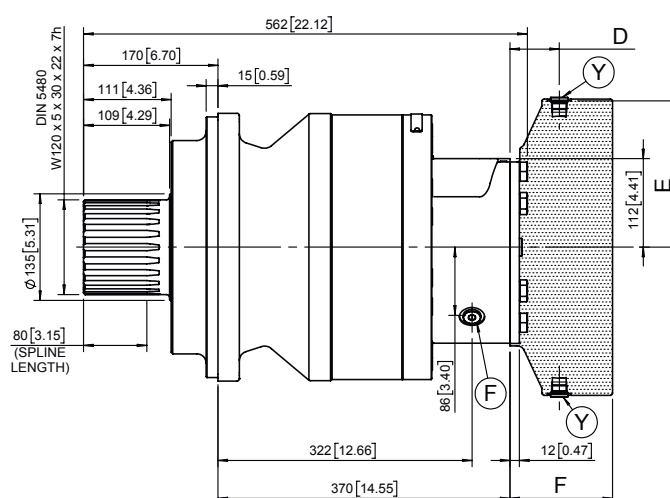
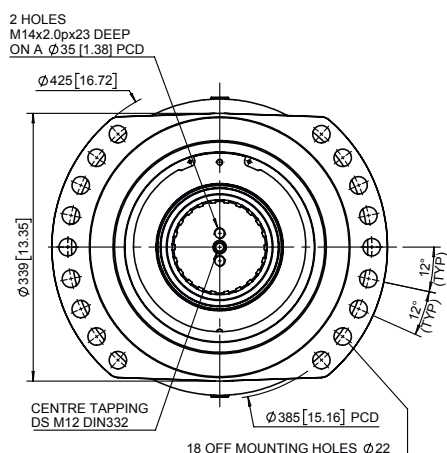
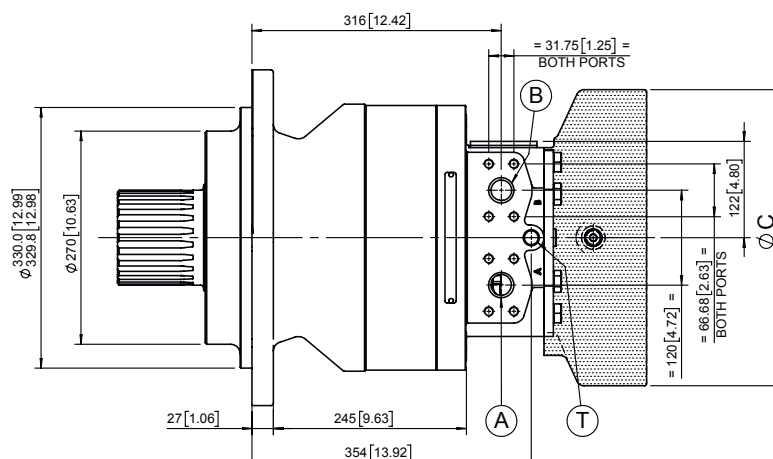
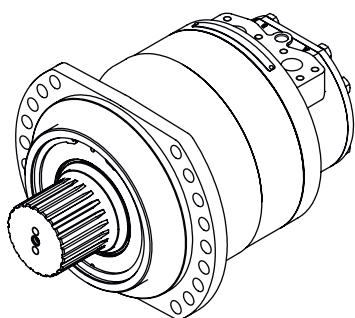


 164 kg [362 lb] without brake




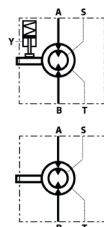
Option	Rated holding torque	C	D	E	F	Weight
P	21 kNm [14,488 lbf.ft]	Ø375 [14.764]	59 [2.323]	185 [7.283]	142 [5.591]	74 kg [163 lb]

See page 20 for hydraulic connection options.



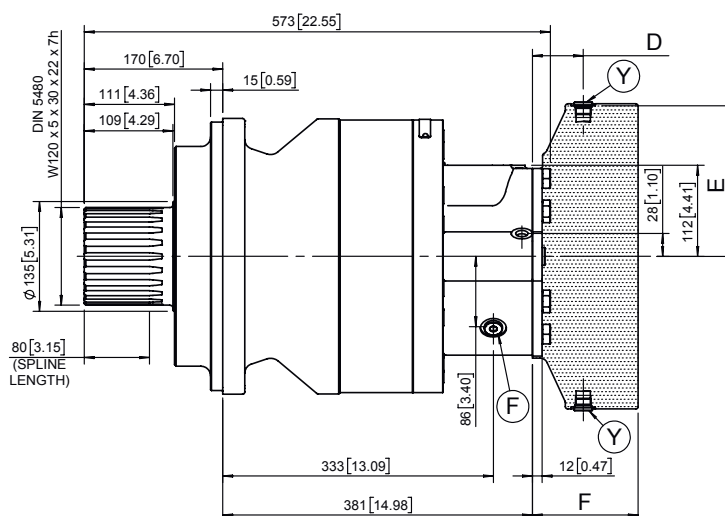
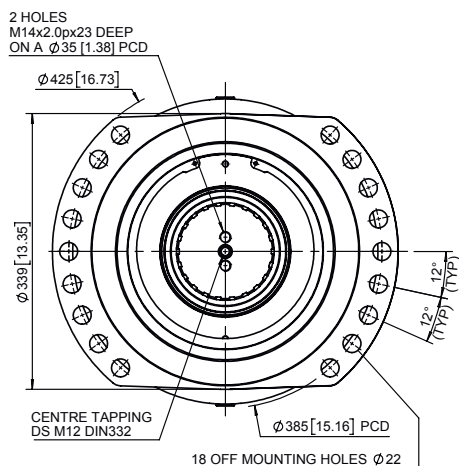
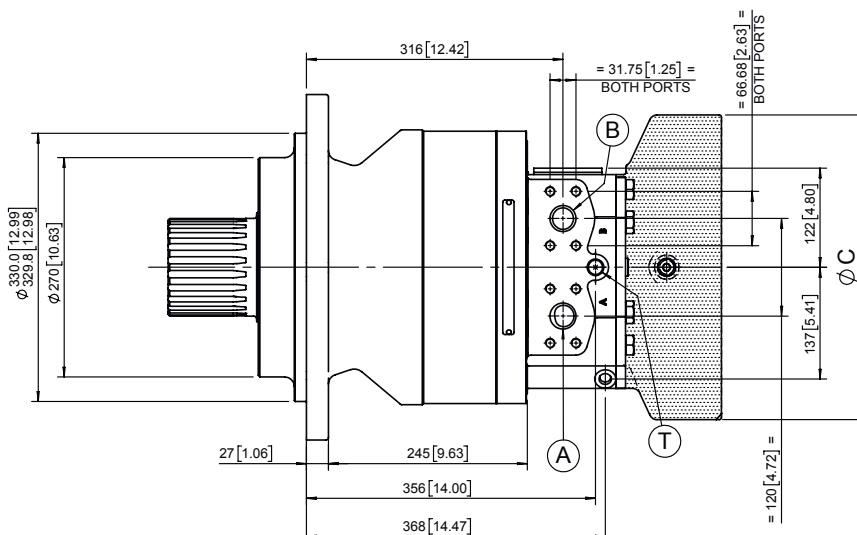
PRODUCT	CAM	FRONT MODULE					PORT MODULE					REAR BRAKE	OPTIONS			SPECIALS	DESIGN
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18
XJ40		S	E	N	1	N	N		1	N	N					00	A2

 171 kg [377 lb] without brake



Option	Rated holding torque	C	D	E	F	Weight
P	21 kNm [14,488 lbf.ft]	Ø375 [14.764]	59 [2.323]	185 [7.283]	142 [5.591]	74 kg [163 lb]

A technical line drawing of a hydraulic cylinder. The cylinder has a main body with a flange at one end. A piston rod extends from the front of the cylinder, featuring a threaded section and a hexagonal base. A mounting bracket is attached to the side of the cylinder, with a bolt and nut visible. The drawing is a perspective view, showing the cylindrical shape and the various components in detail.

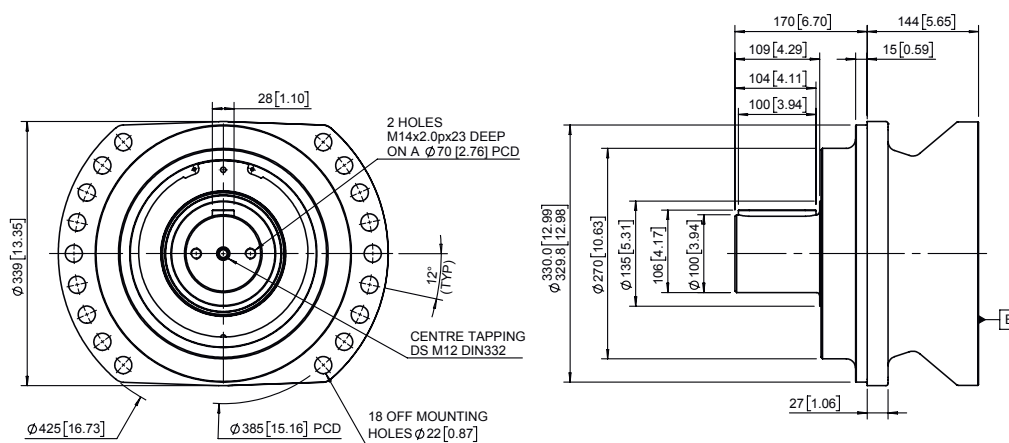


SHAFT MOTOR OUTPUT OPTIONS

PRODUCT 01	CAM 02	FRONT MODULE					PORT MODULE					REAR MODULE	OPTIONS			SPECIALS	DESIGN
		03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18
XJ40																00	A2

XJ40 HOUSING - KEYED OUTPUT

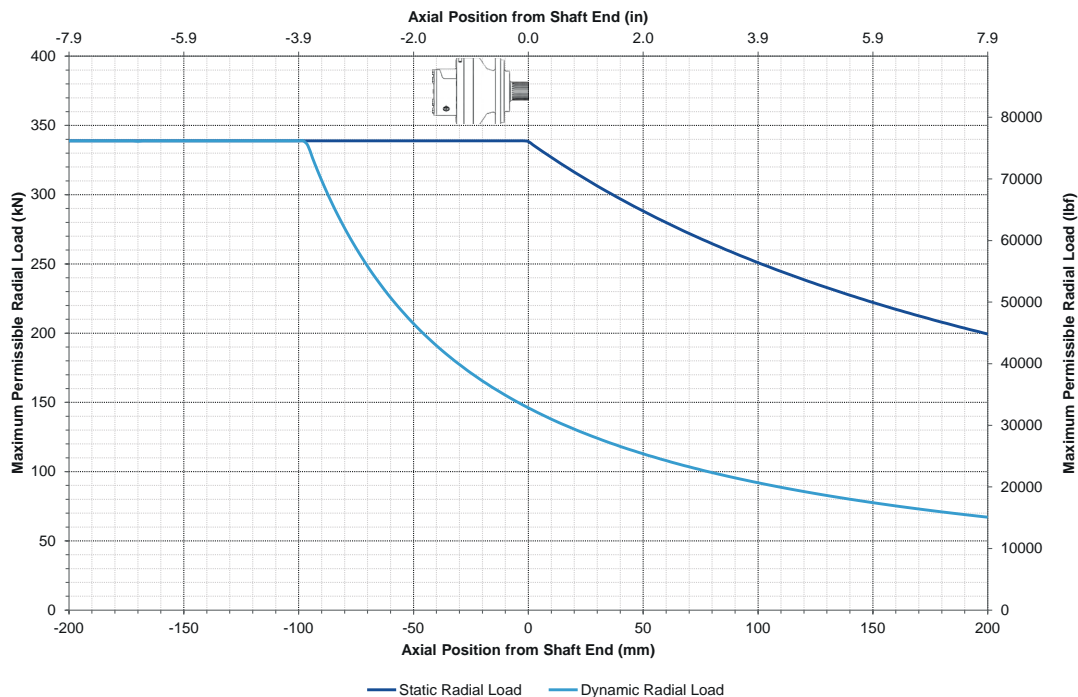
FRONT MODULE				
03	04	05	06	07
S	C	N	1	N



NOTE: TORQUE UNIT BEYOND FACE [B] IS
AS PER MAIN DRAWINGS

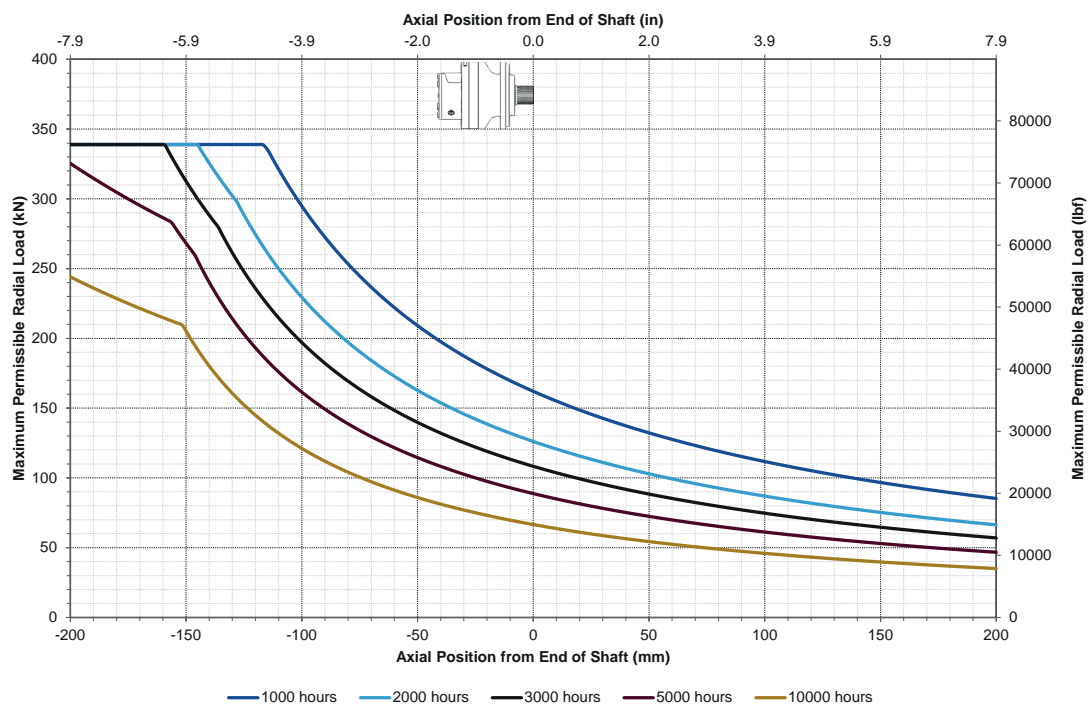
SHAFT MOTOR

PERMISSIBLE DYNAMIC AND STATIC RADIAL LOAD



SHAFT MOTOR

L10 LIFE AT 150 BAR, 35 RPM



$$\text{New life (hours)} = \frac{\text{plotted speed (rpm)} \times \text{plotted life (hours)}}{\text{desired speed (rpm)}}$$

Contact us for alternative cycle duties.
 All data is based on the standard spline motor output shaft, option E.
 All data is based on theoretical calculations.

WHEEL MOTOR

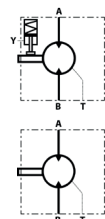
SINGLE SPEED OPTION

PRODUCT 01	CAM 02	FRONT MODULE					PORT MODULE					REAR BRAKE	OPTIONS			SPECIALS	DESIGN
XJ40		03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18
		W	Q		N	N	L		1	N	N					00	A2

(For models shown below)

 264 kg [582 lb] with P brake

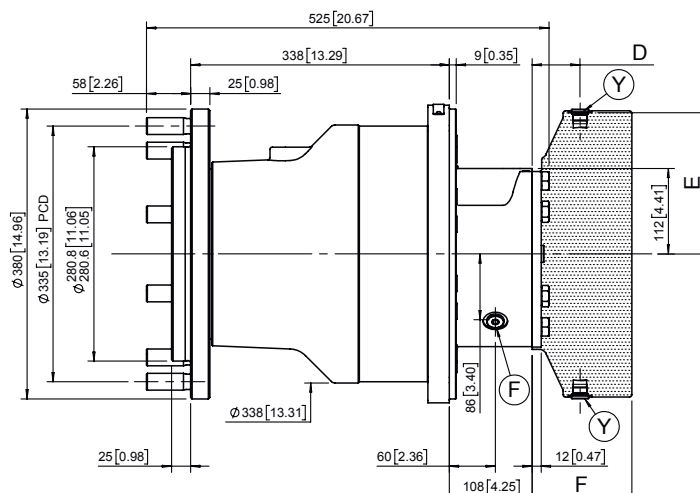
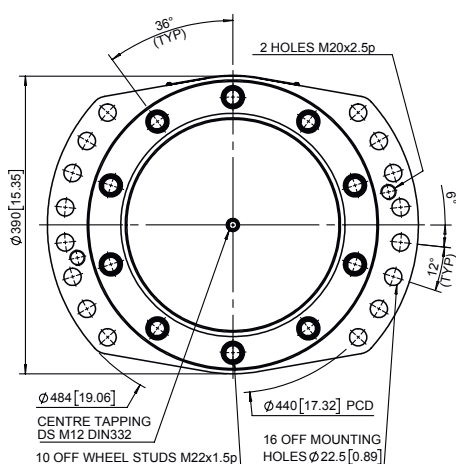
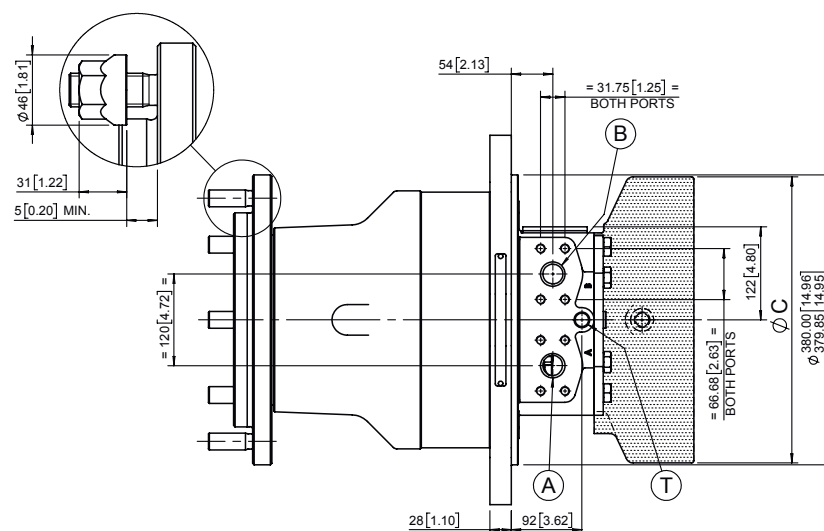
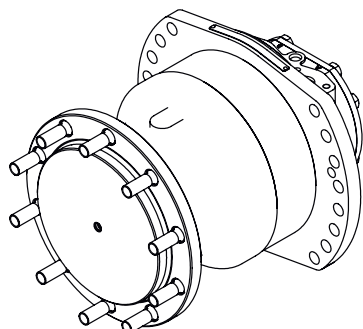
 190 kg [419 lb] without brake




Option	Rated holding torque	C	D	E	F	Weight
P	21 kNm [14,488 lbf.ft]	Ø375 [14.764]	59 [2.323]	185 [7.283]	142 [5.591]	74 kg [163 lb]

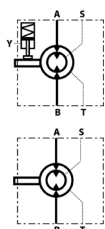
Option	Output fittings
A	M22 x 1.5p wheel studs (standard)
B	M22 x 1.5p wheel studs with nuts fitted
F	Ø24 through holes
H	M22 x 1.5p tapped holes

See page 20 for hydraulic connection options.



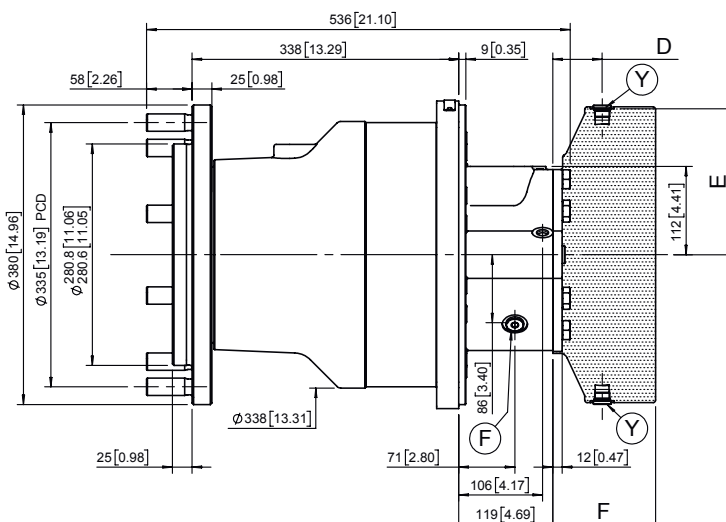
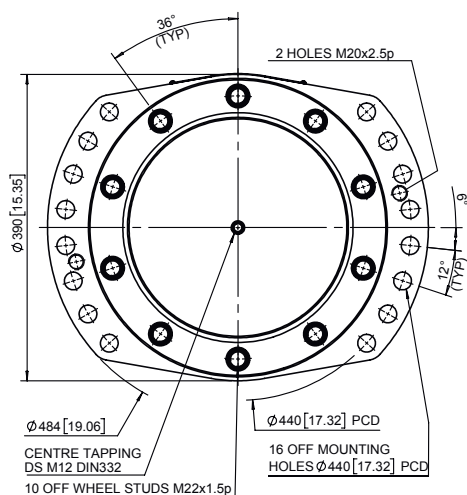
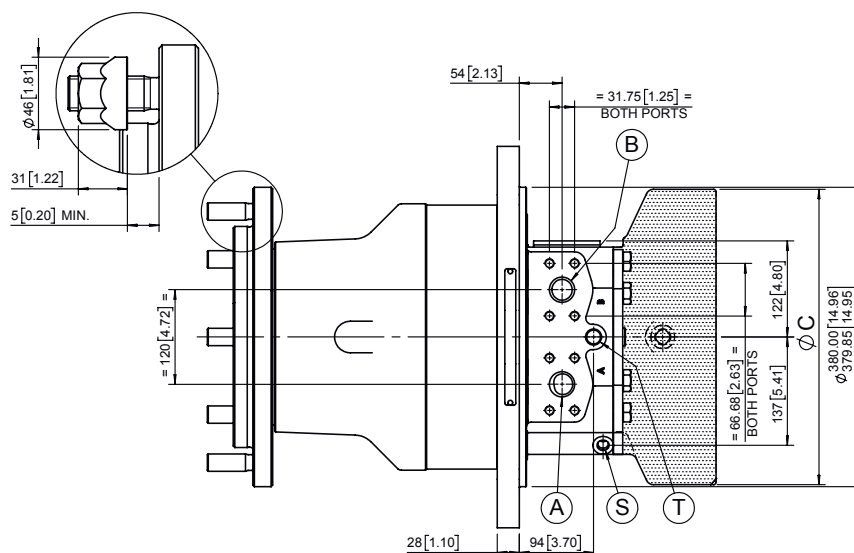
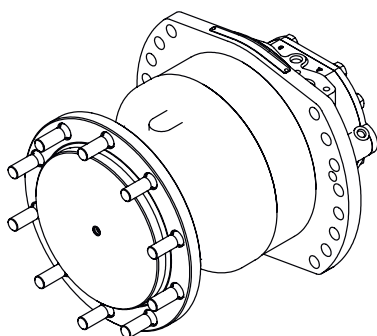
PRODUCT	CAM	FRONT MODULE					PORT MODULE					REAR BRAKE	OPTIONS			SPECIALS	DESIGN
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18
XJ40		W	Q		N	N	L		1	N	N					00	A2

 197 kg [434 lb] without brake



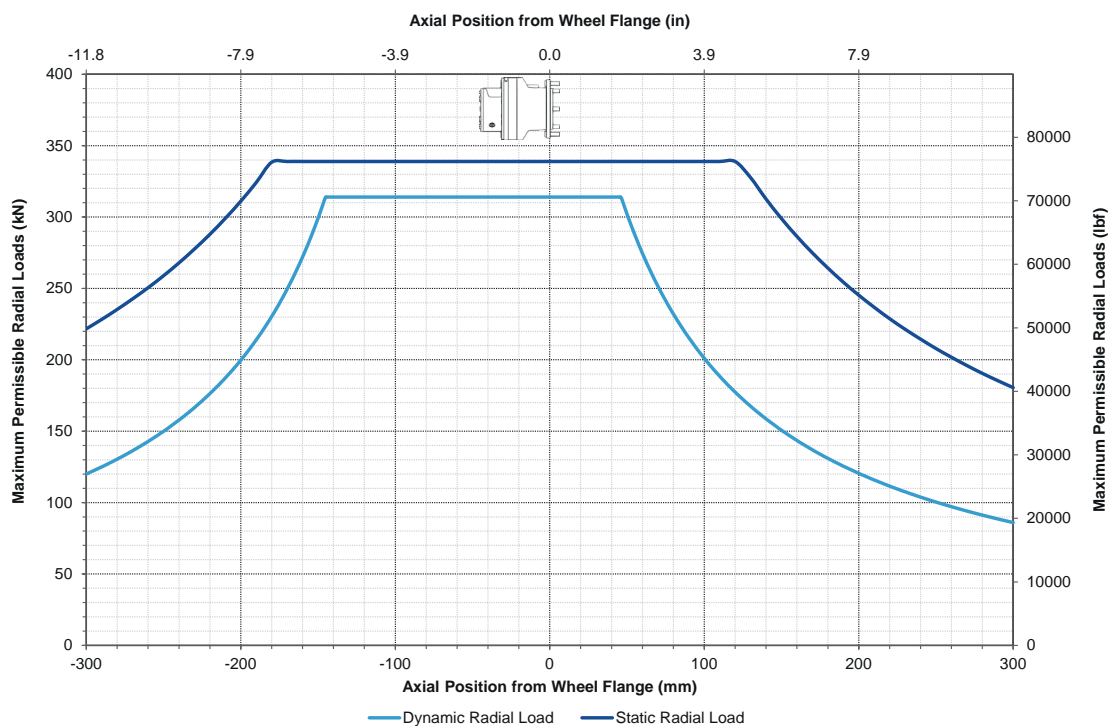
Option	Rated holding torque	C	D	E	F	Weight
P	21 kNm [14,488 lbf.ft]	Ø375 [14.764]	59 [2.323]	185 [7.283]	142 [5.591]	74 kg [163 lb]

Option	Output fittings
A	M22 x 1.5p wheel studs (standard)
B	M22 x 1.5p wheel studs with nuts fitted
F	Ø24 through holes
H	M22 x 1.5p tapped holes



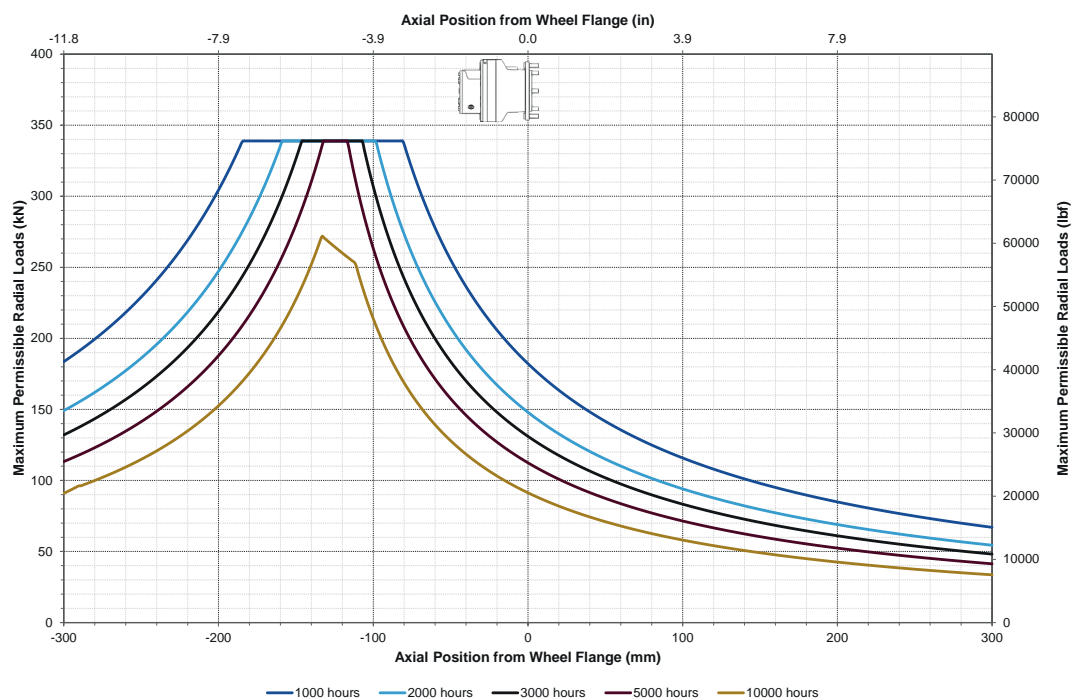
WHEEL MOTOR

PERMISSIBLE DYNAMIC AND STATIC RADIAL LOAD



WHEEL MOTOR

L10 LIFE AT 150 BAR, 42.5 RPM



$$\text{New life (hours)} = \frac{\text{plotted speed (rpm)} \times \text{plotted life (hours)}}{\text{desired speed (rpm)}}$$

Contact us for alternative cycle duties.

All data is based on the standard wheel motor output shaft, option Q.

All data is based on theoretical calculations.

PARKING BRAKES

PRODUCT 01	CAM 02	FRONT MODULE 03 04 05 06 07					PORT MODULE 08 09 10 11 12					REAR BRAKE 13	OPTIONS 14 15 16			SPECIALS 17	DESIGN 18
XJ40																00	A2

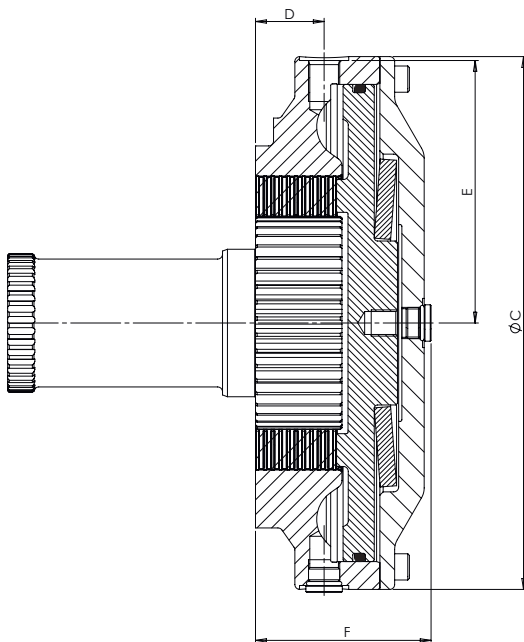
Option	Rated holding torque	C	D	E	F	Weight
P	21 kNm [14,488 lbf.ft]	Ø375 [14.764]	59 [2.323]	185 [7.283]	142 [5.591]	74 kg [163 lb]

The XJ40 multi-disc parking brake is a spring applied, hydraulic release, fail safe brake designed to be used with XJ40 motors in static situations.

The multi-disc brake has a modular design which ensures it can be connected to any variant of the XJ40 motor.

The brake has two hydraulic release ports, one at the top of the housing and one at the bottom. The brake can be manually released by removing the plug in the cover and using an M20 screw to pull the piston back.

P BRAKE



Brake static capacity when new	21 kNm [15,483 lbf.ft]
Static capacity after ten dynamic uses	16.1 - 18.3 kNm ⁽¹⁾ ⁽²⁾ ⁽³⁾ [11,925 - 13,474 lbf.ft] ⁽¹⁾ ⁽²⁾ ⁽³⁾
Volume to fill	1,200 cc [73.2 in ³]
Volume to fully release brake	300 cc [18.3 in ³]
Min. pressure to fully release brake	20 bar [290 psi]
Max. acceptable pressure	30 bar [435 psi]
Time to release brake	< 0.5 seconds ⁽⁴⁾ ⁽⁵⁾
Time to engage brake	< 1 second ⁽⁴⁾ ⁽⁵⁾
Emergency release fitting	M20 torqued to 350 Nm [M20 torqued to 258 lbf.ft]
Weight	74 kg [163 lbs]

(1) Do not run in brake, wearing the plates will reduce the static capacity.

(2) Dynamic use of the brake is not recommended and should only be used in emergency situations.

(3) The disc pack should be replaced after ten dynamic uses.

(4) Times may vary depending on fluid viscosity and valves used.

(5) During low temperature applications, flushing the brake housing is recommended to maintain a constant oil viscosity.

All data is based on ISO46 fluid at 50°C/122°F. If a different fluid will be used, please consult Rotary Power.

DIRECTION OF SHAFT ROTATION

PRODUCT 01	CAM 02	FRONT MODULE 03 04 05 06 07					PORT MODULE 08 09 10 11 12					REAR BRAKE 13	OPTIONS 14 15 16			SPECIALS 17	DESIGN 18
XJ40																00	A2

PORT MODULE - SPEED AND ROTATION

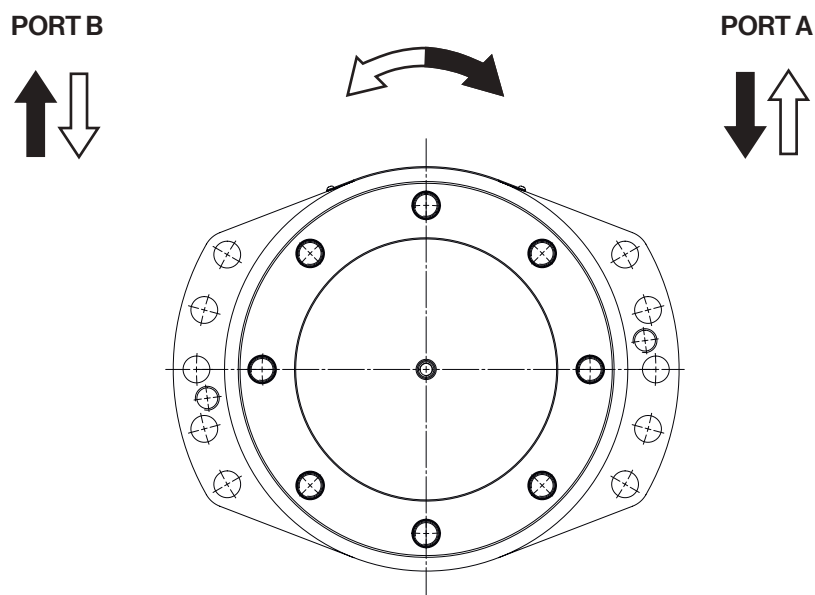
1R	Single speed - flow to port A = CW rotation
1L	Single speed - flow to port A = ACW rotation
RA	Two speed (Ratio 2:1) - flow to port A = CW preferred rotation
LA	Two speed (Ratio 2:1) - flow to port A = ACW preferred rotation

The XJ motor code defines the starting direction of the motor. This is selected by the customer to best suit their application needs.

The starting direction is based on flow being supplied to port A. A single speed motor can have its starting direction reversed by supplying flow to port B.

In two speed motors, pressurising port A is preferred as this prevents the motor from recirculating high pressure oil when shifted into second displacement. It is important to select the correct starting direction of a two speed motor to ensure optimum performance in the required direction.

DIRECTION OF SHAFT ROTATION VIEWED FROM THE SHAFT END



HYDRAULIC CONNECTIONS

PRODUCT 01	CAM 02	FRONT MODULE					PORT MODULE					REAR BRAKE	OPTIONS			SPECIALS	DESIGN
XJ40		03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18
																00	A2

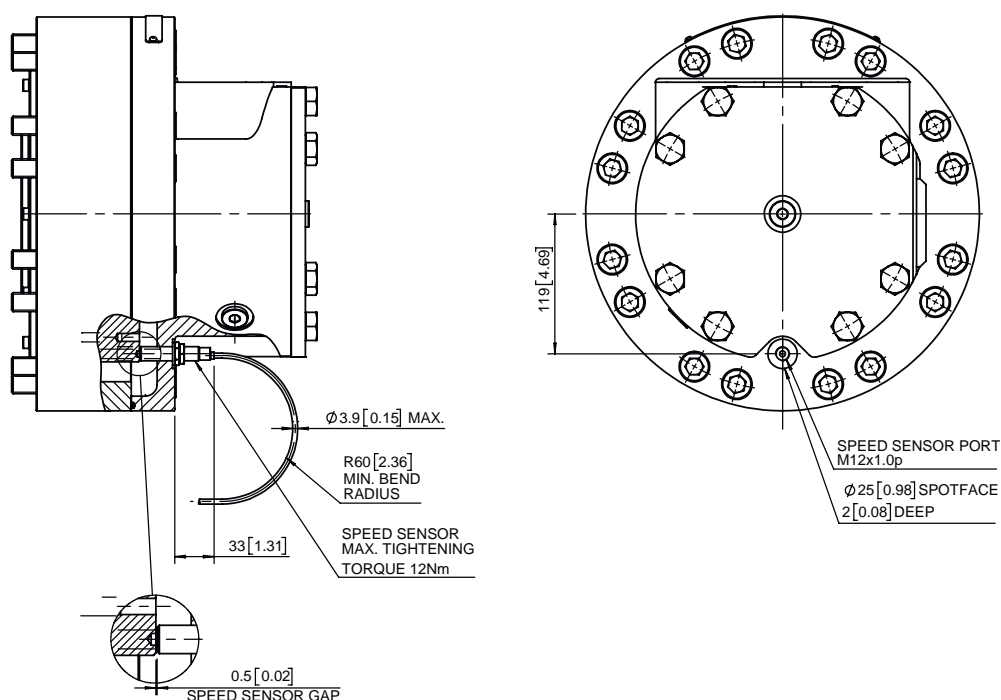
		Power supply		Drain	Speed change	Flushing	Parking brake
	Port	A	B	T	S	F	Y
XJ40 housing options	1	ISO 6162 DN 32 (standard)		1/2" SAE J514 (3/4"-16 UNF)	3/8" SAE J514 (9/16"-18 UNF)	1/2" SAE J514 (3/4"-16 UNF)	1/2" SAE J514 (3/4"-16 UNF)
	6	ISO 6162 DN 25		M22x1.5	M18x1.5	M22x1.5	M16x1.5
XJ20 housing options	5	ISO 6162 DN 32		1/2" SAE J514 (3/4"-16 UNF)	3/8" SAE J514 (9/16"-18 UNF)	1/2" SAE J514 (3/4"-16 UNF)	1/2" SAE J514 (3/4"-16 UNF)
	2	ISO 6162 DN 19		M22x1.5	M22x1.5	M22x1.5	M16x1.5
Max. pressures	bar [psi]	450 [6,527]		6 [90]	40 [580]	6 [90]	30 [435]

EXTRA OPTIONS

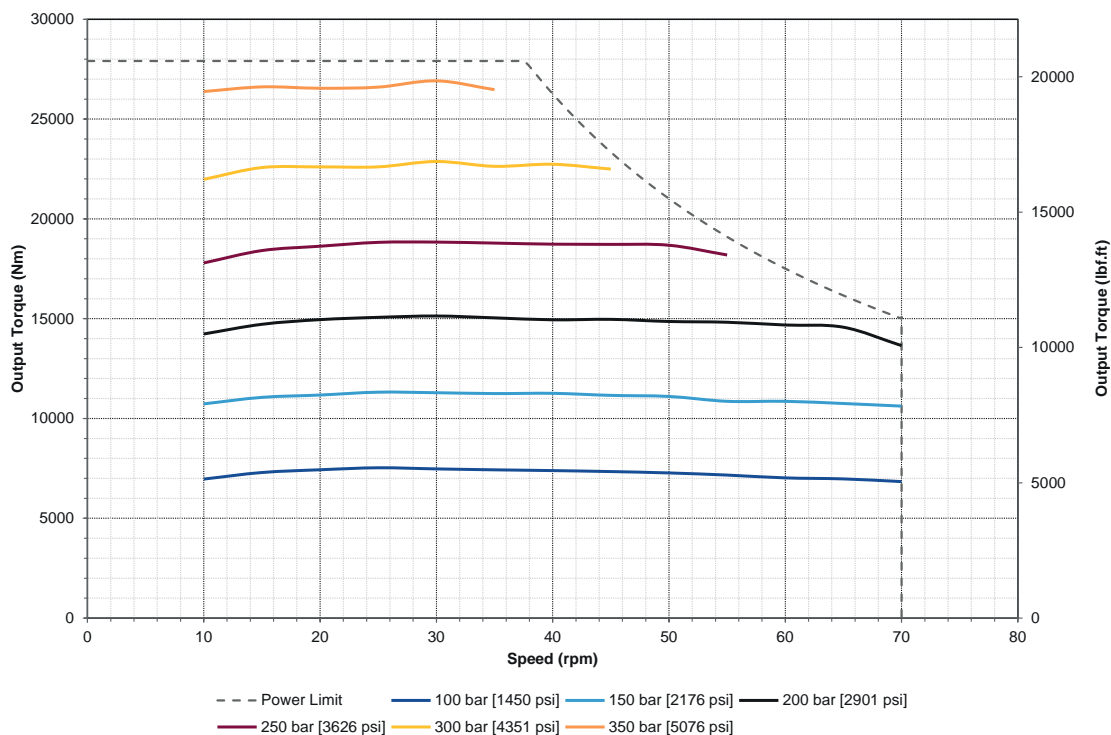
SPEED SENSOR

This sensor provides a square wave signal used to calculate motor speed. Note that the sensor target is constructed using a modified XJ40 rotor. Integrating the sensor target into the rotor allows the envelope of the motor to remain consistent with standard sizes.

Sensor type	Differential hall effect speed sensor
Rotary Power part number	W949000005
Supply voltage	8 – 32 VDC
Current consumption	<ul style="list-style-type: none"> Max. without load: 15 mA Max. with load: 30 mA
Plug type	AMP 282105-1, 3 pins <ul style="list-style-type: none"> Integrated cable and connector only Cable length (including connector): 350 mm ± 20 mm
Signal output	<ul style="list-style-type: none"> Square wave Push-pull outputs: $I_{max} = \pm 20$ mA <ul style="list-style-type: none"> With pull-up resistor (for $R=560$ Ohm): $U_{low} < 2.5V$, $U_{high} > 0.95 * U_{supply}$ With pull-down resistor (for $R=560$ Ohm): $U_{low} < 0.1V$, $U_{high} > U_{supply} - 4.0 V$
Frequency range	5 Hz – 20 kHz
Standard number of pulses per revolution	60
Operating temperature	-40°C to +125°C [-40°F to +257°F]
Protection rating	<ul style="list-style-type: none"> Sensor head: IP68 Cable outlet: IP67

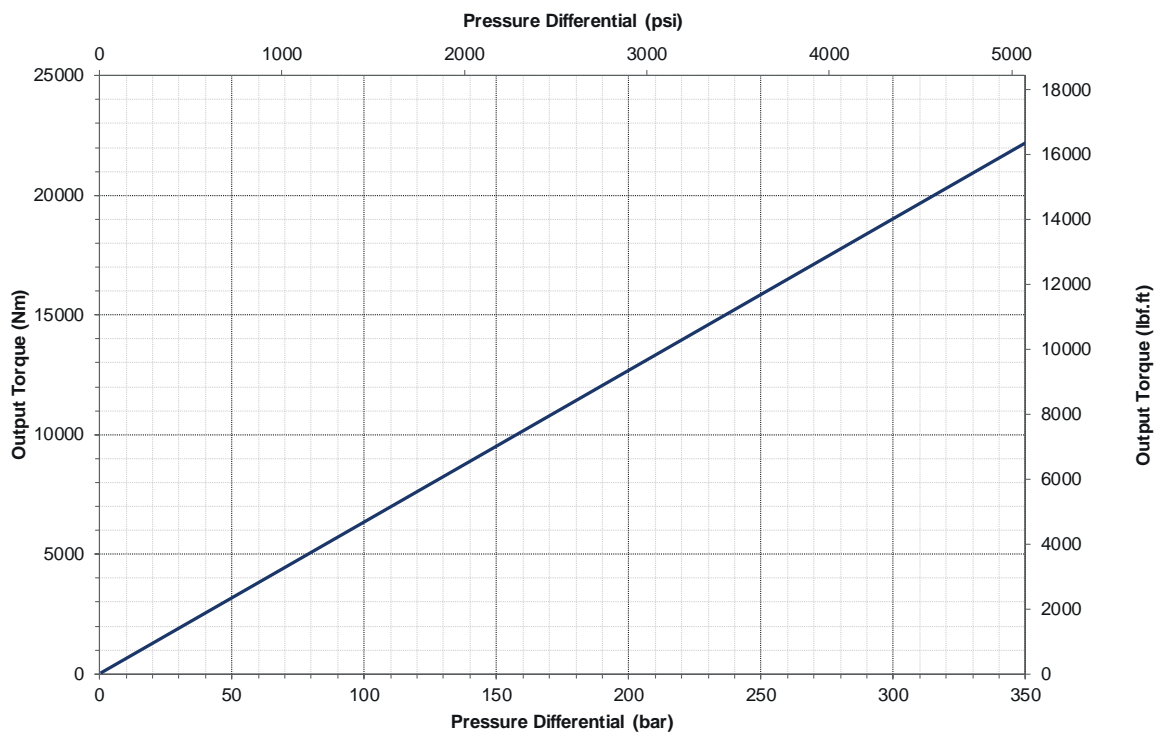


TORQUE OUTPUT



STARTING TORQUE

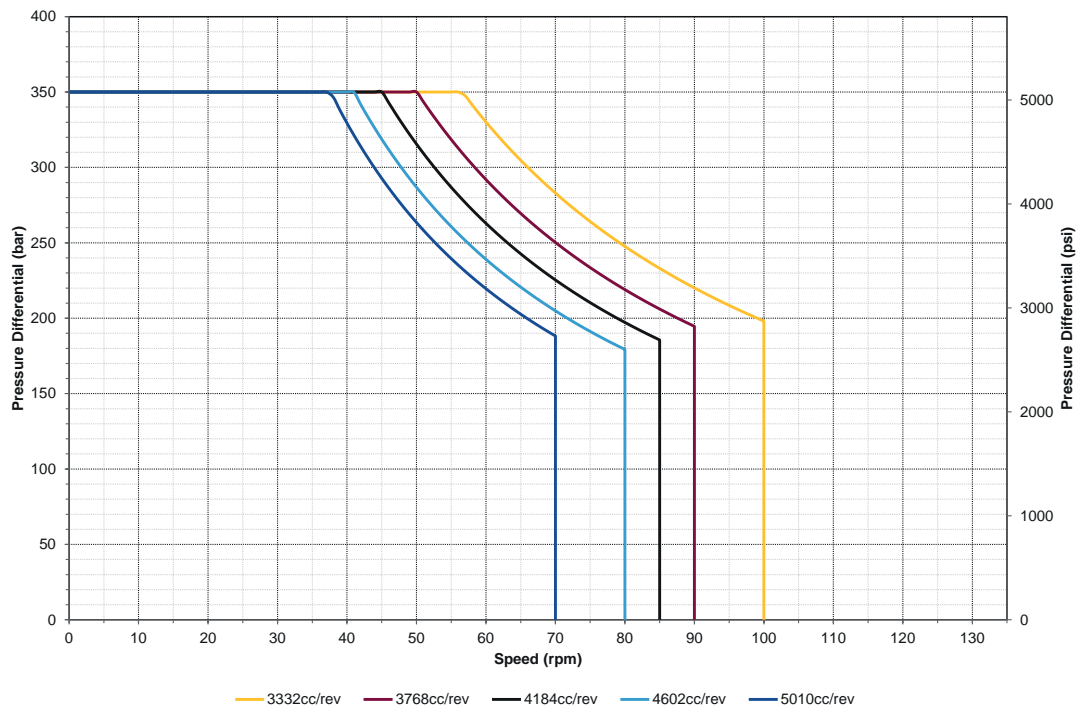
MAX. AVAILABLE TORQUE AT ZERO RPM



All performance graphs plotted for maximum displacement (5,010 cc/rev) using ISO46 fluid at 50°C.

POWER ENVELOPE

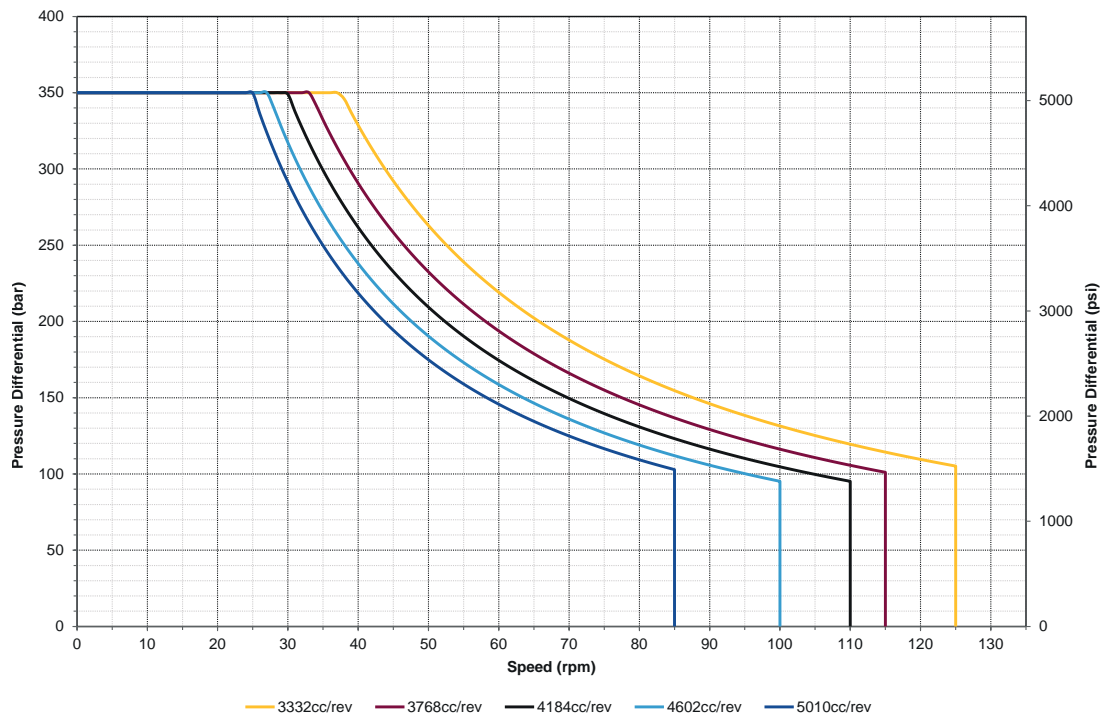
SINGLE SPEED 110KW MAX. CONTINUOUS POWER



POWER ENVELOPE

TWO SPEED 73KW MAX. CONTINUOUS POWER

MIN. DISPLACEMENT - PREFERRED DIRECTION

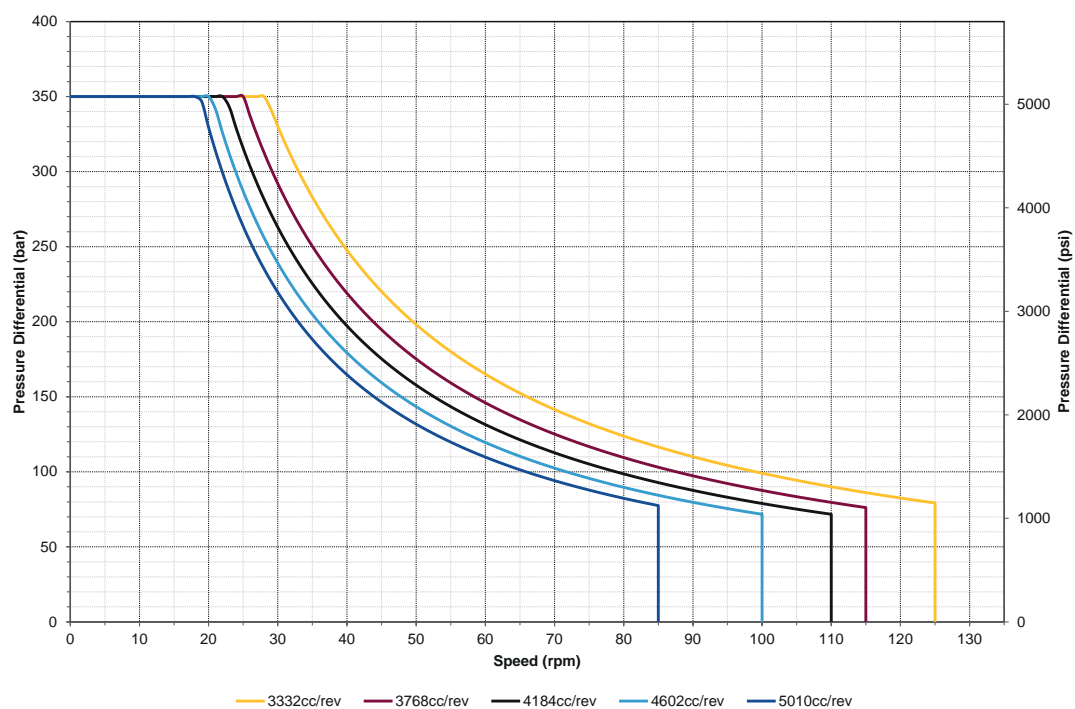


All performance graphs plotted for maximum displacement (5,010 cc/rev) using ISO46 fluid at 50°C.

POWER ENVELOPE

TWO SPEED 55KW MAX CONTINUOUS POWER

MIN. DISPLACEMENT - NON PREFERRED DIRECTION



All performance graphs plotted for maximum displacement (5,010 cc/rev) using ISO46 fluid at 50°C.

CALCULATIONS

$$\text{Output torque (Nm)} = \frac{\text{Motor displacement (cc)} \times \text{delta pressure (bar)} \times \eta_m}{20\pi}$$

$$\text{Flow (lpm)} = \frac{\text{Motor displacement (cc)} \times \text{rotational speed (rpm)}}{1000 \times \eta_v}$$

$$\text{Output power (kW)} = \frac{\text{Output torque (Nm)} \times \text{rotational speed (rpm)}}{9,550}$$

Where:

η_m = Mechanical efficiency

η_v = Volumetric efficiency

For approximate estimates of performance use:

$\eta_m = 0.95$

$\eta_v = 0.95$

CONVERSIONS

$$\text{Nm} \rightarrow \text{lbf.ft} = \times 0.7376$$

$$\text{N} \rightarrow \text{lbf} = \times 0.2248$$

$$\text{bar} \rightarrow \text{psi} = \times 14.5038$$

$$\text{cc} \rightarrow \text{in}^3 = \times 0.061$$

$$\text{lpm} \rightarrow \text{U.S. gpm} = \times 0.2641$$

$$\text{kW} \rightarrow \text{hp} = \times 1.341$$

$$\text{kg} \rightarrow \text{lb} = \times 2.2046$$

[illegible]

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