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XF RANGE

radial piston motors

ROTARY POWER has over 35 years experience in the design and development of high quality Hydraulic equipment.

Our current product range includes :-

"A" Axial Piston Thruster Motors purpose designed for R.O.V applications. Fixed and variable capacities from 11.5 to 125 cm3/rev.

"C" Axial Piston Pumps for high accuracy fluid metering with precision flow controls and high-pressure capability. Specifically designed for the Polyurethane Industry. Capacities from 3 to 62 cm3/rev.

"XL" Cam Motors of radial piston configuration. Wheel/shaft/torque module configurations. Design offers high-speed capability. Capacities from 150 to 1120 cm3/rev.

"XF" Cam Motors of radial piston configuration. NEW generation design, developed from the proven technology of the "XL" but with a smaller envelope, radial ports & more displacement.

"XK" Cam Motors radial piston configuration offering static/dynamic brakes, single/2 speed, wheel/shaft & torque-module mount options. Heavy-Duty External Load & High-Speed options. Capacities from 1000 to 5000 cm3/rev.

"SMA" Motors heavy-duty radial piston/eccentric configuration, offering excellent life. Withstands high mechanical and hydraulic shock loads. 350bar Continuous pressure rating. Speed & power ratings significantly greater than standard HTLS motors. Displacements from 150 to 10500 cm3/rev.

Wholly owned subsidiaries in the USA and Germany and a network of distributors throughout the world provide product support in most countries.

ROTARY POWER is a company within British Engines Ltd (BEL) group, which was established over 60 years ago.

The British Engines group of companies design manufacture and market a wide range of engineered products for offshore, electrical, construction, engineering and other industries, employing nearly 700 people on a 4600 sq m site in Newcastle upon Tyne, England.

XF FEATURES

Modular Concept

· Common torque unit with shaft or wheel motor housings

Pintle Design

• No axial bearing thrust support required

High Pressure Rating

 Designed to operate up to 420bar peak pressure

High Start Output Torque

· Pintle valve reduces mechanical losses

High Reliability

Few moving parts

Low Maintenance

• Sealed/lubricated bearings in shaft and wheel motors

High Radial Load Capacity

· Heavy duty tapered roller bearings as standard

Freewheel

• True (zero displacement) available

Fully Reversible

Equal torque in both rotation directions

Compact

· High power to weight ratio and minimum overall dimensions

XF STANDARD OPTIONS

- Speed sensor
- SAE or "G" ports
- Axial ports
- Viton seals

Customised solutions are available -Please consult Rotary Power

XF COMPACT PISTON MOTORS

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XF MOTOR OPERATION







Oil is fed under pressure through the valve and into the cylinders. 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.

Each piston completes four strokes per revolution of the motor. The symmetrical arrangement balances hydraulic forces, eliminating the need for bearings.

TECHNICAL DATA

ORDER CODE



EXAMPLE SHOWN;

XF05-D-S2-A-1-N-0-AA-02 680cc ANSI splined shaft Standard mount Radial SAE O-ring ports Rear mounted speed sensor facility Nitrile seals

Displacement Code	А	В	С	D	-
Displacement Nominal	390	490	560	680	СС
Displacement Actual	392.7	493.1	558.6	680.9	CC
Theoretical Torque at 100 bar	625	785	889	1084	NM
Max Speed	500	500	450	370	rpm
Max Freewheel Speed	850	850	850	850	rpm
Max Power		50)		kW
Max Main Port Pressure*		42	0		bar
Max Case Port Pressure		bar			
Min Viscosity		15	5		cSt
Max Viscosity		cSt			
Optimum Viscosity Operating Range	35 to 200 cSt				
Fluid Type Min Requirements	HL; HLP to DIN 51524				
Fluid Cleanliness	NAS 1638 Class 9 ISO Code 18/15				
Min Fluid Operating Temperature	-30 (Nitrile); -20 (Viton) °C				
Max Fluid Operating Temperature		+8	0		°C
Optimum Temperature Range		+40 to	+70		°C

*Peak; Max 1% of every 1 duty cycle minute (Typical Relief Valve pressure spike)

GENERAL NOTES ON FOLLOWING TECHNICAL DATA

- All dimensions are in mm.
- General dimension tolerances; +/- 0.25mm
- Material specifications provided are for guidance & should only be used to support end-user's finalised design.
- Motor performance data is provided to assist in the optimum selection of displacement & frame size. However, where system pump maximum capacity is close to full utilisation, actual flow & case leakage measurements should be obtained, under worst-case operating conditions.
- All tightening torques given are based on the safe motor operation at the specified external load envelope & maximum output torque. Screws are assumed to be un-lubricated & exhibiting a friction coefficient (Torque /Induced Tensile Load x Nominal Diameter)in the range 0.19 – 0.25 {Screw Grades are minimum requirements}

Symbols;





rotation





Motor inlet Motor shaft flow direction direction

Dry weight torque (unlunbricated)

2





13	14 15 digits	5				
A	02					
			DESIGN SERIES			
			02 Factory specified			
		SPEC	IAL CODES (consult RP)			
		AA	Standard			
		, , , ,	otandara			
		G	SENERAL OPTIONS			
		0	Standard			
		1	Shaft-up air vent port			
	, L		SEALS			
		N Nitrile				
		V Viton				
	R	FAR HO	USING OPTIONS			
	0	None				
	1 R	ear mounted speed sensor facility				
	2	Over	sized drain ports ##			
	3	Opt	ions 1+2 combined			
es	## Axial ports only					
_ L	REA	R HOUS	SING STYLE/PORTS			
		A	Radial SAE O-ring ports			
	dard	В	Radial 'G' ports			
	tanc	С	Axial SAE O-ring ports			
	S S	D	Axial 'G' ports			
	_ #	R	Radial SAE O-ring ports			
	ing ing	S	TBA			
	1 2 2 3		ТРА			
	Steer pivo	LT	IDA			
	Steer pivo mounti	U T	ТВА			

TORQUE UNIT (XF05*N0A0*0AA**)



CUSTOMER MOUNTING



Housing Material; Rm ≥ 320 N/mm2 (fixing screw thread engagement of 20mm minimum is assumed)

TORQUE UNIT



 ΔP > 150bar consult RP –see duty cycle pg.12

For a given pressure P [bar] & speed N [rpm];	E
Ng[rpm] = Graph speed, for given cam displacement &	F
pressure P.	F
New L10 [hr]= Graph Hours x Ng / N	Г



Example;

For 390ccCam, Pressure P = 175bar & speed N = 200 rpm; From graph, using the 390cc line @ 175bar; Ng = 120 rpm Thus; L10 = 5,000 x 120/200 = 3,000 hr

SHAFT MOTOR

SHAFT MOTOR SPLINED



Coupling Material; BS970 -709M40 or equivalent - hardened to achieve Rm = 775 - 925 N/mm2

SHAFT MOTOR - FRAME MOUNTING OPTIONS



SHAFT MOTOR

SHAFT MOTOR KEYED (XF05*S1A0*0AA**)



SHAFT MOTOR - EXTERNAL RADIAL LOADS

Maximum Static Radial Load Fr = 62kN (Fa = 0) Maximum Static Axial Load Fa = +/-79kN (Fr = 0)

Consult Rotary Power, for applications combining radial & axial dynamic loads.



(*L10 hours@ N rpm; multiply "Graph L10" by ratio "100rpm/N rpm") Pressure has no direct effect on the L10 data shown (see also Torque Unit L10) Graph Max Dynamic loads assume $\Delta P = 150$ bar (max weighted motor rating) For $\Delta P > 150$ bar consult RP. (See duty cycle pg.12)



WHEEL MOTOR

WHEEL STUDS (XF05*W2*0*0AA*)



WHEEL STUDS WITH NUTS - XF05*W3*0*0AA**



THREADED MOUNTING HOLES - XF05*W1*0*AA*



CLEARANCE MOUNTING HOLES - XF05*W0*0*0AA



WHEEL MOTOR

WHEEL MOTOR FRAME MOUNTING OPTIONS



EXTERNAL RADIAL LOADS & L10 LIFE

Consult Rotary Power, for applications combining radial & axial dynamic loads.



Pressure has no direct effect on the L10 data shown (see also Torque Unit L10) Graph Max Dynamic loads assume $\Delta P = 150$ bar (max weighted motor rating) For $\Delta P > 150$ bar consult RP

Fr= $\sqrt{(Ft^2 + Fw^2)}$ where; Ft [kN]= Motor Torque [kN.M]/R[M] & Fw = Wheel Vertical Load[kN]

(Motor torque may be derived from "Torque Output" graphs on page 15, once the actual pressure differential at the motor ports is determined)



HYDRAULIC CONNECTIONS

STANDARD PORTS



MOTOR CODE	PORTS "A" & "B"	PORT "T"
XF05***A1*0AA**	3/4" SAE J514 (1 1/16" - 12 UNF)	5/8" SAE J514 (7/8" - 14 UNF)
XF05***B1*0AA**	ISO 228/1 G 3/4"	ISO 228/1 G 1/2"

T

10

AXIAL PORTS

MOTOR CODE	PORTS "A" & "B"	PORT "T"
XF05***C1*0AA**	3/4" SAE J514 (1 1/16" - 12 UNF)	5/8" SAE J514 (7/8" - 14 UNF)
XF05***D1*0AA**	ISO 228/1 G 3/4"	ISO 228/1 G 1/2"





PORTS "A" & "B"

3/4" SAE J514

(1 1/16" - 12 UNF)

ISO 228/1 G 3/4"

OVERSIZE DRAIN PORTS (AXIAL PORTS ONLY)

MOTOR CODE

XF05***C3*0AA**

XF05***D2*0AA**

XF05***D3*0AA**



(в)

123

= =

T)

35



OPTIONS

SHAFT-UP AIR VENT PORT (XF05*****1AA**)



SPEED SENSOR

PORT "T"

3/4" SAE J514

(1 1/16" - 12 UNF)

ISO 228/1 G 3/4"

10



3/8" SAE J514 (9/16" -18 UNF0 (1-1/16" -12 UNF)

Ensure drain line routing prevents air traps forming



PERFORMANCE

POWER ENVELOPES



For optimum motor life, operation should be limited to the "Continuous" envelope of the above graphs. Intermittent operation may occur for 10% of every minute, as part of a known duty cycle. Maximum Intermittent Pressure would typically be the Relief Valve setting, for mobile applications. For operation with sustained periods >10% of every minute outside the "Continuous" envelope, consult RP.!

DUTY CYCLE

Pressure (wei	ghted) Maximum :	= 150bar - Exam p	le;					
TIME (%)	SPEED (rpm)	PRESSURE (bar		TIME	SPEED	REVOLUTIONS	%N	
5	50	210		(%)	(rpm)	IN 10,000 HOUR	REVOLUTIONS #	p(10/3) x %N
70	200	80		5	50	1.5 x 10°	1 5%	925 700
25	100	160		- 5	50	1.5 X 10	1.5%	025,700
				70	200	84 x 10	83.5%	1,842,128
				25	100	15 x 10°	15%	3,335,476
					Σ	100.5 x 10 [°]	100%	6,003,304
#Example; 50rpm x 60 = 3,000 revolutions/hr 5% of 10,000hr = 500hr Thus; Revolutions = 500 x 3,000 = 1.5 million					P (weighte	d) = (6,003,304) °	³ = 108 bar	
Total Revolutions in 10,000 hr = 100.5 million Thus; % Revolutions in 10,000 hr @ 50rpm/210bar = 1.5/100.5 = 1.5%					! If F	P (weighted) > 150b	oar, consult RP	

PERFORMANCE

20bar back pressure & ISOVG 37 oil @ 40C (38cSt) Above performance is indicative only. Actual performance is dependent on the motor running-in period, operating viscosity & motor return-line pressure.

20bar back pressure & ISOVG 37 oil @ 40C (38cSt) Above performance is indicative only. Actual performance is dependent on the motor running-in period, operating viscosity & motor return-line pressure.

680 cc = 150bar 125bar 100bar 180 200 220 240 260 Speed - rpm

PERFORMANCE

NO LOAD PRESSURE DROP

Differential pressure across the main ports required to drive the motor over its speed range, with the output shaft disconnected. 20bar back pressure & ISOVG 37 oil @ 40C (38cSt) Above performance is indicative only. Actual performance is dependent on the motor running-in period, operating viscosity & motor return-line pressure.

CASE LEAKAGE

20 bar back pressure & ISOVG 37 oil @ 40C (38cSt) Above performance is indicative only. Actual performance is dependent on the motor running-in period, operating viscosity & motor return-line pressure. It may be necessary to provide a cooling flow (typically 2 LPM) through the motor case, where continuous running conditions produce oil temperature or viscosity values outside the recommended operating range (see Technical Data - page 2)

PERFORMANCE

MINIMUM BOOST PRESSURE (PUMPING)

ISOVG 37 oil @ 50C (25cSt)

! Where the shaft torsion load can overrun the motor (i.e. motor is operating as a pump) it is important to ensure sufficient supply boost pressure, to avoid incomplete filling of the cylinders & cavitation. To prevent damaging cavitation, the minimum boost pressure required at the motor inlet port is equal to the sum of the above graph & the actual case pressure.

FREEWHEELING

being sufficient to maintain freewheel, under all speed conditions.

minimum, for max freewheel speed)

! In designing the freewheel circuit, care must be taken to ensure that the max case pressure limit, shown on page3, is not exceeded.

INSTALLATION

- Detailed installation drawings are available on request.
- Motor shaft drives should be designed to eliminate unnecessary axial & radial loads; thus prolonging output housing bearing life.
- Keyed shafts are recommended for a flexible coupling output connection.
- Splined shafts are suited to installations where the driven shaft & motor are rigidly mounted. (Alignment between motor & driven shaft should be maintained within 0.05mm)
- For maximum life, splines should be lubricated with Molybdenum Disulphide grease, on assembly, or preferably run in oil lubrication.
- Do not remove protective plugs from hydraulic or speed sensor ports until immediate connection into the system pipe work is made.
- Always examine the motor externally to ensure no damage has been caused in transit.
- Case drain lines, connected to either of the "T" ports indicated, should be returned directly to tank.
- The "T" port should be positioned as the uppermost port, to ensure air is properly vented from the pipe work.
- Where the motor is mounted with shaft uppermost, an air vent port is necessary to ensure proper lubrication of the bearing housing shaft seal (General Option "1" in Product Code).
- The bore size of the case drain line should be sufficient to ensure that case pressure does not exceed the maximum specified in "Technical Data" on page 3, under all operating conditions (especially during cold-start)
- If the difference between motor case drain temperature & the tank temperature is > 40°C, then a case warming flow must be provided, to prevent possible thermal shock damage to the motor.
- For series connection of motors consult ROTARY POWER

COMMISSIONING

- Prior to motor assembly, thoroughly de-scale, clean & flush all pipe work, fittings & oil tank.
- Fill the system with new, filtered oil (refer to "Technical Data" on page 3 for motor oil requirements)
- Fill the motor case & drain line with oil through the case drain port "T" & re-connect case drain pipe work.
- Check rotation direction required is consistent with the direction of inlet flow (see relevant motor dimensional data)
- Start the drive pump at lowest practical speed to prime the system (for combustion engines turn over the starter motor for a few seconds at a time. For electric motors use a series of rapid on/off cycles)
- Run the system at high flow & low pressure & actuate all systems in all modes until all entrained air is purged.
- Check & top-up oil levels if necessary
- Check & adjust settings where necessary, in compliance with all system & component supplier requirements.
- Check steady state operating temperature is in compliance with all system & component supplier requirements.
- Check for & repair any external leaks.
- After the first few hours of running, clean or renew all filters, as appropriate.
- IF IN DOUBT CONSULT ROTARY POWER

PRODUCT OVERVIEW

XL MOTORS

- Radial piston, multi-stroke cam design
- Displacement 150 cc 1120 cc/rev
- Continuous pressure 210 Bar
- Fixed displacement
- Compact design with 4 output styles
- Freewheel capability

XK MOTORS

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- Radial piston, multi-stroke cam design
- Displacement 999cc 5010 cc/rev
- Continuous pressure 350 Bar
- Two speed option
- Dynamic and parking brakes
- Freewheel capability

XF MOTORS

- Radial piston, multi-stroke cam design
- Displacement 150 cc 1360 cc/rev
- Continuous pressure 210 Bar
- Fixed displacement
- Compact design with 4 output styles
- Freewheel capability

SMA MOTORS

- Radial piston eccentric design
- Displacement 200cc 16,000 cc/rev
- Continuous pressure 350 Bar
- Fixed displacement
- High power
- High speed
- Freewheel capability
- Two speed option