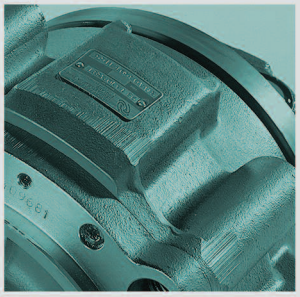
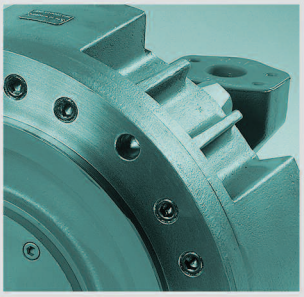
ROTARY POWER


SMA | 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 Pumps for heavy-duty open circuit applications. Wide range of controls. Excellent life characteristics. Suitable for most fluids, including HLP,HFA, HFB, HFC ,HFD, HFR , HFE , Isocyanates & Polyols. 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 2 to 125 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.

"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 200 to 16,400 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.

SMA FEATURES

High Pressure Capability

- Most SMA motors are designed for continuous 350 bar & intermittent 490 bar duty.
- Will withstand higher peak pressures.

High Power Capability

- Designed for continuous high power use.

High Speed Range

- Designed to operate over a wide speed range.
- Up to 150:1 for standard models.
- Up to 1000:1 for some special models.

High Efficiencies

- Minimal no load pressure drop even at high speed.
- Efficient design based on hydrostatic & taper roller bearings.

Robust

- Built to withstand high mechanical & hydraulic shock load.
- Hardened high tensile steel crankshaft supported in large taper roller bearings.
- Gears may be mounted directly on motor shafts (please ask for details).

Series Operation

- Max system pressure allowed on inlet and outlet ports simultaneously.
- This allows greater system flexibility.

Freewheel

- True freewheel possible.
- Recirculating freewheel possible.

Multi Displacements

- Displacement ratios range 1.6 - 2.6
- for multi-motor circuits, series/parallel circuits are possible.

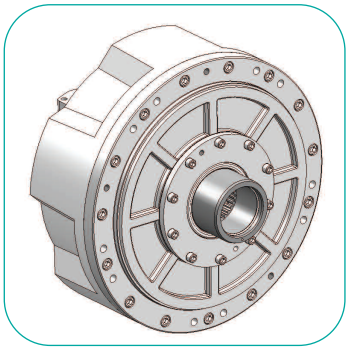
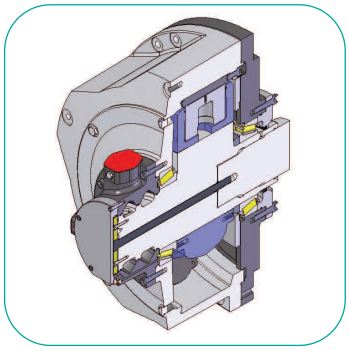
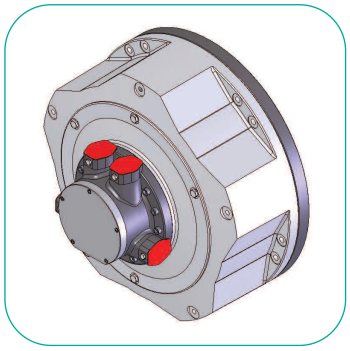
High Power Options

- Typically 60% higher rating than standard SMA motors.

Fluid Versatility

- Suitable for use with most hydraulic fluids.
- HFA,HFB,HFC,HFD.

INDEX

THE SMA MOTOR

DESCRIPTION OF OPERATION

The motor function is achieved by five pistons carried radially in a cylinder block mounted on an eccentric on the driveshaft. Hydraulic fluid under pressure is fed to each piston in turn from axial galleries in the crankshaft through a timing slot in the eccentric. The pistons are supported by flat reaction pads inside the motor case. Pressurising the pistons produces a turning moment on the eccentric by direct hydraulic pressure, thus eliminating connecting rods or other mechanical linkage between piston and crankshaft and the resultant losses associated with such components. Each piston is supported at the reaction pad end by a hydrostatic bearing and is free to float sideways to accommodate the orbiting action of the cylinder block. Correct location of the cylinder block relative to the reaction pads is maintained by a coupling. The crankshaft is supported on large taper roller bearings capable of accepting both radial and axial external loads. Fluid is fed to and from the crankshaft galleries through a rotating distributor system at the non-drive end of the shaft.

FREE-WHEEL ABILITY

The ability to free-wheel is an inherent feature of the SMA range. Only hydraulic system pressure retains the pistons against their respective pads; therefore if the motor is isolated from the rest of the system the piston sleeves are free to retract, thus allowing the cylinder block to orbit without pumping fluid and consequently with negligible resistance. Piston retraction is achieved by pressurising the motor case. Drive is re-engaged by opening the hydraulic supply to the motor, when the pistons resume their normal working position against their respective pads. During this process the large hydrostatic bearing surface has a dampening effect, preventing harsh contact between each piston and its pad.

MULTIPLE DISPLACEMENT OPTION

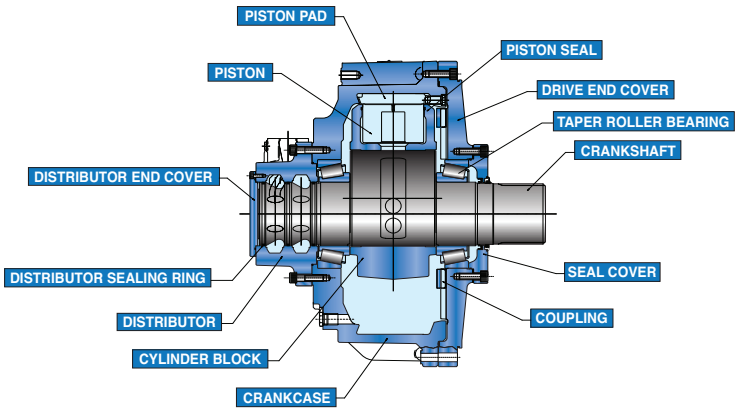
Multiple displacements are achieved as follows:

'C' Configuration:
By separating the bore and wall areas of the pistons, so they can be pressurised simultaneously or independently. Pressurising the full area gives maximum torque and displacement, whilst pressurising the wall or bore areas gives intermediate and minimum displacements respectively.

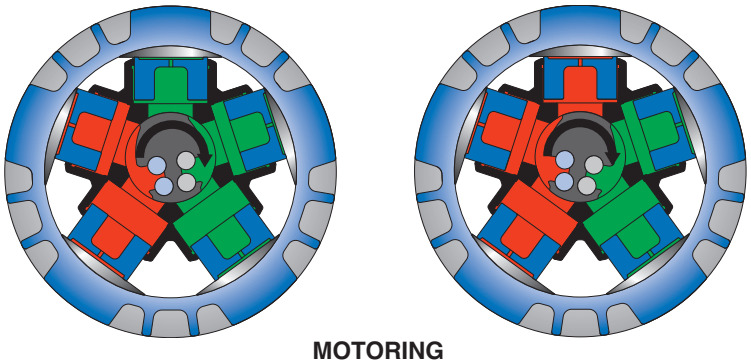
'T' Configuration:
By separating each bank of this double-bank motor, so each bank can be pressurised simultaneously or independently. Pressurising both banks gives maximum torque and displacement, whilst pressurising only one bank gives minimum displacements respectively.

In each case, flow is directed to individual displacement areas through dual galleries in the crankshaft, via an integral pilot-operated selector valve, mounted on the distributor housing. This valve ensures that the non-pressurised area remains full of hydraulic fluid, thus allowing displacement to be changed while the motor is turning, under load.

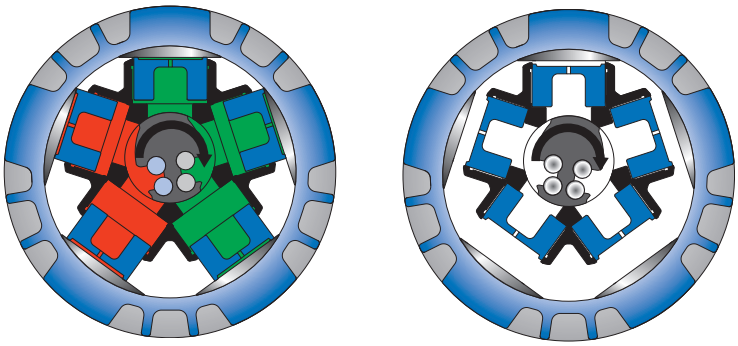
COMPONENT IDENTIFICATION



High pressure **Low pressure**



MOTORING

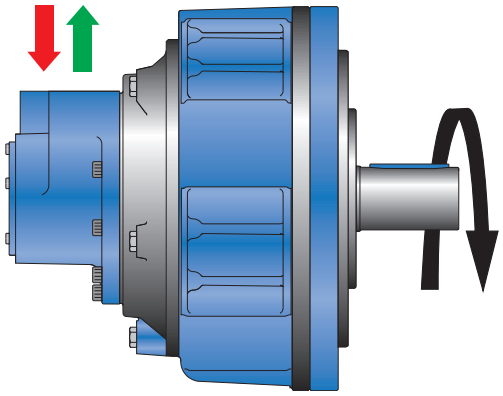


MOTORING **FREEWHEEL**

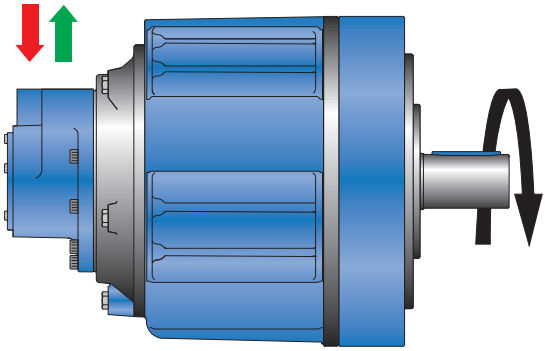
CONFIGURATIONS

ROTATING SHAFT

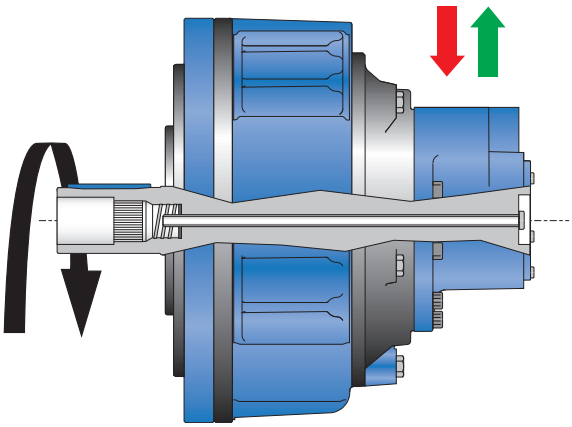
SINGLE BANK C



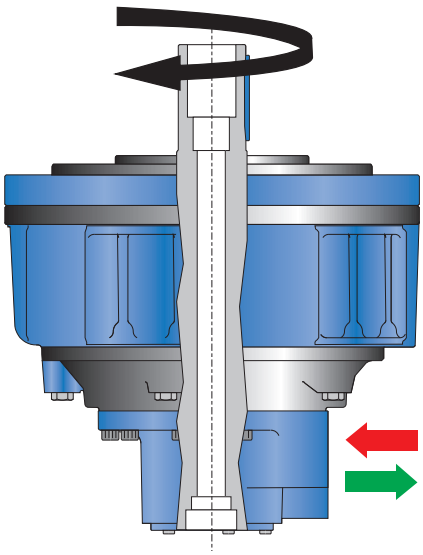
DOUBLE BANK T



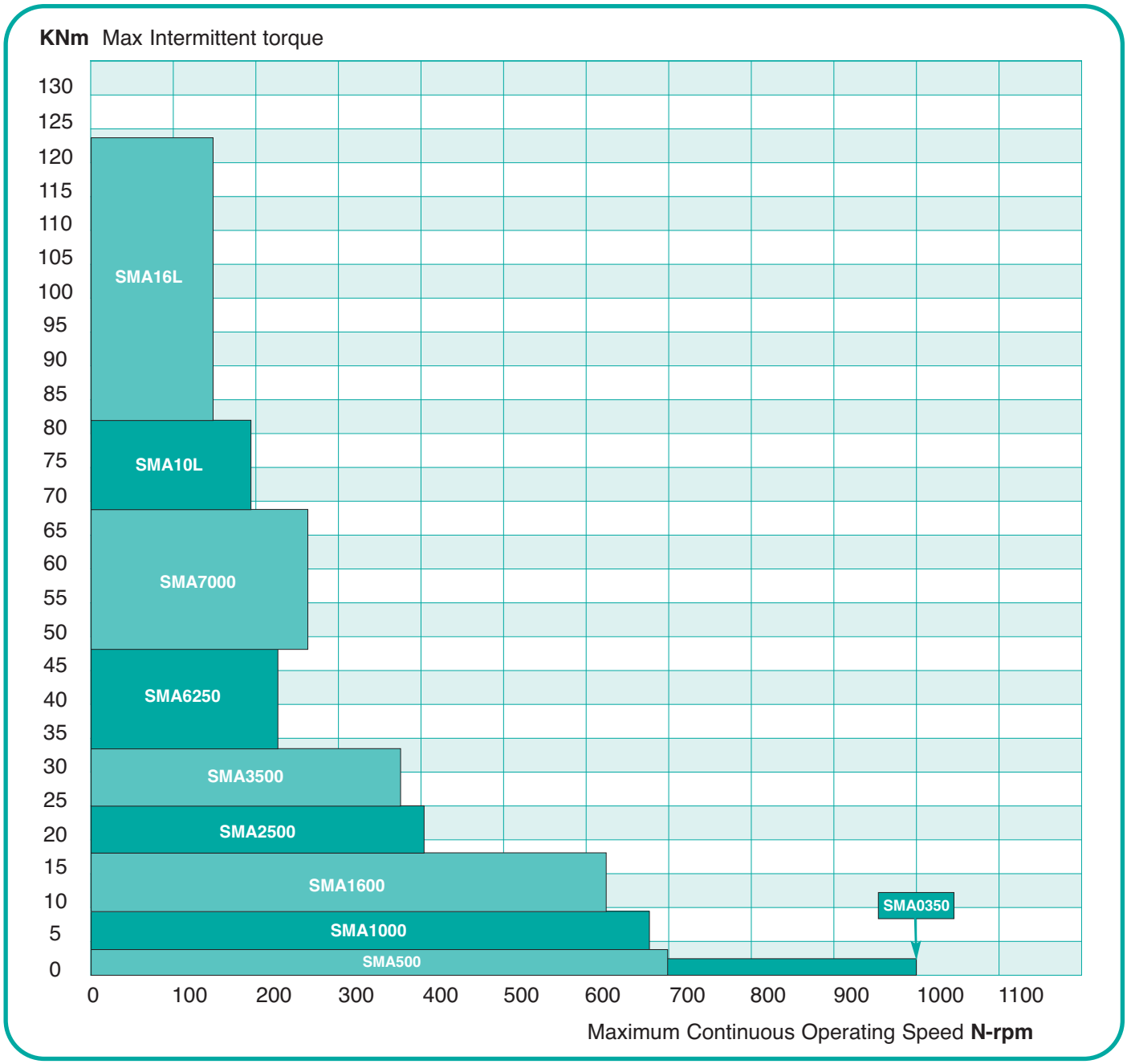
TORQUE ARM MOUNT V



W TOP DRIVE (Vertical-Mount)



MOTOR SELECTION



1. Operating envelopes shown, cover High Power option, Max Intermittent Torque @ 490 bar & Max Continuous Speed capabilities, within each frame size. (Refer to page 16 for definition of 'intermittent')
2. Use the above chart for Initial Frame Size selection & then consult the appropriate Technical Data sheet, for specific motor capabilities.

CALCULATIONS

Output torque (NM) = $\dfrac{\text{Motor displacement (cc) x delta pressure (bar) x } \eta m}{20\pi}$

Flow (lpm) = $\dfrac{\text{Motor displacement (cc) x rotational speed (rpm)}}{1000 \times \eta v}$

Output power (Kw) = $\dfrac{\text{Output torque (NM) x rotational speed (rpm)}}{9550}$

Where:

ηm = Mechanical efficiency

ηv = Volumetric efficiency

For approximate estimates of performance use:

$\eta m = 0.95$

$\eta v = 0.95$.

SMA ORDER CODES

SMA MOTOR MODEL CODE

SMA 0350 C 1 XXX

Up to 8,700 cc/rev

NOMINAL DISPLACEMENT cc/rev
0200
0350
7000
8700

SMA10L and SMA16L

NOMINAL DISPLACEMENT cc/rev
10L3 - 7,400
10L2 - 8,800
10L1 - 10,500
16L2 - 13,000
16L1 - 16,400

Sequential reference number, determined according to build specification

NOMINAL DISPLACEMENT
1 - Single
2 - Double

CONFIGURATION
C - Rotating shaft, single-bank
T - Rotating shaft, double-bank
V - Rotating shaft, torque arm mount
- Other

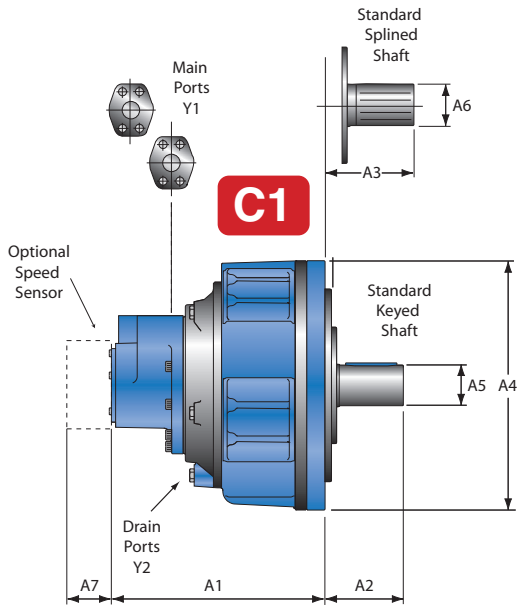
Individual motor specification will be established at the time of ordering.
Refer to CONFIGURATION & TECHNICAL DATA sheets for available options.

Options include: Viton seals, mechanical shaft seal, special splines, speed sensing, marine shaft sealing
Consult RP application engineers for details of 'W' top-drive and rotating case options.

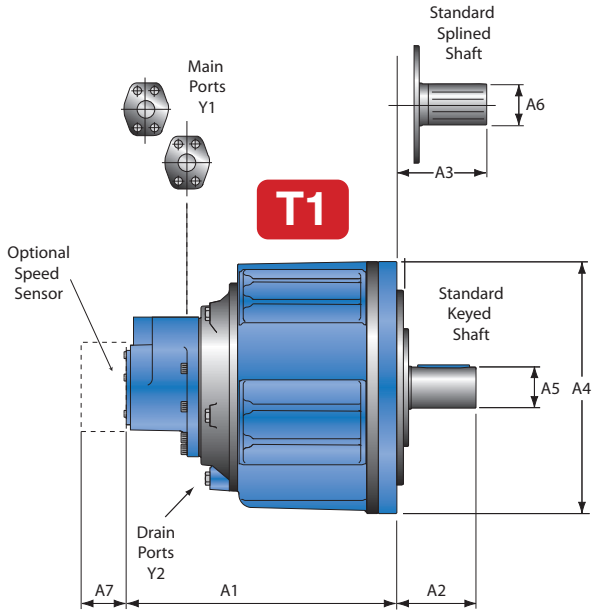
DIMENSION DATA

ROTATING SHAFT MOTORS

SMAXXXX C1 XXX



SMAXXXX T1 XXX



Rotating Shaft	C1/T1	FRAME SIZE									
Dimensions (mm, *inches*)	Nominal Displacement (cc/rev)	200	500	750	1340	2000	3500	5000	7000	7400	13000
		290	-	850	1600	2500	4350	6250	8700	8800	16400
		350	-	1000	2200	2800	-	-	-	10500	-
		480	-	1230	-	3200	-	-	-	-	-
	Configuration	C1	C1	C1	C1	C1	C1	C1*	T1	C1*	C1*
Envelope	A1	315	335	394	449	508	602	T.B.A.	761	604	706
	A2	122	154	156	181	184	225		225	310	292
	A3	122	154	156	181	184	225		223	310	292
	A4-dia	345	370	436	545	583	695		700	900	1140
	A5-dia	50	60	63	80	95	110		120	180	220
	A6-dia	*19t 10/20*	*18t 8/16*	*19t 8/16*	*24t 8/16*	*28t 8/16*	*25t 6/12*		*26t 6/12*	*41t 6/12*	*48t 6/12*
	A7	16	16	32	11	25	27		25	0	0
Main Ports	Y1	*1”*	*1”*	*1-1/4”*	*1 1/2”*	*2”*	*2”*		*2”*	*2”*	*2 x 2”*
		SAE J518 Code 62							*SAE J518 Code 62*		
Drain Ports	Y2	*1/2”*	*1/2”*	*1/2”*	*1/2”*	*5/8”*	*5/8”*		*1”*	*1”*	*1”*
		SAE J514							*SAE J514*		

*These motors are V1 configured, but supplied with an assembled shaft to convert to a C1.

TECHNICAL DATA - ROTATING SHAFT C1 & T1

Motor Size		General Data		Standard		High Power	
Nominal Displacement cc/rev	Geometric Displacement cc/rev	Moment of Inertia Kg.m²	Approx Dry Weight Kg	Max Continuous Power kW	Max Continuous Speed rpm	Max Continuous Power kW	Max Continuous Speed rpm
200	207.8	0.0052	83	28	480	54	1000
290	289.3	0.0052	83	40	480	76	1000
350	339.3	0.0052	83	48	480	89	1000
480	480.7	0.0057	88	68	480	126	710
500	502	0.0094	110	61	430	103	700
750	757	0.0174	170	84	380	137	620
850	857	0.0174	170	95	350	155	620
1000	996	0.0199	170	100	350	187	600
1230	1160	0.0210	180	124	283	196	580
1340	1343	0.0487	290	125	320	221	565
1600	1602	0.0487	290	140	300	264	565
2200	2227	0.0900	-	195	216	264	406
2000	2003	0.0715	440	165	285	222	380
2500	2507	0.0715	440	185	285	278	380
2800	2801	0.0715	440	200	260	300	380
3200	3215	0.0715	440	237	240	357	380
3500	3504	0.2293	790	245	240	358	350
4350	4349	0.2293	790	304	240	400	240
5000	5019	0.2850	-	Not Applicable		450	210
6250	6250	0.2850	-			550	190
7000	7009	0.4100	1140			491	240
8700	8698	0.4100	1140			609	240
7400	7381	0.6440	1250			443	180
8800	8812	0.6440	1250			528	150
10500	10498	0.6440	1250			630	125
13000	13000	0.9550	-			820	125
16000	16400	0.9550	-			900	125

Unless otherwise stated:	
Maximum Continuous Pressure	350 bar
Maximum Intermittent Pressure	490 bar
Minimum Return Pressure	7 bar
Maximum Case Pressure	8 bar
Maximum Intermittent Speed	160% Maximum Continuous Speed
Maximum Freewheel Speed	160% Maximum Continuous Speed
Minimum Speed	5 rpm (Standard) / 10 rpm (High Power)

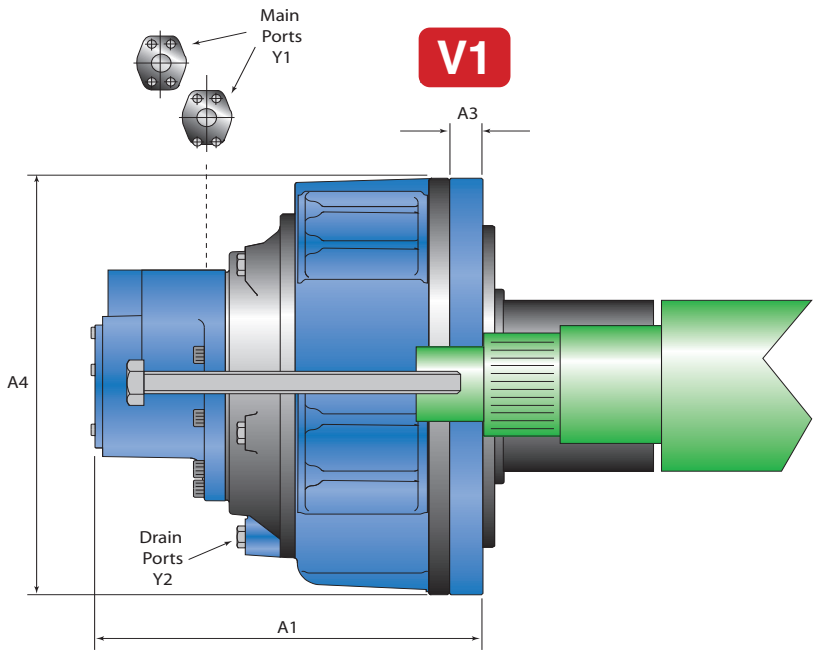
Ideally suited to applications requiring high powers or high speeds

- **Select Standard** option, where application power/speed allows, if best volumetric efficiency is required.
- Otherwise, select **High Power** option, for max motor performance.
- Options include Viton seals, speed sensors, shaft-up seal cover vent porting, 4 port distributor.

INSTALLATION DATA

TORQUE ARM MOUNT - ROTATING SHAFT MOTORS

SMAXXXX V1 XXX



Top Drive	V1	Frame Size					
Dimensions (mm, *inches*)	Nominal Displacement cc/rev	1340	2500	3500	5000	7400	13000
		1600	2800	4350	6250	8800	16400
						10500	
Mounting	A1	381	514	554	549	604	706
	A2	184	33	147	147	144	122
	A3 #	-4	96	132	132	126	178
	A4 - dia	545	583	695	758	900	1140
	A5 - dia	168	100	158	174	180	250
Ports - SAE J514	Y1	*1 1/4”*	*2”*	*2”*	*2”*	*2”*	*2 x 2”*
		SAE J518 Code 62					
Drain Ports	Y2	*1/2”*	*5/8”*	*5/8”*	*5/8”*	*1”*	*1”*
		SAE J514					

- ve Dimension indicates this feature is outboard of the motor mounting face.

TECHNICAL DATA - TORQUE ARM MOUNT ROTATING SHAFT V1

Motor Size		General Data			
Nominal Displacement cc/rev	Geometric Displacement cc/rev	Moment of inertia $Kg.m^2$	Approx Dry Weight Kg	Max Continuous Power kW	Max Continuous Speed rpm
1340 1600	1343 1602	0.0487	314 314	125 140	320 300
2500 2800	2507 2801	0.0715	446 446	185 206	285 260
3500 4350	3504 4349	0.2293	683 683	245 304	240 240
5000 6250	5019 6250	0.2850	812 812	450 550	210 190
7400 8800 10500	7381 8812 10498	0.6440	1322 1322 1322	443 528 630	180 150 125
13000 16000	13000 16400	0.9550	2443 2443	820 900	125 125

Unless otherwise stated:	
Maximum Continuous Pressure	350 bar
Maximum Intermittent Pressure	490 bar
Minimum Return Pressure	7 bar
Maximum Case Pressure	8 bar
Maximum Intermittent Speed	160% Maximum Continuous Speed
Maximum Freewheel Speed	160% Maximum Continuous Speed
Minimum Speed	10 rpm
Available only in standard power specification.	

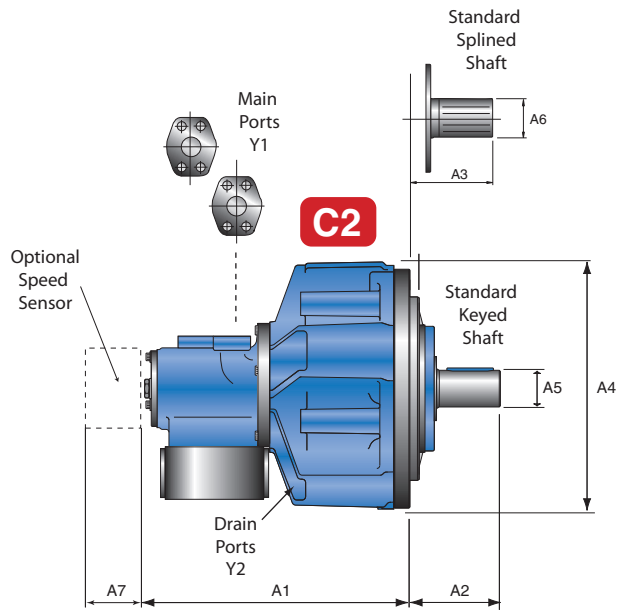
Ideally suited to torque-arm mounted applications requiring high powers or high speeds.

- Options include Hall-Effect & Proximity type speed sensor ports & Viton Seals
- Request mating shaft and central mounting bolt dimensional drawings from RP

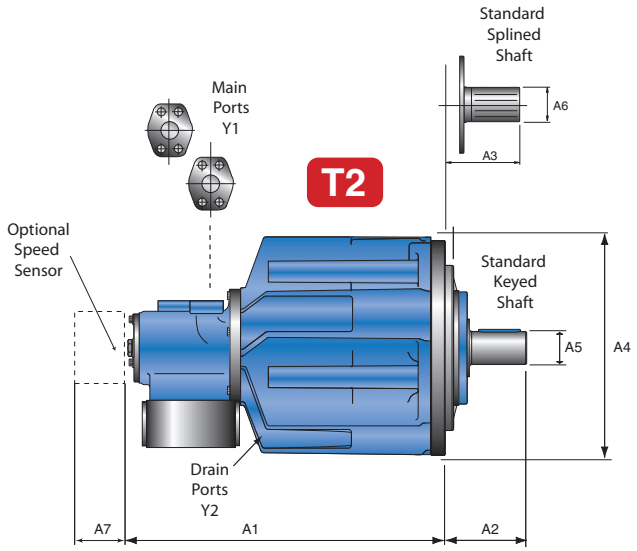
INSTALLATION DATA

ROTATING SHAFT MOTORS: MULTI-DISPLACEMENT

SMAXXXX C2 XXX



SMAXXXX T2 XXX



Rotating Shaft	C2 / T2	Frame Size		
Dimensions (mm, *inches*)	Nominal Displacement cc/rev	750 1000	1340 1600	7000 8700
	Configuration	C2	C2	T2
Envelope	A1	456	557	807 #
	A2	156	181	225
	A3	156	181	225
	A4-dia	436	545	700
	A5-dia	63	80	110
	A6-dia	19t 8/16	24t 8/16	26t 6/12
	A7	tba	tba	tba
Main Ports	Y1	*1-1/4”*	*1-1/2”*	*2”*
		SAE J518 Code 62		
Drain Ports	Y2	*1/2”*	*1/2”*	*1”*
		SAE J514		

add 46mm when X-Line R/Valve fitted

TECHNICAL DATA - MULTI-DISPLACEMENT - ROTATING SHAFT (SINGLE BANK) - C2

Motor Size	General Data		MAX Displacement			1.6 Ratio MID Displacement			2.6 Ratio MIN Displacement		
Nominal Displacement - cc/rev	Moment of Inertia - Kg.m^2	Approx. Dry Weight - Kg	Geometric Displacement - cc/rev	Max Continuous Power Kw	Max Continuous Speed - rpm	Geometric Displacement - cc/rev	Max Continuous Power Kw	Max Continuous Speed - rpm	Geometric Displacement - cc/rev	Max Continuous Power Kw	Max Continuous Speed - rpm
750	0.02	170	757	84	360	469	69	505	288	64	760
1000	0.02	175	996	100	350	625	85	465	371	76	700
1340	0.05	304	1343	125	320	832	103	425	511	95	640
1600	0.05	305	1602	140	300	1036	121	400	566	108	600

Unless otherwise stated:	
Maximum Continuous Pressure	350 bar
Maximum Intermittent Pressure	490 bar
Minimum Return Pressure	7 bar
Maximum Case Pressure	8 bar
Maximum Intermittent Speed	160% Maximum Continuous Speed
Maximum Freewheel Speed	160% Maximum Continuous Speed
Minimum Speed	10 rpm
Available only in standard power specification	

Ideally suited to applications requiring high power, combined with high speed range.

- Motors may be run in both directions
- Displacements may be changed dynamically, during normal motor operation
- Displacement change is signalled hydraulically
- Options include Viton seals, speed sensor ports and shaft up seal cover vent porting.

TECHNICAL DATA - MULTI-DISPLACEMENT - ROTATING SHAFT (DOUBLE BANK) - T2

Motor Size	General Data		MAX Displacement			Available Options			
						MIN Displacement			
Nominal Displacement - cc/rev	Moment of Inertia - Kg.m^2	Approx. Dry Weight - Kg	Geometric Displacement - cc/rev	Max Continuous Power Kw	Max Continuous Speed - rpm	Displacement Ratio	Geometric Displacement - cc/rev	Max Continuous Power Kw	Max Continuous Speed - rpm
7000 8700	0.41 0.41	1140 1190	7009 8698	490 607	240 240	2.0 2.0	3504 4344	245 304	240 240

Unless otherwise stated:	
Maximum Continuous Pressure	350 bar
Maximum Intermittent Pressure	490 bar
Minimum Return Pressure	7 bar
Maximum Case Pressure	8 bar
Maximum Intermittent Speed	160% Maximum Continuous Speed
Maximum Freewheel Speed	160% Maximum Continuous Speed
Minimum Speed	10 rpm
Available only in standard power configuration	

Ideally suited to applications requiring fine positional speed control, combined with high speeds [high speed range].

- Motors may be run in both directions
- High-pressure port requires application designation, to provide minimum internal motor leakage
- Displacements may be changed dynamically, during normal motor operation
- Displacement change is signalled hydraulically
- Options include Viton seals, speed sensor ports and shaft up seal cover vent porting.

MOTOR INSTALLATION AND APPLICATION

GENERAL

The following information is for general guidance only and it is recommended that individual applications are discussed with Rotary Power.

Always examine the motor externally to check that damage has not occurred during transit. Ensure that the areas around the protective plugs are clean and remove all protective coatings.

Do not remove protective plugs from the main ports and drain connections until system flushing is complete and imminent connection to the circuit is to be made.

MOUNTING

Installation and motor specification available upon request

Case mounting

Provision is made for locating the motor by means of a spigot diameter on the motor case. The motor should be mounted on a flat, machined face with a pilot diameter machined to the nominal spigot +0.025 to +0.075 mm. Clearance should be provided for the fillet radius between the motor spigot and mounting face. Fixing is by either 5 or 10 mounting bolts, depending upon motor model. All fixing holes provided should be utilised. If heavy or frequent torque reversals are anticipated, one or more of the attachment holes should be reamed in conjunction with the mounting bracket and then bolts fitted.

Torque Arm Mounting

Please consult Rotary Power for details.

Shaft details C1/C2/T1/T2

Two standard output shaft end options are available on the SMA motor range; cylindrical shaft with parallel key or BS involute side fit splined shaft.

Motor drive connections should be designed to eliminate unnecessary axial and radial loads and thus prolong bearing life. A cylindrical shaft is recommended for a flexible coupling output connection, and a splined shaft used where the driven shaft is rigidly connected to the motor. Alignment of the two shafts should be maintained within 0.05 mm TIR.

Splined shafts should be assembled using molybdenum grease, or preferably in an oil bath.

When using cylindrical shafts in applications where pressures are high or where reverse loadings or shock loads are expected then the coupling should be shrunk onto the shaft to provide an interference fit. Note: hammering or pressing components onto the shaft may cause damage to the crankshaft bearings.

MOTOR INSTALLATION AND APPLICATION

CASE DRAINS

Rotating shaft motors are provided with 2 or more main drain ports located on the main crankcase.
The drain port that is to be used should be installed in the highest possible position. The bore size of the drain line should be large enough to minimise case pressure under all operating conditions. Rotary Power can advise case flow and flushing flow (if applicable) for each specific model so that drain lines can be sized correctly.

For shaft up applications, an optional top vent must be used and for shaft down an optional distributor end vent port must be used. These are to be used in conjunction with the main case drain port, which itself must be looped up to the level of the top or distributor vent, to prevent siphoning.

Motor case pressure should be kept to a minimum. Continuous high pressure will adversely affect the life of the shaft seal system, and also affect the minimum boost pressure requirements for correct motor operation. Motor drain lines should be independently returned to the tank.

RADIAL/AXIAL LOADS

SMA motors will accept high radial and axial loads. For individual motor information, or to discuss your application requirements, please contact Rotary Power.

FREEWHEELING

The ability to freewheel is an inherent feature of the SMA motor. True freewheel is achieved by isolating the main ports from the pressure supply and connecting them direct to tank.

The case pressure needs to be developed by adding flow to the motor case, and creating a back pressure in the drain line (nominally 2 Bar above any remaining main port pressures).

This retracts and holds the pistons in their respective bores and provides internal lubrication to hydrostatic bearings. It is possible to engage and dis-engage freewheel whilst the motor is rotating. However, due to the potentially high flow rates that may be required, the high risk of pump cavitation damage and excessive motor case pressures, it is highly recommended where possible to engage and dis-engage freewheel whilst the motor is stationary.

FLUIDS

SMA motors will operate successfully on a wide variety of fluids. As a general guide de-rating factors are set out below:

Fluid type	% of maximum catalogue speed rating	% of maximum catalogue pressure rating
HF-A High water base	66	50
HF-B Water in oil	75	60
HF-C Water glycol	50	50
HF-D Phosphate ester	100	100
HF-E Synthetic ester	100	100
HL-P Mineral oil	100	100
HF-R Rape seed oil	100	100

Recommended fluid type HL; HLP to DIN 51524

MOTOR INSTALLATION AND APPLICATION

VISCOSITY

Optimum viscosity 20-200 cSt.
Minimum / maximum viscosity 15-1000 cSt.

FILTRATION / CLEANLINESS

Fluid cleanliness to NAS 1638 Class 9 ISO code 18/13 or better
Filtration B25 ratio 75 or better for a simple closed loop system.

OUT OF BALANCE FORCES

The orbiting motion of the cylinder block in rotating shaft motors creates an out of balance force as the motor rotates. In most low to medium speed applications this has no detectable effect. However, where speed is high or where the machine mass is very low, it may be beneficial to install a counterbalance weight.

SEALING

All standard SMA motors are fitted with a nitrile sealing system that is compatible with mineral hydraulic fluids.

STARTING TORQUE

Many factors will influence starting efficiencies, such as differential pressure and the rate of rise of pressure. Typical starting torque efficiency is 92% .

LOW SPEED OPERATION

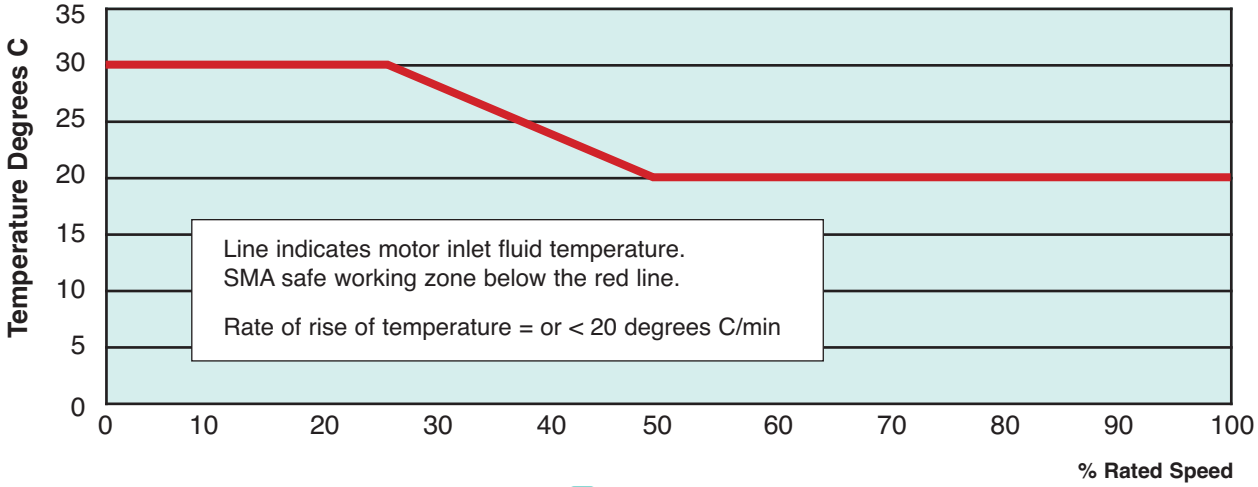
The minimum operating speed capable will depend upon the motor model and the operating conditions but can be as low as 5 rpm for a standard motor and 10 rpm for the high power version. Special designs are available to provide optimised low speed operation.

TEMPERATURE

Recommended minimum/maximum operating temperature range between -20 and +90 degrees Centigrade. Higher temperatures may be permissible if required through the use of alternative seal materials, providing the fluid viscosity remains within the optimum range.

A temperature differential above 30 degrees Centigrade between the motor and the bulk oil should be avoided. A case warming flow taken from a 'hot' part of the circuit can be used to minimise this differential.

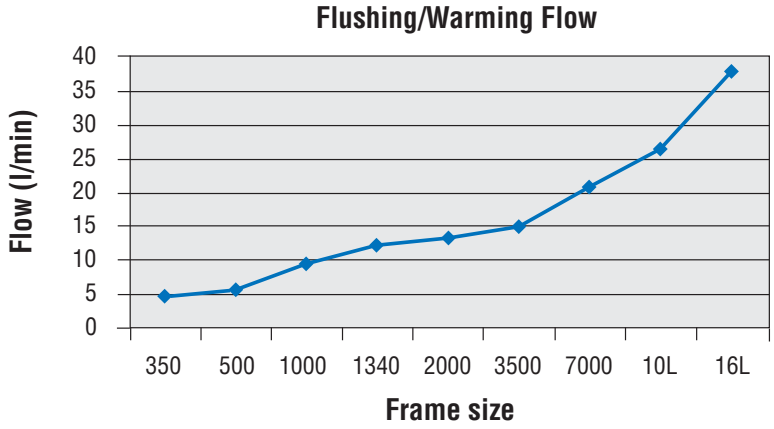
SMA SAFE WORKING DIFFERENTIAL TEMPERATURE



MOTOR INSTALLATION AND APPLICATION

FLUSHING/WARMING FLOW

A case warming flow may be required if temperature differentials of 30 degrees Centigrade are envisaged between motor temperature and the bulk oil temperature. Flushing flow on graph below can be used for guidance to meet temperature. (Valves can be supplied, consult with Rotary Power)



EFFICIENCY

The SMA motor is highly efficient as a result of its unique 'column of oil' operating principal.
Mechanical efficiency is high on all models being around 95% at pressures above 200 Bar.
Volumetric efficiency is dependant upon the specific model applied.

DUTY - CONTINUOUS, MAX / INTEMITTENT VALUES

Continuous ratings, quoted in the Technical Data sheets, are allowable for continuous periods of operation & for durations which provide an acceptable life for the application.

(Refer to Rotary Power product support department for motor life estimates, based on typical application duty cycle).

Intermittent values quoted in the technical charts may occur for up to 10% of every minute of a known duty cycle.

PRESSURES

All motors are rated at maximum continuous pressure of 350Bar, with an intermittent rating of 490 Bar.
Positive gauge pressure must be maintained at both main ports at all times while the motor is under load, whether or not the motor shaft is rotating. Boost pressure should not be less than 7 Bar above case pressure, with a fluid viscosity of 30 cSt. When using higher viscosity fluids, higher boost pressures will be required. For over-running conditions, consult Rotary Power.

MULTI SPEED

Dependant upon the model, multi speed ratios between 1.6 & 2.6 are possible.

OPEN CIRCUIT OPERATION

SMA motors can operate successfully in open circuit systems. A minimum back pressure of 7 Bar must be maintained.

SERIES OPERATION

Maximum system pressure is allowed on both inlet and outlet ports simultaneously.
This allows for operation of the motors in a series circuit.

COMMISSIONING / SERVICE

READ THIS TOGETHER WITH INSTRUCTIONS SUPPLIED FOR OTHER COMPONENTS FITTED.

1. During system assembly thoroughly descale, clean and flush all pipework, fittings and the reservoir.
   Fill the system with new, filtered fluid that meets required specifications regarding viscosity at envisaged operating temperature, type and cleanliness for all components fitted within the system. Motor requirements are given in each technical data section. The motor case must be filled through the motor case drain port on rotating shaft motors or, through one of the case vent ports located in the crankcase on rotating case motors. Ensure the case drain line is filled and all connections tightened.

2. Check the rotation-flow information given on the installation drawing.

3. Start the drive pump slowly
   - for engines, turn over on the starter motor for a few seconds at a time.
   - for electric motors, by a series of rapid on /off cycles.
   This is to ensure the pump internal components are filled with oil.
   Run the system at 25% max high flow and low pressure, actuate all systems in all modes until all entrained air in the system has been released. This air could cause some pulsation but, the motor should run smoothly after approximately ten minutes operation.

4. After the motor rotation has been proved under no- load conditions, it may be operated up to maximum pressure.

5. Check and top up fluid level if necessary.

6. The motor case pressure should be checked in all operating modes to ensure that the maximum allowable value for the specific motor model is not exceeded.

7. Check and adjust all settings where necessary in compliance with all supplier's instructions to system requirements.

8. Check steady state operating temperature is in accordance with system and component requirements.

9. Check for and repair any leaks.

10. After the first few hours running, clean or renew (as appropriate) all filters.

11. The following points should be incorporated in the machine maintenance instructions:

    After one hundred hours operation ;

A. Check the security of all mounting bolts and socket head screws used in the assembly of the motor.

B. Check the security of the drive coupling and pipe connections.

C. Clean or replace filter elements as recommended by the manufacturer.

SMA SERVICE

Full factory service is available for general overhaul and test to new motor standard. Shaft seals may wear and need periodic replacement. Seal kits are available and it is recommended that a suitable stock level is held.

Motors returned for factory overhaul should have been cleaned externally and drained of fluids. Transport plugs should be fitted to all ports as soon as machine pipe work has been removed and before the motor is dismounted. All ancillary equipment should be removed where possible and the unit should be clearly labelled, stating who has sent it, and where from.

Please contact ROTARY POWER product support department for further information.

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