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Gears & Variable Speed

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MKF3, 4 & 5 Carter Variator

INSTALLATION & MAINTENANCE INSTRUCTIONS

INSTALLATION, STARTING UP AND ROUTINE MAINTENANCE INSTRUCTIONS

Carter Variators are precision built machines and are subjected to thorough testing before despatch. If the correct size of variator is selected and installed and careful attention is given to the following instructions, then reliable service can be expected.

MOUNTING

MKF type Variators must be rigidly mounted with feet and shafts horizontal. Where it is desired to mount them other than in the horizontal position, full details of proposed application and mounting should be forwarded for our approval. Supporting structure should be adequately proportioned to resist all the forces imposed by the drive reactions and to maintain correct alignment of all drive components. Large flat areas of thin metal should be stiffened to prevent undue amplification of noise. Where drives are enclosed within structures or guards, it is essential to provide adequate ventilation to ensure reasonable ambient temperature conditions.

OVERLOAD PROTECTION

On applications where there is a known or suspected risk of severe and/or sudden shock loads or dead stops, our overload protection unit should be fitted. **NB:** Driving motor overload trips do *NOT* provide adequate overload protection for the Carter Variator.

INPUT DRIVE

The input shaft should only be driven in the direction indicated by the arrow on the fan cowl or belt guard.

SIZE	MAX INPUT RPM	MIN INPUT RPM
MKF3	1840	500
MKF4	1675	500
MKF5	1160	500

OUTPUT DRIVE

Output drive ratios should be arranged so that the maximum output speed of the variator coincides with the required maximum machine shaft speed, thus ensuring maximum power transmission and speed control efficiency. Both directions of output rotation are possible through operation of the speed control. However, it may be restricted to only one direction by a mechanical stop.

If the variator is to be used in any application where the output shaft is submerged (i.e. flanged to a gearbox full of oil), then it will be necessary to fit an extra seal to the output cover. These can be supplied on request.

MKF3, 4 & 5 TYPE CARTER VARIATOR

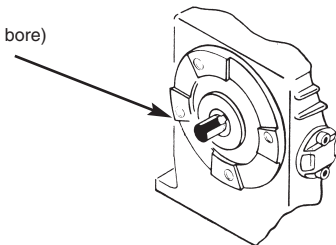
SHAFT FITTING RECOMMENDATIONS

Couplings, pinions and pulleys should incorporate 'Taper' bushes or be bored a light keying fit to ensure that during fitting, no heavy driving force is applied to the variator input or output shaft.

Similarly, end thrust **MUST NOT** be imposed on the shafts during operation. If the variator is to be directly coupled to either the driving or driven shaft, a flexible coupling must be used with ample clearance between shaft ends. Alignment of shafts should be carefully checked. Any misalignment puts unnecessary loading upon the whole drive and in particular the bearings and oil seals.

NOTE:- When fitting a flanged motor to the variator, the plastic shim provided should be placed into the bore as shown in figure 1. Before fitting the shim, the keyway must be carefully deburred and the bore thoroughly cleaned out.

Figure 1
(fitting plastic shim to input bore)



OVERHUNG LOADS

Belt drives, spur gears or chain drives, etc., may be used in conjunction with MKF type Variators, but consideration must be given to the overhung loads that these drives impose on the input and output shaft. This may be calculated as follows:

$$\text{Load (N)} = \frac{\text{TORQUE (Nm)} \times 10^3 \times F}{\text{RADIUS (mm)}}$$

$$1 \text{ Newton} = 0.2248 \text{ lbf}$$

Where: RADIUS = Pitch circle radius of chain sprocket, spur gear or belt pulley, and

F = Application Factor ie.

Chain sprocket	- 1.00	Vee/Wedge pulley	- 1.50
Spur Gear	- 1.25	Flat Belt pulley	- 2.00

The maximum permissible shaft loads are given in the table below, and are concentrated loads imposed at the centre of the keyway, midway along the shaft length. Any deviation from this position will increase or decrease the amount that can be safely applied.

CARTER VARIATOR

Maximum overhung loads (Newtons)

	Carter Variator size		
	MKF3	MKF4	MKF5
Input shaft	300	350	700
Output shaft	400	500	900

RS SERIES REDUCTION UNIT

Maximum overhung loads (Newtons)

1 Newton = 0.2248 lbf

Maximum output speed (rev/min)	RS Series Size						
	GM0D	GM1T	GM2D	GM2T	GM3D	GM3T	GM4T
800 to 601	900	-	-	-	3780	-	-
600 to 501	1040	-	2070	-	3910	-	-
500 to 401	1100	-	2200	-	4140	-	-
400 to 301	1200	-	2420	-	4450	-	-
300 to 251	1290	-	3160	-	4600	-	-
250 to 201	1380	-	3780	-	4710	-	-
200 to 151	1470	-	4400	-	4890	-	13340
150 to 101	1650	-	4840	-	5380	-	13340
100 to 81	1870	-	5480	-	6050	-	12630
80 to 61	2050	-	5830	5780	6580	-	11920
60 to 51	2050	3560	6000	5560	6940	-	11560
50 to 36	-	4000	-	5470	7120	9160	11030
35 to 21	-	4670	-	5180	-	8900	10670
20 to 11	-	5340	-	4890	-	8450	9990

SPEED CONTROLS

Speed control settings are adjustable with the variator running or stationary and frequent or infrequent speed changes can be made without detriment to the unit. The control can be used to positively accelerate or dynamically brake the driven load providing the main driving motor remains energised.

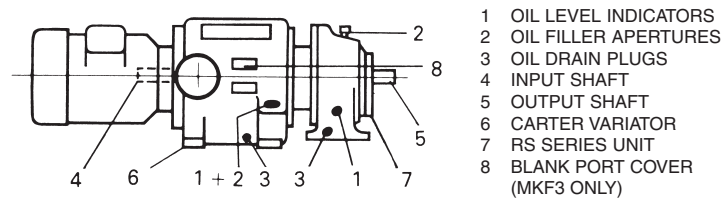
Speed controls are usually set up and tested prior to despatch. However, to avoid damage during transit, combined handwheel and speed indicator controls are packed in a protective carton and supplied loose.

Electric remote and electronic controls should be set up in accordance with the appropriate technical data sheets supplied.

OIL LEVELS

When installing MKF Type Variators fitted with flange mounted RS Series Reduction Gears it is important to remember that these have SEPARATE OIL SUMPS (see figure 2) and require DIFFERENT GRADES OF OIL.

Figure 2



Gear Size	Litres	Oil Capacity (approx).	
		Imperial Pints	US Pints
MKF3	1.7	3.0	2.47
MKF4	3.8	6.7	5.52
MKF5	4.0	7.0	5.8
GM0D	0.4	0.7	0.58
GM1T	0.6	1.1	1.4
GM2D	0.9	1.6	1.30
GM2T	1.3	2.3	1.86
GM3D	1.8	3.2	2.64
GM3T	2.6	4.5	3.71
GM4T	2.6	4.5	3.7

RECOMMENDED GRADES OF OIL

Use a straight mineral oil of good quality, preferably with anti-oxidant, anti-foaming, anti-rust, film strength improvement and low pour point additives and with a flat viscosity curve to ensure ease of starting when cold. COMPOUND OILS MUST NOT BE USED. A range of standard brands are listed below. Other brands may be used provided they conform to the specification relevant to site conditions. Details are available upon request.

AMBIENT TEMP RANGE CENTIGRADE	OIL GRADE	MOUNTING ASSEMBLY
0 - 13	MOBIL DTE15M	MKF VARIATOR WITH DIRECT FLANGED MOTOR
	SHELL TELLUS T46	
13 - 30	MOBIL DTE19M	MKF VARIATOR WITH TOP MOUNTED MOTOR OR COUPLED MOTOR
	SHELL TELLUS T100	
0 - 13	MOBIL DTE15M	RS SERIES REDUCER FLANGED TO VARIATOR
	SHELL TELLUS T46	
13 - 43	MOBIL DTE18M	
	SHELL TELLUS T100	
0 - 43	MOBIL GEAR 632	
	SHELL OMALA 320	

INITIAL STARTING

Before any attempt is made to run the Carter Variator it must be filled with the appropriate quantities and grades of CLEAN oil as detailed above.

The hydraulic system should then be primed as follows:-

Rotate the input shaft or motor fan by hand in the direction indicated by the arrow on the fan cowl or belt guard until the output shaft also rotates. The hydraulic system is now primed.

Wire up the driving motor and CHECK THAT THE INPUT ROTATION TO THE VARIATOR IS CORRECT. The variator will then be ready to be driven under full load conditions.

WEEKLY MAINTENANCE

Examine oil level and top up as required. If it is found that oil has to be added regularly then input and output shaft oil seals and all external fastenings should be checked for leaks.

OIL CHANGES

Under normal conditions of temperature and environment the oil should be changed every 2500 hours or 12 months, whichever is the sooner. Where other working conditions apply, consult your oil supplier. Take care to ensure that dirt does not enter the variator whilst changing the oil. The best time to drain off oil is after running, whilst the oil is still warm (the oil will drain more easily from the drain plug if the oil level plug is also removed).

OIL LEAKAGE

Where oil leakage is evident it will be necessary to renew the relevant oil sealing component as soon as possible. However, oil leaking will, in general, have no effect on the variator performance unless the oil level in the sump falls so low that the hydraulic circuit is starved of oil, thus causing eventual drive failure. Checking the oil level weekly should prevent this and give an early indication of oil leakage. NOTE: Upon completion of any renewal of oil sealing components it is essential that the instructions given under heading 'Initial Starting' are carried out.

MAJOR OVERHAUL

The Carter Variator, correctly applied and maintained, will give many years of reliable service. Should it eventually require overhaul we recommend this is carried out at our works, where all variators are thoroughly tested before despatch and carry our usual warranty. Where this is impracticable, detailed instructions for the required procedure are given in our service manual which is available on request.

For overseas installation, our subsidiary companies and agents are, in general, equipped to carry out examinations and repairs.