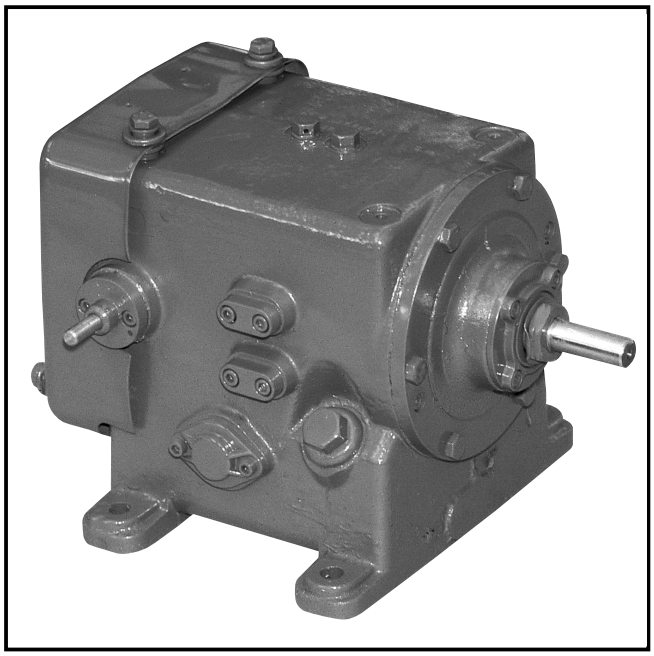
RENOLD
Gears & Variable Speed
Station Road
Milnrow
Rochdale
OL16 3LS

Telephone +44 (0) 1706 751000
Fax +44 (0) 1706 751001
Email **carter@renold.com**

WEB www.renold.com

RENOLD
Gears & Variable Speed



MF Carter Variator

INSTALLATION & MAINTENANCE INSTRUCTIONS

INSTALLATION, STARTING UP AND ROUTINE MAINTENANCE INSTRUCTIONS

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 overleaf. The hydraulic system should then be primed as follows:

Remove plug (Item 8 on fig 1) and rotate the input shaft by hand, in the direction indicated by the arrow on the fan cowl or belt guard until oil flows from the unplugged hole. Replace plug (Item 8) and continue turning the input shaft by hand 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 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). At the same time clean the oil filter element, located in the filter holder (Item 9 on fig 1). When replacing the filter element take care to insert the OPEN end of the filter into the holder first.

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.

MF TYPE CARTER VARIATOR

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 upon request.

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

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
'MF' 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 'V' belt guard at a speed within the range listed below.

	MF10	MF12	MF13	MF14
	rev/min	rev/min	rev/min	rev/min
Max	1900	1720	1430	1160
Min	500	500	500	500

OUTPUT DRIVE

Output drive ratios (whatever type of power transmission equipment is used) should be arranged so that 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.

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 shafts.** 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 mis-alignment puts unnecessary loading upon the whole drive and in particular the bearings and oil seals.

OVERHUNG LOADS

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

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

Where: RADIUS = Pitch circle radius of chain sprocket, spur gear or belt pulley.
and F = Application Factor i.e.

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 tables 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)

1 Newton = 0.2248 lbf

	Carter Variator size			
	MF10	**MF12**	**MF13**	**MF14**
Input shaft	151	298	360	471
Output shaft	186	373	471	956

RS SERIES REDUCTION UNIT

Maximum overhung loads (Newtons)

Maximum output speed (rev/min)	RS Series Size								
	OCS	**OCD**	**OCT**	**1DNRS**	**1DNRD**	**1CDRT**	**GM3/D**	**GM3/T**	**GM4/T**
1500 to 1001	1557			1112					
1000 to 601	1557			1335			3780		
600 to 501	1780			1512			3910		
500 to 401	1780			1735			4140		
400 to 351	1780	1780		1913			4450		
350 to 301	1780	2000		1913	1780		4510		
300 to 251	1780	2000		1913	1780		4600		
250 to 201	1780	2000		2046	1780		4710		
200 to 161		2000			1780		4890		
160 to 121		2000			2000		5250		
120 to 101		2000			2000		5780		
100 to 91		2000	2000		2000		6050		
90 to 81		2000	2000		2000	2224	6320		
80 to 71		2000	2000		2000	2224	6580		
70 to 61		2000	2000		2000	2224	6760		
60 to 51		2000	2000		2000	2224	6940		
50 to 46		2000	2000			2090	7120	9340	11 390
45 to 41		2000	2000			2090	7120	9250	11 210
40 to 36			2000			2090	7120	9160	11 030
35 to 31			2000			2000	7120	9070	10 850
30 to 26			2000			2000	7120	8980	10 670
25 to 21			2000			1913	7120	8900	10 670
20 to 16			2000			1913	7120	8670	10 670
15 to 11			2000			1913	7120	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.

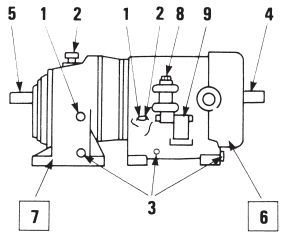
Speed controls are usually set up and tested prior to despatch. However, to avoid damage during transit, combined handwheel and speed indicator controls are packed in a protective carton and supplied loose.

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

OIL LEVELS

When installing 'MF' type Variators fitted with flange mounted RS Series Reduction Gears, it is important to remember that these have SEPARATE OIL SUMPS (see FIG 1) and require DIFFERENT GRADES OF OIL.

FIG 1



1 OIL LEVEL INDICATORS
2 OIL FILLER APERTURES
3 OIL DRAIN PLUGS
4 INPUT SHAFT
5 OUTPUT SHAFT
6 CARTER DRIVE
7 RS SERIES UNIT
8 PUMP DELIVERY BLOCK PLUG
9 FILTER HOLDER

APPROXIMATE OIL QUANTITIES

Carter Variator	Oil Capacity (approx)			Associated RS Series Unit	Oil Capacity (approx)		
	Litres	Imperial pints	US pints		Litres	Imperial pints	US pints
MF10	1,14	2	1.65	OCS	1,14	2	1.65
				OCD	1,14	2	1.65
				OCT	1,14	2	1.65
MF12	1,70	3	2.47	1DNRS	1,70	3	2.47
				1DNRD	1,70	3	2.47
				1CDRT	2,27	4	3.30
MF13	3,12	5.5	4.54	GM3/D	1,8	3.2	2..64
				GM3/T	2,6	4.5	3.71
MF14	4,55	8	6.60	GM3/D	1,8	3.2	2.64
				GM4/T	2,6	4.5	3.71

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.

In exceptional conditions such as extremes of temperature, high humidity, corrosive atmospheres, etc., consult your oil supplier for recommendations. These should be based on the oils listed for normal conditions.

MF TYPE CARTER VARIATOR

HOT CONDITIONS - Site temp 30°C (86°F) - 43°C (110°F)

Shell Companies	Shell Tellus Oil 68 (formerly Tellus Oil 33)
Mobil Oil Company Ltd	Mobil DTE Oil Heavy/Medium (VG.68)
	Mobil DTE 16M
Esso Petroleum Company Ltd	Teresso 68
BP Oil Ltd	Bp Energol HLP 68

NORMAL CONDITIONS - Site temp 13°C (55°F) - 30°C (86°F)

Shell Companies	Shell Tellus Oil 46 (formerly Tellus Oil 29)
Mobil Oil Company Ltd	Mobil DTE Oil Medium (VG.46)
	Mobil DTE 15M
Esso Petroleum Company Ltd	Teresso 40
BP Oil Ltd	Bp Energol HLP 46

COLD CONDITIONS - Site temp 2°C (35°F) - 13°C (55°F)

Shell Companies	Shell Tellus Oil 37 (formerly Tellus Oil 27)
Mobil Oil Company Ltd	Mobil DTE Oil Light (VG.32)
	Mobil DTE 13M
Esso Petroleum Company Ltd	Teresso 32
BP Oil Ltd	BP Energol HLP 32

FLANGE MOUNTED RS SERIES REDUCTION UNITS

Shell Companies	Omala Oil 320
Mobil Oil Company Ltd	Mobil Gear 632
Esso Petroleum Company Ltd	Spartan EP320
BP Oil Ltd	Energol GR-XP320