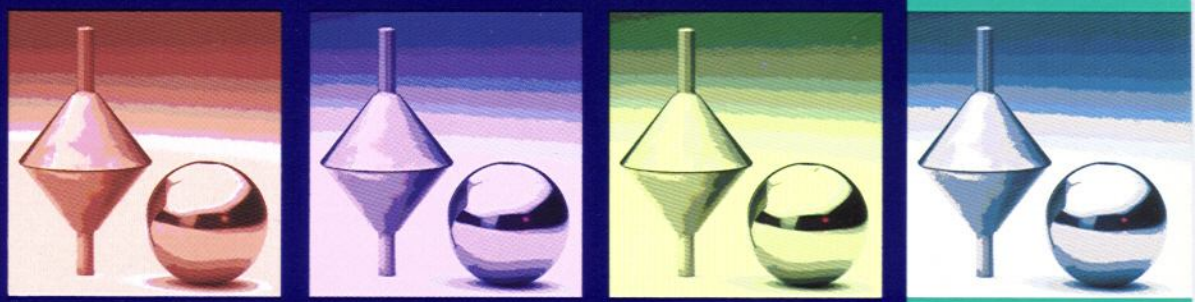
SPEED CONTROL



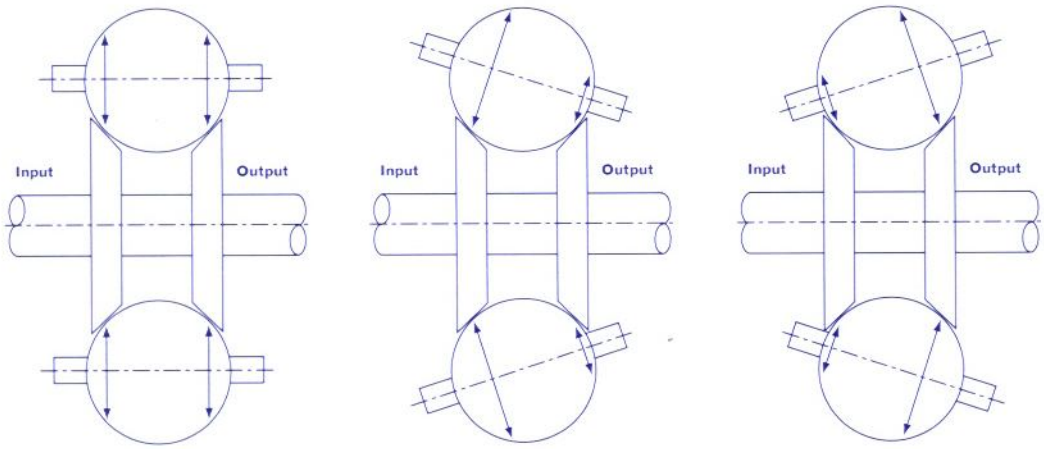
Kopp

VARIATORS
SAFETY CLUTCHES
HIGH RATIO GEARS

Principles - 'Ball' Series Variator

Imagine a ball rotating on its axis and two other components contacting the periphery of the ball each at an angle of 45° to the axis. The diameter and peripheral speed of the ball at the points of contact will therefore be identical. Inclining the axis of the ball to the left, however, results in a larger diameter at the points of contact with the cone on the right hand side and a smaller diameter at the points of contact on the left hand cone. This results in a speed differential between the two drive cones in contact with the balls.

It is on this basic principle that the Allspeeds Ball Series Variator operates, the difference between the input and output speeds being dependent on the geometric position of these components. The speed variation is 9:1 (one-third to three times the input speed), so that with an input of, say, 1500 r.p.m., a variation in output speeds of between 500 r.p.m. and 4500 r.p.m. are available.



1 : 1 Ratio | 3 : 1 Increase | 1 : 3 Reduction

The advantages of using the Allspeeds Ball Series Variator

1. It has coaxial in line input and output shafts: this combined with its compactness and weight is advantageous when converting an existing machine or designing into a new machine.
2. The control is very sensitive: for example, it requires 0.89 Nm of torque to change speed on the 11 kW drive, and only 0.18 Nm for the 0.18 kW drive.
3. The control using the integral indicator enables previously established speeds to be accurately reset.
4. The variator has good speed holding characteristics, so that, when a particular speed is set, there is minimal 'creep' due to any outside influences such as temperature.

Ball Series

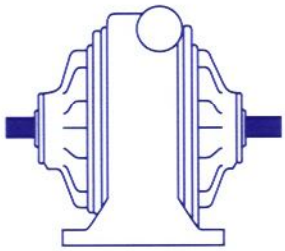
5. Due to the speed holding characteristics, it is often not necessary to use automatic and semi-automatic controls.
6. The variator is totally enclosed, quiet and relatively vibration-free.
7. The variator has constant power characteristics. The lower the output speed the greater the torque and has a positive advantage in overcoming friction and high inertia loads. This has particular advantages on machine tools and reeler drives.
8. The variator can be very easily 'Close Coupled' to an electric motor and/or speed reducer enabling 'easy fitting', ie four bolts are all that is required to fit a completely integrated drive to a machine, thereby avoiding the manufacture of baseplates, extra guards, intermediary belt tensioning devices, etc.
9. A wide speed range of 9:1.
10. An increasing speed of 3:1 over the input speed: particularly useful for certain applications.
11. The Allspeeds Variator, when judged against other comparable variable speed drives, gives the least 'down' time when any breakdown occurs. This is due to the fact that, owing to its simplicity of construction, any intelligent person with average mechanical 'know-how' can strip, repair, and reassemble our larger variators within a maximum of two hours, the smaller ones within one hour.

Points to be taken into consideration when using the Allspeeds Variator

1. The variator must be protected against shock loads.
2. It is not possible to change the speed of the variator when it is stationary.
3. The variator, due to its constant power characteristics, gives an increase torque at lower speeds. This can cause problems if the drive is not correctly rated. Therefore, for a constant torque application, the rating of the drives following the variator may need to be considered if there is any likelihood of the variator overloading these parts.
4. The correct oil must be used. To this end we provide the initial supply of variator oil free of charge with each variator.

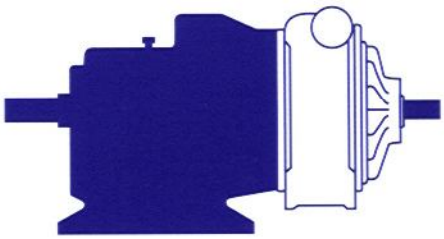
Ball Series

Standard Types



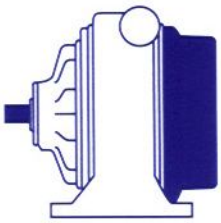
F

With free input and output shafts.



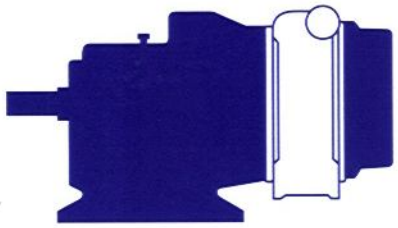
FR

With free shafts and reduction gear.



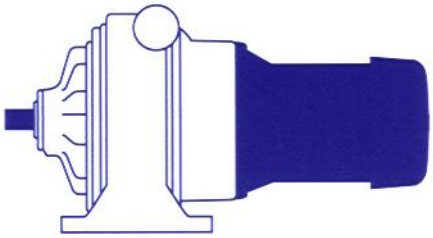
H

With spacer to accept flange mounting.
B.S. Metric/I.E.C. motor.



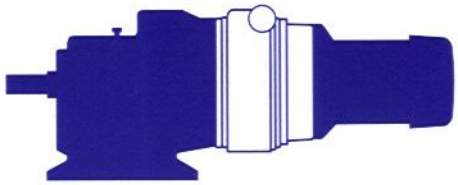
HR

With reduction gear and spacer to accept flange mounting. B.S. Metric/I.E.C. motor.



M

Motorised with flange mounted
B.S. Metric/I.E.C. motor.

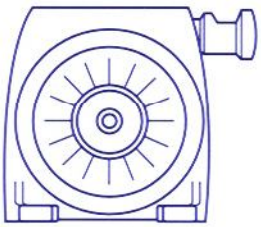


MR

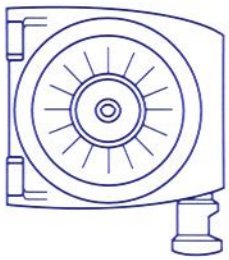
With motor and reduction gear.

Ball Series

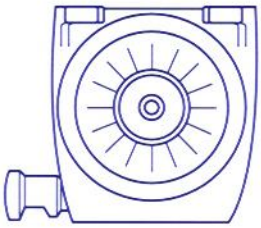
Mounting Positions



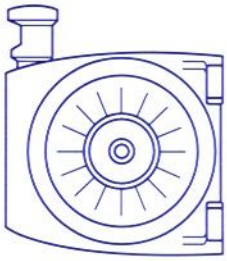
Handing A.



Handing B.

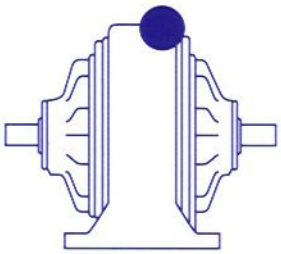


Handing C.



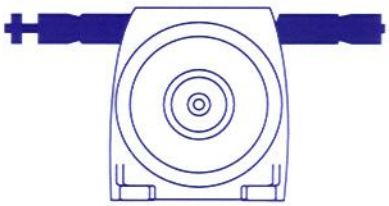
Handing D.

Standard Controls



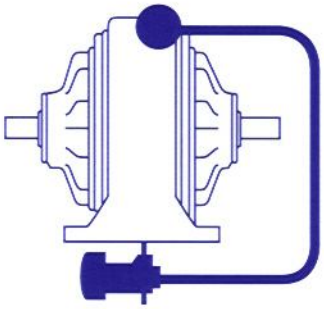
S

Handwheel.



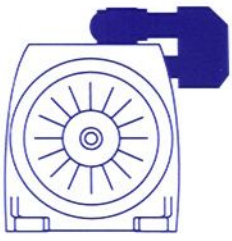
T

Rack for power operation.



X

Mechanical Remote.



E

Electrical Remote.

Ball Series - technical data

Input Power Ratings

Variator Size	Power Ratings				Kw @	
	6 Pole– 930 rev./min.		4 Pole– 1410 rev./min.		Revolutions per minute	
	kW	h.p.	kW	h.p.	500rpm	750rpm
312	0.18	1/4	0.25	1/3	0.13	0.30
314	0.37	1/2	0.55	3/4	0.25	0.34
315	0.55	3/4	0.75	1	0.33	0.44
316	0.75	1	1.10	1 1/2	0.50	0.67
317	1.10	1 1/2	1.50	2	0.60	0.82
318	1.50	2	3.00	4	1.31	1.76
320	2.20	3	4.00	5 1/2	1.79	2.42
321	4.00	5 1/2	5.50	7 1/2	2.46	3.30
322	5.50	7 1/2	7.50	10	3.36	4.55
324	7.50	10	11.00	15	5.11	6.86

Input power ratings of variators at various input speeds between 500 rev./min. and 1410 rev./min.

Applications where input speeds below 500 rev./min. or above 1800 rev./min. are involved should be discussed with our Engineering Department.

Output speed ranges

With free shaft ends

From one-third of input speed to three times input speed (a stepless speed variation of 9:1).

With flange mounted motors and reduction gears

Reduction gears				Output speed ranges (rev./min.)	
Ratio	Gear ratio for each size of Variator			Input 930 rev./min.	Input 1410 rev./min.
	A 312 to 314	B 315 to 321	C 322 to 324	Speed range 9 to 1	Speed range 6 to 1
R1	101.15:1*	91.3:1	85.57:1*	a 3 to 27 b 3.4 to 30.6 c 3.6 to 32.4	a 4.5 to 27 b 5.1 to 30.6 c 5.4 to 32.4
R2	59.7 :1*	59.6 :1*		5.3 to 48	8 to 48
R3	30.7 :1*	31.4 :1*		10 to 90	15 to 90
R4	15.9 :1	15.8 :1		20 to 180	30 to 180
R5	7.9 :1 *	7.5 :1		40 to 360	60 to 360
R6	3.5 :1*	4.0 :1		80 to 720	120 to 720

*These reduction gears have CONTRA-ROTATING input and output shafts.

To obtain output speed ranges other than those listed, non-standard reduction gears can be supplied.

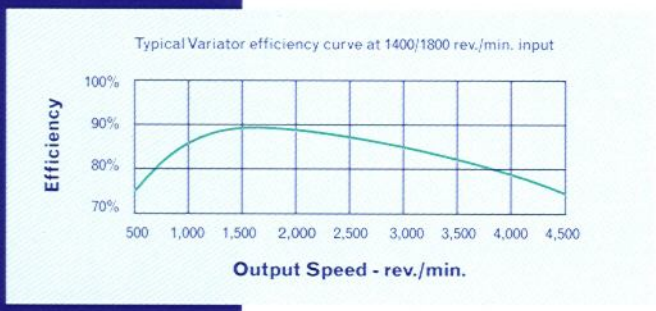
Ball Series - technical data

With flange mounted motors

Input	Output
rev./min.	rev./min.
930 (6 pole)	310 to 2790
1410 (4 pole)	470 to 4230

- The output speed ranges shown are only approximate, since motor speeds vary with power ratings. Standard motors are suitable for all normal 3-phase 50 Hz supplies.
- Motors for special voltages, flameproof conditions, single-phase supplies, etc, are available on request.
- It will be noted that when high input speeds are used such as 1410 rev./min., the output speed range of the unit when fitted to a reduction gear is reduced to 6:1. This is due to the input speed limitation of the reduction gears.
- Where the electrical supply is 60 Hz., all output speeds are increased by 20%.

Fig. 1.

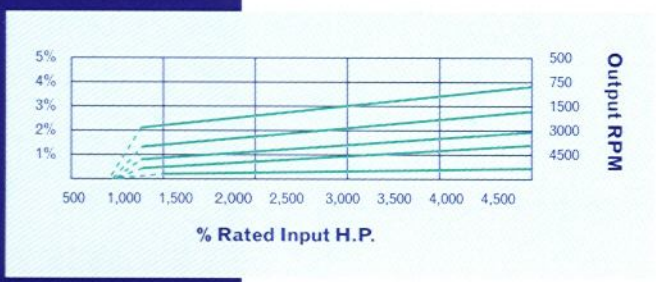


Variator efficiency

Fig 1. shows a typical variator efficiency curve related to output speed. It will be seen that the variator has a very high efficiency at output speeds between half and double the input speed, ie for the majority of the output speed range. The curve is representative of a horizontal unit - efficiencies varying slightly with different sizes of variators. Individual efficiency curves are available on request.

Vertical units incorporate an internal lubricating pump which, of necessity, reduces the efficiency of the variator. Efficiency curves for vertical units can be supplied if required.

Fig. 2.



Speed holding

Under constant load conditions the speed-holding characteristic of the Kopp variator is inherently stable. Under varying load conditions, however, speed fluctuations can occur. Fig 2. shows percentage speed deviation under varying load with a constant input speed of 1500 rev./min.

It must be emphasised that the speed deviation referred to above is not due to slip, but to variations in load producing corresponding changes in axial pressure (as described on page 3). Due to the elasticity of the component parts to which this pressure is applied, and to a lesser degree to the elimination of running clearances, any change in the load will result in minor alterations in the relative positions of the drive balls and drive cones, and will cause a slight change in the speed ratio.

For example, where input speed and output speed are both 1500 rev./min. it will be found that the speed deviation from full load to half load is only 0.7 per cent. It should be borne in mind, however, that under CONSTANT LOAD conditions the deviation of speed may be as little as 0.1 per cent.

In practice, when speed fluctuates with load, it can most frequently be attributed to a pull-down of the speed of the prime mover.

Ball Series - technical data

Constant speed operation

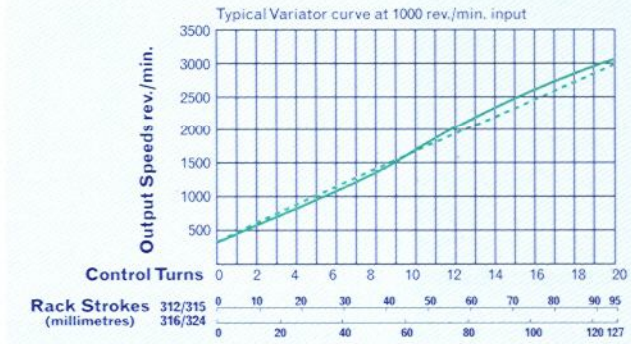
Due to the elasto-hydrodynamic film which exists between the drive surfaces, prolonged running at a set speed will not affect the life of the unit nor will it impair the sensitivity of the speed control.

Speed regulation

The output speed of the variator is controlled by a wormshaft which requires twenty turns to give the full 9:1 speed range.

Fig. 3 shows changes of speed relative to turns for the control wormshaft for all sizes of variators. These result in an almost linear graph, deviation being no more than 5%. To obtain this linear relationship, it is essential that the drive shaft nearer the control is used as the input shaft.

Fig. 3.



Note: One unit on the handwheel represents one full turn of the worm.

Output torque ratings

Apart from varying efficiencies shown in Fig.1, the output power of the variator throughout its speed range follows constant power characteristics. As will be seen from Fig.4, this results in high torque capacities at low speeds, and low torque at high speeds. Where a unit is applied to constant torque requirements it is essential that, in selecting the size of the unit, it should be capable of providing this torque at the highest required speed.

Fig. 4

Variator output torque at 1500 rev./min. input														
Unit Size	Speed ratio : output rev./min. ÷ input rev./min.													
	1/3		1/2		1		1 1/2		2		2 1/2		3	
	Nm	lb. ins.	Nm	lb. ins.	Nm	lb. ins.	Nm	lb. ins.	Nm	lb. ins.	Nm	lb. ins.	Nm	lb. ins.
312	3.62	32.0	2.82	25.0	1.56	13.8	1.01	8.9	0.71	6.3	0.55	4.9	0.43	3.8
314	7.46	66.0	5.83	51.6	3.12	27.5	2.00	17.7	1.39	12.3	1.06	9.4	0.85	7.5
315	9.83	87.0	7.77	68.8	4.18	37.0	2.67	23.6	1.84	16.3	1.41	12.5	1.13	10.0
316	14.91	132.0	11.64	103.0	6.21	55.0	3.95	35.0	2.77	24.5	2.12	18.8	1.69	15.0
317	21.13	187.0	16.04	142.0	8.47	75.0	5.20	46.0	3.73	33.0	2.94	26.0	2.26	20.0
318	39.54	350.0	31.07	275.0	16.61	147.0	10.62	94.0	7.34	65.0	5.65	50.0	4.52	40.0
320	62.14	550.0	44.06	390.0	22.59	200.0	14.69	130.0	10.17	90.0	7.79	69.0	6.21	55.0
321	84.74	750.0	60.45	535.0	31.07	275.0	19.99	177.0	13.89	123.0	10.62	94.0	8.47	75.0
322	112.98	1000.0	80.78	715.0	40.67	360.0	27.12	240.0	18.42	163.0	14.12	125.0	11.29	100.0
324	169.48	1500.0	112.02	1080.0	61.01	540.0	38.41	340.0	27.12	240.0	21.47	190.0	16.61	147.0

At input speeds below 1500 rpm multiply output torque by the following factors.

Input rev./min.	500	750	900	1000	1200
Torque factor	1.32	1.18	1.13	1.11	1.06

Ball Series - technical data

Variator / gearbox combinations output torque

When the variator is used with a reduction gear box, the output torques are multiplied by the reduction ratio.

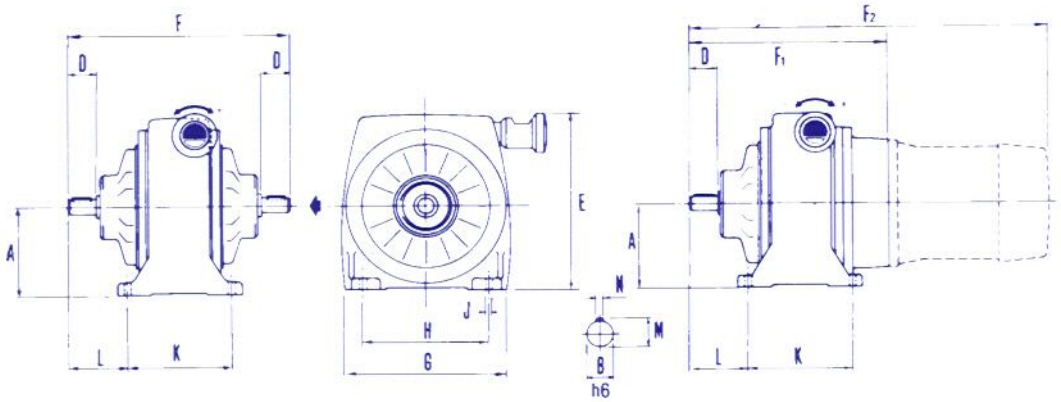
Due to the increased torques available at the lower speed settings, it is normal to use a gear box of capacity sufficient to take the torque at mean speed settings.

Allspeeds Torque limitations of Reduction Gears

Ratio	Unit Size							
	G1		G2		G3		G4	
	Nm	lb. ins.	Nm	lb. ins.	Nm	lb. ins.	Nm	lb. ins.
R1	56.5	500	90.4	800	305	2700	621.4	5500
R2	56.5	500	90.4	800	305	2700	621.4	5500
R3	56.5	500	90.4	800	305	2700	621.4	5500
R4	–	–	90.4	800	–	–	–	–
R5	–	–	–	–	–	–	–	–
R6	–	–	–	–	–	–	–	–

Ball series dimensions

Type F, H and M



Unit Size	A	B	D	E	F	F1	F2	G	H	J	K	L	M	N	Weights F kg.	F lb.	H kg.	H lb.	M kg.	M lb.
312	70	10	20	152*	177	156	354	124	90	8	80	48.5	11.2	3	5.3	11.6	6.7	14.7	14.7	32.3
314	100	15	35	204	270	230	476	173	130	9.5	130	70	17	5	14.2	31.2	17.5	38.5	30.4	67.0
315	100	15	35	204	270	230	476	173	130	9.5	130	70	17	5	16.5	36.4	19.1	42.0	31.4	69.0
316	130	24	45	279	340	302	572	244	190	11	160	90	27	8	36.7	81	41.5	91.5	61	134
317	130	24	45	279	340	302	572	244	190	11	160	90	27	8	40.8	90	45.6	101	68	150
318	170	28	58	345	416	365	665	295	220	15	190	113	31	8	66.7	147	75.3	166	104	230
320	190	35	70	383	490	444	828	323	240	17.5	200	135	38	10	89	196	101.2	224	152	334
321	190	35	70	383	490	444	828	323	240	17.5	200	135	38	10	93	205	108	238	175	386
322	220	45	75	440	576	533	1031	381	300	19	260	147	48.5	14	170	375	199	440	268	592
324	220	45	75	440	576	533	1031	381	300	19	260	147	48.5	14	176	388	205	452	311	686

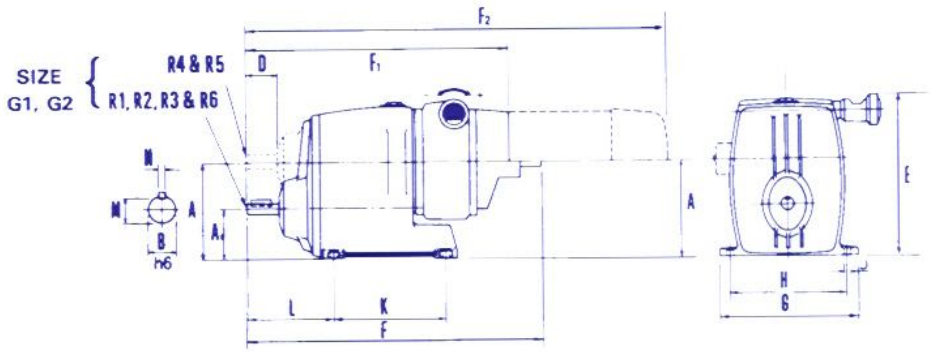
*166mm if motorised

All dimensions are in millimetres

Certified drawings on request.

Ball series dimensions

Type FR, HR and MR



Sizes G3 to G4
All ratios use inline output Shaft Dimension 'A'.

Unit Size	A	A1	B	D	E	F	F1	F2	G	H	J	K	L	M	N	FR kg.	FR lb.	HR kg.	HR lb.	MR kg.	MR lb.
312 G1	128	69.8	18	51	211	343	323	521	180	149	11	165	122	14.5	6	17.8	39.2	19.2	42.2	27.2	59.8
314 G2	157	82.5	20	51	261	457	424	675	213	131	11	178	140	16.5	6	35.1	77.2	38.4	84.5	51.3	113.0
315 G3	130	–	28	51	234	457	423	669	210	140	13	210	57	24	8	41.0	90.2	43.6	96.0	55.9	123.0
315 G2	157	82.5	20	51	261	457	424	675	213	131	11	178	140	16.5	6	37.4	82.7	40.0	88.0	52.3	115.0
316 G4	175	_	42	83	324	594	556	826	275	191	14	241	99	37	12	84	185	88.8	196	109	241
316 G3	130	_	28	51	279	543	505	794	210	140	13	210	57	24	8	61.2	135	66.0	145	85.5	188
317 G4	175	_	42	83	324	594	556	826	275	191	14	241	99	37	12	88	194	92.8	205	115	254
317 G3	130	_	28	51	279	543	505	794	210	140	13	210	57	24	8	65.3	144	70.1	155	92.5	204
318 G4	175	_	42	83	345	683	632	943	275	191	14	241	99	37	12	114	251	122	270	151	334

ONLY USE FOR INFORMATION PURPOSES - REQUEST CERTIFIED DRAWING

Ball series - dimensions - verticals

FV With free input and output shafts.

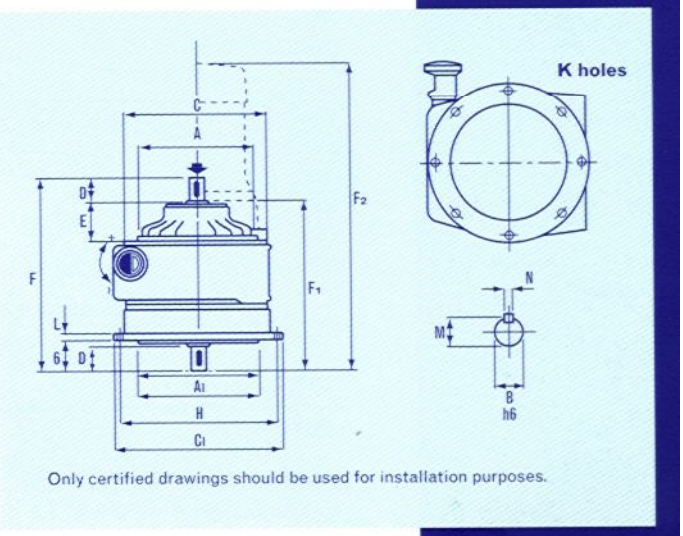
HV With spacer to accept flange mounting BS Metric / IEC motors.

MV Motorised with flange mounted BS Metric / IEC motors.

Units can be supplied with feet for wall mounting, when they will have the same dimensions as those given on page 11.

Note that vertical units are fitted with an internal pump to supply oil to the upper bearings. Standard horizontal units are splash lubricated and are NOT suitable for use vertically. When ordering vertical units it is necessary to specify the proposed method of mounting, and whether the output shaft is to be above or below the unit.

A letter 'U' (for upward-pointing output shaft) or 'D' (for downward-pointing output shaft) is added to the type designation FV, HV or MV. If a reduction gear is fitted, a letter 'R' is added BETWEEN the first two letters of the type designation, eg HRVD is a vertical unit with input spacer and with a reduction gear on the output side, below the variator.



Only certified drawings should be used for installation purposes.

Unit Size	A	A_1	B	C	C_1	D	E	F	F_1	F_2	G	H	K		L	M	N
													No.	Dia.			
312 D63D	90	95	11	122	140	23	32	182	164	368	23	115	4	9	9.5	12.5	4
312 D71D	90	110	14	122	160	30	32	196	171	376	30	130	4	9	9.5	16	5
314 D71D	140	110	14	171	160	30	45.2	159	230	481	30	130	4	9	9.5	16	5
314 D80D	140	130	19	171	200	40	45.2	279	240	491	40	165	4	12	8.89	21.5	6
315 D71D	140	110	14	171	160	30	45.2	159	230	481	30	130	4	9	9.5	16	5
315 D80D	140	130	19	171	200	40	45.2	279	240	491	40	165	4	12	8.89	21.5	6
316 D90D	200	130	24	241	200	50	62	350	307	596	50	165	4	12	12.7	27	8
317 D90D	200	130	24	241	200	50	62	350	307	596	50	165	4	12	12.7	27	8
318 D100D	248	180	28	295	250	60	74.5	419	366	677	60	215	4	15	12.7	31	8
320 D100D	292	180	28	330	250	60	35	450	434	850	60	215	4	15	15	31	8
320 D132D	292	230	38	330	300	80	35	490	454	870	80	265	4	15	15	41	10
321 D112D	292	180	28	330	250	60	35	450	434	850	60	215	4	15	15	31	8
321 D132D	292	230	38	330	300	80	35	490	454	870	80	265	4	15	15	41	10
322 D132D	350	230	38	390	300	80	54.3	564	537	1077	80	265	4	15	20	41	10
322 D160D	350	250	42	390	350	110	54.3	624	567	1077	110	300	4	19	20	45	12
324 D132D	350	230	38	390	300	80	54.3	564	537	1077	80	265	4	15	20	41	10
324 D160D	350	250	42	390	390	110	54.3	624	567	1077	110	300	4	19	20	45	12

Cone K-Series

The K Series Variator uses a system of double conical rollers. A disc on the input shaft drives the rollers on the inside face and the outside face of the rollers in turn drives a ring attached to the output shaft. In Fig.5 below, the input disc is driving on a large diameter of the roller and the outer ring on a small diameter, so producing an output speed lower than the input. In Fig. 6 below, the roller carrier has moved axially in relation to the cone and ring, bringing the cone in contact with a small diameter of the roller and the ring in contact with a large diameter, producing an output speed higher than the input.

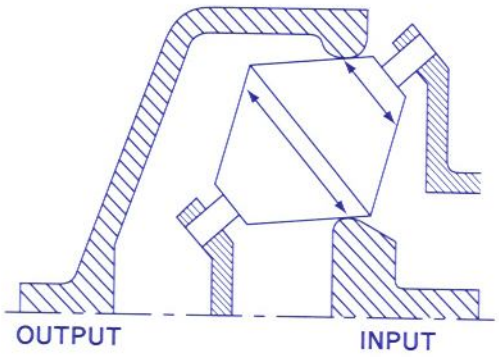


Fig. 5
Low output speed

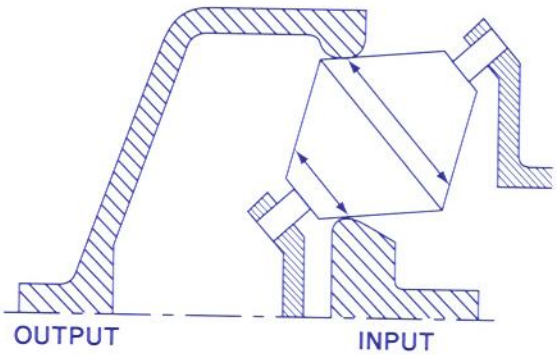


Fig. 6
High output speed

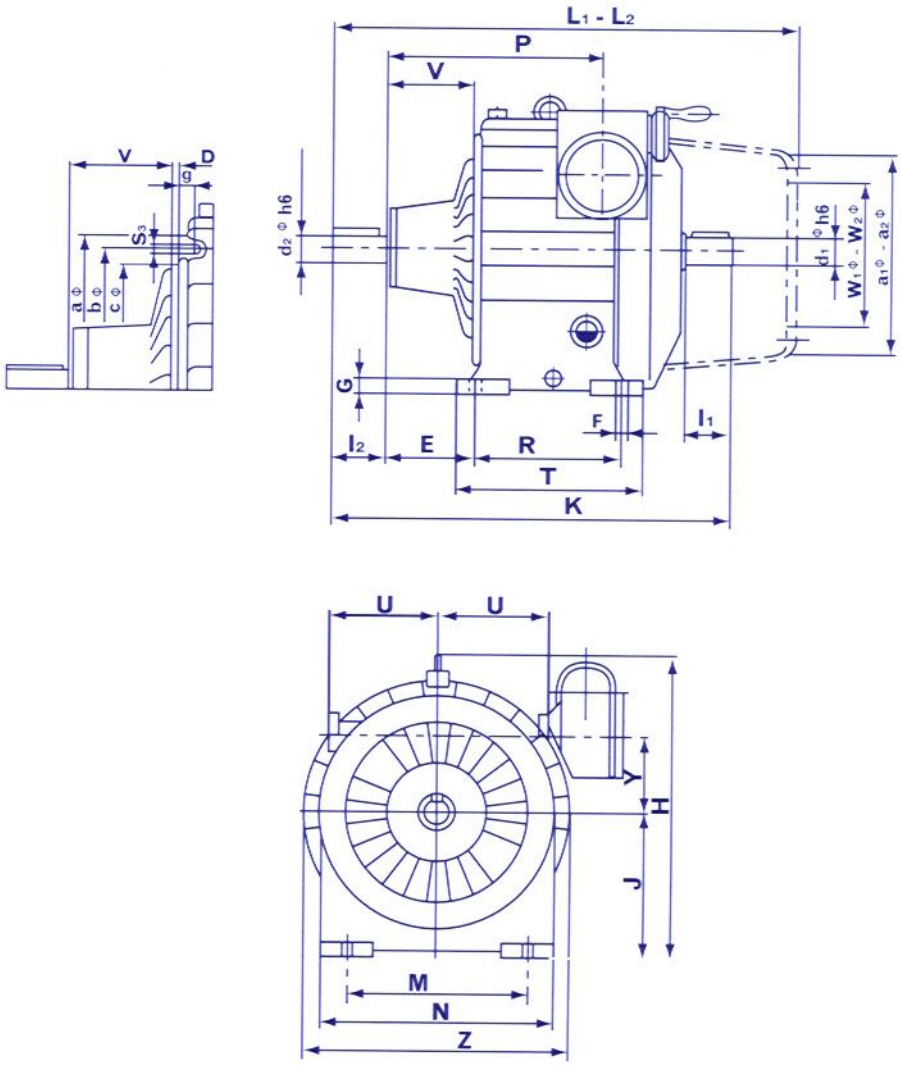
By using two cylindrical components the area of contact is a larger ellipse than that which applied using a sphere, and therefore the pressure per unit area was reduced, and has allowed the system to be used up to 75kW. The K Series Variator can produce speed variations of up to 11:1, the power capacity being dependent on the speed range used.

The advantages of using Allspeeds Cone K-Series

In addition to the advantages of the Ball Series Variator, below are listed the advantages of the ALLSPEEDS K Series Variator:–

1. High power capacity is achieved by distributing the power transmission over a large number of rollers arranged in a circle around the input and output power elements in a manner similar to that of a planetary gear.
2. The rotating members which transmit the power are under low stresses, which means the drives are highly reliable and have a long life.
3. The K Series Variators have a wide speed range 11:1, i.e. 7:1 to low speed and 1:1.57 to high speed.
4. The drives produce a high output torque through the transmission of the output power on the large diameter of the ring.
5. The optimised rolling geometry of the rollers, disc and ring, low loading of the rollers and bearings, and correct lubrication lead to highly efficient drives.
6. K Series Variators are characterised by their vibrationless operation: all power transmitting parts are perfect rotary bodies. The sound level is approximately equal to that of an electric motor of the same power.
7. The K Series Variator has excellent speed holding characteristics. Speed variation is less than 0.03% and is unsurpassed by any other means of mechanical transmission.
8. The drives may be universally mounted, i.e. horizontal, vertical, inclined input side, above, or below.
9. Where high output speeds are required, the Variator can be driven from the flange side, thereby multiplying the output speed up to 5 times the input speed.

Dimensions

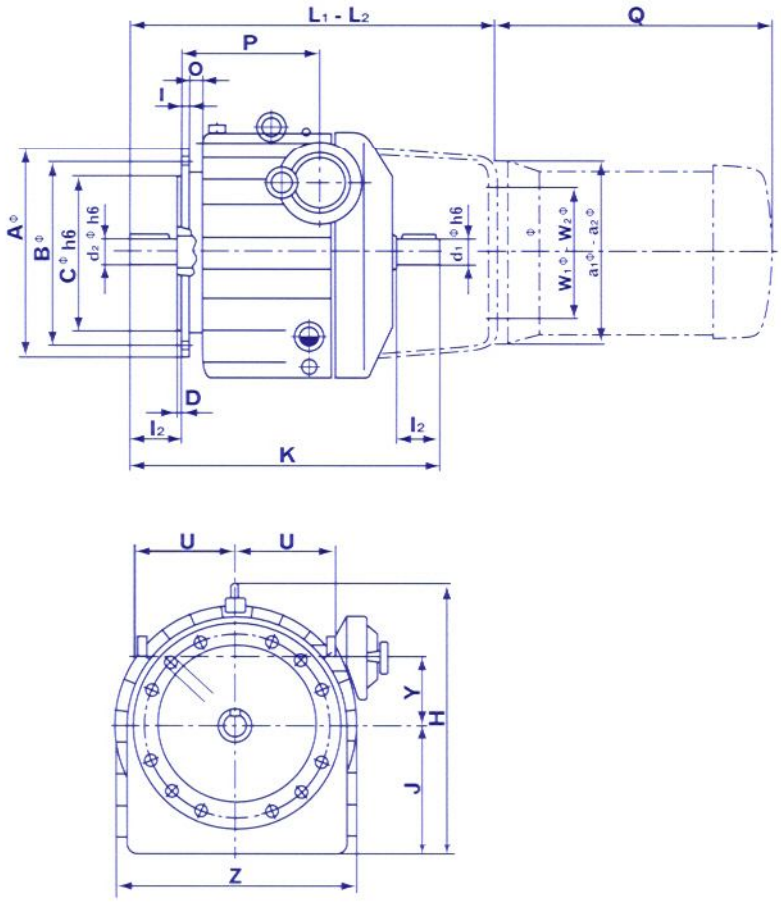


General Dimensions - all units													Foot mounted units								
Size	d_1	l_1	d_2	l_2	K	H	Z	P	U	V	J	Y	R	T	E	F	G	M	N	a	b
K 1.0	14	30	15	30	257	230	200	150	101	25	100	–	155	180	57	8	14	155	180	160	130
K 1.6	18	40	20	40	310	280	244	173	123	32	125	–	175	200	77.5	9	16	180	220	200	165
K 2.5	25	45	30	50	365	330	278	201	140	51	150	–	205	235	98	13	20	200	252	252	230
K 6	30	54	35	65	488	400	350	266	148	86	180	95	230	265	148.5	13	24	270	305	305	280
K 16	40	70	45	80	574	470	413	302	170	107	212	120	245	285	184	16	26	300	327	372	340
K 25	50	80	50	90	648	550	464	332	192	114	280	132	260	320	207	18	25	360	450	410	370
K 50	50	85	55	100	754	610	530	418	220	83	300	155	380	460	190	18	30	380	475	450	400
K100	65	120	75	130	960	780	664	523	270	100	400	192	500	570	225	20	35	560	648	550	500

*All shafts can be supplied in standard inch dimensions.
Designation is Ka (ex. Ka 1.0).

Dimensions

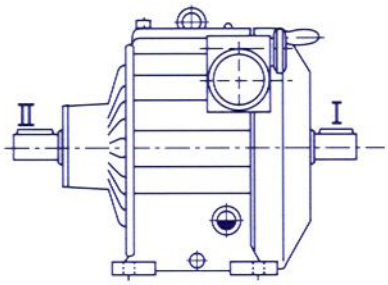
Flange/Motor Mounted Units



Flange mounted units								Motor mounting**							
c S3/g	A	B	C	D	I	O	S	L_1	W_1	a_1	L_2	W_2	a_2	Q.min	Q. max.
110 4xM8/12	160	130	110	3	9	18	4x9	298	110	160	302	130	200	226	232
130 4xM10/14	200	165	130	3	10	20	4x11.5	362	130	200	–	–	–	226	274
200 8 M10/14	250	215	180	4	12	22	4x14	418	130	200	428	180	250	265	323
260 8xM10/15	300	265	230	4	14	27	4x14	556	180	250	576	230	300	323	422
300 8xM12/16	350	300	250	5	15	30	4x18	657	230	300	687	250	350	422	473
340 12xM12/18	400	350	300	5	15	34	4x18	762	250	350	762	300	400	517	687
350 8xM16/22	450	400	350	5	15	30	8x18	770	250	350	770/800	300/350	400/450	517	687
450 8xM16/22	–	–	–	–	–	–	– –	978	350	450	978	450	550		

**The dimensions for motor mounting on adaptor are only for estimation convenience.

Basic Styles



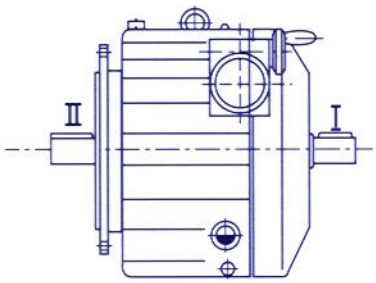
Style B3

Style B3

Standard horizontal foot mounting.

Style B314

Horizontal foot mounting with output side of housing machined and drilled for integral reducer.



Style B5

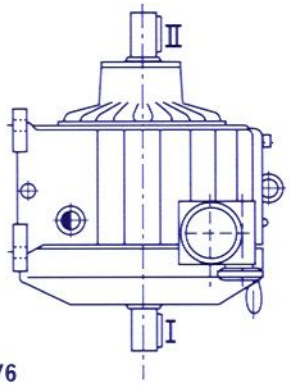
Style B5

Horizontal flange mounted.

Style V1

Same as Style B5, except with output shaft down.

NOTE:
Basic style are available with Output and Input Shafts on the same side.



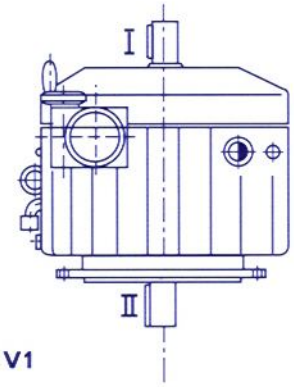
Style V6

Style V6

Same as Style B3, except wall mounting with output shaft up.

Style V614

Same as Style B314, except wall mounted with output shaft up.



Style V1

Style V3

Vertical Flange Mounted with output shaft up (not shown).

NOTE:
Shaft "I" is input for normal operation, providing 7:1 reduction and 1:1.57 increase ratios. Shaft "II" is considered the input only for Speed Increaser Drives (Type H.S.).

Standard Controls - Ball and Cone Types

Vertical Mounting Units are available

Handwheel Control

For direct manual control of Variators, the standard handwheel incorporates a counter calibrated to one decimal place. For "opposite to standard" mounting, a similar handwheel with reversed counter mechanism is supplied.

All indicator handwheels incorporate a slipping clutch to prevent the Variator being damaged should the control be moved whilst the unit is stationary. Simple means are provided for zero setting handwheels which include counters.

Mechanical Remote Control

Remote manual control is effected by a flexible shaft which is available for any distance up to 3 metres. Standard lengths are from 0.25 metres up to 3 metres in 0.25 metre increments.

Mechanical remote controls are provided with indicator handwheels and include a mounting plate. They can be attached to either side of the Variator. If required for "opposite to standard" mounting, this should be stated.

Electrical Remote Control

For remote operation from any distance, electrical remote controls are available with alternative speeds of response, the standard type giving full speed range adjustment (in around 20 seconds). These controls can incorporate a potentiometer to provide remote indication of the control setting (or approximate speed), or they can be used to furnish feedback information for automatic control systems.

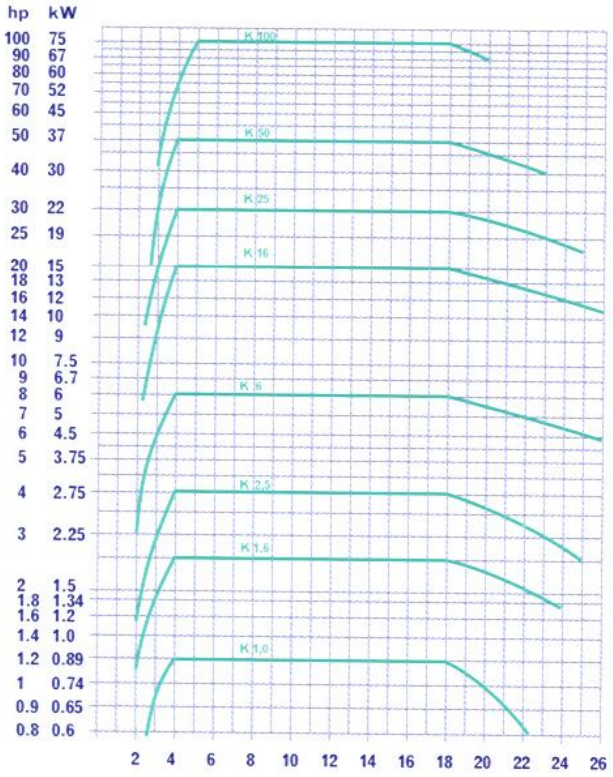
The servo motors are normally wound for 120/240V., 1-phase 50Hz a.c. supply.

As an alternative to the rotary switch, a push button control panel is available.

More sophisticated controls are available, e.g. synchronization and proportional control, please contact us for details.

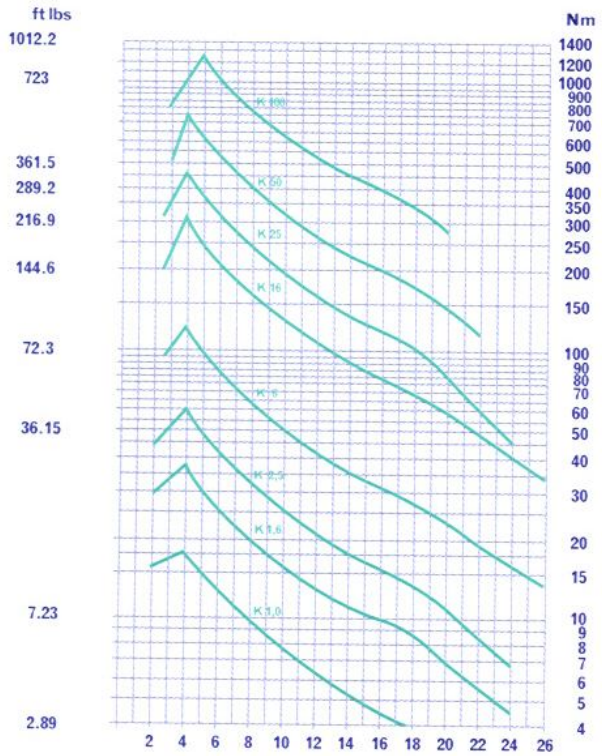
Power Diagram

Input 1500 r.p.m.



Torque Output

Input 1500 r.p.m.



Power Capacities

Unit Selection

Max. allowable input power and torque in relation to output speed.

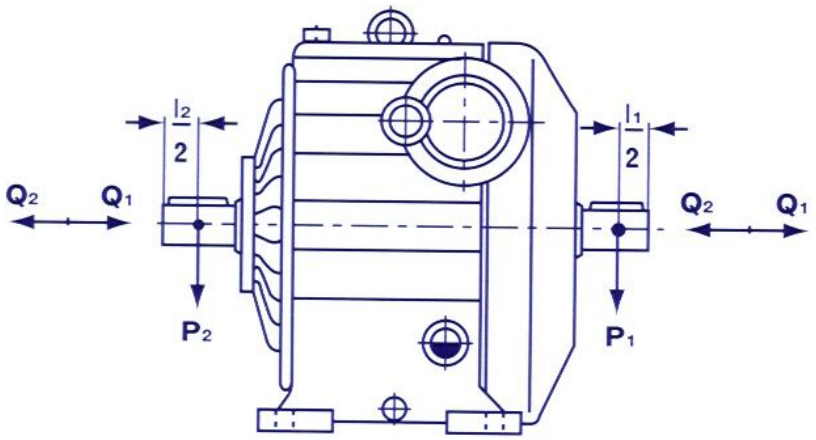
Type	Input speed n_1 m_1 = 1500 min^{-1}				Input speed n_1 = 1800 min^{-1}			
	Output speed n_2				Output speed n_2			
	Input power		With constant power	With constant torque	Input power		With constant power	With constant torque
	kW	HP			kW	HP		
K 6	3.0	4.0	250-2580	220-2580	3.0	4.0	280-2900	265-2900
	4.0	5.5	300-2580	220-2580	4.3	6	360-2900	265-2900
	5.5	7.5	380-2000	220-2000	5.5	7.5	420-2700	265-2700
	6.0	8.0	400-1800	220-1800	6.7	9	480-2160	265-2160
K 16	5.5	7.5	230-2600	230-2600	6.7	9	300-2800	288-2800
	7.5	10	270-2600	230-2600	8.8	12	340-2800	288-2800
	11	12	330-2600	230-2600	14.7	20	450-2450	288-2450
	15	20	400-1800	230-1800	16.8	22.5	480-2150	288-2150
K 25	15	20	320-2500	250-2500	14.7	20	350-2600	300-2600
	18.5	25	360-2300	250-2300	18.4	25	400-200	300-2600
	22	30	400-1800	250-1800	25.5	34	480-2160	300-2160

Remark

To reach lower speeds as indicated in above list, it is generally more economical to apply reduction gears instead of 8 or more pole motors and accordingly larger variators.

External shaft loads, oil content, weight

The figure **P** and **Q** shown are the permissible loads, in kilogrammes, for both the Input and Output shafts of the series "K" Variable Speed Drive, when the load is applied at the midpoint of the shaft.



External Loads in kg (1kg = 2.2 lbs)

		K 1.0	K 1.6	K 2.5	K 6	K 16	K 25	K 50	K 100
P 1 max.	kg	40	60	75	100	200	225	350	500
P 2 max.	kg	80	120	150	200	400	450	1300	2000
Q 1 max.	kg	40	60	80	100	130	150	300	600
Q 1 max.	kg	20	30	40	50	65	75	150	300

Oil Content in litres (1 US Gallon = 3.8 litres, 1 imper. Gallon = 4.55 litres)

Style		K 1.0	K 1.6	K 2.5	K 6	K 16	K 25	K 50	K 100
B3/B314	Litres	0.4	0.9	1.5	1.8	3.2	5.0	7.0	24.0
B5	Litres	0.4	0.8	1.8	2.6	3.0	6.6	–	–
V6, V614	Litres	0.5	1.2	2.0	2.8	5.0	6.0	9.1	16.0
V3	Litres	0.5	1.0	1.8	2.8	5.2	6.8	9.1	–
V1	Litres	0.4	0.8	1.7	2.5	5.0	6.2	14.0	–

WEIGHT OF VARIATORS

		K 1.0	K 1.6	K 2.5	K 6	K 16	K 25	K 50	K 100
All units	kg	20	33	58	98	147	213	345	605
	lbs	44	73	128	216	323	469	759	1331

Service Factors

When running a variator under irregular conditions apply the following safety factors to the Power and Torque.

Variator load	Direct coupling	Overload clutch
Regular load, medium masses to accelerate	1.0	1.0
Regular load, heavy masses to accelerate	1.1	1.0
Irregular load, slight shocks, medium masses to accelerate	1.2	1.1
Shock loads with medium load and masses to accelerate	1.3	1.2
Shock load, reversing of speed, heavy masses to accelerate	1.5	1.3
Combustion engines / Diesel motors } the variator should be driven with the KOPP UK clutch	2.5	1.7

Ambient Temperature

below	30°C	below	90°F	values given above
	30-40°C		90-105°F	multiply above factors by 1.2
	40-50°C		105-120°F*	multiply above factors by 1.4

*Sizes K 25-100 must have an oil cooler for these temperatures

The maximum oil temperature with continuous operation must not be over 90°C.

Equivalent factors for Power and Torque (speeds from 10 to 3000 r.p.m.)

When the input speed of the variator is not 1400-1500 r.p.m., the listed factors must be applied to obtain the correct power, torque and output speed for that variator.

Input Speed	10	50	100	200	500	750	900	1200	1500	1800	2000	2500	3000
Input Power	0.01	0.05	0.1	0.2	0.44	0.59	0.68	0.85	1.0	1.13	1.22	1.40	1.59
Output Torque	1.5	1.5	1.5	1.5	1.32	1.18	1.13	1.06	1.0	0.94	0.92	0.84	0.80
Output Speed	0.0066	0.033	0.066	0.133	0.33	0.5	0.6	0.8	1.0	1.2	1.33	1.66	2.0

Selection Examples

The K16 variator can transmit 15 kW at 1500 r.p.m. input over a speed range of 400-1800 r.p.m. at constant power.

Question
What constant power is transmitted by the K16 when using an input of 500 r.p.m. over the same output speed range, what are the max torque and output speeds?

Solution
Max power at 500 r.p.m. input 15 kW x 0.44 = 6.6kW.

Output speed range for a constant power of 6.6kW with 500 r.p.m. input.

n2 = 0.33 x (400 to 1800 r.p.m.) = 132 to 594 r.p.m.

Output torque with 1500 r.p.m. n1

n2 at 400 r.p.m. = 294 Nm.
n2 at 1800 r.p.m. = 65 Nm.
n2 at 132 r.p.m. = 294 x 1.32 = 388 Nm.
n2 at 594 r.p.m. = 65 x 1.32 = 86 Nm.

Question
Which variator will transmit 15 kW at 500 r.p.m.?

Solution
K50
with n1 at 1500 r.p.m. variator transmits 37 kW.
with n1 at 500 r.p.m. 37 kW x 0.44 = 16.3 kW.

NOTE: For irregular loads apply the appropriate safety factor to the required Power and Torque before using the equivalent Power and Torque conversions from 1500 r.p.m.