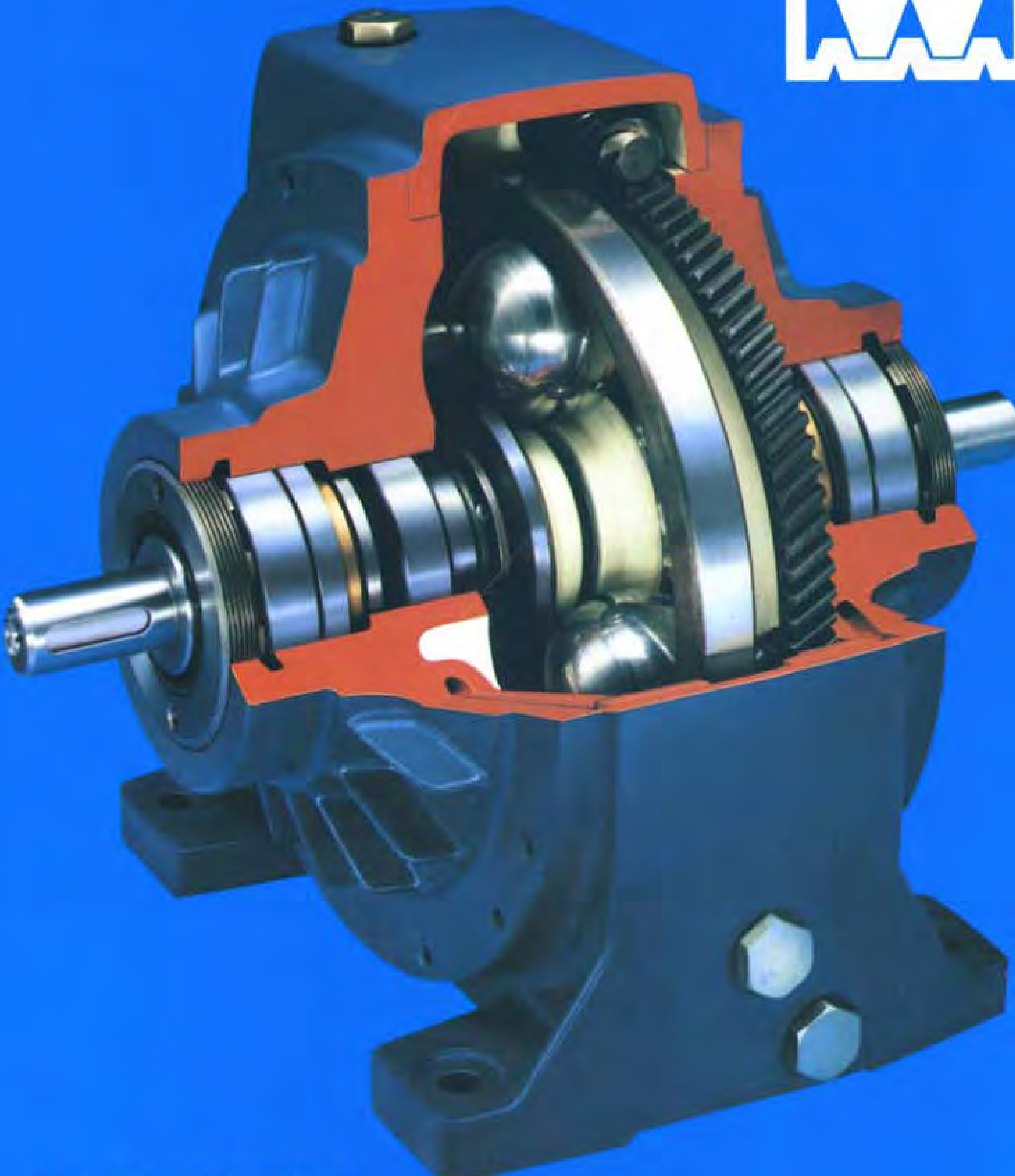
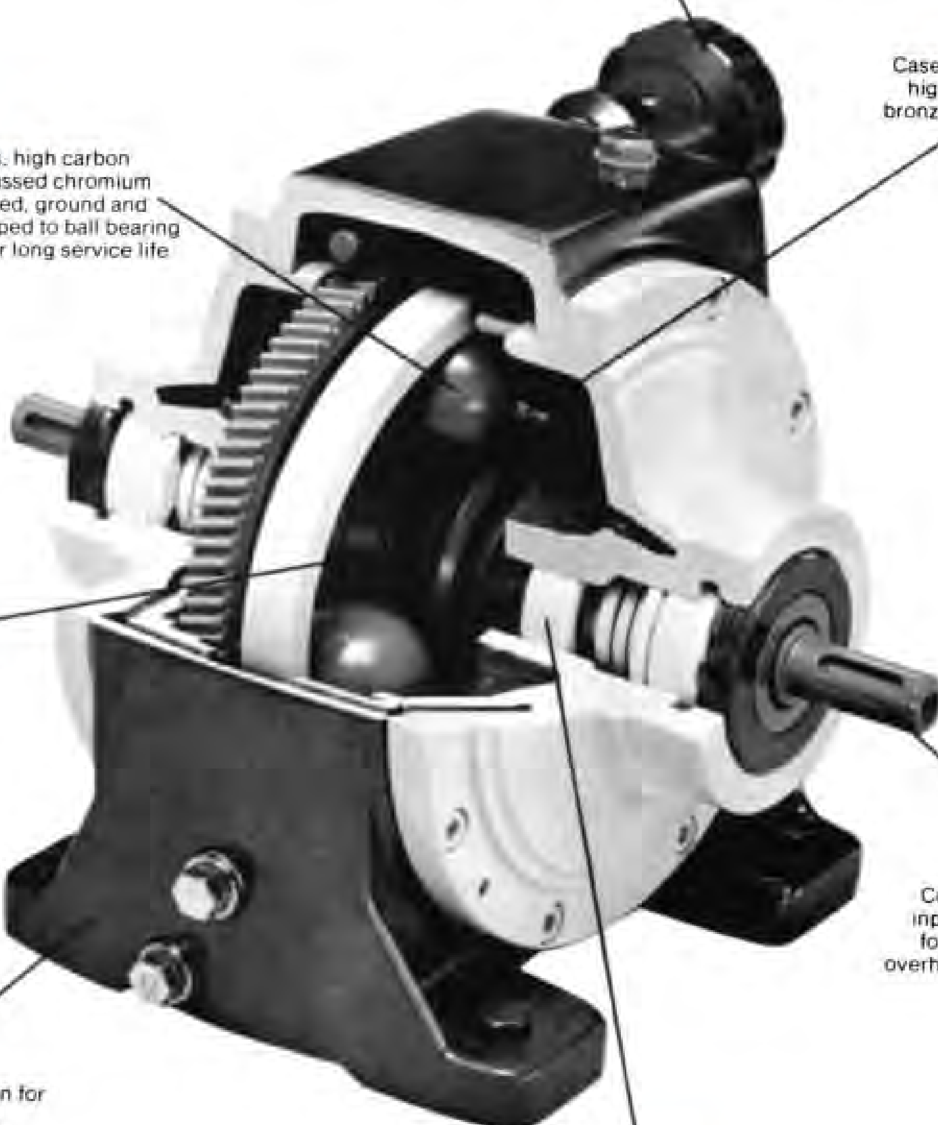
WINSMITH



WINKOPP® ADJUSTABLE SPEED DRIVES

CATALOG 323D

WINKOPP® ADJUSTABLE SPEED DRIVES



Since its introduction, Winkopp Variators have been installed in an infinite variety of applications world wide. The variator is ideally suited to meet industry's need for a highly efficient, compact, versatile, adjustable speed drive. Due to its unique design, the Winkopp has outstanding ability to make frequent, precise, and repeatable speed changes easily, by manual or automatic methods using either integral or remote controls.

The Winkopp rolling contact principle of operation and totally enclosed oil bath lubricated design facilitate smooth, quiet operation even in wet, dusty, or corrosive atmospheres.

FEATURES

WIDE SPEED RANGE
Smooth, stepless speed variation at input horsepower ratings varying from 0.17 HP to 16.85 HP input speeds from 600 RPM to 1800 RPM, over a 9:1 output speed range (1/3 to 3 times the input speed).

CONSTANT POWER
Except for minor efficiency variations, the output horsepower of the variator is constant throughout the speed range. Constant torque application requirements can be satisfied by selecting a unit capable of providing the required torque at the highest required output speed.

HIGH EFFICIENCY
Rolling contact between oil bath lubricated precision drive components provides up to 90% efficiency depending on unit size and output speed.

POSITIVE DRIVE
Built-in pressure device automatically increases pressure between drive balls and cones insuring positive non-slip operation.

SMOOTH, QUIET
Power transmission through rolling action of precision components results in quiet vibration-free operation.

SENSITIVE, ACCURATE
Speed control is exceptionally light and sensitive, permitting changes of speed to be linked to variations in temperatures, pressure, humidity, etc., or to sequence control requirements. Changes of speed can be made under full load. Pre-determined speeds can be quickly selected and accurately maintained with less than 0.1% deviation under constant load conditions. Excellent repeatability. Return to preselected speed within 1%.

COMPACT
Co-axial input-output shaft configuration plus slim, low profile results in a compact, space saving package ideally suited for limited space requirements or as an integral part of a machine.

LOW MAINTENANCE
Simplicity of design and construction facilitates repairs or replacement of parts. All adjustments can be made externally. No replacement of belts, chains, or internal adjustments required over 15,000 hours design life. Parts and service available world-wide.

ENCLOSED: OIL BATH
Perfect for dusty, wet, or corrosive atmospheres.

INDEX

PRINCIPLES OF OPERATION

CONSTRUCTION

The sectional illustration (Fig. 1) is of a typical Variator, the principle of which is common to all sizes. The outer casing consists of a body and two end covers accurately aligned and dowelled in position. The co-axial input and output drive shafts are mounted in identical bearing assemblies and rotate in the same direction. Power is transmitted from the input drive shaft (C) through a disc (A) splined on to the shaft. Via a pressure device (B) it passes to the input drive cone (D) and thence to a series of drive balls (E) mounted on ball spindles (K) which incorporate two sets of needle roller bearings (J). The ball spindles are located at each end in radial slots in the end covers, passing through a series of cam shaped slots in an iris plate (F) which can be rotated by the control worm (G). This movement tilts the axes of the drive balls and produces the speed variation.

From the drive balls (E) power is transmitted through the output drive cone (L), via a second pressure device (N), to the disc (P) which is splined to the output drive shaft (M). The drive balls (E) are held in position and in contact with the drive cones (D) and (L) by a retaining ring (H).

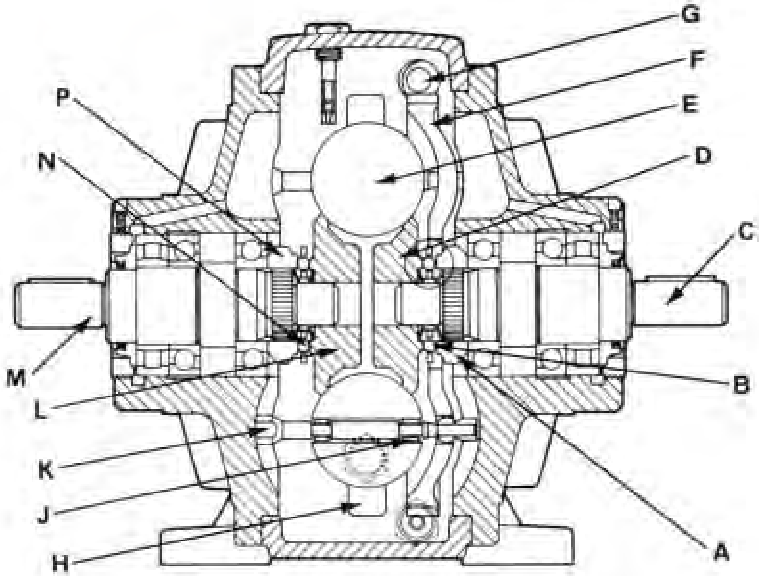


Figure 1

PRINCIPLE OF SPEED VARIATION

It will be apparent that when the ball spindles (K) are parallel to the drive shafts (Fig. 2) the ratio is 1:1 as the diameters on the drive balls (E), at the points of contact with the drive cones (D) and (L) are equal. When, as previously described, the ball spindles are tilted by the movement of the iris plate, the relative diameters of the drive balls at the points of contact with the drive cones are changed. One direction of tilt reduces the output speed (Fig. 3) whereas the reverse direction of tilt increases the output speed (Fig. 4).

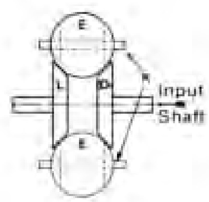


Figure 2

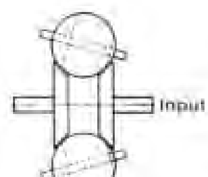


Figure 3

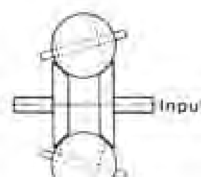


Figure 4

PRINCIPLE OF THE PRESSURE DEVICES

The pressure devices (Fig. 5) automatically ensure that the necessary pressure between the drive cones and the drive balls is maintained in proportion to the torque. A disc (P) is splined onto the drive shaft (M). The drive cone (L) is free to revolve on the shaft. Both the drive cone and splined disc have a series of 'V' shaped ramps (R) between which are inserted spherical rollers (S). Pairs of conical spring washers (T) are also fitted in recesses in the drive cones and splined discs.

Fig. 6 shows that under "NO LOAD" conditions, each roller is located at the bottom of the ramps, and no axial pressure is being exerted other than the initial pre-load, induced by the conical spring washers. This produces the necessary starting traction.

Under "ON LOAD" conditions, however, as further torque is applied (Fig. 7) in the direction of the arrow (X), the rollers ride up the ramps and produce a wedging action which, in turn, produces an axial pressure in the direction of the arrow (Y), causing a pressure increase between the drive balls and drive cones.

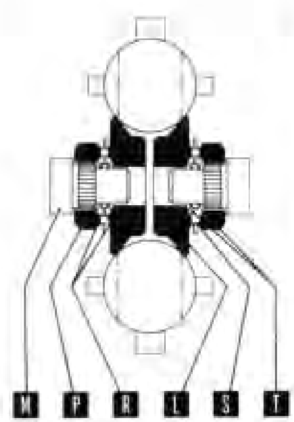


Figure 5

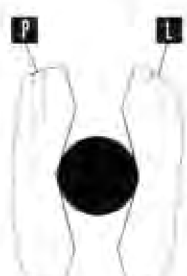


Figure 6

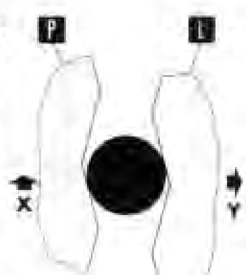


Figure 7

FS	HS	MS
 Free input and output shafts. Integral handwheel control.	 NEMA C flange input, free shaft output. Integral handwheel control.	 Motorized, with free output shaft. Integral handwheel control.
FX  Free input and output shafts. Remote handwheel control.	**HX**  NEMA C flange input, free shaft output. Remote handwheel control.	**MX**  Motorized, with free output shaft. Remote handwheel control.
FCS*  Free input shaft. NEMA C flange output. Integral handwheel control.	**HCS***  NEMA C flange input and output. Integral handwheel control.	**MCS***  Motorized, with NEMA C flange output. Integral handwheel control.
FCX*  Free input shaft. NEMA C flange output. Remote handwheel control.	**HCX***  NEMA C flange input and output. Remote handwheel control.	**MCX***  Motorized with NEMA C flange output. Remote handwheel control.

***Available in sizes 314 through 317 only.**

HANDWHEEL CONTROL (S)

The standard handwheel incorporates a digital counter. Twenty revolutions are required to adjust speed from minimum to maximum. The counter is calibrated to 1/10 of a handwheel turn. Simple means are provided for zero setting the handwheel.

The handwheel may be mounted on either side of the Variator and incorporates a clutch to prevent damage, should the control be moved while the unit is not in operation.

REMOTE CONTROL (X)

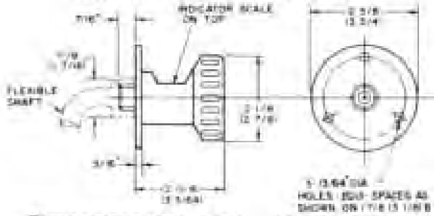
Remote manual control is accomplished by the use of a remotely mounted counter which controls the Variator through a flexible shaft which can be provided in any of the standard lengths shown in the table below.

STANDARD REMOTE CONTROL FLEXIBLE CABLE LENGTHS (INCHES)

10" (9.84")	**70"** (68.88")
20" (19.68")	**80"** (78.72")
30" (29.52")	**90"** (88.56")
40" (39.36")	**100"** (98.40")
50" (49.20")	**110"** (108.24")
60" (59.04")	**120"** (118.68")

Numbers shown in ( ) are exact dimensions.

REMOTE CONTROL MOUNTING DIMENSIONS



Dimensions shown in ( ) apply to sizes 316 and larger.

SELECTION, HOW TO ORDER

SELECTION PROCEDURE

CONSTANT HORSEPOWER APPLICATIONS

STEP ONE.
Determine the speed range required (Max. RPM—Min. RPM)

STEP TWO.
Determine the horsepower required at the output shaft of the Variator or Variator-Reducer combination (Step 1)

$$HP=\frac{\text{Torque}\times\text{RPM}}{63{,}025}$$

STEP THREE.
Refer to selection table on page 6. In "Output Speed Range" column find a speed range which includes the required speed range from Step 1.

STEP FOUR.
Select a Variator or Variator-Reducer combination whose output horsepower rating (from the "CONSTANT HORSEPOWER" chart) is equal to or greater than the horsepower required from Step 2.

Example:
(a) Speed range = 15 RPM—85 RPM
(b) HP required = .35 HP
(c) Referring to the selection tables on page 6, select the speed range of 14-90 RPM and select 4C314 or 926314 with 3/4 HP motor and 40:1 worm gear reducer.

CONSTANT TORQUE APPLICATIONS

STEP ONE.
Determine speed range required (Max. RPM—Min. RPM).

STEP TWO.
Determine the torque required at the output shaft of the Variator or Variator-Reducer combination at MAXIMUM RPM (Step 1).

$$\text{Torque}=\frac{HP\times 63{,}025}{\text{RPM}}$$

STEP THREE.
Refer to selection table page 7. In "Output Speed Range" column find a speed range which includes the required speed range from Step 1.

STEP FOUR.
Select a Variator or Variator-Reducer combination whose output torque rating (from the "CONSTANT TORQUE" chart) is equal to or greater than the torque from Step 2.

Example:
(a) Speed range = 60 RPM—200 RPM
(b) Torque @ 200RPM = 75 in. lbs.
(c) Referring to the selection tables on page 7, select the speed range of 38-240 RPM and select 1C314 or 917314 with 1/2 HP motor and 15:1 worm gear reducer.

HOW TO ORDER

Variator—
(1) Case Size (312, 314 etc)
(2) Model & Control (FS, FX, HS etc) specify cable length for "X" units.
(3) Configuration (control location) Specify Arrangement "L" or "R" ("L" is standard)
(4) Speed Range.
(5) For "H" or "C" model units specify input and/or output NEMA frame required.
(6) Mounting position (A, B, C, D)

Reducer—
(1) Model ("C" series or Wingear)
(2) Size
(3) Ratio
(4) Motor Frame
(5) Assembly
(6) Mounting Position

Motor—
(1) Horsepower
(2) Speed
(3) NEMA Frame
(4) Enclosure
(5) Phase
(6) Voltage

WINSMITH ALSO SELLS TRACTION FLUID — CONTACT YOUR LOCAL DISTRIBUTOR.
***USE SUN OIL-SOLNUS 55 or SHELL TELLUS R10 or R15**

TECHNICAL NOTE

CONSTANT HORSEPOWER OR CONSTANT TORQUE

WINKOPP is a *constant horsepower* device. This means that the horsepower delivered at its output shaft stays the same throughout its speed range (5). The *torque* delivered at the output shaft varies inversely with the output speed. In other words:
—Maximum torque is produced at the low speed range.
—Minimum torque is produced at the high speed range.

APPLICATIONS may require either constant horsepower or constant torque depending on the nature of the driven equipment and load. Since a reducer is basically a constant torque device, the size of gearbox selected may vary depending on whether the application requires constant horsepower or constant torque. For example, consider a 1 HP drive with a speed range of 10 to 60 rpm. Referring to the selection table on page 6, we see that the proper selection for constant horsepower is a 6C315—a size 315 variator and a size 6C reducer. This combination delivers 2219 in-lb torque at low speed and only 483 in-lb at high speed. It was necessary to select a reducer capable of producing the full 2219 in-lb required at low speed. This is a size 6C. At high speed the 6C reducer is still capable of handling considerably more torque than the variator can transmit. Thus the reducer simply has extra capacity when operating in the high speed range.

If the same drive were used in a *constant torque application*, we must ask: What is the greatest amount of torque which this drive will handle over its entire speed range? The answer is 483 in-lb. Thus, if the torque required by the application is only 483 in-lb, we can select a smaller reducer—one capable of producing 483 in-lb rather than 2219 in-lb. A size 4C would be adequate. Thus, we obtain a more economical selection. Note that the constant torque selection in the same example is a 4C315. This 4C315 produces slightly more torque (561 in-lb.) since the operating power losses are less in the smaller reducer.

A word of caution in the constant torque example, the variator is capable of overpowering the reducer causing premature failure if the load should suddenly require more than the torque listed. Be sure the required torque does not exceed the amount shown.

In summary:

MAKE CONSTANT HORSEPOWER SELECTIONS AT MINIMUM SPEED.
MAKE CONSTANT TORQUE SELECTIONS AT MAXIMUM SPEED.

NOTES:

1. All selections shown are for a service factor of 1.00 (8-10 hours operation, uniformly loaded.) For applications involving 12-24 hour operation, multiply the required horsepower or torque by a service factor of 1.25. For applications involving shock loading contact Winsmith or your Winsmith representative.

2. All selections shown in the selection tables are based on 1725 RPM input speed. For selections involving variator input speeds other than 1725 RPM or for output speed ranges not shown in this catalog contact Winsmith or your Winsmith representative.

3. For overhung load ratings see ratings tables pages 8-9.

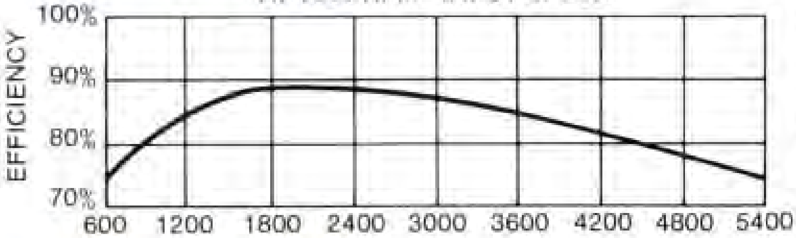
4. For other Variator performance characteristics see performance data page 5. For reducer ratings, overhung load capacity etc., refer to Winsmith Catalog 1000.

5. The minor variations in actual output horsepower shown in the rating and selection tables reflect relatively small differences in the efficiency of the Variator or Variator-Reducer combination which occur at different speeds.

PERFORMANCE DATA

WINKOPP EFFICIENCY

TYPICAL VARIATOR EFFICIENCY CURVE
AT 1800 RPM - INPUT SPEED



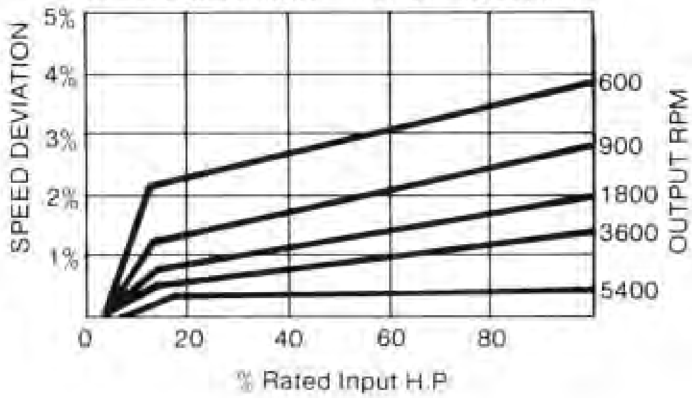
The chart shows a typical Variator efficiency curve related to output speed. It will be seen that the Variator has a very high efficiency at output speeds between half and double the input speed, i.e. for the majority of the output speed range. The curve is representative of a horizontal unit—efficiencies vary slightly with different sizes of Variators. Individual efficiency curves are available on request.

SPEED HOLDING

Under constant load conditions the speed-holding characteristic of the Variator is inherently stable. Under varying load conditions, however, speed fluctuations can occur. Fig. 16 shows percentage speed deviation under varying load with a constant input speed of 1800 RPM.

It must be emphasized 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 2). 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 a minor alteration in the relative positions of the drive balls and drive cones, and will cause a slight change in the speed ratio. However, under constant load conditions the speed deviation can 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 mower.

SPEED DEVIATION INPUT—1800 RPM



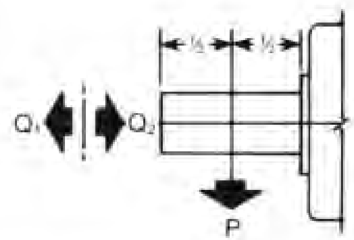
EXTERNAL SHAFT LOADS

In calculating overhung loads on shafts, the following formulae should be used:

$$P(\text{lbs.}) = \frac{\text{h.p.} \times 63000 \times K}{N \times R\ (\text{in.})}$$

where:
N = Shaft revolutions per minute
R = Pitch radius of driving member
K = Driving member factor

Values of K:	
Chain Drives	= 1.00
Spur Gear Drives	= 1.25
Vee Belt Drives	= 1.50
Flat or "Multi-Vee" Belt Drives	= 3.00



LOADS (P & Q)

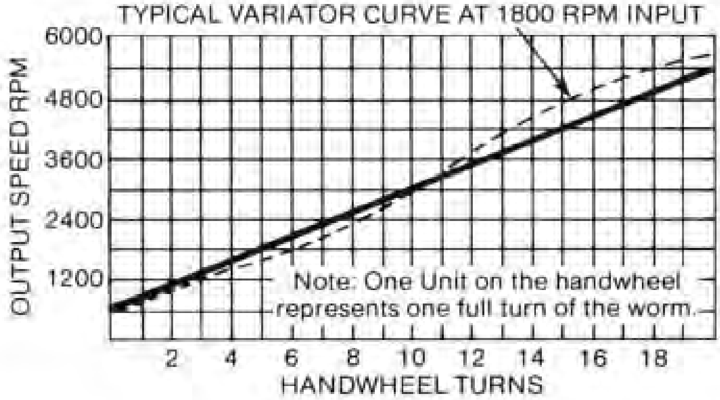
VARIATOR SIZE						
Shaft Loads	312 lbs.	314/315 lbs.	316/317 lbs.	318 lbs.	320/321 lbs.	322/324 lbs.
P	66	110	250	330	600	1100
Q_1	33	42	98	142	240	460
Q_2	16.5	21	49	71	120	230

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.

The chart shows changes of speed relative to turns of 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 (See drawings on pages 10 & 12).

TYPICAL VARIATOR CURVE AT 1800 RPM INPUT



REDUCER SELECTION
(CONSTANT HORSEPOWER)

Indicates D90 Type SE Series unit.
Unshaded selections indicate "C" Series.

REDUCER TYPE	OUTPUT SPEED RANGE (RPM)	SELECT: MOTOR H.P.	SELECT: REDUCER VARIATOR SIZE	SELECT: REDUCER RATIO	OUTPUT RATINGS H.P. AT MAX RPM	OUTPUT RATINGS H.P. AT MIN RPM	OUTPUT RATINGS TORQUE AT MAX RPM	OUTPUT RATINGS TORQUE AT MIN RPM
NON GEAR	600 to 5400	1/3	312	NONE	25	24	3.0	25
		1/2	314	NONE	38	36	4.4	40
		3/4	314	NONE	58	56	6.5	59
		1	315	NONE	75	77	8.7	81
		1-1/2	316	NONE	1.16	1.13	13	119
		2	317	NONE	1.64	1.58	18	172
		3	318	NONE	2.37	2.31	28	243
		5	320	NONE	3.85	4.40	46	462
		7-1/2	321	NONE	5.65	6.50	69	682
		10	322	NONE	7.60	8.50	89	893
		15	324	NONE	11.25	12.75	131	1339
SINGLE REDUCTION	115 to 720	1/3	1C312	5	19	20	17	108
			913 312		19	20	17	108
		1/2	1C314	5	32	30	28	167
			913 314		32	30	28	167
		3/4	2C314	5	51	47	45	256
			917 314		51	47	45	256
		1	2C315	5	71	62	62	346
			917 315		71	62	62	346
		1-1/2	3C316	5	1.11	87	97	532
			917 316		1.11	84	97	482
		2	4C317	5	1.51	1.32	132	726
			920 317		1.51	1.24	132	681
		3	4C318	5	2.32	2.08	203	1067
			924 318		2.32	2.00	202	1098
		5	5C320	5	4.07	3.14	356	1723
			930 320		4.07	3.51	356	1921
		7-1/2	6C321	5	6.10	4.58	534	2511
SINGLE REDUCTION	77 to 480	1/3	1C312	7-1/2	18	19	24	108
		1/2	1C314	7-1/2	32	29	42	254
		3/4	2C314	7-1/2	51	47	67	384
		1	2C315	7-1/2	71	58	93	478
		1-1/2	4C316	7-1/2	1.10	87	144	796
		2	4C317	7-1/2	1.49	1.31	196	1069
		3	5C318	7-1/2	2.16	1.82	287	1568
		5	6C320	7-1/2	3.83	3.32	503	2770
		7-1/2	7C321	7-1/2	5.62	4.79	738	3847
		10	8C322	7-1/2	8.07	6.52	1059	5257
		15	9C324	7-1/2	11.35	8.51	1490	6998
SINGLE REDUCTION	57 to 360	1/3	1C312	10	19	19	31	194
			913 312		19	19	31	194
		1/2	2C314	10	30	32	53	245
			917 314		31	30	55	328
		3/4	2C314	10	59	45	88	483
			917 314		51	46	88	369
		1	3C315	10	78	61	122	679
			920 315		78	62	122	685
		1-1/2	4C316	10	1.18	95	191	1049
			924 316		1.18	95	191	1050
		2	4C317	10	1.49	1.27	200	1405
			928 317		1.49	1.33	200	1248
		3	5C318	10	2.23	1.75	408	1903
			930 318		2.23	2.00	408	2210
		5	7C320	10	3.48	3.19	645	3029
		7-1/2	8C321	10	5.80	4.84	980	5358
		10	9C322	10	7.95	6.78	1376	7498
		15	10C324	10	11.93	9.52	2088	10,520
SINGLE REDUCTION	38 to 240	1/3	1C312	15	14	16	46	281
			913 312		16	17	48	281
		1/2	2C314	15	30	27	78	448
			917 314		30	29	79	486
		3/4	4C314	15	47	42	124	702
			920 314		49	44	128	772
		1	4C315	15	58	57	174	951
			924 315		58	57	178	948
		1-1/2	4C316	15	1.04	87	273	1449
			924 316		1.08	81	279	1344
		2	3C317	15	1.47	1.20	386	2030
			926 317		1.45	1.16	381	1851
		3	6C318	15	2.13	1.79	557	2967
			930 318		2.27	1.79	597	2972
		5	8C320	15	3.74	3.09	983	5125
		7-1/2	9C321	15	5.26	4.95	1381	7375
		10	10C322	15	7.46	6.29	1960	10,434
		15	11C324	15	10.81	8.19	2838	13,580
SINGLE REDUCTION	29 to 180	1/3	2C312	20	17	16	58	358
			917 312		17	18	60	382
		1/2	3C314	20	28	26	98	563
			917 314		29	29	103	544
		3/4	4C314	20	47	42	163	917
			924 314		47	43	166	834
		1	4C315	20	65	57	229	1241
			924 315		66	58	232	1262
		1-1/2	5C316	20	1.02	88	357	1942
			926 316		1.04	84	365	1856
		2	6C317	20	1.38	1.19	473	2577
			930 317		1.40	1.20	490	2625
		3	7C318	20	2.08	1.81	727	3936
		5	9C320	20	3.50	3.08	1225	6692
		7-1/2	10C321	20	5.51	4.87	1931	10,595
		10	11C322	20	7.15	6.20	2506	13,482
		15	13C324	20	11.05	9.60	3870	19,551

REDUCER TYPE	OUTPUT SPEED RANGE (RPM)	SELECT: MOTOR H.P.	SELECT: REDUCER VARIATOR SIZE	SELECT: REDUCER RATIO	OUTPUT RATINGS H.P. AT MAX RPM	OUTPUT RATINGS H.P. AT MIN RPM	OUTPUT RATINGS TORQUE AT MAX RPM	OUTPUT RATINGS TORQUE AT MIN RPM
SINGLE REDUCTION	20 to 120	1/3	2C312	30	15	15	80	475
			917 312		16	16	84	510
		1/2	3C314	30	27	24	140	741
			924 314		27	26	141	816
		3/4	4C314	30	43	39	224	1163
			924 314		45	42	234	1262
		1	4C315	30	60	48	314	1528
			926 315		63	55	329	1731
		1-1/2	6C316	30	89	78	467	2461
			930 316		96	84	505	2632
		2	6C317	30	1.24	1.00	650	3147
		3	8C318	30	1.92	1.72	1009	5426
		5	9C320	30	3.21	2.53	1686	7979
		7-1/2	11C321	30	5.01	4.43	2629	13,871
		10	13C322	30	6.73	6.03	3534	18,994
SINGLE REDUCTION	14 to 90	1/3	3C312	40	14	13	97	575
			917 312		15	12	107	541
		1/2	4C314	40	25	22	175	984
			924 314		26	23	180	1016
		3/4	4C314	40	42	31	292	1412
			928 314		43	36	301	1630
		1	5C315	40	58	43	407	1921
			930 315		58	48	407	2166
		1-1/2	6C316	40	89	85	622	2924
		2	7C317	40	1.18	91	825	4111
		3	9C318	40	1.83	1.34	1285	5946
		5	10C320	40	3.17	2.43	2222	10,929
		7-1/2	12C321	40	4.80	3.54	3360	15,917
		10	14C322	40	6.42	4.98	4497	22,403
SINGLE REDUCTION	12 to 72	1/3	3C312	50	14	12	121	650
			920 312		14	14	124	749
		1/2	4C314	50	25	23	218	1221
			924 314		26	23	218	1093
		3/4	5C314	50	38	32	345	1715
			926 314		42	32	364	1688
		1	6C315	50	52	47	454	2484
			930 315		56	48	492	2595
		1-1/2	7C316	50	85	71	740	3729
		2	8C317	50	1.14	1.03	995	5409
		3	9C318	50	1.75	1.37	1533	7196
		5	11C320	50	3.04	2.38	2664	12,499
		7-1/2	13C321	50	4.59	3.49	4015	18,373
SINGLE REDUCTION	10 to 60	1/3	4C312	60	12	12	140	677
			924 312		12	14	140	898
		1/2	5C314	60	22	22	230	1374
			926 314		24	22	253	1390
		3/4	6C314	60	31	29	327	1798
			930 314		38	34	401	2148
		1	6C315	60	46	35	483	2219
		1-1/2	8C316	60	77	74	814	4868
		2	9C317	60	1.04	93	1093	6197
		3	10C318	60	1.63	1.48	1715	9302
		5	13C320	60	2.61	2.36	2741	14,811
		7-1/2	14C321	60	4.38	3.11	4605	19,618
DOUBLE REDUCTION	6 to 36	1/3	40312	100	12	13	213	1373
		1/2	50314	100	24	24	426	2504
		3/4	60314	100	40	36	699	3732
		1	70315	100	52	47	904	4842
		1-1/2	80316	100	86	76	1505	8034
		2	90317	100	1.16	94	2037	9604
		3	100318	100	1.95	1.62	3421	17,050
		5	120320	100	3.23	2.52	5648	26,521
		7-1/2	150321	100	4.91	4.31	8595	45,248
		10	150322	100	6.75	5.13	11,817	53,866
DOUBLE REDUCTION	3 to 18	1/3	50312	200	12	12	417	2576
		1/2	60314	200	21	18	739	3877
		3/4	70314	200	35	29	1229	6148
		1	80315	200	52	48	1811	8934
		1-1/2	100316	200	84	74	2936	15,644
		2	110317	200	98	87	3414	17,187
		3	120318	200	1.57	1.30	5509	27,308
		5	140320	200	2.78	2.05	9744	42,459
DOUBLE REDUCTION	1 to 7	1/3	80312	500	08	08	723	3980
		1/2	80314	500	18	13	1637	6433
		3/4	100314	500	25	18	2209	11,675
		1	100315	500	37	25	3357	16,138
		1-1/2	100316	500	63	37	5653	23,217
		2	140317	500	89	52	8029	40,008
		3	150318	500	1.35	96	12,170	60,389

NOTES:

1. All selections shown are for a service factor of 1.00 (8-10 hours operation, uniformly loaded.) For applications involving 12-24 hour operation, multiply the required horsepower or torque by a service factor of 1.25. For applications involving shock loading contact Winsmith or your Winsmith representative.

2. All selections shown in the selection tables are based on 1725 RPM input speed. For selections involving variator input speeds other than 1725 RPM or for output speed ranges not shown in this catalog contact Winsmith or your Winsmith representative.

3. For overhung load ratings see ratings tables pages 8-9.

4. For other Varistor performance characteristics see performance data page 5. For reducer ratings, overhung load capacity etc., refer to the appropriate Winsmith Worm Gear Catalog.

5. The minor variations in actual output horsepower shown in the rating and selection tables reflect relatively small differences in the efficiency of the Variator or Variator-Reducer combination which occur at different speeds.

REDUCER SELECTION
(CONSTANT TORQUE)

Indicates D90 Type SE Series unit.
Unshaded selections indicate "C" Series.

REDUCER TYPE	OUTPUT SPEED RANGE (RPM)	SELECT			OUTPUT RATINGS	
		MOTOR H.P.	REDUCER VARIATOR SIZE	REDUCER RATIO	TORQUE	HORSEPOWER
NON GEAR	600 to 5400	1/3	312	NONE	3.0	24
		1/2	314	NONE	4.4	38
		3/4	314	NONE	6.5	56
		1	315	NONE	8.7	75
		1-1/2	316	NONE	13	1.16
		2	317	NONE	18	1.64
		3	318	NONE	26	2.37
		5	320	NONE	46	3.95
		7-1/2	321	NONE	69	5.93
		10	322	NONE	89	7.60
		15	324	NONE	131	11.25
SINGLE REDUCTION	115 to 720	1/3	1C312	5	17	19
			913 312		17	19
		1/2	1C314	5	28	32
			913 314		28	32
		3/4	1C314	5	45	51
			913 314		45	51
		1	1C315	5	63	72
			917 315		62	71
		1-1/2	1C316	5	97	1.11
			917 316		97	1.11
		2	2C317	5	131	1.50
			917 317		131	1.50
		3	3C318	5	201	2.30
			924 318		203	2.32
		5	4C320	5	344	3.93
			924 320		343	3.92
		7-1/2	5C321	5	540	6.17
			930 321		540	6.17
		10	6C322	5	717	8.19
SINGLE REDUCTION	77 to 480	1/3	1C312	7-1/2	24	18
		1/2	1C314	7-1/2	42	32
		3/4	1C314	7-1/2	67	51
		1	1C315	7-1/2	93	71
		1-1/2	2C316	7-1/2	145	1.10
		2	2C317	7-1/2	197	1.50
		3	3C318	7-1/2	303	2.30
		5	4C320	7-1/2	510	3.88
		7-1/2	5C321	7-1/2	743	5.66
		10	6C322	7-1/2	1030	7.84
		15	8C320	7-1/2	1600	12.25
SINGLE REDUCTION	57 to 360	1/3	1C312	10	31	18
			913 312		31	18
		1/2	1C314	10	53	30
			913 314		53	30
		3/4	1C314	10	85	49
			917 314		88	51
		1	1C315	10	118	67
			917 315		123	70
		1-1/2	2C316	10	180	1.08
			917 316		192	1.10
		2	3C317	10	259	1.48
			920 317		260	1.49
		3	4C318	10	399	2.28
			924 318		390	2.28
		5	5C320	10	598	3.96
			926 320		878	3.67
		7-1/2	6C321	10	1007	5.90
		10	7C322	10	1331	7.80
		15	8C324	10	2014	11.50
SINGLE REDUCTION	38 to 240	1/3	1C312	15	48	18
			913 314		48	18
		1/2	1C314	15	78	30
			913 314		79	30
		3/4	1C314	15	126	48
			917 314		129	49
		1	2C315	15	175	67
			917 315		179	68
		1-1/2	3C316	15	254	97
			917 316		278	1.06
		2	4C317	15	372	1.42
			924 317		380	1.45
		3	4C318	15	571	2.17
			924 318		582	2.22
		5	6C320	15	959	3.65
			930 320		934	3.56
		7-1/2	7C321	15	1417	5.40
		10	8C322	15	2047	7.79
		15	9C324	15	2819	10.73
SINGLE REDUCTION	29 to 180	1/3	1C312	20	56	16
			913 312		56	16
		1/2	1C314	20	94	27
			917 314		103	29
		3/4	2C314	20	162	46
			917 314		168	48
		1	2C315	20	225	64
			917 315		233	67
		1-1/2	3C316	20	347	99
			924 316		364	1.04
		2	4C317	20	490	1.40
			924 317		498	1.42
		3	5C318	20	757	2.16
			926 318		764	2.18
		5	6C320	20	1256	3.59
		7-1/2	8C321	20	1950	5.57
		10	9C322	20	2582	7.37
		15	10C324	20	4046	11.56

REDUCER TYPE	OUTPUT SPEED RANGE (RPM)	SELECT			OUTPUT RATINGS	
		MOTOR H.P.	REDUCER VARIATOR SIZE	REDUCER RATIO	TORQUE	HORSEPOWER
SINGLE REDUCTION	20 to 120	1/3	1C312	30	81	15
			917 312		84	16
		1/2	1C314	30	137	26
			917 314		145	28
		3/4	2C314	30	225	43
			917 314		235	45
		1	3C315	30	320	61
			917 315		300	57
		1-1/2	4C316	30	493	94
			924 316		514	98
		2	4C317	30	628	1.20
			924 317		674	1.28
		3	6C318	30	1017	1.94
			930 318		956	1.82
		5	7C320	30	1626	3.10
		7-1/2	9C321	30	2522	4.99
		10	10C322	30	3716	7.08
		15	11C324	30	4933	9.39
SINGLE REDUCTION	14 to 90	1/3	1C312	40	91	13
			917 312		107	16
		1/2	2C314	40	172	25
			917 314		184	26
		3/4	2C314	40	280	40
			917 314		300	43
		1	4C315	40	410	59
			924 315		419	60
		1-1/2	4C316	40	631	90
			924 316		659	94
		2	5C317	40	860	1.23
			930 317		894	1.28
		3	7C318	40	1309	1.87
		5	8C320	40	2231	3.19
		7-1/2	10C321	40	3503	5.00
		10	11C322	40	4619	6.60
		15	13C324	40	6736	9.62
SINGLE REDUCTION	12 to 72	1/3	1C312	50	99	11
			917 312		128	15
		1/2	2C314	50	206	24
			917 314		220	25
		3/4	3C314	50	328	40
			920 314		336	41
		1	4C315	50	510	58
			924 315		506	58
		1-1/2	5C316	50	787	90
			926 316		802	92
		2	6C317	50	1040	1.19
			930 317		1081	1.23
		3	7C318	50	1532	1.75
		5	9C320	50	2727	3.12
		7-1/2	11C321	50	4240	4.84
		10	12C322	50	4971	6.30
		15	15C324	50	8630	9.86
SINGLE REDUCTION	10 to 60	1/3	1C312	60	117	11
			917 312		147	14
		1/2	2C314	60	216	21
			917 314		253	24
		3/4	4C314	60	421	40
			924 314		418	40
		1	4C315	60	561	53
			924 315		585	56
		1-1/2	6C316	60	794	76
			930 316		914	87
		2	7C317	60	1196	1.14
			930 317		1140	1.09
		3	8C318	60	1912	1.82
		5	10C320	60	3180	3.03
		7-1/2	13C321	60	4934	4.70
		10	13C322	60	5746	5.92
DOUBLE REDUCTION	6 to 36	1/3	2D312	100	210	12
		1/2	2D314	100	364	21
		3/4	3D314	100	585	33
		1	4D315	100	853	54
		1-1/2	4D316	100	1475	84
		2	5D317	100	2068	1.30
		3	7D318	100	3266	1.87
		5	8D320	100	5785	3.30
		7-1/2	9D321	100	8655	4.94
		10	10D322	100	11,479	6.56
		15	13D324	100	16,126	9.21
DOUBLE REDUCTION	3 to 18	1/3	2D312	200	387	11
		1/2	3D314	200	718	21
		3/4	4D314	200	1235	35
		1	5D315	200	1870	53
		1-1/2	6D316	200	2830	81
		2	7D317	200	4004	1.14
		3	8D318	200	6447	1.84
		5	9D320	200	9700	2.77
		7-1/2	11D321	200	14,876	4.25
		10	14D322	200	20,774	5.93
		15	15D324	200	32,737	9.35
DOUBLE REDUCTION	1 to 7	1/3	3D312	500	786	09
		1/2	4D314	500	1475	16
		3/4	5D314	500	2803	29
		1	6D315	500	3377	37
		1-1/2	8D316	500	4764	53
		2	9D317	500	8833	98
		3	10D318	500	12,541	1.39
		5	13D320	500	23,462	2.60
		7-1/2	15D321	500	34,294	3.81
		10	15D322	500	42,458	4.71

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RATINGS

OUTPUT RPM	312 INPUT H.P.	312 OUTPUT TORQUE (IN.-LBS.)	312 OHL†	314 INPUT H.P.	314 OUTPUT TORQUE (IN.-LBS.)	314 OHL†	315 INPUT H.P.	315 OUTPUT TORQUE (IN.-LBS.)	315 OHL†	316 INPUT H.P.	316 OUTPUT TORQUE (IN.-LBS.)	316 OHL†	317 INPUT H.P.	317 OUTPUT TORQUE (IN.-LBS.)	317 OHL†
1800 RPM INPUT**															
600		32			66			87			132			187	
900		25			52			69			103			142	
1800		14			27			37			55			75	
2700	.42	9	66	.84	18	110	1.08	24	110	1.67	35	250	2.16	46	250
3600		6.3			12.3			16.3			24			33	
*4500		4.9			9.4			12.5			19			26	
*5400		3.8			7.5			10			15			20	
1500 RPM INPUT															
500		32			66			87			132			187	
750		25			52			69			103			142	
1500		14			27			37			55			75	
2250	.39	9	66	.78	18	110	1.0	24	110	1.55	35	250	2.0	46	250
3000		6.3			12.3			16.3			24			33	
*3750		4.9			9.4			12.5			19			26	
*4500		3.8			7.5			10			15			20	
1200 RPM INPUT															
400		34			70			92			140			198	
600		27			55			73			109			151	
1200		15			29			39			58			80	
1800	.29	9.5	66	.57	19	110	.75	25	110	1.15	37	250	1.5	49	250
2400		6.7			13			17			25			35	
3000		5.2			10			13			20			28	
3600		4.0			8			11			16			21	
900 RPM INPUT															
300		36			75			98			149			211	
450		28			59			78			116			160	
900		16			31			42			62			85	
1350	.23	10	66	.46	20	110	.59	27	110	.90	40	250	1.1	52	250
1800		7.1			14			18			27			37	
2250		5.5			11			14			21			29	
2700		4.3			8.5			11			17			23	
600 RPM INPUT**															
200		40			83			109			165			234	
300		31			65			86			129			178	
600		18			34			46			69			94	
900	.17	11	66	.34	23	110	.44	30	110	.68	44	250	.80	58	250
1200		7.9			15			20			30			41	
1500		6.1			12			16			24			33	
1800		4.8			9.4			13			19			25	

*When used with speed reducers, do not exceed maximum permissable input speed ratings of the reducer. Consult Winsmith for applications involving reducer input speeds in excess of 3600 RPM.

**Variators should not be operated below 600 or above 1800 RPM input speeds due to loss of effective lubrication.

†Overhung load given at mid-point of shaft.

Output RPM	318 Input H.P.	318 Output Torque (In.-Lbs.)	318 OHL†	320 Input H.P.	320 Output Torque (In.-Lbs.)	320 OHL†	321 Input H.P.	321 Output Torque (In.-Lbs.)	321 OHL†	322 Input H.P.	322 Output Torque (In.-Lbs.)	322 OHL†	324 Input H.P.	324 Output Torque (In.-Lbs.)	324 OHL†

1800 RPM INPUT**

Output RPM	318 Input H.P.	318 Output Torque (In.-Lbs.)	318 OHL†	320 Input H.P.	320 Output Torque (In.-Lbs.)	320 OHL†	321 Input H.P.	321 Output Torque (In.-Lbs.)	321 OHL†	322 Input H.P.	322 Output Torque (In.-Lbs.)	322 OHL†	324 Input H.P.	324 Output Torque (In.-Lbs.)	324 OHL†
600		350			550			750			1000			1500	
900		275			390			535			715			1080	
1800		147			200			275			360			540	
2700	4.32	94	330	5.94	130	600	8.1	177	600	11.23	240	1100	16.85	340	1100
3600		65			90			123			163			240	
*4500		50			69			94			125			190	
*5400		40			55			75			100			147	

1500 RPM INPUT

Output RPM	318 Input H.P.	318 Output Torque (In.-Lbs.)	318 OHL†	320 Input H.P.	320 Output Torque (In.-Lbs.)	320 OHL†	321 Input H.P.	321 Output Torque (In.-Lbs.)	321 OHL†	322 Input H.P.	322 Output Torque (In.-Lbs.)	322 OHL†	324 Input H.P.	324 Output Torque (In.-Lbs.)	324 OHL†
500		350			550			750			1000			1500	
750		275			390			535			715			1080	
1500		147			200			275			360			540	
2250	4.00	94	330	5.50	130	600	7.5	177	600	10.4	240	1100	15.6	340	1100
3000		65			90			123			163			240	
*3750		50			69			94			125			190	
*4500		40			55			75			100			147	

1200 RPM INPUT

Output RPM	318 Input H.P.	318 Output Torque (In.-Lbs.)	318 OHL†	320 Input H.P.	320 Output Torque (In.-Lbs.)	320 OHL†	321 Input H.P.	321 Output Torque (In.-Lbs.)	321 OHL†	322 Input H.P.	322 Output Torque (In.-Lbs.)	322 OHL†	324 Input H.P.	324 Output Torque (In.-Lbs.)	324 OHL†
400		371			583			795			1060			1590	
600		292			413			567			758			1145	
1200		156			212			292			382			572	
1800	2.80	100	330	3.90	138	600	5.5	188	600	7.8	254	1100	10.4	360	1100
2400		69			95			130			173			254	
3000		53			73			100			133			201	
3600		42			58			80			106			156	

900 RPM INPUT

Output RPM	318 Input H.P.	318 Output Torque (In.-Lbs.)	318 OHL†	320 Input H.P.	320 Output Torque (In.-Lbs.)	320 OHL†	321 Input H.P.	321 Output Torque (In.-Lbs.)	321 OHL†	322 Input H.P.	322 Output Torque (In.-Lbs.)	322 OHL†	324 Input H.P.	324 Output Torque (In.-Lbs.)	324 OHL†
300		396			622			848			1130			1695	
450		311			441			605			808			1220	
900		166			226			311			407			610	
1350	2.36	106	330	3.24	147	600	4.42	200	600	6.1	271	1100	9.2	384	1100
1800		73			102			139			184			271	
2250		57			78			106			141			215	
2700		45			62			85			113			166	

600 RPM INPUT**

Output RPM	318 Input H.P.	318 Output Torque (In.-Lbs.)	318 OHL†	320 Input H.P.	320 Output Torque (In.-Lbs.)	320 OHL†	321 Input H.P.	321 Output Torque (In.-Lbs.)	321 OHL†	322 Input H.P.	322 Output Torque (In.-Lbs.)	322 OHL†	324 Input H.P.	324 Output Torque (In.-Lbs.)	324 OHL†
200		438			688			938			1250			1875	
300		344			488			669			894			1350	
600		184			250			344			450			675	
900	1.76	118	330	2.40	163	600	3.3	221	600	4.5	300	1100	6.85	425	1100
1200		81			113			154			204			300	
1500		63			86			118			156			238	
1800		50			69			94			125			184	

*When used with speed reducers, do not exceed maximum permissable input speed ratings of the reducer. Consult Winsmith for applications involving reducer input speeds in excess of 3600 RPM.

**Variators should not be operated below 600 or above 1800 RPM input speeds due to loss of effective lubrication.

†Overhung load given at mid-point of shaft.

NON-MOTORIZED UNITS

SERIES: FS, FX
FCS, FCX

10 SIZES .42 H.P. to 16.85 H.P.
OUTPUT TORQUE RANGE 3.8 to 1500 in.lbs.
WITHOUT GEAR REDUCER (To 60,000 in.lbs. with reducer)

For Horsepower, Torque and Overhung Load Ratings— See pages 8-9
For Service Factors—See page 6

TABLE OF WEIGHTS

Size	312	314	315	316	317	318	320	321	322	324
FS, FX	15	40	45	81	90	147	196	204	375	388
FCS, FCX	—	47	52	97	106	—	—	—	—	—

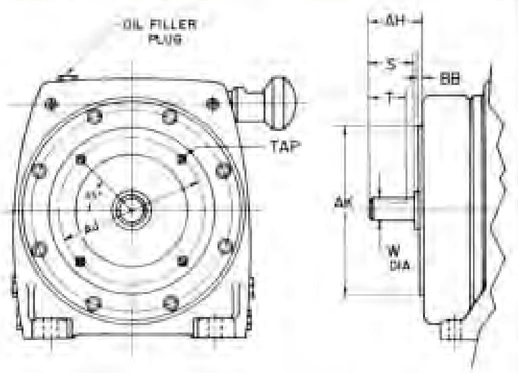
FS

FCS

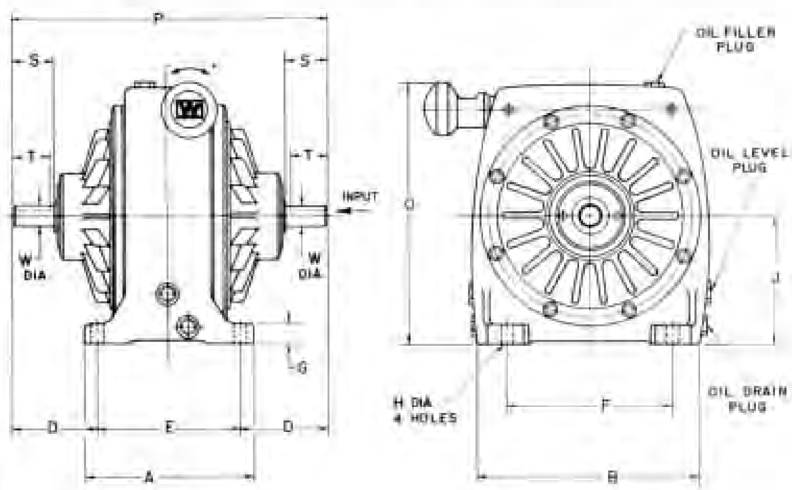
FX

FCX

DIMENSIONS:



FCS FCX
Available in sizes 314 through 317 only.



FS FX

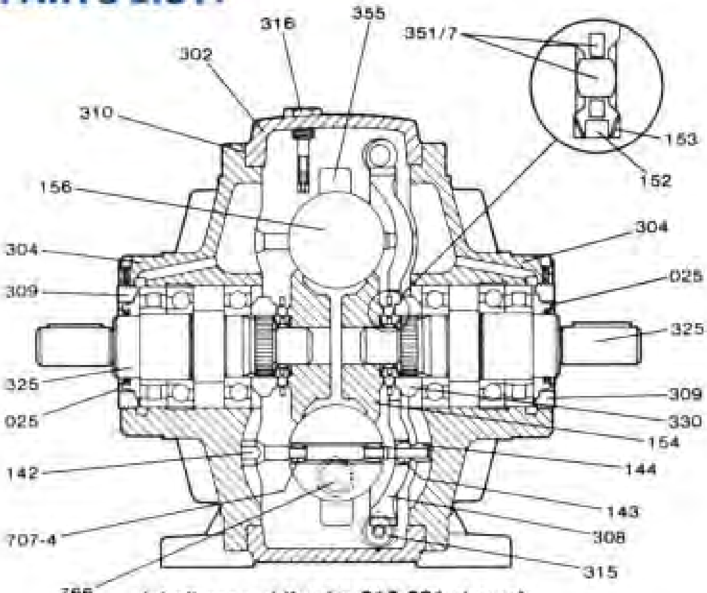
VARIATOR DIMENSIONS (in inches):

VARIATOR	A	AH	AJ	AK	B	BB	D	E	F	G	H	J	O	P	S	T	W*	KEYWAY	TAP	OUTPUT FRAME SIZE
312	4 1/32	—	—	—	4 7/8	—	1 29/32	3 5/32	3 35/64	7/16	5/16	2 3/4	6	6 31/32	25/32	21/32	3/8	1/8×1/16	—	—
314	6 3/8	1 1/2	5 7/8	4 1/2	6 13/16	1/8	2 3/4	5 1/8	5 1/8	19/32	3/8	3 15/16	8 1/32	10 5/8	1 3/8	1 5/64	5/8	3/16×3/32	3/8-16	56C
315	6 3/8	1 1/2	5 7/8	4 1/2	6 13/16	1/8	2 3/4	5 1/8	5 1/8	19/32	3/8	3 15/16	8 1/32	10 5/8	1 3/8	1 5/64	5/8	3/16×3/32	3/8-16	56C
316	7 1/2	2 3/16	7 1/4	8 1/2	9 19/32	1/4	3 35/64	6 5/16	7 31/64	3/4	7/16	5 1/8	11	13 13/32	1 25/32	1 29/64	7/8	3/16×3/32	1/2-13	MODIFIED**
317	7 1/2	2 3/16	7 1/4	8 1/2	9 19/32	1/4	3 35/64	6 5/16	7 31/64	3/4	7/16	5 1/8	11	13 13/32	1 25/32	1 29/64	7/8	3/16×3/32	1/2-13	MODIFIED**
318	9	—	—	—	11 19/32	—	4 29/64	7 31/64	8 21/32	1	19/32	6 11/16	13 19/32	16 13/32	2 9/32	1 61/64	1	1/4×1/8	—	—
320	9 7/8	—	—	—	12 11/16	—	5 5/16	7 7/8	9 29/64	1	11/16	7 31/64	15 3/32	19 5/16	2 3/4	2 13/32	1 3/8	5/16×5/32	—	—
321	9 7/8	—	—	—	12 11/16	—	5 5/16	7 7/8	9 29/64	1	11/16	7 31/64	15 3/32	19 5/16	2 3/4	2 13/32	1 3/8	5/16×5/32	—	—
322	12 1/4	—	—	—	15	—	5 51/64	10 1/4	11 13/16	1	3/4	8 21/32	17 5/16	22 11/16	2 15/16	2 5/8	1 3/4	3/8×3/16	—	—
324	12 1/4	—	—	—	15	—	5 51/64	10 1/4	11 13/16	1	3/4	8 21/32	17 5/16	22 11/16	2 15/16	2 5/8	1 3/4	3/8×3/16	—	—

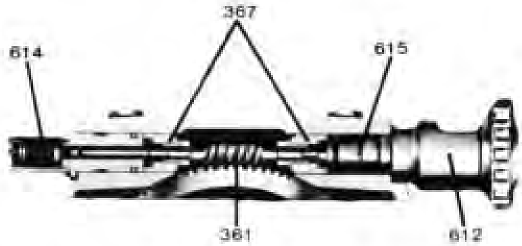
* Shaft diameter tolerance +.000" —.001".
For construction purposes, request certified dimension print.
Specify "AK" dia. and "W" dia. when ordering reducer.

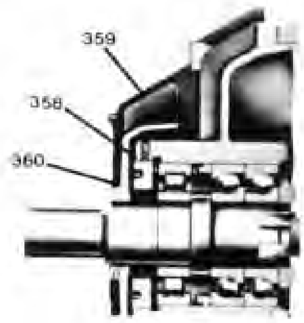
** 8 1/2 in. REGISTER; 7/8 in. BORE

PARTS LIST:

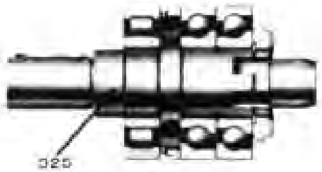


(shaft assemblies for 318-321 shown).





(size 312-317)



(size 322-324)

Item No.	Quantity	Description	Item No.	Quantity	Description
025	2	Shaft Seal, Free Shaft	355	1	Retaining Ring
142	*	Ball Spindle	358	1	Fan (sizes 320-324 only)
143	*	Guide Ball	359	1	Fan Housing (sizes 320-324 only)
144	*	Guide Roller			
152	2	Roller Cage Ring	360	1	Fan Housing Cover (sizes 320-324 only)
153	4	Preload Spring			
154	2	Drive Cone	361	1	Worm
156	*	Drive Ball (replace as a set)	367	2	Worm Bushing
302	1	Main Housing	521	1	Output Adapter Flange (optional, 314-317 only, not shown)
304	2	End Cover, Free Shaft			
306	1	Iris Plate	612	1	Handwheel
309	2	Adjustment Disc	614	1	Limit Stop Assembly (optional)
310	2	Gasket, End Cover	615	1	Handwheel Adapter
315	1	Magnetic Drain Plug	622	1	Stop Plug (not shown)
316	1	Breather Plug	707-4	**	Ball Spindle Needle Bearings
325	2	Free Shaft Subassembly (‡)	766	2	Oil Level Plug
330	2	Splined Disc	780	1	Flexible Shaft (not shown)
351/7	2	Roller Cage Assembly			

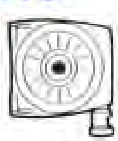
*Quantity varies with size
312, 314, 316=3
315, 317, 318, 320, 322=6
321, 324=8

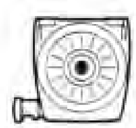
**Quantity varies with size:
312 through 315=none
316=6
317, 318, 320, 322=12
321, 324=16

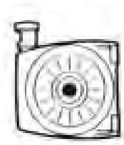
‡Replace as a complete assembly
Includes shaft, bearings, spacer.

MOUNTING ARRANGEMENTS:


POSITION A


POSITION B


POSITION C


POSITION D

MOUNTING A—Standard (as shipped from factory). MOUNTINGS B & D—Relocation of filler, level and drain plug required.
MOUNTING C—Special—Must be specified—Consult factory.

4

MOTORIZED UNITS

SERIES: HS, HX, HCS, HCX MS, MX (WITH MOTOR) MCS, MCX (WITH MOTOR)

10 SIZES 1/3 H.P. to 15 H.P.
OUTPUT TORQUE RANGE 2.9 to 1233 in.lbs. WITHOUT GEAR REDUCER (To 60,000 in.lbs. with reducer)

For Horsepower, Torque and Overhung Load Ratings— See pages 8-9.
For Service Factors—See page 6.

TABLE OF WEIGHTS

Size	312	314	315	316	317	318	320	321	322	324
MS, MX HS, HX	17.5	44	49	92	101	166	224	238	440	452
MCS, MCX HCS, HCX	—	51	56	108	117	—	—	—	—	—

Weights are without motor.

HS

MS (WITH MOTOR)

HCS

MCS (WITH MOTOR)

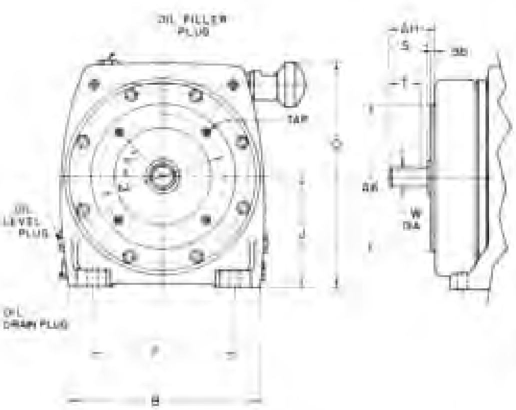
HX

MX (WITH MOTOR)

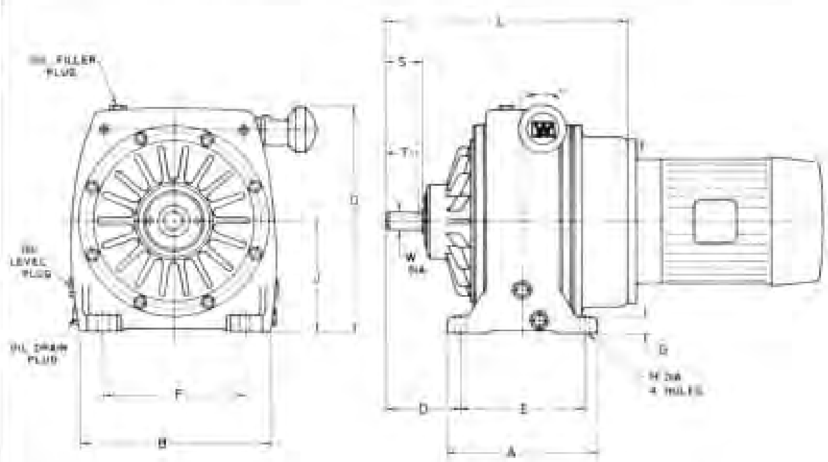
HCX

MCX (WITH MOTOR)

DIMENSIONS:



HCS HCX MCS MCX
Available in sizes 314 through 317 only.



HS HX MS MX

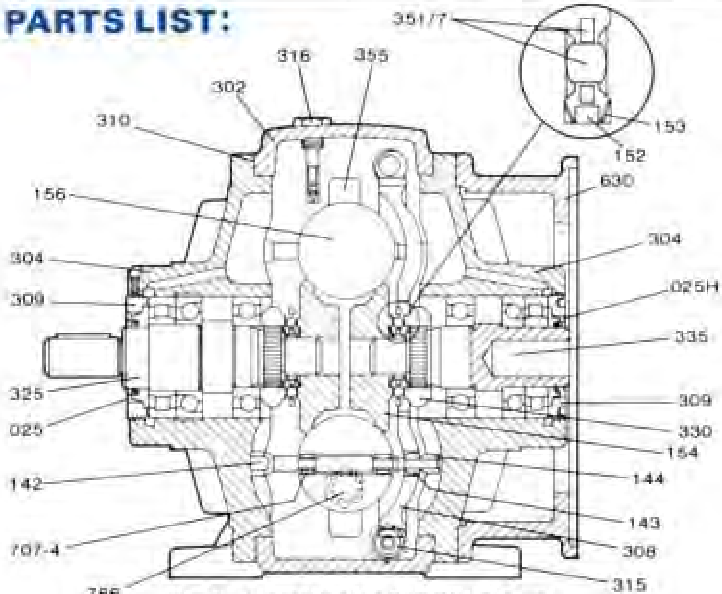
VARIATOR DIMENSIONS (in inches):

VARIATOR	A	AH	AJ	AK	B	BB	D	E	F	G	H	J	L	O	S	T	W*	KEYWAY	TAP	OUTPUT FRAME SIZE	INPUT FRAME SIZE
312	4 1/32	—	—	—	4 7/8	—	1 29/32	3 5/32	3 35/64	7/16	5/16	2 3/4	6 11/32	6	25/32	27/32	3/8	1/8x1/16	—	—	56C
314	6 3/8	1 1/2	5 7/8	4 1/2	6 13/16	1/8	2 1/4	5 5/8	5 1/8	19/32	3/8	3 15/16	9 1/8	8 1/32	1 3/8	1 5/64	5/8	3/16x3/32	3/8-16	56C	56C
315	6 3/8	1 1/2	5 7/8	4 1/2	6 13/16	1/8	2 1/4	5 5/8	5 1/8	19/32	3/8	3 15/16	9 1/8	8 1/32	1 3/8	1 5/64	5/8	3/16x3/32	3/8-16	56C	56C
316	7 1/2	2 3/16	7 1/4	8 1/2	9 15/32	1/4	3 35/64	6 3/16	7 31/64	3/4	7/16	5 1/8	12 11/64	11	1 25/32	1 29/64	7/8	3/16x3/32	1/2-13	MODIFIED**	56C, 145TC
317	7 1/2	2 3/16	7 1/4	8 1/2	9 15/32	1/4	3 35/64	6 3/16	7 31/64	3/4	7/16	5 1/8	12 11/64	11	1 25/32	1 29/64	7/8	3/16x3/32	1/2-13	MODIFIED**	56C, 145TC
318	9	—	—	—	11 15/32	—	4 23/64	7 31/64	8 21/32	1	19/32	6 11/16	14 45/64	13 19/32	2 9/32	1 61/64	1	1/4x1/8	—	—	184TC
320	9 7/8	—	—	—	12 11/16	—	5 5/16	7 7/8	9 29/64	1	11/16	7 31/64	17 21/32	15 3/32	2 3/4	2 13/32	1 3/8	5/16x5/32	—	—	184TC, 215TC
321	9 7/8	—	—	—	12 11/16	—	5 5/16	7 7/8	9 29/64	1	11/16	7 31/64	17 21/32	15 3/32	2 3/4	2 13/32	1 3/8	5/16x5/32	—	—	184TC, 215TC
322	12 1/4	—	—	—	15	—	5 31/64	10 1/4	11 13/16	1	3/4	8 21/32	21 15/64	17 5/16	2 15/16	2 5/8	1 3/4	3/8x3/16	—	—	184TC to 256TC
324	12 1/4	—	—	—	15	—	5 31/64	10 1/4	11 13/16	1	3/4	8 21/32	21 15/64	17 5/16	2 15/16	2 5/8	1 3/4	3/8x3/16	—	—	184TC to 256TC

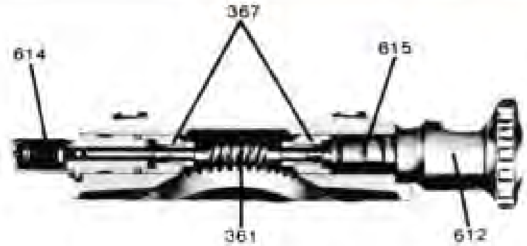
* Shaft diameter tolerance +.000" —.001".
For construction purposes, request certified dimension print.
Specify "AK" dia. and "W" dia. when ordering reducer.

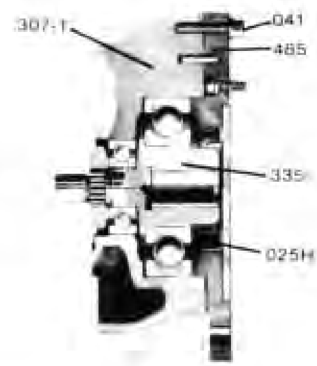
** 8 1/2 in. REGISTER; 7/8 in. BORE.

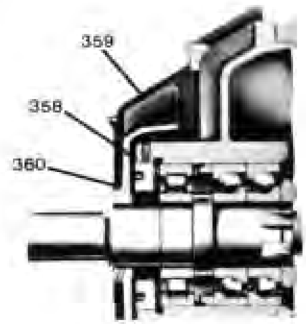
PARTS LIST:



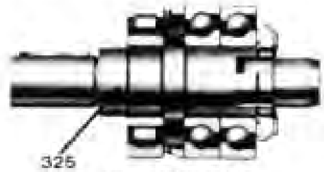
(shaft assemblies for 318-321 shown).







(size 312-317)



(size 322-324)

Item No.	Quantity	Description	Item No.	Quantity	Description
025	1	Shaft Seal, Free Shaft	351/7	2	Roller Cage Assembly
025H	1	Shaft Seal, Motorized	355	1	Retaining Ring
041	4	Motor Adapter Bolt	358	1	Fan (sizes 320-324 only)
142	*	Ball Spindle	359	1	Fan Housing (sizes 320-324 only)
143	*	Guide Ball	360	1	Fan Housing Cover (sizes 320-324 only)
144	*	Guide Roller	361	1	Worm
152	2	Roller Cage Ring	367	2	Worm Bushing
153	4	Preload Spring	485	1	Motor Adapter Flange (size 312-315)
154	2	Drive Cone	521	1	Output Adapter Flange (optional 314-317 only, not shown)
156	*	Drive Ball (replace as a set)	612	1	Handwheel
302	1	Main Housing	614	1	Limit Stop Assembly (optional)
304	†	End Cover, Free Shaft	615	1	Handwheel Adapter
307-1	†	End Cover, Motorized (NOTE: 312 through 315 only. In sizes 316 & larger part no. 304 is used for both free and hollow shafts.)	622	1	Stop Plug (not shown, used to close housing if limit stops not used)
308	1	Iris Plate	630	1	Motor Adapter Flange (size 316-324)
309	2	Adjustment Disc	707-4	**	Ball Spindle Needle Bearings
310	2	Gasket, End Cover	766	2	Oil Level Plug
315	1	Magnetic Drain Plug	780	1	Flexible Shaft (not shown)
316	1	Breather Plug			
325	1	Free Shaft Subassembly (‡‡)			
330	2	Splined Disc			
335	1	Hollow Shaft Subassembly (‡‡)			

*Quantity varies with size:
312, 314, 316=3
315, 317, 318, 320, 322=6
321, 324=8

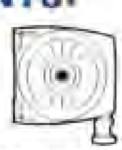
**Quantity varies with size
312 through 315=none
316=6
317, 318, 320, 322=12
321, 324=16

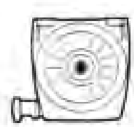
†Quantity varies with size:
312 through 315=(1) P/N 304 and (1) P/N 307-1
316 & Larger=(2) P/N 304

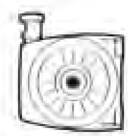
‡‡Replace as a complete assembly
Includes shaft, bearings, spacer

MOUNTING ARRANGEMENTS:


POSITION A


POSITION B


POSITION C


POSITION D

MOUNTING A—Standard (as shipped from factory). MOUNTINGS B & D—Relocation of filler, level and drain plug required.
MOUNTING C—Special—Must be specified—Consult factory.

D-90® TYPE SE®

The D-90 TYPE SE is the latest version of WINSMITH®'s world class single enveloping worm gear reducers. It encompasses our high efficiency gearing with improved flexibility plus many special features and new offerings to provide the most complete selection of worm gear products, ever, from WINSMITH. Available in single and double reduction in all models and now available in a 4.25" center distance unit. Ratios from 4:1 to 10,000:1 and with output torques up to 10,700 inch pounds.
Request Catalog 290

D-90® TYPE DE®

The D-90 TYPE DE uses double enveloping worm gearing thus combining high load capacity with high efficiency to achieve more torque per pound. Available in single and double reductions, it has a combined ratio range from 5:1 to 10,000:1 and output torques up to 93,000 in. lbs.
Request Catalog 190

TYPE SW

The WINSMITH Type SW gear reducer is designed for maximum torque in the smallest possible package. Its compact design results in the "size wise" use of available space in machine design applications. It is available in seven center distance sizes from 1.33" to 3.75", and in single and double reduction ratios, from 5:1 to 3600:1. Eight popular models are cataloged, with output torques up to 6500"#.
Request Catalog 300

MOTION CONTROL PRODUCTS

The WINSMITH MOTION CONTROL gear product line has been specifically designed for motion control applications. The backlash control levels are well below standard industrial products, the motor interfaces are designed for NEMA frames and servo motors, the selection procedures are uniquely motion control sensitive and the speeds of operation match most servo capabilities. WINSMITH's new precision gear drives for motion control applications make it easy to specify the right precision gear drive for your situation.
Request Catalog 400

W/H GEAR

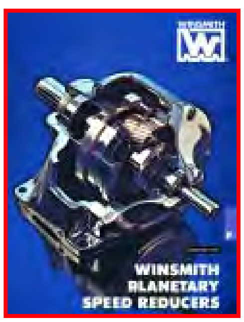
The W/H Gear Series is available in helical inline units and in a helical-bevel right angle design. The concentric inline units come in 10 sizes with a ratio range from 1.6:1 to 1250:1 with output torques up to 140,000 in. lbs. The helical-bevel right angle units (solid or hollow output shafts) are available in ratios from 12.5:1 to 1250:1 in six (6) sizes with a maximum torque of 49,000 in. lbs. Catalog features selection tables, ratings, and dimensions on both versions of the W/H Gear Series products.
Request Catalog 200

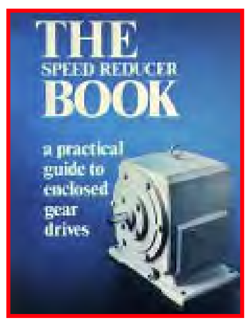
C-LINE

WINSMITH's C-Line worm gear reducer has set the industry standard in versatility, reliability and performance. Single, double and triple reduction units with ratios as high as 180,000:1 and torque ratings up to 65,000 inch pounds.
Request Catalog 100

PLANETARY

WINSMITH planetary reducers combine high load capacity, smooth quiet operation and long operating life in a very compact package. Offers any ratio of reduction from 1.1:1 up to 50,000:1 as standard in a single stage and housing.
Request Catalog 110





THE BOOK

"The Speed Reducer Book" is a practical guide to enclosed gear drives. It covers the history, application, installation and maintenance of all popular types of enclosed gear drives used in industry. Includes guidance in selection, analysis, and trouble shooting.
Request "The Book"

FOR ADDITIONAL INFORMATION ON THESE AND OTHER WINSMITH PRODUCTS
CALL: 716/592-9310 • FAX 716/592-9546
OR WRITE 172 EATON STREET, SPRINGVILLE, NY 14141-1197

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