



WORM GEARS STIRRER UNITS



PREMIUM ADAPTABLE SPEED REDUCERS

Premium Stirrer Units form the most comprehensive range available to industry. They are based on the standard V type single reduction Greaves Worm gear units the major component parts, including cases being common to both. Thus Greaves Stirrer Units offer standardised designs which give complete interchangeability and economy.

Versatility : Ten sizes cater for drives up to 150 HP. A wide range of ratios from 5/1 to 70/1 in each size, used in conjunction with the V belt drive, provide any required stirrer speed. Stirrer speed can be altered after plant installation by simply changing V belt ratio.

Construction : Substantial output shaft strength and bearing capacity permit rigid coupling of the stirrer shaft, using gear unit bearings for complete support of the stirrer shafts.

Larger taper roller bearings, greater bearing spans and extra large output shafts of high tensile steel characterise the heavy duty units, designed specifically for withstanding the higher loads imposed by the more arduous stirrer duties.

Compact Drive : The top mounted pivoted motor plate with belt tensioning device permits mounting of the motor directly above the gear unit. Thus, in addition to space saving, foundation costs are minimised and vessel design simplified. Time, expense and alignment errors on site can be reduced by having motor and V belt drive accurately fitted beforehand.

Selection

Information required for unit selection

As much information as possible should be given so that the correct size and type of gear unit can be selected for a given duty. Essential details are listed in the following

1. Horse-power or torque required at the stirrer shaft.
2. Type of prime mover and horse-power of prime mover.
3. Speed or range of speeds of stirrer shaft.
4. Total operating time per day with full details of loading cycles.
5. Nature of medium to be stirred i.e. constant or variable density.
6. Dimensions of the stirrer shaft, including length from the centre of the paddle to the top of the shaft, paddle diameter and shaft extension diameter.
7. Weight and thrust from paddle and direction of thrust.
8. Details of any abnormal operating conditions, e.g. ambient temperatures, humidity, etc.

Check torque capacity : Calculate the equivalent torque (t_e) on the stirrer shaft. $t_e = \text{Required output torque (t)} \times \text{service factor}$. Refer to Premium publication and select the size of unit which has an output torque capacity equal to or greater than equivalent torque.

Check shaft stress : Calculate load (p) on stirrer shaft.

$$p = [1000xt/0.75r] \dots \text{kN}$$

(assumed centre of pressure on paddle is 0.75r, where r = paddle radius in mm)

Calculate bending moment (M) on stirrer shaft.

$$M = p.K/1000 \text{ kN.m}$$

"Refer to shaft stress limitation table, pages 4 and 5, and select the type of unit which has allowable bending moment equal to or greater than M"

Check bearing capacity : Determine bearing span(d) from page 6. Calculate equivalent load (p_e) on the stirrer shaft

$$p_e = p \times \text{service factor} \dots \text{kN}$$

Calculate the loads on bearings as shown below and check with capacities given on pages 4 and 5. Select the suitable type of unit.

STANDARD 'V' TYPE UNITS

Combined bearing Load = $pe(k+d)/d + f...kN$

where f = paddle thrust - paddle weight...kN

STANDARD DUTY STIRRER UNITS

Journal load = $pe(k+d)/d + f...kN$

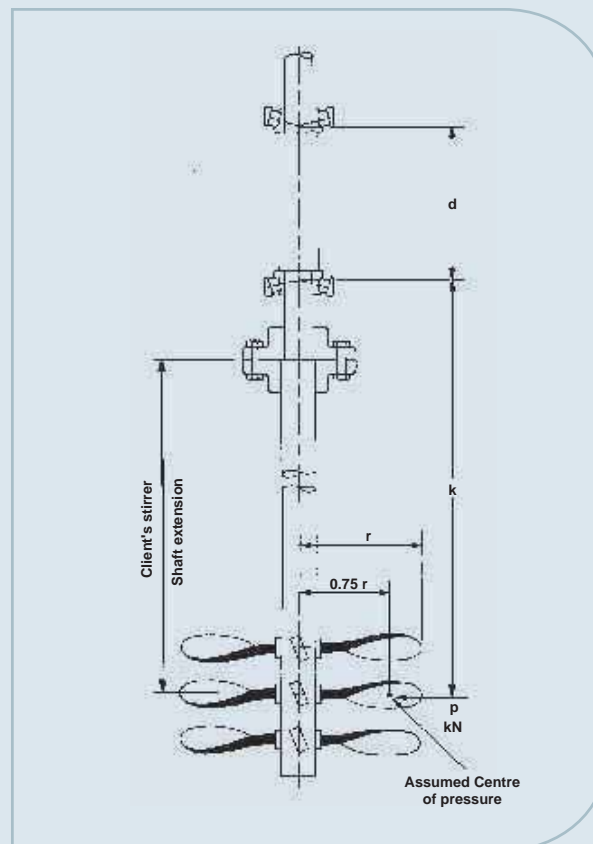
Thrust load (f) = paddle thrust \pm paddle weight...kN

HEAVY DUTY STIRRER UNITS

Journal load = $pe.k/d...kN$

Thrust load (upward) = paddle thrust (upward) paddle weight...kN

Thrust load (downward) = paddle weight \pm paddle thrust...kN


Service factors Load characteristics

Medium to be Stirred	Load Characteristics
Liquid or Semi-Liquid Variable density	Uniform Moderate shock

Prime Mover	Duration of Service hrs per day	Nature of Load on Gear Unit from Driven Machine	
		Uniform	Moderate
Electric Motor	under 3 to 10	0.8	1.0
		1.0	1.25



Example of selection

To select a Premium unit suitable for a stirrer drive, given the following information.

Power at stirrer shaft = 7.0 KW

Stirrer shaft speed = 40 r.p.m.

Running time is 12hrs continuous/day

Medium to be stirred is of variable density.

Stirrer shaft is to be supported entirely by the gear unit bearings as only a steady bearing is provided at the base of the vessel. Distance from centre of paddle to top of the stirrer shaft extension is 1016mm.

Outside diameter of paddle is 1780 mm

Combined thrust and weight from stirrer shaft is 6.675 kN downwards.

Step-I

Check torque capacity

service factor (see table below) is 1.25 Equivalent output Torque = $9.55 \times 7 \times 1.25/40$

= 1.671×1.25

= **2.089 kN.m**

Referring to Premium rating catalogues for an output speed of approximately 40 r.p.m., a V 700 worm reduction unit is suitable for this duty. A nominal ratio of 40/1 for an input speed of 1500 r.p.m., or 25/1 for 1000 r.p.m., will be suitable.

Step-II

Check load (p) on stirrer shaft

$$= 1000xt/0.75xr$$

$$= 1000 \times 1.671 / 0.75 \times 890$$

$$= \mathbf{2.503 \text{ kN}}$$

where k = stirrer extension + W

$$= 1016 + \mathbf{200.7}$$

$$= 1216.7 \text{ mm}$$

Bending Moment (M) = **p.k./1000**

$$\text{(on Stirrer shaft)} = 2.503 \times 1216.7/1000$$

$$= 3.04 \text{ kN.m}$$

Since, the standard 'V' type unit has allowable bending moment less than the bending moment acting on the stirrer shaft, select standard duty stirrer unit.

$$\text{Now, } k = 1016 + W$$

$$= 1016 + \mathbf{203.7}$$

$$= \mathbf{1219.7 \text{ mm}}$$

Bending moment on stirrer shaft

$$= 2.503 \times 1219.7/1000$$

$$= \mathbf{3.05 \text{ kN.m}}$$

Step-III

Checking bearing capacity

$$\text{Bearing span, } d = 189.48 \text{ mm}$$

$$k = 1219.7 \text{ mm}$$

$$\text{Equivalent load } = (pe) = p \times 1.25$$

$$= 2.503 \times 1.25$$

$$= 3.128 \text{ kN}$$

$$\text{Journal load} = pe(k+d)/d$$

$$= 3.128 \times (1219.7 + 189.48)/189.48$$

$$= \mathbf{23.263 \text{ kN}}$$

Thrust load on gearbox bearing = **6.675 kN**

Referring to catalogue, the loads imposed on the gearbox bearings are well within their capacity.

Bearing Limitation

Allowable Bending Moment at Bottom Bearing (kN)										
Output Speed (r.p.m.)		STD V TYPE UNITS								
		SIZE OF UNIT								
		400	500	600	700	800	1000	1200	1400	1700
280	Taper Roller Bearings	2.84	2.15	2.35	2.64	1.76	8.53	10.79	24.13	44.14
190		6.27	7.06	9.41	6.18	5.88	9.02	7.35	24.72	50.77
125		8.14	9.41	12.26	10.79	14.02	14.22	15.1	25.31	40.62
84		10.59	13.93	16	15	18.14	21.28	22.26	39.73	65.93
56		12.99	16.97	21.09	21.68	25.8	29.52	33.55	51.3	77.92
37		15.69	21.38	26.68	25.4	31.98	36.78	44.24	65.92	98.44
25		18.64	26	31.98	32.56	41.2	48.75	57.19	83.97	124.14
20 and below		21.19	28.94	35.7	35.02	45.32	54.54	64.55	94.26	128.53

Bearing Limitation

Allowable Bending Moment at Bottom Bearing (kN)											
Output Speed (r.p.m.)		STD DUTY STIRRER UNITS									
		SIZE OF UNIT									
			400	500	600	700	800	1000	1200	1400	1700
280	Wider Taper Roller Bearings	thrust	6.57	8.24	10.4	10.98	13.53	19.42	23.54	36.98	43.75
		journal	10.59	14.02	15.89	17.75	20.2	29.03	37.18	56.9	77.5
190		thrust	9.41	12.16	15.89	15.2	17.95	22.66	24.72	41.79	47.18
		journal	13.14	17.65	21	20.7	24.52	32.57	39.43	63.17	84.36
125		thrust	11.67	15.1	19.32	19.81	24.91	28.35	32.76	47	59.35
		journal	15.3	20.6	24.52	25.11	26.88	38.55	48.07	70.24	100.06
84		thrust	14.12	19.13	23.44	24.32	29.82	35.31	40.22	59.74	70.14
		journal	17.76	24.56	28.25	29.23	35.9	45.32	56.31	83.87	113.79
56	thrust	16.57	22.36	28.15	30.21	36.69	43.36	50.13	71.51	85.74	
	journal	20.79	28.74	33.84	35.9	43.55	54.54	68.76	99.08	135.37	
37	thrust	19.71	26.68	33.84	35.9	43.55	54.54	68.76	99.08	135.37	
	journal	24.32	34.13	40.22	41.4	51.6	64.35	81.71	117.72	158.9	
25	thrust	22.85	31.58	39.73	42.08	52.38	61.9	72.98	103	122.62	
	journal	28.05	39.43	46.2	48.85	60.72	76.61	95.94	138.32	186.39	
20 and below	thrust	24.91	34.23	43.16	45.61	56.7	67.29	79.95	112.81	133.41	
	journal	31	42.87	50.52	52.38	65.92	84.01	105.95	151.07	202.08	



BEARING LIMITATION

Allowable Bending Moment at Bottom Bearing (kN)											
Output Speed (r.p.m.)		Heavy Duty Stirrer Units									
		Size Of Unit									
			400	500	600	700	800	1000	1200	1400	1700
280	journal	thrust upward	10.10	13.34	14.81	16.48	18.54	28.15	36.20	55.42	64.25
		thrust downward	6.57	8.14	10.40	10.98	13.04	19.42	23.54	36.98	57.14
		thrust downward	15.20	18.14	21.09	26.97	33.15	38.16	39.14	54.05	60.41
190	journal	thrust upward	12.85	17.16	20.01	19.42	22.76	37.47	38.26	61.90	97.36
		thrust downward	9.41	12.16	15.79	15.20	17.95	22.66	24.72	41.79	67.40
		thrust downward	19.42	23.74	28.05	33.55	40.80	43.85	43.94	59.64	83.19
125	journal	thrust upward	14.91	19.91	23.44	23.774	29.62	37.57	46.80	68.08	99.86
		thrust downward	11.67	15.10	19.32	19.81	24.91	28.35	32.76	47.00	68.36
		thrust downward	23.05	28.25	33.35	40.80	51.11	52.00	52.68	69.45	94.60
84	journal	thrust upward	17.26	24.23	27.17	27.86	34.23	44.34	55.13	82.01	122.33
		thrust downward	14.12	19.13	23.44	24.32	29.72	35.31	40.22	59.74	89.02
		thrust downward	26.88	33.94	39.33	48.07	59.44	63.07	63.47	83.77	114.22
56	journal	thrust upward	20.40	28.15	32.86	34.72	41.88	53.75	67.88	97.31	141.45
		thrust downward	16.57	22.36	28.15	30.21	36.69	43.36	50.13	71.51	103.58
		thrust downward	31.39	39.43	46.40	57.58	70.73	74.26	75.63	99.96	136.45
37	journal	thrust upward	23.74	33.45	39.14	39.92	50.03	63.66	80.93	116.24	169.20
		thrust downward	19.71	26.68	33.84	35.21	43.36	51.30	61.11	86.23	123.91
		thrust downward	36.78	46.50	54.93	66.80	82.89	87.60	89.85	117.23	158.50
25	journal	thrust upward	27.56	38.84	45.12	47.48	59.25	75.83	95.45	137.14	199.67
		thrust downward	22.76	31.58	39.63	42.08	52.38	61.90	72.98	103.00	148.03
		thrust downward	42.38	54.05	63.76	78.08	96.82	98.88	105.06	137.14	185.26
20 and below	journal	thrust upward	30.50	42.37	49.54	50.71	64.25	83.77	98.78	147.44	220.43
		thrust upward	24.91	34.23	43.06	45.61	54.80	67.29	79.95	112.81	196.73

SHAFT STRESS LIMITATION

Allowable Bending Moment at Bottom Bearing (kN.m)									
Output Speed (r.p.m.)	STD V TYPE UNITS SIZE OF UNIT								
	400	500	600	700	800	1000	1200	1400	1700
280	0.83	1.19	1.69	2.32	3.09	5.48	8.52	15.02	24.77
190	0.82	1.15	1.63	2.2	2.92	4.96	7.92	14.37	24.04
125	0.81	1.11	1.51	2.07	2.74	4.66	7.53	13.95	23.58
84	0.8	1.12	1.4	1.87	2.44	4.46	7.18	13.65	23.36
56	0.78	1.07	1.43	1.8	2.37	4.16	6.93	13.2	22.61
37	0.74	1	1.27	1.66	2.14	3.91	6.55	12.93	22.5
25	0.73	1.03	1.25	1.58	2.04	4.01	6.6	12.88	22.3
20 and below	0.77	1.06	1.23	1.28	1.85	3.96	6.53	12.88	22.41

Allowable Bending Moment at Bottom Bearing (kN.m)									
Output Speed (r.p.m.)	STD V TYPE UNITS SIZE OF UNIT								
	400	500	600	700	800	1000	1200	1400	1700
280	1.32	1.95	2.75	3.78	5	8.52	13.1	11.85	41.76
190	1.31	1.93	2.72	3.71	4.88	8.32	12.93	22.67	41.76
125	1.3	1.87	2.69	3.68	4.85	8.12	12.65	22.3	41.36
84	1.29	1.9	2.62	3.58	4.71	7.92	12.33	22.02	41.11
56	1.28	1.85	2.59	3.58	4.68	7.82	12.2	21.82	40.86
37	1.27	1.84	2.57	3.41	4.48	7.57	11.98	21.55	4.036
25	1.25	1.82	2.49	3.36	4.43	7.55	11.93	21.42	40.11
20 and below	1.27	1.83	2.49	3.24	4.33	7.67	11.88	21.42	40.11

Allowable Bending Moment at Bottom Bearing (kN.m)									
Output Speed (r.p.m.)	HEAVY DUTY STIRRER UNITS SIZE OF UNIT								
	400	500	600	700	800	1000	1200	1400	1700
280	3.43	5.65	6.3	9.59	12.18	14.8	18.81	30.15	47.16
190	3.48	5.6	6.45	9.56	12.01	15.1	19.21	30.89	48.41
125	3.43	5.5	6.33	9.54	12.21	15.49	19.68	31.64	49.58
84	3.43	5.6	6.23	9.41	12.01	16.29	20.65	33.39	52.5
56	3.41	5.5	6.23	9.56	12.08	16.22	21.18	34.38	54.18
37	3.36	5.5	6.2	9.19	11.71	16.57	21.55	34.88	55.12
25	3.33	5.48	6.08	9.19	11.76	16.76	22.05	35.63	56.2
20 and below	3.41	5.5	6.08	8.84	11.61	17.81	22.42	36.38	57.32

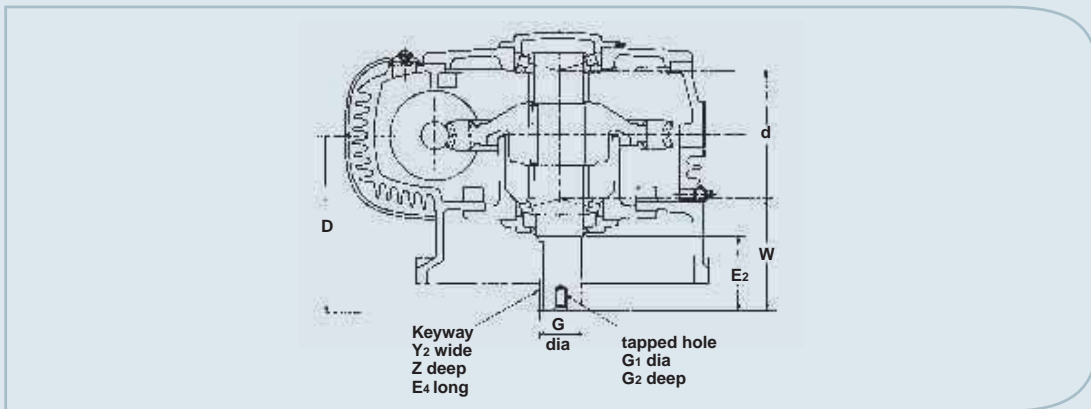


BENDING MOMENT & JOURNAL LOAD VALUES

Allowable Bending Moment at Bottom Bearing (kN.m)			
OUTPUT R.P.M.	V 900 STD	V 900 SDS	V 900 HDS
50	3.18	6.18	14.14
60	3.29	6.27	14.16
75	3.39	6.3	14.17

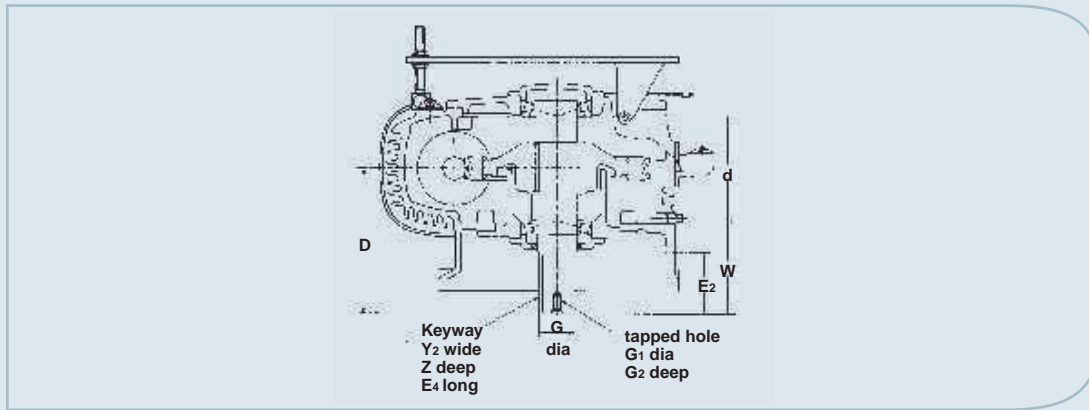
Allowable Journal & Thrust Loads (kn)						
OUTPUT R.P.M.	V 900 STD	V 900 SDS		V 900 HDS		
		Journal	Thrust	Journal	Thrust Upward	Thrust Downward
50	29.64	51.74	43.33	50.55	42.21	76.45
60	26.49	47.81	40.25	46.5	38.91	70.8
75	22.21	43.27	35.39	41.85	34.85	64.7

COMPARATIVE DETAILS (mm)

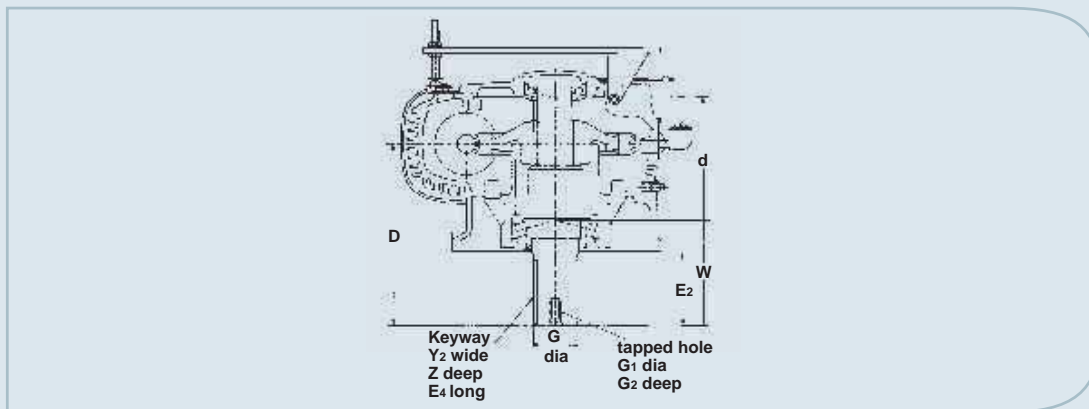


STANDARD V TYPE UNITS									
Taper roller bearings fitted on the output shaft.									
SIZE	400	500	600	700	800	1000	1200	1400	1700
d	151.4	170.7	177.3	195.6	204.2	255.5	285.5	329.2	401.8
W	150.4	162.3	184.4	200.7	209.0	246.0	270.0	318.0	345.2
G	44.45	50.80	57.15	63.50	69.85	82.55	95.25	114.30	139.70
Y ₂	11.11	12.70	15.88	15.88	19.05	22.23	25.40	31.75	38.10
Z	4.83	4.83	6.60	6.60	7.62	9.40	11.43	13.21	15.24
E ₂	88.9	101.6	114.3	127.0	139.7	152.4	171.5	190.5	203.2
E ₄	82.6	95.3	114.3	114.3	127.0	142.9	161.9	209.6	222.3
G ₁	M16	M16	M20	M20	M20	M20	M24	M24	M24
G ₂	36	36	40	40	40	40	50	50	50
D	215.9	247.7	273.1	298.5	311.2	374.7	412.8	482.6	546.1

RATINGS AT 1500 RPM INPUT SPEED



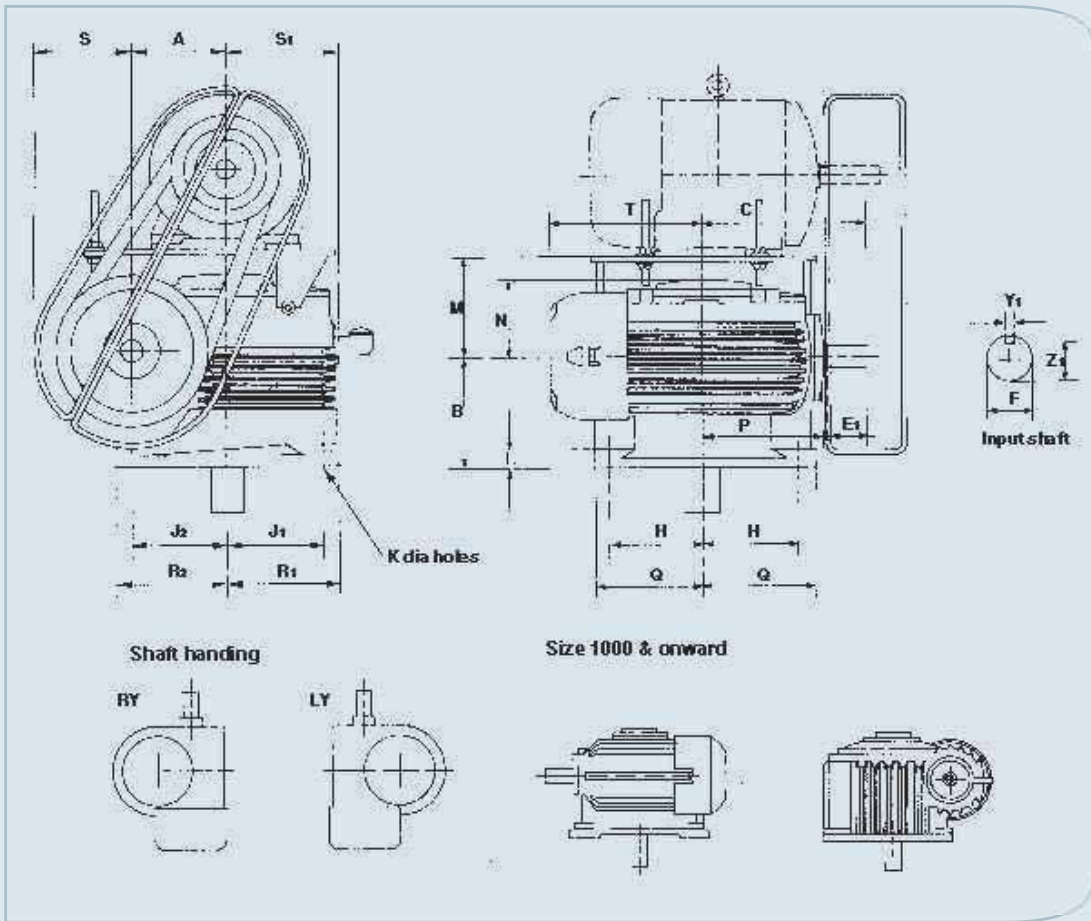
STANDARD DUTY STIRRER UNITS									
Wider taper roller bearings fitted. Output shaft made of high tensile steel									
SIZE	400	500	600	700	800	1000	1200	1400	1700
d	151.4	170.7	177.3	189.5	199.6	245.4	273.3	306.8	373.9
W	140.2	162.3	184.4	203.7	211.3	252.0	276.1	329.2	359.2
G	44.45	50.80	57.15	63.50	69.85	82.55	95.25	114.30	139.70
Y ₂	11.11	12.70	15.88	15.88	19.05	22.23	25.40	31.75	38.10
Z	4.83	4.83	6.60	6.60	7.62	9.40	11.43	13.21	15.24
E ₂	88.9	101.6	114.3	127.0	139.7	152.4	171.5	190.5	203.2
E ₄	82.6	95.3	114.3	114.3	127.0	142.9	161.9	209.6	222.3
G ₁	M16	M16	M20	M20	M20	M20	M24	M24	M24
G ₂	36	36	40	40	40	40	50	50	50
D	215.9	247.7	273.1	298.5	311.2	374.7	412.8	482.6	546.1



HEAVY DUTY STIRRER UNITS									
Extra large taper roller & wider taper roller bearings fitted. Larger bearing span, larger dia. shaft of high tensile materials									
SIZE	400	500	600	700	800	1000	1200	1400	1700
d	109.1	218.2	245.9	256.5	267.7	297.9	316.7	376.2	428.0
W	184.4	203.7	211.1	244.6	270.3	377.2	442.2	424.9	406.7
G	63.50	69.85	82.55	95.25	101.60	114.30	120.65	127.00	190.50
Y ₂	15.88	19.05	22.23	25.40	25.40	31.75	31.75	38.10	50.80
Z	6.60	7.62	9.40	11.43	11.43	13.21	13.21	13.21	20.83
E ₂	127.0	139.7	152.4	171.5	190.5	282.6	342.9	323.9	279.4
E ₄	127.0	127.0	139.7	158.8	177.8	209.6	209.6	209.6	304.8
G ₁	M20	M20	M20	M24	M24	M24	M24	M24	M36
G ₂	40	40	40	50	50	50	50	50	70
D	304.8	336.6	368.3	406.4	438.2	552.5	622.3	647.7	647.7



PRINCIPAL DIMENSIONS (MM)



SIZE	A	B	C	E1	F	H	J1	J2	K	L	M
400	101.6	171.5	228.6	66.7	31.75	114.3	114.3	114.3	20.6	31.8	165
500	127.0	190.5	260.4	73.0	38.10	139.7	139.7	139.7	20.6	31.8	184
600	152.4	209.6	279.4	76.2	38.10	152.4	152.4	152.4	23.8	38.1	197
700	177.8	228.6	317.5	85.7	44.45	177.8	177.8	177.8	23.8	38.1	210
800	203.2	241.3	342.9	88.9	44.45	203.2	203.2	203.2	27.0	44.5	216
1000	254.0	279.4	425.5	120.7	57.15	260.4	260.4	235.0	31.8	50.8	229
1200	304.8	304.8	459.3	123.8	63.50	317.5	317.5	266.7	34.9	57.2	254
1400	355.6	330.2	571.5	149.2	76.20	355.6	355.6	304.8	41.3	63.5	330
1700	431.8	406.4	698.5	190.5	82.55	431.8	431.8	431.8	41.3	76.2	394

RATINGS AT 1500 RPM INPUT SPEED

SIZE	N	P	Q	R1	R2	S	S1	T	Y1	Z1
400	120	158.8	139.7	139.7	139.7	111	152.4	222	7.94	27.94
500	133	184.2	165.1	165.1	165.1	124	177.8	254	9.52	34.29
600	140	200.0	184.2	184.2	184.2	133	196.9	270	9.52	34.29
700	151	228.6	209.6	209.6	209.6	143	222.3	305	11.11	39.62
800	159	250.8	238.1	238.1	238.1	149	254.0	327	11.11	39.62
1000	194	311.2	311.2	298.5	273.1	160	298.5	378	15.88	50.55
1200	216	368.3	368.3	355.6	304.8	178	355.6	441	15.88	56.90
1400	254	425.5	425.5	412.8	362.0	203	412.8	521	19.05	68.58
1700	305	514.4	501.7	501.7	501.7	241	501.7	629	22.23	73.15

Shaft tolerances conform to B.S. 1916/1953H6, Keyways are to B.S. 46/1958.

The motor plate is available as additional equipment, duly slotted if required, to suit motor feet holes; full details of motor handing of the unit and preferably a layout drawing should be furnished.

As improvements in design are continually being made this specification is not to be regarded as binding in detail; dimensions are subject to alteration without notice.

EXACT STANDARD RATIOS

SIZE	5/1	7.5/1	10/1	12.5/1	15/1	20/1	25/1	30/1	35/1	40/1	50/1	60/1	70/1
400	4.83	7.5	9.67	12.75	14.5	19.5	25	30	-	40	50	60	70
500	5.0	7.4	9.75	-	14.5	19.5	24.5	30	35	40	50	60	70
600	4.88	7.6	9.75	-	14.67	20	24.5	30	35	40	50	60	70
700	5.0	7.5	9.75	-	14.67	19.5	24.5	30	35	40	50	60	70
800	5.0	7.5	9.75	-	14.67	19.5	24.5	29.5	-	40	50	60	70
1000	4.89	7.33	10.25	-	14.67	20.5	25.5	29.5	-	40	50	60	70
1200	4.9	7.43	9.8	12.25	14.67	19.67	24.5	29.5	35.5	40	50	60	70
1400	4.91	7.71	9.8	12.75	14.75	19.67	24.5	30.5	-	40	50	60	70
1700	-	-	10.17	-	15.25	19.67	24.67	29.5	-	40.5	50	60	70

SHIPPING SPECIFICATION & OIL CAPACITY

Description	Standard Duty									HeavyDuty								
	400	500	600	700	800	1000	1200	1400	1700	400	500	600	700	800	1000	1200	1400	1700
Size of Unit	400	500	600	700	800	1000	1200	1400	1700	400	500	600	700	800	1000	1200	1400	1700
Net Weight (kg)	77	109	145	200	254	465	690	970	1750	86	123	164	227	286	495	730	1020	1900
Gross Weight (kg)	90	125	163	226	286	580	830	1250	2100	109	143	186	264	327	625	890	1300	2350
Volume packed (cu.m.)	0.11	0.15	0.19	0.25	0.39	0.90	1.30	1.75	2.6	0.14	0.19	0.23	0.31	0.39	1.10	1.60	2.10	3.90
Oil required at 1st filling (Lit)	4.0	5.7	6.3	10.2	12.5	22.7	37.4	68.5	105	4.0	5.7	6.3	10.2	12.5	22.7	37.4	68.5	105

Weights and volumes are for gear units only. They do not include motors, motor plates, pulleys belts or guards.



PREMIUM

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