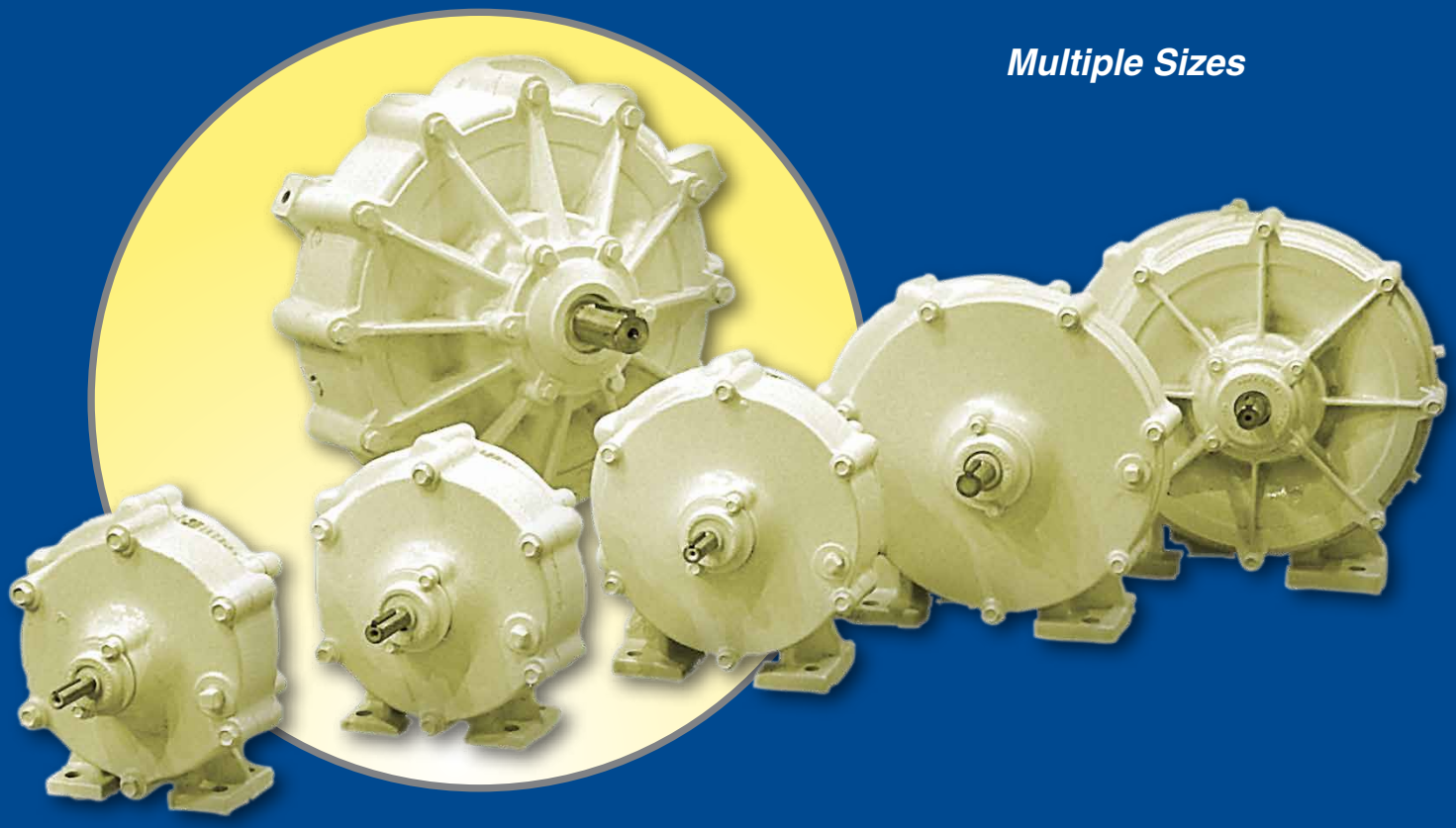
AJAX Vibratory Shaker Drives

For use on Conveyors, Feeders, Screeners, Densification Tables and other Vibratory Equipment

- ***Continuous Operation***
- ***Long Life Dependability***
- ***Low Maintenance Schedule***
- ***Totally Enclosed Gear Driven Eccentrics***
- ***Multiple Sizes***



RENOLD

Superior Technology

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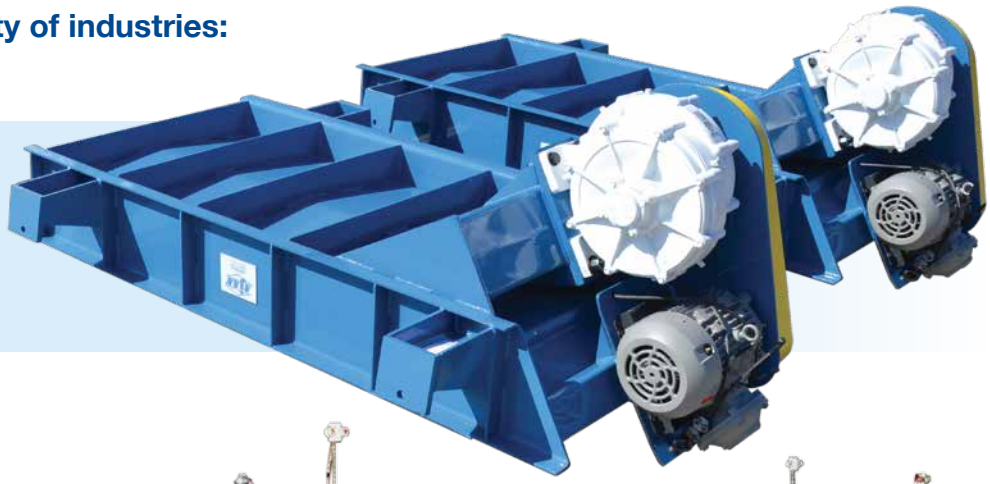
The Energy Efficient Vibratory Drive

Renold Ajax Vibrating Shaker Drives are recognized and used as energy efficient drives for a wide variety of vibrating equipment throughout the world. Applications include open and enclosed pan conveyors, screeners, feeders, packing tables, dewatering units, tampers and cable laying plows. Our shaker's unique operating principle is applicable to countless other new and unusual application possibilities.

Feeders and Conveyors are ideal applications for Ajax Shakers in a variety of industries:

Coal Feeders spread coal evenly on a belt conveyor for further processing

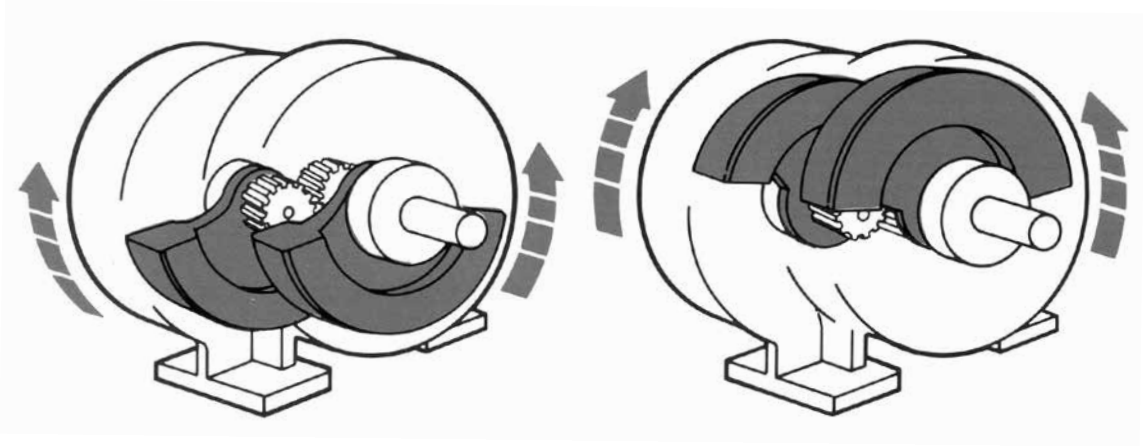


Tubular Feeder for dusty applications

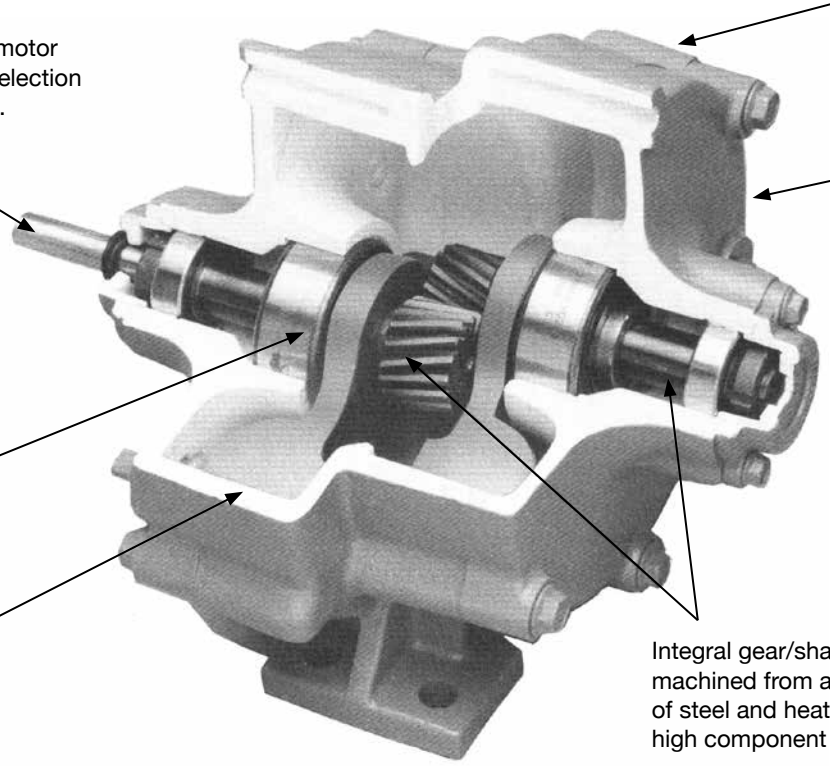
Custom Feeder with air operated gate

Basic Operating Principle

Ajax Shakers harness the forces created as two eccentric weights are simultaneously rotated in opposite directions within a common housing. Each eccentric weight is mounted on a gear shaft and supported by anti-friction bearings. The weights are timed and coupled by the gear set to rotate in opposite directions, each producing a centrifugal force. When the two weights are oriented in the same direction, the centrifugal forces add; when weights are oriented in opposite directions the forces cancel. This results in a straight line output force, sinusoidal in magnitude, directed along an axis perpendicular to the Shaker mounting pad. When the Shaker is attached to a body supported by flexible elements, it induces an oscillatory movement to that body. In typical applications, all the force required to vibrate the body is generated by the Shaker. Therefore, minimal force is transmitted to surrounding structures. The straight line motion generated by the Ajax Shaker imparts a gentle lift and throw action to the material in the pan. The speed at which the material travels varies with material characteristics, Shaker frequency and stroke amplitude.



Design Features



V-belt drive connection to motor allows operational speed selection matched to the application.

Typically driven by standard electric motors. Air, hydraulic or special electric motors are also options.

Large capacity bearings provide long service life.

Splash oil lubrication is provided to bearings and gears as weights rotate.

Cylindrical, offset design creates a compact unit with high rigidity and strength; high output force to weight ratio.

Rugged cast housing is dust proof and oil-tight, suitable for operation in severe environments.

Low power consumption, economical to operate.

Inherently explosion proof; suitable for use in hazardous locations when driven by an appropriate motor.

Integral gear/shafts are machined from a single piece of steel and heat treated for high component strength.

Guide to Shaker Selection

AJAX Shakers are offered in six basic sizes. Each of these is available with a variety of eccentric weight selections, so a wide range of performance is possible for a given size. Selections include:

- "Light" weight for reduced force output
- "Standard" weights for normal force output
- "Heavy" weights for increased force output

A total of 22 weight/model selections are available. Standard configuration is "Right Hand." (Handing indicates drive shaft offset, when viewing shaft.) Sizes #12 and #20 are also available in Left Hand configuration, for use with Right Hand units on tandem drives.

The following method should be used to determine the correct shaker for your application.

1. Select the stroke length and operating frequency suitable for the application.

   Stroke length: .24" (6mm) - .45" (12mm)
   Frequency: 675-850 RPM

   Short strokes are generally associated with higher frequency, long strokes with lower frequency.

2. Determine the weight of the pan or vibrating body to which the Shaker will be attached (Net vibrated weight).

3. Use graphs to select Shaker which will impart desired stroke. Do not include the weight of the Shaker when using graphs. "L" and "H" weight shakers produce stroke lengths below and above the "Standard Weight" curves shown.

4. Stroke may also be computed using the formula:

   $$\frac{24 \times ER\ (in)}{VW} \quad \text{or} \quad \frac{2000 \times ER\ (mm)}{VW}$$

   Where:
   VW = Net Vibrated Weight + Shaker Weight (lb) (kg)
   ER = Eccentric Unbalance (lb – ft) (kg – m)

5. Determine output force of Shaker:

   Force (lbs) = 3.41×10^{-4} x ER (lb –ft) x RPM^2
   Force (N) = 1.097×10^{-2} x ER (kg – m) x RPM^2

   Shaker mount/ support structure must be sufficient to transmit this force to vibrating body or pan.

Notes:

a) Strokes given in graphs and equations are for a true "free body." Spring-arm pan support system may act to amplify stroke slightly.

b) Weight of conveyed material (live load) has been ignored in the selection process; live loads typically dampen stroke very little. The designer may wish to include a portion of the live load, if severe loading conditions will exist.

Other useful equations:

Acceleration (g's) = 1.42×10^{-5} x stroke (in) x RPM^2
Acceleration (g's) = 5.59×10^{-7} x stroke (mm) x RPM^2

Force required to vibrate a body at given stroke and speed;
Fo (lb) = 1.42×10^{-5} x VW (lb) x stroke (in) x RPM^2
Fo (N) = 5.48×10^{-6} x VW (kg) x stroke (mm) x RPM^2

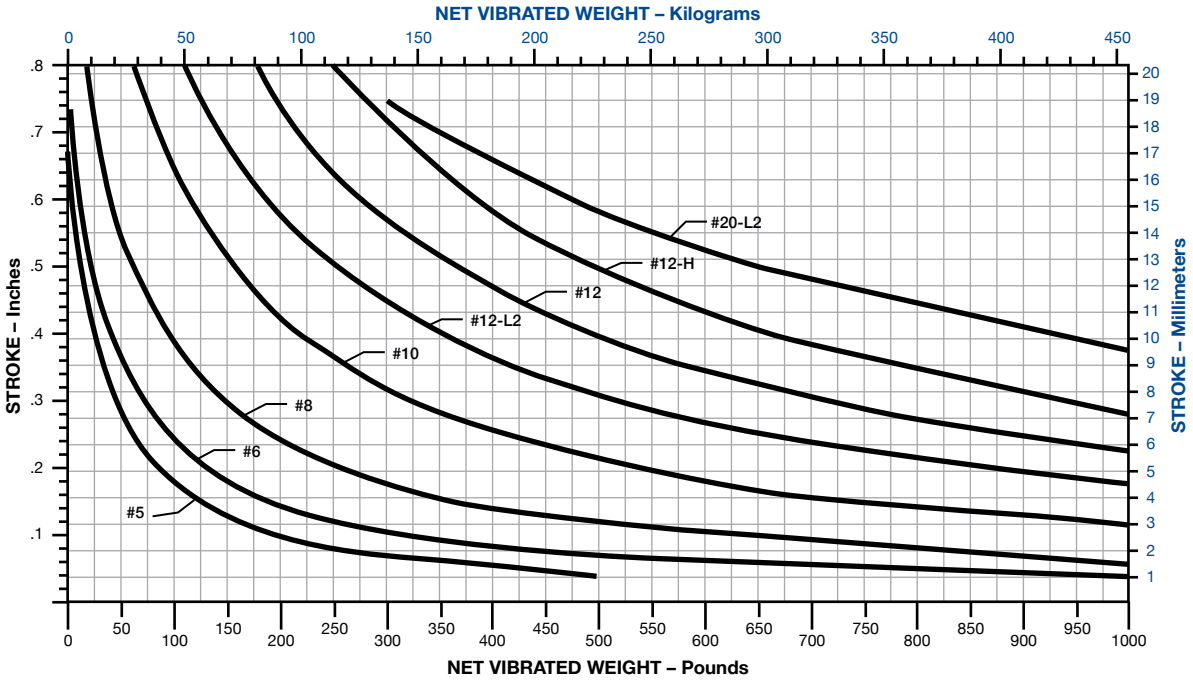
Shaker Performance Data (Force Output in Pounds)

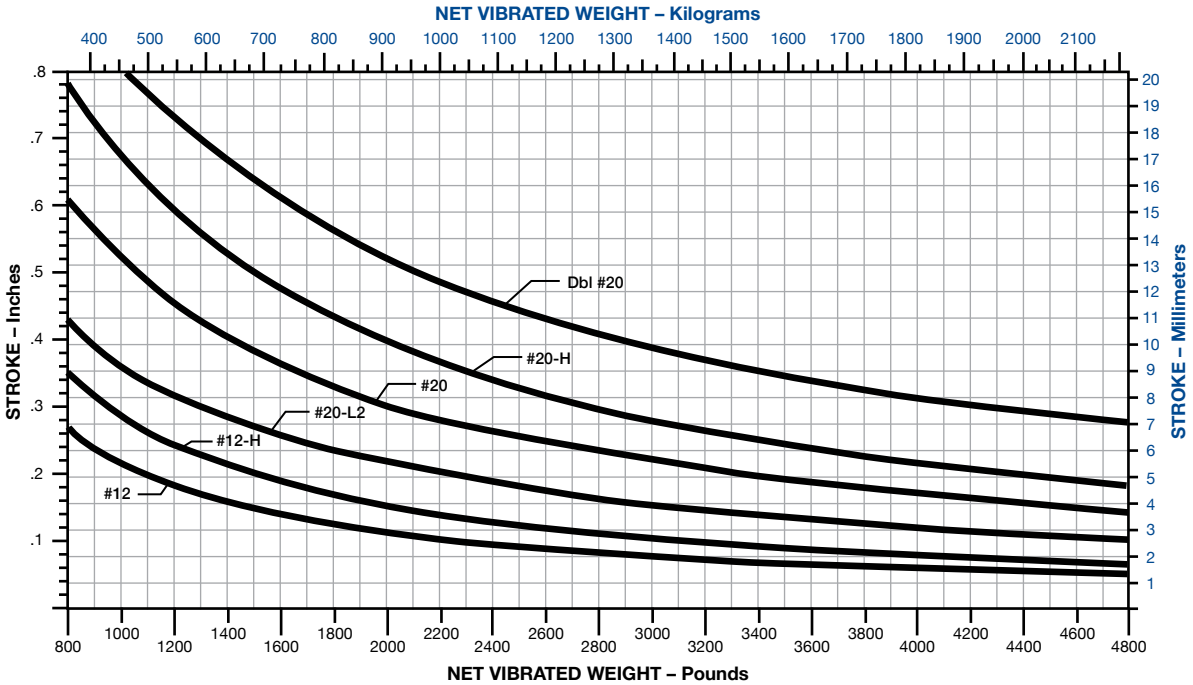
Shaker	ER		Motor		Force at various RPM								Max. RPM	Maximum Force	
					700		750		800		850				
	LB-FT	kg-m	HP	kw	LB	N	LB	N	LB	N	LB	N		LB	N
5-L	0.68	0.095	0.33	0.25	114	511	131	586	149	667	169	753	1300	394	1761
5	1.02	0.141	0.33	0.25	171	758	196	870	223	990	252	1118	1300	588	2614
5-H	1.47	0.203	0.50	0.25	245	1091	282	1253	321	1425	362	1609	1200	721	3207
6-L	1.35	0.187	0.50	0.37	226	1005	259	1154	295	1313	333	1482	1250	719	3205
6	1.54	0.213	0.50	0.37	257	1145	295	1314	336	1495	379	1688	1250	819	3651
6-H	1.98	0.274	0.50	0.37	331	1473	380	1691	432	1924	488	2172	1100	817	3637
8-L	2.44	0.338	0.75	0.55	408	1817	469	2086	533	2373	602	2679	1100	1008	4487
8	2.72	0.376	0.75	0.55	454	2021	521	2320	593	2640	670	2980	1040	1002	4461
8-H	3.52	0.486	0.75	0.55	587	2612	674	2999	767	3412	866	3852	915	1004	4464
10-L	4.67	0.646	1.00	0.75	781	3472	896	3986	1020	4535	1151	5120	975	1515	6737
10	5.35	0.740	1.00	0.75	894	3978	1027	4566	1168	5195	1319	5865	910	1512	6722
10-H	6.90	0.955	1.00	0.75	1154	5133	1324	5893	1507	6705	1701	7569	800	1507	6705
12-L3	7.27	1.005	1.5	1.1	1214	5402	1394	6201	1586	7056	1790	7965	1150	3277	14580
12-L2	8.17	1.129	1.5	1.1	1364	6069	1566	6967	1782	7926	2012	8948	1085	3278	14580
12-L1	9.35	1.293	1.5	1.1	1562	6950	1793	7979	2041	9078	2304	10248	1015	3285	14613
12	10.67	1.475	1.5	1.1	1783	7929	2047	9102	2329	10356	2629	11691	950	3284	14603
12-H	13.84	1.913	2.0	1.5	2312	10283	2654	11804	3020	13431	3409	15162	835	3290	14632
20-L3	17.38	2.402	3.0	2.2	2903	12911	3333	14822	3792	16864	4281	19038	975	5633	25049
20-L2	22.14	3.060	5.0	3.0	3699	16448	4246	18882	4831	21484	5454	24253	950	6812	30295
20-L1	26.75	3.699	5.0	3.0	4470	19883	5132	22825	5839	25970	6591	29318	900	7390	32868
20	31.60	4.369	5.0	4.0	5280	23485	6061	26959	6896	30674	7785	34628	900	8728	38822
20-H	40.91	5.656	5.0	4.0	6835	30403	7847	34901	8928	39710	10079	44828	900	11299	50258

Note: Motor selections are typical for electric motor driven shakers operating in 700-800 RPM range and mounted to vibratory conveyors. Power requirements may be larger, depending on equipment operating characteristics. Air and hydraulic motor selections must be made based on starting torque considerations, resulting in slightly higher nominal power requirement.

Performance Curves

These graphs indicate the stroke amplitude imparted to a given weight by various sizes of AJAX Shakers. Stroke indicated for 0 lbs Net Vibrated Weight represents the stroke length a shaker will impart only to itself. As weight is added, stroke length decreases, rapidly at first, then gradually, but never reaching zero.



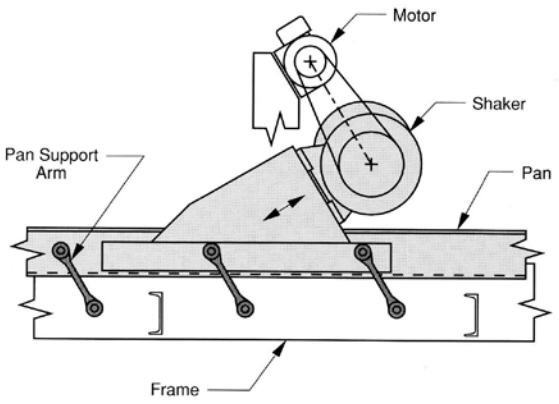


ER Values and Shaker Performance

Renold uses the term “ER” to indicate the unbalance of a Shaker’s eccentric weights. ER is derived by multiplying the weight of the eccentric weight by its centroidal radius. Shaker force output and pan stroke amplitude are direct functions of ER value.

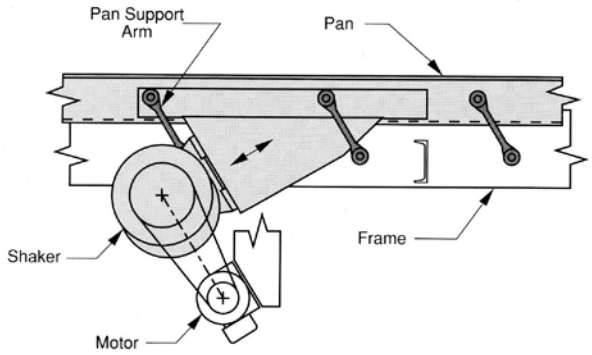
Typical Mounting Methods

Conveyor: Drive above pan, motor stationary



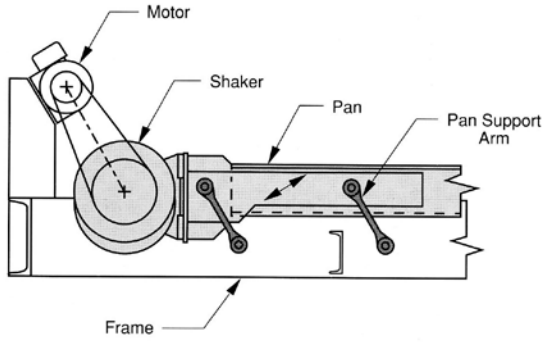
The shaker drive can be located anywhere along the pan, but usually inward from either end. Motor is attached to an extension of the stationary base frame. Note that shaker feet and V-belt centerline are both parallel to the pan support arms.

Conveyor: Drive below pan, motor stationary



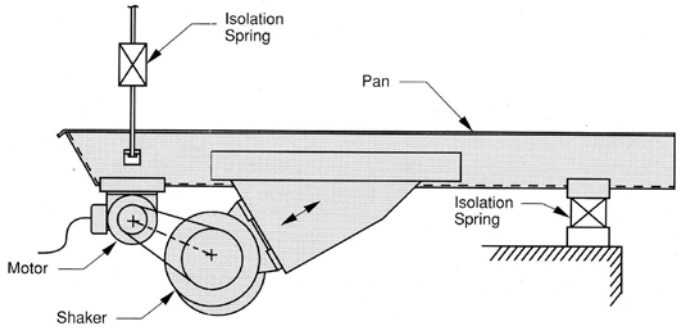
Use of this design allows full access to the conveyor pan.

Conveyor: Drive on end, motor stationary



This design is used when full access to the pan is required, but is impractical to mount the drive below the pan. Shaker may be mounted with feet perpendicular to the pan as shown, or with feet parallel to pan arms. In either case, the V-belt centerline must be parallel to pan arm supports.

Suspended/ Supported Feeder Pan, Motor Vibrated



In this design, the drive location is chosen so that the force generated by the Shaker is directed through (or near) the system's center of gravity. The motor terminal box must be packed with insulating putty to prevent vibration of the wires; connect utilizing flexible cable.

Mounting Instructions

1. Shakers must be mounted to a flat, rigid surface. Mounting must be constructed to avoid flexing during operation.
2. Use new, Grade 2 steel hex head bolts with helical spring lock washers and hex nuts, or self-locking nuts. Use new mounting bolts whenever the shaker is removed. Check bolt tightness after initial 24 and 48 hours of operation.
3. Do not hammer pulley or sheave onto drive shaft. Use a steel taper-lock bushing on all but the smallest sizes of Shakers.
4. Do not exceed maximum operating speed as listed in the table (Typical vibratory conveyors and feeders operate well in the 700 to 850 RPM range).
5. Provide appropriate guards for all rotating power transmission components.

Calculating Capacity for Vibratory Conveyor Pans

The following formula is useful in sizing vibratory conveyor and feeder pans:

TPH = (BD x W x D x V)/4800

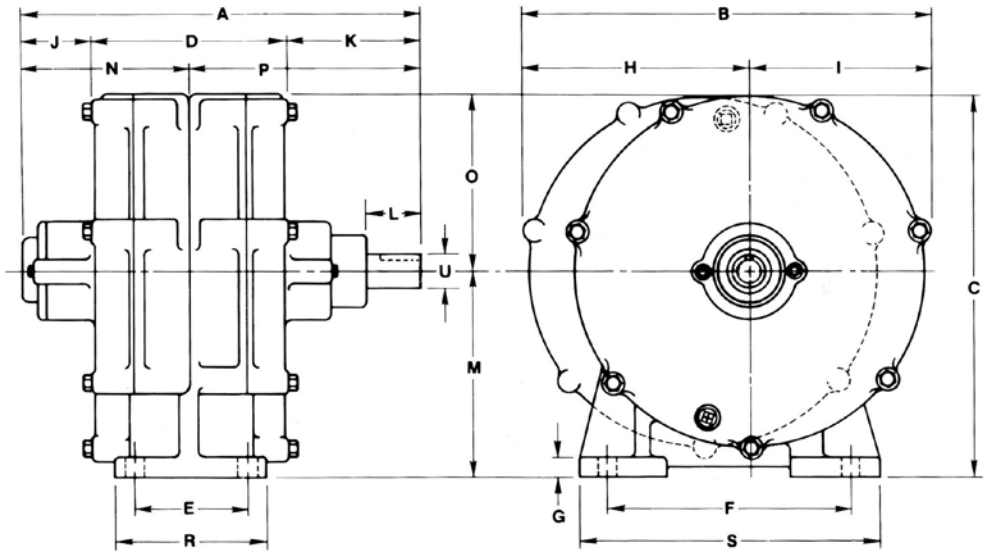
TPH = 6×10^{-8} x BD x W x D x V (metric)

Where TPH = Tons per hour (2000 lbs/hr) (1000 kg/hr)

BD = Bulk Density (lb./ft^3) (kg/m^3)
W = Pan Width (in) (mm)
D = Average Material bed Depth (in) (mm)
V = Conveying Velocity (ft/min) (m/min)

Using the stroke and frequency recommendations in this publication, conveyors will transport most dry, granular bulk materials with a velocity range of 28-38 feet/minute (8.5-12 meters/min).

Dimensions for Ajax Vibrating Shaker Drives



Shaker Dimensions - English/FPS System | Metric/SI System

	SIZE	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	R	S	U	KEYWAY	BOLT	WGT.
in.	5D	11.00	8.44	8.81	5.03	1.75	4.88	0.50	4.81	3.63	2.13	3.84	1.63	4.75	4.63	4.06	6.38	3.00	6.00	0.50	1/8 X 1/16	0.50	37lb.
mm.	5D	279	214	224	128	44	124	13	122	92	54	98	41	121	117	103	162	76	152	12.7	3.18 X 1.59	12	17kg.
in.	6D	11.50	9.03	9.38	6.16	2.25	5.13	0.50	5.13	3.91	1.66	3.66	1.88	5.00	4.75	4.38	6.75	3.50	6.25	0.63	3/16 X 3/32	0.50	50lb.
mm.	6D	292	229	238	156	57	130	13	130	99	42	93	48	127	121	111	171	89	159	15.9	4.76 X 2.38	12	23kg..
in.	8D	11.50	10.19	10.75	6.16	3.00	6.25	0.63	5.69	4.50	1.66	3.66	1.88	5.81	4.75	4.94	6.75	4.25	7.50	0.63	3/16 X 3/32	0.50	66lb.
mm.	8D	292	259	273	156	76	159	16	144	114	42	93	48	148	121	125	171	108	191	15.9	4.76 x 2.38	12	30kg.
in.	10D	12.88	13.63	12.50	6.25	3.75	8.13	0.63	7.56	6.06	2.13	4.56	2.06	6.75	5.25	5.75	7.63	5.00	10.00	0.88	1/4 x 1/8	0.63	101lb.
mm.	10D	327	346	318	159	95	206	16	192	154	54	116	52	171	133	146	194	127	254	22.2	6.35 x 3.18	16	46kg.
in.	12M	12.97	15.25	14.44	7.03	4.00	9.50	0.75	8.44	6.81	1.84	4.09	1.94	7.63	5.38	6.81	7.59	5.50	11.38	0.88	1/4 x 1/8	0.63	146lb.
mm.	12M	329	387	367	179	102	241	19	214	173	47	104	49	194	137	173	193	140	289	22.2	6.35 x 3.18	16	66kg.
in.	20M	19.66	21.13	20.25	9.63	4.50	10.50	1.00	12.06	9.06	3.34	6.69	3.00	10.75	8.16	9.50	11.50	7.50	13.50	1.50	3/8 x 3/16	1.00	430lb.
mm.	20M	499	537	514	244	114	267	25	306	230	85	170	76	273	207	241	292	191	343	38.1	9.52 x 4.76	24	195kg.

Lubrication

Gears and bearings on Ajax Shakers are oil splash lubricated as the eccentric weights rotate within the housing. All units are filled at the factory with the correct amount of oil, ready for use. Required periodic oil changes may use readily available, good quality motor oils. Synthetic oils are also acceptable.

Shaker Size	Quantity		Temperature		Grade	
	Liter	Ounce	˚C	˚F	SAE	ISO
5D	0.18	6				
6D	0.24	8	-35/-20˚C	-30/0˚F	10	32
8D	0.30	10	-20/+10˚C	-0/+50˚F	20	68
10D	0.30	10	+10/+45˚C	+50/+110˚F	30	100
12M	0.48	16				
20M	0.95	32				

Shaker designation for identification and ordering

Example: 10DF-H

1. Number prefix (10) indicates size
2. First letter (D or M) indicates design group
3. Second letter indicates housing style:
   F - standard right-hand housing, foot mount
   L - optional left hand housing, foot mount
   (available for sizes #12 and #20 only)
4. Letter after hyphen indicates eccentric weight selection:
   L - light weight
   H - heavy weight
   No letter indicates standard weight

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