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

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

RENOLD
Superior Technology

www.renold.com
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**

- 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.
- 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.

![Diagram of Ajax Shaker](image)
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 force output.

4. Stroke may also be computed using the formula:
   \[ \text{Force (lb)} = 1.42 \times 10^{-5} \times \text{VW (lb)} \times \text{stroke (in)} \times \text{RPM} \]

5. Determine output force of Shaker:
   \[ \text{Force (lbs)} = 3.41 \times 10^{-4} \times \text{ER (lb-ft)} \times \text{RPM}^2 \]
   \[ \text{Force (N)} = 1.097 \times 10^{-2} \times \text{ER (kg-m)} \times \text{RPM}^2 \]

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 x 10^{-5} x stroke (in) x RPM
- Fo (lb) = 1.42 x 10^{-5} x VW (lb) x stroke (in) x RPM
- Fo (N) = 5.48 x 10^{-6} x VW (kg) x stroke (mm) x RPM

Shaker Performance Data (Force Output in Pounds)

<table>
<thead>
<tr>
<th>Shaker</th>
<th>ER kg-m</th>
<th>Motor HP</th>
<th>Force at various RPM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>700</td>
</tr>
<tr>
<td>5-L</td>
<td>0.68</td>
<td>0.095</td>
<td>0.33</td>
</tr>
<tr>
<td>5</td>
<td>1.02</td>
<td>0.141</td>
<td>0.33</td>
</tr>
<tr>
<td>5-H</td>
<td>1.47</td>
<td>0.203</td>
<td>0.50</td>
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<tr>
<td>6-L</td>
<td>1.35</td>
<td>0.187</td>
<td>0.50</td>
</tr>
<tr>
<td>6</td>
<td>1.54</td>
<td>0.213</td>
<td>0.50</td>
</tr>
<tr>
<td>6-H</td>
<td>1.98</td>
<td>0.274</td>
<td>0.50</td>
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<tr>
<td>8-L</td>
<td>2.44</td>
<td>0.338</td>
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<tr>
<td>8</td>
<td>2.72</td>
<td>0.376</td>
<td>0.75</td>
</tr>
<tr>
<td>8-H</td>
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<td>0.75</td>
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<td>10-L</td>
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<td>10</td>
<td>5.35</td>
<td>0.740</td>
<td>1.00</td>
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<td>10-H</td>
<td>6.90</td>
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<td>8.17</td>
<td>1.129</td>
<td>1.5</td>
</tr>
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<td>1.475</td>
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<td>20-L3</td>
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<tr>
<td>20-H</td>
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<td>5.0</td>
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</tbody>
</table>

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:

$$TPH = \frac{BD \times W \times D \times V}{4800}$$

$$TPH = 6 \times 10^4 \times BD \times W \times D \times V \text{ (metric)}$$

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/minute).
# 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 | 42 | 3 | 99 | 48 | 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 | 3 | 93 | 48 | 41 | 127 | 121 | 111 | 171 | 89 | 159 | 15.9 | 4.76 X 2.38 | 12 | 23kg. |
| in. | 8D | 1.50 | 10.19 | 10.75 | 6.16 | 3.00 | 6.25 | 0.63 | 5.09 | 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 | 41 | 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 | 2.05 | 6.75 | 5.25 | 5.75 | 6.83 | 5.00 | 10.00 | 0.83 | 1/4 x 1/8 | 0.63 | 101lb. |
| mm. | 10D | 327 | 346 | 318 | 159 | 95 | 206 | 16 | 192 | 154 | 54 | 116 | 152 | 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 | 4.90 | 1.94 | 7.63 | 5.38 | 6.81 | 7.59 | 5.50 | 11.48 | 0.88 | 1/4 x 1/8 | 0.63 | 146lb. |
| mm. | 12M | 329 | 387 | 367 | 179 | 102 | 241 | 19 | 214 | 173 | 47 | 104 | 89 | 228 | 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 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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