Kinergy Corporation

The most complete line of vibratory machines for "inducing" bulk solid materials to either vertically flow or convey.

Saving Energy by Using Kinergy

Instruction Manual for Kinergy Driven Vibrating Screens

IM-KDSN-390-LS
Rev. May, 2007

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INSTRUCTION MANUAL

FOR

KINERGY DRIVEN VIBRATING SCREEN
OPEN OR ENCLOSED AND DUST-TIGHT

LIGHT, STANDARD, HEAVY, AND EXTRA HEAVY DUTY TYPES

SCALPING, SIZING, DE-DUSTING, DESLIMING DRAIN AND RINSE, WASHING, DE-LIQUEFYING, AND FOUNDRY SHAKEOUTS

INSTALLATION, OPERATION, AND MAINTENANCE

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NOTICE Limited "routine" type field service is available by the local KINERGY Engineering Sales Representative. See the Instruction Manual transmittal form for the name, address, and telephone number of the KINERGY Representative to contact.

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INSTALLATION **OPERATION** **MAINTENANCE**

I. PRELIMINARY INSPECTION

Damage in Transit - Examine the unit(s) carefully for any damage in transit. The Vibrating Screen is usually shipped as a complete assembly and should be visually inspected for physical damage. Normally, auxiliary items such as bolted tuning plates, flexible socks, isolation springs, electrical controls, or the like, will be packed in separate cartons. If so, they should be inspected for loss or damage.

If a discrepancy is noted, notify the transporting carrier immediately and advise your local KINERGY Representative.

Missing Parts - Check the packing slip carefully upon arrival. Any missing parts should be immediately called to the attention of the transporting carrier and your local KINERGY Representative.

II. INSTALLATION

Confirm that the proper "Interface Layout" of the Vibrating Screen's installation into the Material Handling System has been made. (See "Interfacing" Section VI.) Then, refer to the provided outline drawings and proceed as follows:

A. **Lifting** - All Vibrating Screens should be lifted by connecting to the counterbalance. Lift by attaching to the side brackets used for the mounting of the isolation springs.

If it is necessary to hoist the unit by the screen body, confirm the lifting force is fully distributed, or spread out, along its length.

B. **Installing and Securing** - The Vibrating Screen will be of the "counterbalanced" type. It is usually supported by steel coil type isolation springs installed on the counterbalance.

Set the screening unit into position by means of blocks under the counterbalance. Obtain reasonable alignment with the material's input and discharge ports. Maintain a vertical clearance of at least 3″ with surrounding or underside fixed equipment or objects. Also, make certain a clearance exists to service the vibratory motor and to remove it. When flexible socks are utilized, a vertical clearance of 1 to 2″ is recommended at the point of connection.

Vibrating Screens of the Heavy or Extra-Heavy Duty designs are always recommended to be supported from underneath on compression springs. However, they can be suspended by overhead springs from above provided no large impact or high shock loading will be encountered. The following comments apply to each of these two supporting methods.

1. **Undersupport** - These units are normally supplied with vertical standing, steel coil type isolation springs. Occasionally, air mounts or solid rubber isolators will be utilized. In either case, the compression spring or mount should be checked to ensure it has been properly seated and stands vertically "plumb".

    a. For steel coil springs, the internal diameter of the spring will slip over and around an internal, circular sleeve which is located on both the top and bottom mounting plate.

    b. Rubber mounts - Insert the round hole of the mount and slide it into its centered retaining peg.

    Before permanently fixing the bottom mounting plate, the compression springs should be checked to confirm they are standing vertical and are not tilted in any direction.

    c. Air mounts are secured by bolted plates on the top and the bottom of this kind of isolator.

2. **<u>Overhead Springs</u>** - When the Screener is suspended by cables from above, the steel coil or rubber type isolation springs are usually supplied with a top, circular cap and eye bolts. The isolation spring should be located at the top of the suspension point. The threaded shank of the eye bolt permits vertical adjustment to ensure proper load distribution at each of the points of suspension.

Standard, stranded steel type, flexible cable may also be needed. If so, it should be "sized" in accordance with the load rating per isolator shown on the outline drawing. Thimbles will be required at the bends of the cable. It is good practice to laterally shim any "jaw-eye" connections with round washers to hold the "eye bolt" in the center of the jaw. All of the suspension cable points should have approximately the same length. This will assure the appropriate portion of the load will be carried on all of the suspension points.

When looking into either end of the screening unit, the overhead springs should be vertical or slightly sloped outboard from the axial centerline of the Screen. Preferably, the outboard slope of the suspension should be less than 15° from the vertical. Otherwise, field adjustment of the load distribution will be more sensitive, and higher loads on the isolation springs and the cable can be expected.

At start-up, these support points should all be checked for lateral whip in any suspension cable. If whipping does occur, adjust the eye bolt upward or downward (while the Screen is vibrating) until this whip has been eliminated. This will correct for improper load distribution.

WARNING: Do not use the overhead type of suspension when high impact or shock loading can occur. For this type of loading, it is recommended to support the Screen from underneath on compression springs.

Further, an overhead suspension must have appropriate safety cables or structural "stops" on the underside. This kind of suspension must have the proper maintenance attention to ensure its safety over the years ahead. (See Figure 16.)

C. **<u>Slope</u>** - Sometimes a slight decline is maintained even on horizontally mounted units. For example, when a liquid such as water needs to be drained.

Otherwise, a purposely declined installation should slope at the angle shown on the outline drawing. Shimming under the inlet end compression springs can provide the proper slope.

D. **<u>Locating the Vibrating Screen Under the Outlet of an Inlet Chute, Hopper, Bin, or Silo</u>** - When the screening unit is mounted directly under a storage means, the inlet must be properly "interfaced" as described in Section VI of this manual. Particularly, if the incoming material is temporarily "backed up" and stored above the Screen's inlet.

E. **<u>Vibratory Motor Inspection</u>** - The eccentric weight covers should be removed and the holding bolts on both ends of the input motor checked to make certain they are snug tight.

The conduit box of the motor should be inspected to ensure it has been properly packed and that it is secured to the motor's center frame.

The motor must be greased. Only Chevron SRI-2 (preferred), Texaco Premium RB, and Unirex N-2 (Humble Oil) lubricants are recommended. (See the included greasing schedule). Lubricants are applied by pumping grease into the fitting. When clean grease is emitted from the relief plug, the bearing is properly lubricated.

DO NOT OPERATE THE VIBRATING SCREEN UNTIL THE BEARINGS OF THE VIBRATORY MOTOR(S) ARE CONFIRMED TO BE ADEQUATELY GREASED AND THE CONDUIT BOX HAS BEEN FULLY PACKED AND PROPERLY SECURED TO THE CENTER FRAME OF THE MOTOR(S).

F. **<u>Vibratory Motor Wiring and Rotation</u>** - The motor is electrically wired in the same manner as any standard dual or single voltage, A.C. squirrel cage, induction type motor.

1. The **incoming power leads** to the motor should be of rubber sheathed, stranded wire cable. This kind of cable can be enclosed in a flexible metal conduit if required by a local code. It should be at least 4´-0˝ in flexible length. The flexible cable or conduit should pass from the rigid conduit over to the mounting assembly, and then to the conduit box of the motor (See Figure 19). This will prevent wear of the incoming power cable or flexible conduit caused by rubbing against the motor's mounting assembly when the Screen is vibrating.

   CAUTION: Any explosion-proof type flexible conduit must be mounted perpendicular to the longitudinal centerline of the screening unit. This avoids excessive stress on the motor's conduit box and a restriction to the assembly's vibratory movement.

2. **The conduit box of the motor must be totally stuffed with packing.** This prevents the leads from "flexing" inside the conduit box when the unit is vibrating. The packing recommended is Johns-Manville "duct seal" (normal) or "tran-o-seal" (higher temperature).

The internal wall surfaces of the conduit box should first be lined with this packing, and then the motor leads coated. The leads should then be pressed into the conduit box to make them totally immersed in the packing. Attention is called to the second half of the conduit box, which must also be totally stuffed.

3. On single motor units, the **motor rotation** is as shown on the outline drawing. However, if two motors are used, their rotation will be in opposite directions as shown on the Screen's outline drawing. If multi-pairs of motors are required, each pair of two motors rotate opposite to each other. It is preferred that all pairs have the same direction of rotation.

4. **The warranted amperage rating of the vibratory motor(s) is listed on the unit's outline drawing.** However, the best steady state over-current protection will be achieved by measuring the full load current of the motor while screening the rated amount of material. Select an overload relay heater rated as nearly as possible to this load current, which still avoids nuisance tripping. If the motor current exceeds the amount shown on the unit's outline drawing, the local KINERGY Representative should be consulted.

G. Connecting the Electrically Adjustable Feed Rate Control or the "Pulsing"

When the Vibrating Screen is also to perform a "Feeding" function, the adjustable feed rate control will be a VFD that varies the electrical frequency (Hertz) or it is the "Variable Voltage" type of Silicon Controlled Rectifier (SCR). The VFD or the voltage varying SCR are also utilized when the automatic "follow" of the feed rate by a process control signal is required, or when multi-point remote control is needed. The feed rate is changed from virtually zero to the maximum output (TPH) in infinite steps. This means the adjustment is smoothly achieved over a broad range.

This electrical control is often supplied in a NEMA 1 (general purpose) enclosure. If the atmosphere is dusty, a NEMA 12 (dust-tight) enclosure is recommended. If the atmosphere contains moisture or if the area is washed down occasionally, a watertight (NEMA 4) enclosure is recommended. NEMA 7 and 9 explosion proof enclosures are required for hazardous locations.

1. **VFD (Variable Frequency)** - This should be wired to the load side of the branch circuit protection, and its output should be connected to the proper terminals of the vibratory motor. (Drawings AE-131 and AE-214).

   The electrical frequency of the power supply to the motor is varied. As a result of the change in "hertz", the motor's speed is proportionately decreased or increased.

To achieve the "zero feed" condition, the motor's speed is only reduced by about 25% or less. For example, if the motor has a full load, 60 hertz speed of 855 RPM, the "zero feed" condition will occur at about 641 RPM, or at 45 hertz on the VFD. At this setting, the resulting vibratory conveying action does not move the particles over the screen. Thus, the Screening or Feeding rate has become negligible or has completely stopped. Consequently, **"zero feed" does not occur at zero hertz**. Instead, when the Vibrating Screen is at "zero feed", the motor is still rotating, but at a reduced speed.

Fig. 1: A Variable Frequency Control (VFD).

The VFD has a "constant torque" output capability as the motor's speed is either decreased or increased. The reason is the volts per cycle output to the motor remains constant throughout the speed range. However, the Vibrating Screen has a diminishing load curve that is similar to a "variable torque" demand, such as a Fan or Centrifugal Pump. Therefore, **the motor can be continuously rotated at any reduced speed without excessively overheating.**

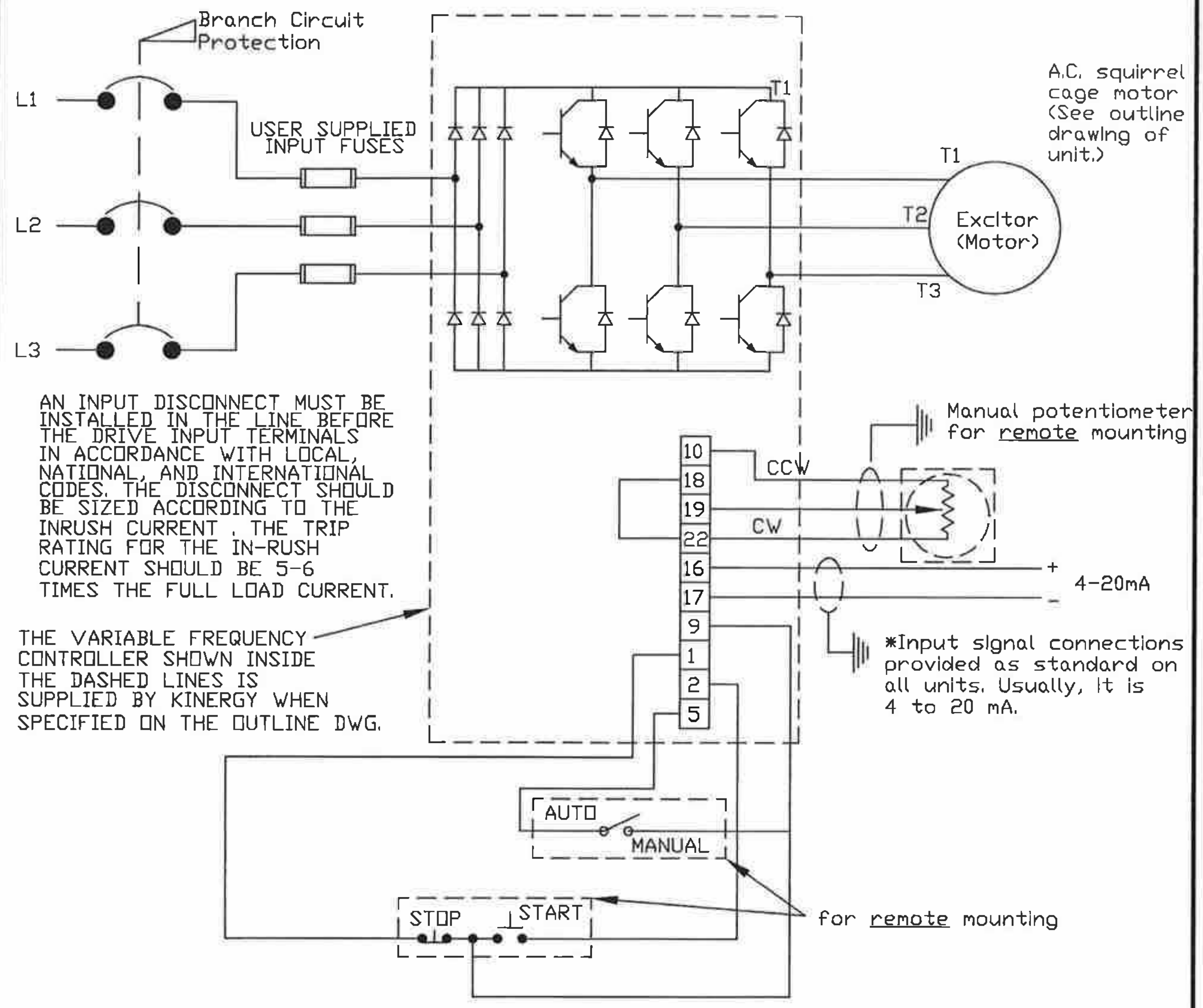
The Vibrating Screen has husky steel coil drive springs that are sub-resonant tuned, as explained in Section III of this manual. **Consequently, the VFD should not be operated above the rated hertz of the electrical power supply.** Typically, the top limit is 50 or 60 hertz, depending upon the local electrical utility supplying the power.

An advantage of the VFD is that it usually eliminates the need for a linestarter.

2. **Variable Voltage Type of SCR** - This kind of control varies the voltage to the motor to adjust the Screen's output. As the voltage is reduced, the operating stroke and frequency are also reduced. When the voltage is increased, vibratory action is also increased. (Drawings AE-116 and AE-210).

The unit should be wired to the load side of the line starter and its output should be connected to the specified terminals of the vibratory motor.

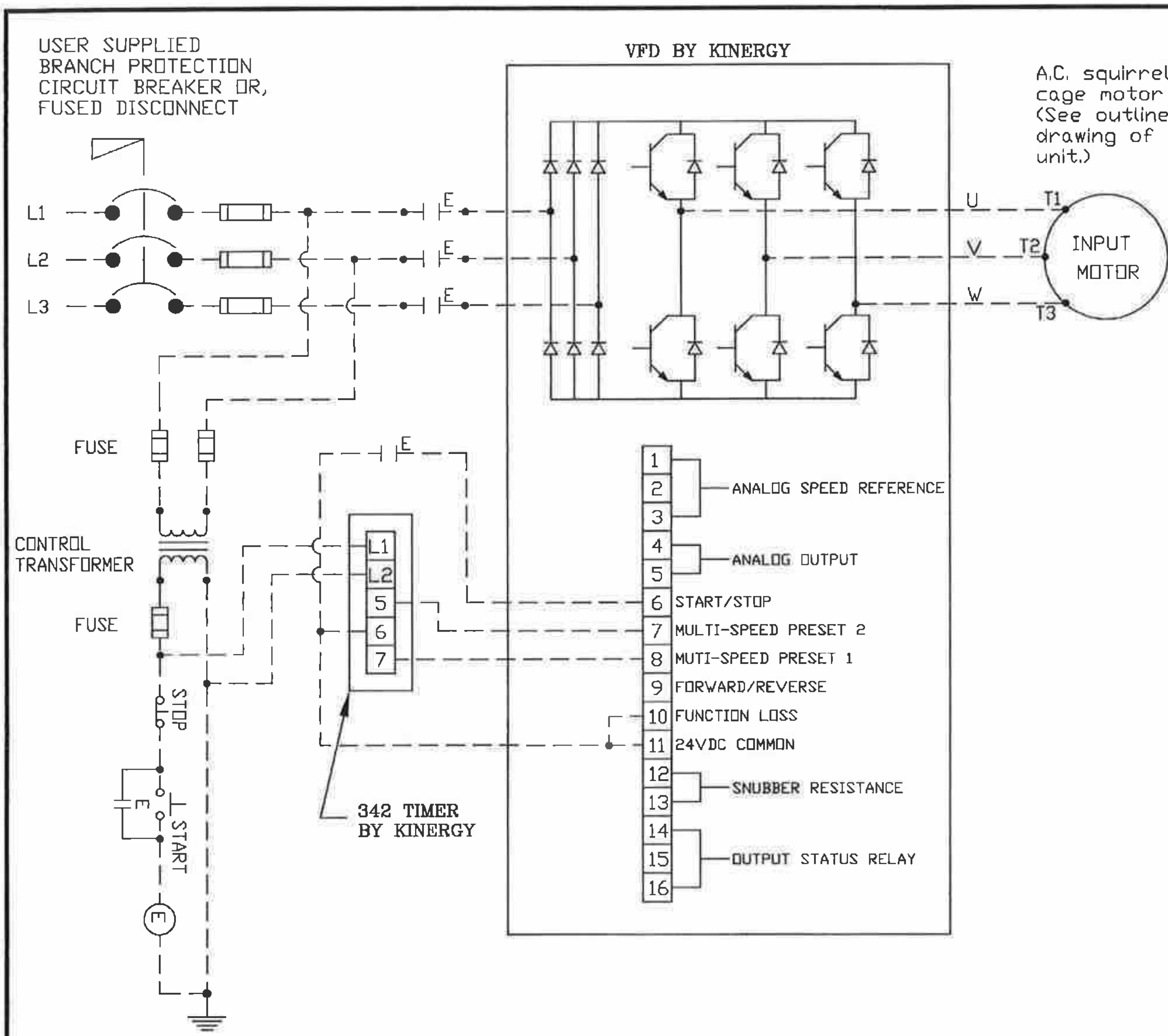
The incoming control signal is wired to the respective terminals indicated on the electrical schematic drawing provided (see AE-116). If the control cable is 100 feet or longer, shielded cable should be used and/or strengthening the incoming D.C. signal may be needed.



NOTES:

1. Variable Frequency Control unit is only provided by Kinergy. The branch circuit protection and external control circuit is normally not included.
2. The motor overload settings should agree with the amperage rating shown on the outline drawing under the heading of motor specifications.

REV.	DATE	DESCRIPTION	FILE DATA	Kinergy Corporation
1	--		DRAWN ...	VFD VARIABLE FREQUENCY CONTROLLER ELECTRICAL SCHEMATIC
2	--		CHECKED	FOR ...
3	--		ENGINEER ...	...
4	--		SCALE ...	...
5	--		FILE NO. ...	DWG. NO. AE-131 REV. NO. ...
6	--		P.O. NO. ...	THIS DRAWING IN DETAIL AND DESIGN IS THE PROPERTY OF KINERGY CORPORATION AND IS LOANED WITH THE UNDERSTANDING THAT IT IS NOT TO BE USED IN ANY WAY THAT IS HARMFUL TO KINERGY CORPORATION AND IT IS TO BE RETURNED UPON REQUEST.
7	--		SERIAL NO. ...	
8	--		S.O. NO. ...	



NOTES:

1. Only Variable Frequency Controller and timer 342 are provided by Kinergy. The branch circuit protection and external control circuit is normally not included.
2. The motor overload settings in the VFD should agree with the amperage rating shown on the outline drawing under the heading of motor specifications.

REV.	DATE	DESCRIPTION	FILE DATA	
1	--	..	DRAWN	RD 12/18/06
2	--		CHECKED	
3	--		ENGINEER	..
4	--		SCALE	NONE
5	--		FILE NO.	..
6	--		P.O. NO.	..
7	--		SERIAL NO.	..
8	--		S.O. NO.	..

Kinergy Corporation

PULSE CIRCUIT WITH VFD ELECTRICAL SCHEMATIC

FOR ..

..

..

DWG. NO. AE-214 REV. NO. 0

The wrong input phasing is corrected by reversing any two input power lines (L1, L2, or L3). To reverse the motor rotation, interchange any two output lines (T1, T2, or T3).

The front of the SCR control panel is usually equipped with a manual potentiometer and a selector switch. The three positions of the switch are: "Auto", "Local", and "Remote". In the "Auto" position, the unit operates automatically from an input signal. In the "Local" control and "Remote" control positions, the unit operates from either the manual potentiometer on the panel or from one at a remote location, respectively.

Fig. 2: An SCR type of Variable Voltage Control

All SCR control units have an automatic "full voltage start" feature.

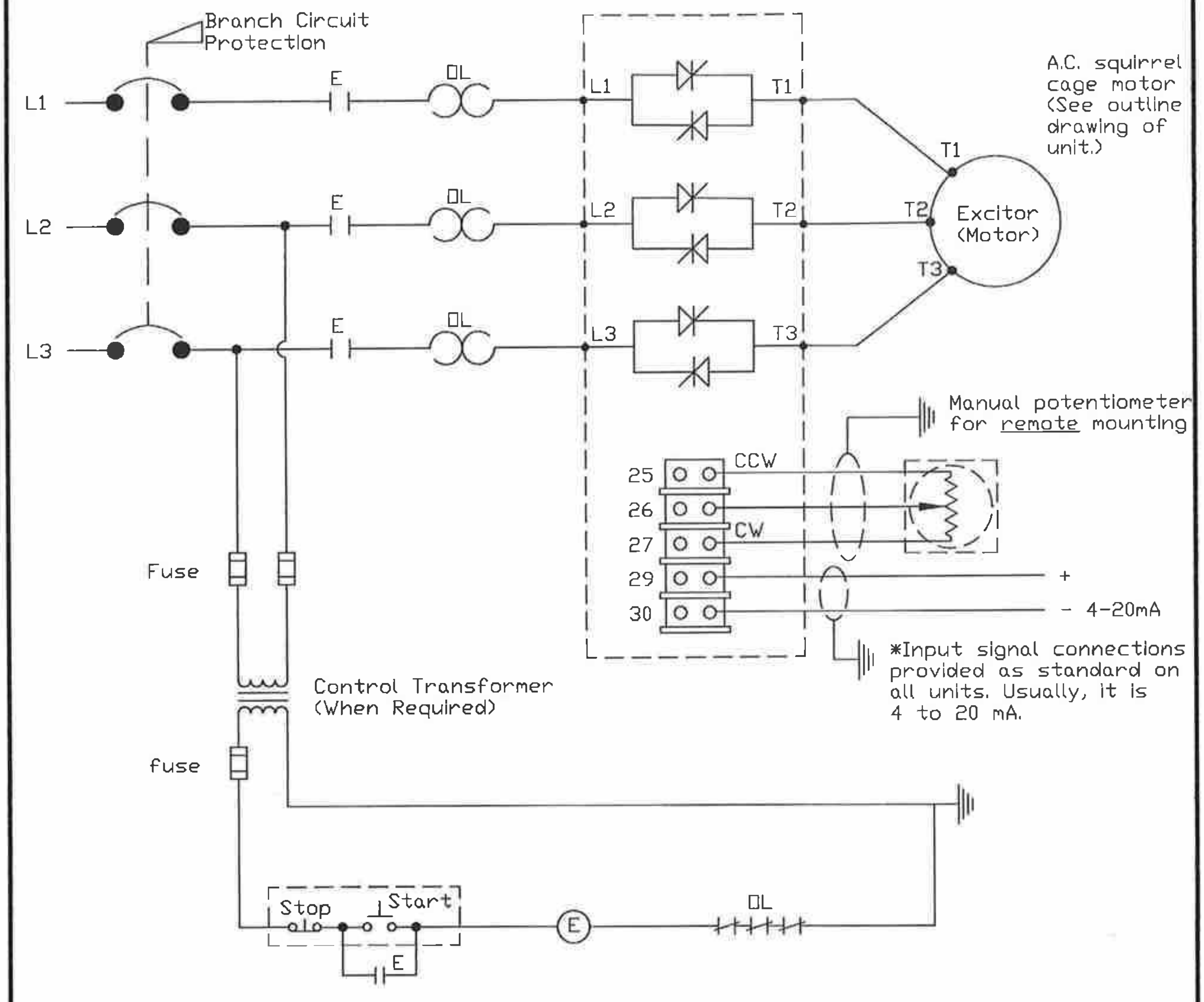
The SCR enclosure should be qualified for the environment in which it is installed. Unless otherwise specified, all units are supplied with NEMA 4 (weather-proof) enclosure. Explosion proof NEMA 7 or 9 enclosures are also available when they are needed.

IMPORTANT NOTE: An instruction manual for either the VFD or the SCR type of "Variable Voltage" Control has been separately provided.

H. Accessories (When Supplied or Specified)

1. **Flexible Socks** - The flexible sock should be slipped over or wrapped around the "socking neck" and the drawband or bolting bars tightened. These bolted connections are normally mounted on their respective socking points for shipment. If a material is dusty, it is recommended that some caulking sealant, such as DAP Butyl-Flex, or equivalent, be applied to the neck before the sock and the drawband are applied. Wrap-around socks also require caulking in the vertical seams. This will provide a good dust seal. Proper sag in the inlet sock is required. At least 1″ lateral sag is suggested. Lateral sag is less important in the outlet sock, but it should allow the trough to vibrate freely.

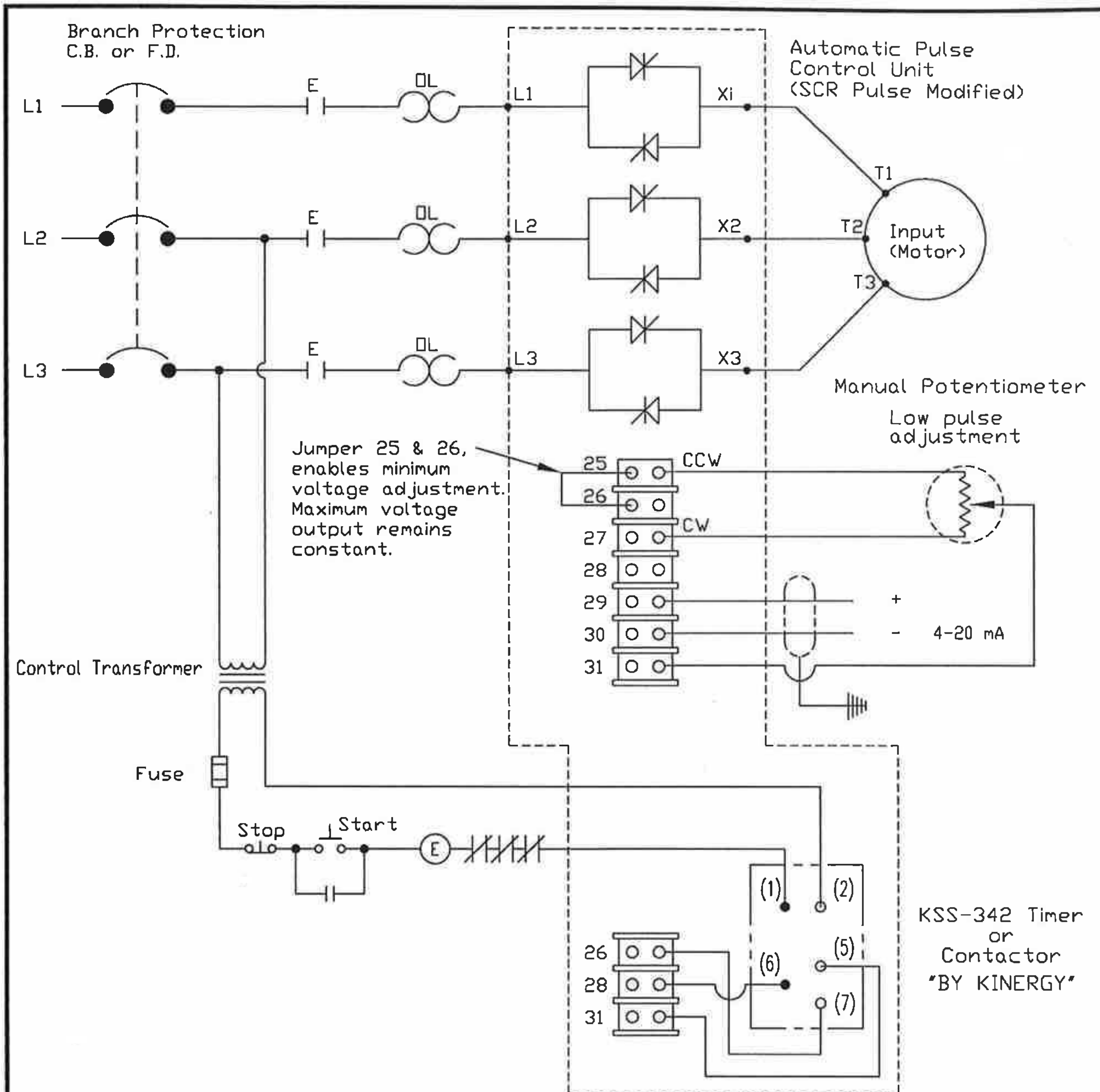
2. **Gates** - The gates are normally factory mounted, and should be checked for proper operation. Air cylinders or power operating devices will require added structural support that extends from the screen body to the operating device. After the added support is installed, the gate and its operator should be observed for any excessive whip when the screening unit vibrates.



NOTES:

1. SCR unit is only provided by Kinergy. The branch circuit protection and line starter are normally not included.
2. All SCR units have an inherent "full voltage start" feature.
3. If two motors are used, the overload relays should be connected in series so both motors are de-energized.
4. The line starter's overload heaters should agree with the amperage rating shown on the outline drawing under the heading of motor specifications.

REV.	DATE	DESCRIPTION	FILE DATA	Kinergy Corporation
1	--		DRAWN ...	
2	--		CHECKED	
3	--		ENGINEER ...	FOR Electrical Schematic for Adjustable Rate
4	--		SCALE ...	S.C.R. Type for any Kinergy Driven
5	--		FILE NO. ...	Vibratory Machine
6	--		P.O. NO. ...	DWG. NO. AE-116 REV. NO. ...
7	--		SERIAL NO. ...	THIS DRAWING IN DETAIL AND DESIGN IS THE PROPERTY OF KINERGY CORPORATION AND IS LOANED WITH THE UNDERSTANDING THAT IT IS NOT TO BE USED IN ANY WAY THAT IS HARMFUL TO KINERGY CORPORATION AND IT IS TO BE RETURNED UPON REQUEST.
8	--		S.O. NO. ...	



NOTES: 1. Pulse unit is only provided by Kinergy. Branch circuit protection and line starter by others.
2. If two motors are used the overload relays should be connected in series so both motors are de-energized.

REV.	DATE	DESCRIPTION	FILE DATA	
1	--		DRAWN ...	**Kinergy Corporation**
2	--		CHECKED	AUTOMATIC "PULSING" OR "MAX-MIN" CIRCUIT
3	--		ENGINEER ...	FOR USING AN SCR "VARABLE VOLTAGE CONTROL
4	--		SCALE ...	
5	--		FILE NO. ...	
6	--		P.O. NO. ...	DWG. NO. AE-210 REV. NO. .
7	--		SERIAL NO. ...	THIS DRAWING IN DETAIL AND DESIGN IS THE PROPERTY OF KINERGY CORPORATION AND IS LOANED WITH THE UNDERSTANDING THAT IT IS NOT TO BE USED IN ANY WAY THAT IS HARMFUL TO KINERGY CORPORATION AND IT IS TO BE RETURNED UPON REQUEST.
8	--		S.O. NO. ...	

3. **Spray Nozzles** - Almost always, the spray nozzles and their piping are non-vibrating. The entire pipe circuit is normally separately supported by the same structure that supports the Vibrating Screen.

III. PRINCIPLE OF OPERATION

The electrically controlled Kinergy Drive System utilizes a motor with a "Free Force" input that is combined with the output of sub-resonant tuned drive springs to power the Vibrating Screen. Stated differently, rotating eccentric weights installed on the extended shaft of the electrically controlled, vibratory motor(s) sustain the action of the stiff, strong, reactive power producing drive springs. **It is the most versatile and "energy efficient" vibratory drive system known.**

The vibratory motor is an A.C. squirrel cage, induction type. It is important to realize that the vibratory motor supplies only a fractional amount of the total driving force required to power the screening unit. The "kinergy" producing drive springs supply most of the required driving force. The term "kinergy" is defined as the specific kinetic energy developed by a spring's motion during the drive portion of its vibratory cycle. **Therefore, the total input power to the screening unit is a combination of both the vibratory motor and the kinergy producing drive springs.** (See Figure 11.)

A. Sub-Resonant Tuning

Since the screening unit always vibrates at the running speed of the motor, the actual "Natural Frequency" of the drive springs cannot be seen, or visually realized. None-theless, it does play an important role in how the Screen performs under load.

When the Screen is in the empty or "no load" condition, the Natural Frequency of the drive springs is markedly above the maximum motor speed. For example, if the motor has a full voltage top speed of 855 RPM, the Natural Frequency of the drive springs would be approximately 950 CPM (or RPM). Then, as material load is applied, the Natural Frequency decreases as a result of the added weight or load placed on the Vibrating Screen. This causes the drive spring's frequency to decrease and approach the speed of the vibratory motor. The result is the drive springs inher-ently work harder under load because their natural speed (frequency) is now more in unison with the motor's top running speed. This is called "Sub-Resonant" tuning. "Sub" means "under". Resonant means "Natural Frequency". Therefore, **"Sub-Resonant" tuning always maintains the motor's speed under the Natural Frequency of the stiff drive springs.** This is the reason the Screen will not markedly change its operating stroke from "No Load" to "Full Load".

B. Mechanical Tuning Adjustments

Removing bolted "tuning" weights or adding more of the stiff drive springs **increases** the kinergy producing drive spring's Natural Frequency. This will decrease the screening unit's "no load" or empty stroke value. Conversely, adding tuning weights or removing drive springs **decreases** the drive spring's Natural Frequency. This will increase the no load or empty stroke value. (See Figure 21.)

When the Vibratory Screen is very large and extremely heavy, adjusting the tuning plates may have little effect. In those instances, steel coil drive springs are added to reduce the "no load" stroke. To increase the "no load" stroke, drive springs are removed.

The ability to feed and screen load (TPH) on the screening unit is a function of the amount of eccentric weights installed on the motor. Increasing their output improves its load-carrying capability (See Figure 22). If the eccentric weights are increased, the unit should be back-checked in the "no load" condition. If the stroke of the trough in the empty condition is too high, it should be reduced by removing tuning plates or adding more drive springs. Otherwise, unnecessary maintenance could be experienced.

The flat bar type stabilizer springs act as "guides" for the steel coil drive springs. On some smaller, light weight Screens, these leaf springs also perform the function of "drive springs".

The prescribed empty or "no load" stroke value is shown on the screening unit's outline drawing. This stroke length should be adhered to for the operation, tuning, and maintenance of the unit. **When a lower stroke will achieve the wanted performance, use that lesser stroke as the operating limit.**

C. Effect of Field Modifications

Unauthorized modifications to the Vibrating Screen should not be made because it could void Kinergy's expressed warranty. This is particularly true when the change adversely affects the structural integrity, performance capability, or the safety of the unit's operation.

Kinergy does recognize the occasional, practical need for acceptable changes to better adapt the Vibrating Screen to the "actual operating conditions" in some applications. Examples of this would be the addition of a liner in the trough, removing a trough divider, or adding a cover over the screen body. Consequently, the resulting effect of a wanted field modification to the screening unit should be discussed with Kinergy and a written approval provided.

Adding any "fixed" (bolted or welded) weight to the screen body or its counter-balance will cause an increase in the stroke for the no load or empty condition. Removing "fixed" weight will cause a decrease in that stroke. **Therefore, field modifications to the body or the counterbalance member may require a complete mechanical "re-tuning" of the Vibratory Screen.** Generally, added weight by a trough modification is compensated for by removing tuning plates from the counterbalance assembly. The opposite is true for screen body weight reductions. After the modification is made, the "no load" or empty full voltage stroke of the Screen must be confirmed. The stroke must be returned to its proper amount by the adjustment of tuning plates or drive springs.

D. Repetitive Starts and Stops

Since the vibratory motor accelerates and decelerates independent of the stiff kinergy producing drive springs, the Screener can be started and stopped frequently, under full load, without harm to the vibratory drive. **The repetitive starts and stops can be up to 5 times per minute.**

This makes "pulsing" to higher strokes practical to help keep the openings in the screen clear of lodged particles. This "Pulsing" also helps to minimize particle adhesion and abrasive wear.

E. Operating Versatility

To achieve a successful application, the design of the Vibrating Screen may be only part of the assignment. The other aspect will depend upon how the screening unit is operated. In some applications, this could make the difference between success and failure.

The Kinergy Drive System, which vibrates the Screen, provides the most operating versatility. This is accomplished by first making all the needed mechanical type of adjustments during the "start-up" stage to better adapt to the actual screening conditions. When it is needed, the simple method of electrical control can be utilized to manually or automatically change the screening rate while the unit is in operation. This control can also provide an automatic, repetitive vibratory "pulse", which is only briefly applied. This momentary "Pulse" can be used to minimize the "blinding" of the openings in the screen, or to stimulate the movement of slowly conveyed particles. (See Section IV).

F. Smooth and Quiet Operation

A properly tuned and operated Kinergy Driven Vibrating Screen generates essentially the same amount of stroke from no load to full load, with full voltage applied to the motor, and shows a continual decrease in stroke when the applied voltage or hertz is gradually reduced or when the motor is de-energized. The Vibrating Screen will vibrate very smoothly and operate very quietly. Usually, only the mild whine of the motor is all that is heard when it is vibrating. (Sometimes the steel coil isolation springs will have a slight chatter, which is permissible.)

G. The "Look and Listen" Check for Maintenance

By observing the "no load" stroke occasionally, scheduling the greasing of the motor, and tracing and correcting any noise in the unit's operation, the Vibrating Screen is properly maintained. In short, just routinely "Look and Listen" to the screening unit to maintain it. Even though the Screen continually vibrates, it should only require minimal maintenance.

IV. "PULSING" THE VIBRATORY ACTION

This is the application of the maximum stroke and frequency to the Vibrating Screen for a brief period of time on a repetitive basis. After the "pulse" is momentarily applied, the Screener returns to a lower stroke for its normal operation for the application. In other words, it temporarily generates a stronger "burst of vibratory energy". It is similar to a dog shaking water from its wet body. It can be manually or automatically applied.

This feature can be used to clean the surfaces of a Vibrating Screen. This includes removing particle adhesion or clearing blinded holes. It can also be used to minimize abrasive wear, overcoming surface tension to move liquid coated pieces and laden bulk solids, to improve deliquefying to stimulate particle movement, reduce operating noise, or whenever a periodic increase in the dynamic force output of the vibratory action is of benefit.

It can be manually done by timely turning the Vibrating Screen on and off. However, this kind of versatile operation is best achieved with the use of an electrical control that can vary the speed of an A.C. squirrel cage type induction motor.

Typically, the Variable Frequency or the Variable Voltage kind of electrical control is utilized. (These are discussed in Section II, paragraph G of this manual).

The automatic time cycle to repetitively apply the "pulse" is often accomplished by the computerized control managing the process. Otherwise, the wanted duration of the stronger "pulse" compared to the allotted time at the lesser stroke is accomplished with an electrical timer that has a wide range of adjustment.

The actual operating time cycle is established by trial and observation during the start-up phase of the Vibrating Screen. As only a guide, a typical operating cycle for a Vibrating Screen is 10 seconds at the stronger pulse once every minute. Most often, the duration of the pulse is just long enough to be effective. After that is established, only the time of the normal operating stroke is usually adjusted until the wanted performance is obtained. For example, the "Pulse" is applied long enough to clear a "few" openings in the screen. Then it applied as often as necessary to keep "most" of the openings clear.

V. CHARACTERIZING THE MATERIAL BEING SCREENED

When vibrated, the material being screened will appear to "stratify" into layers. Small particles will move down to the bottom of the "mat depth" and the larger particles will rise to the top. This happens because the vibratory action reduces the material's "inter-particle" friction. Consequently, the material is being vertically "densified". As a result, it is "stratified".

When liquids such as water are vibrated, it "implodes". This is an internal implosion, which is the opposite of an external explosion. Vibration also reduces the surface tension of the liquid. This "localized" internal pressure rise tends to free pieces or particles from liquids. This is the basic phenomenon that makes "Deliquefying" and De-Watering practical with Vibrating Screens. Normally, the more rigid the particles and dry the material, the easier it will be to "size" the "overs" from the "unders" with a vibratory action.

There are many different kinds of materials that can be screened with vibration. To better understand their screening characteristics, the material can be classified as "Unit Pieces" or "Bulk Solids" that have either "Flake", "Floodable", or "Generally Granular" type particles. When any of these different kinds of particles become saturated with a liquid, they become a "Slurry".

A. Unit Pieces

These are whole solids that are a complete entity. Examples are tomatoes, apples, foundry castings, boxes, cartons, filled bags, metal stampings, briquettes, or wooden logs. (See Figure 3.)

Fig. 3: A steel casting is an example of a "Unit Piece".

In some applications, unit pieces need to be moved as fast as possible. For instance, husked cobs of corn in a food plant. In these situations, use the maximum stroke capability of the Screen.

However, **when unit pieces make unwanted noise, or are being damaged while being screened,** reduce the operating stroke to the least amount that is practical. Then, let the mat depth of the screened material proportionately increase to achieve the wanted capacity. If this reduced stroke tends to blind the openings in the screen, utilize the momentary "pulsing" to keep it clear.

Sometimes unit pieces with flat surfaces are coated with a liquid. For example, water soaked diced carrots in a food plant or oil coated metal stampings. When this happens, allow the screened "mat depth" to markedly increase. Then, move the more deep layers with a higher stroke that is momentarily applied with an automatic, repetitive "pulse". If this kind of control is not available, then turn the Vibrating Screen "on and off" with a repetitive operating cycle by using an adjustable, electrical timer. Otherwise, use a "stippled" bottom liner to help break the liquid's surface tension. If this is needed, contact Kinergy.

When separating poured castings and cleaning them of mold sand in Foundries, **the Screening unit is called a "Shakeout"**. Almost always, the "Shakeout" is of Heavy or Extra Heavy duty construction.

B. Identifying Bulk Solid Particles as Flake, Floodable or Generally Granular

This kind of material is made up of "particles" that can be grouped into three categories.

Most of them are best screened horizontally, or declined to 12.5°, with a deep mat depth at the inlet end. This is obtained by applying the least amount of vibratory stroke that satisfactorily achieves the wanted TPH capacity. If the screen media tends to "blind" or plug the openings at this lesser stroke, then the automatic "pulse" to momentarily apply a higher stroke should be utilized to help clear the openings. In addition to better screening, this kind of operation also minimizes the wear from abrasion. It also limits the adhesion of "sticky" particles.

1. **Flakes** - These are flexible, flat shaped particles or strands that are usually fibrous and they will compress when squeezed by hand. Wood bark, shavings, or chips are examples. Others are glass fibers, polystyrene film, refuse derived fuel (RDF), bagasse, shredded rubber tires, metal turnings, brass needles, stranded insulation, tobacco shreds, or the like. (See Figure 4.)

Fig. 4: Wood bark typifies "Flake" type particles.

   Screening at the least amount of stroke and utilizing the automatic "pulse" is usually very beneficial. Particularly, if the moisture content or the particle size has a wide range of variation.

2. **Floodable** - The particles are very fine and dry. They easily aerate so they are said to be "Floodable". The name calls attention to their being able to flow uncontrolled unless the proper precautionary measures are taken. A particle size smaller than 100 mesh and less than 2% moisture content more specifically describes this kind of bulk solid. The Screen body is enclosed and is "Dust-Tight" in these applications. Hydrated lime, fly ash, kaolin clay, pesticides, virtually all the different "dusts" from collectors, acetylene black, stucco, bentonite, talcum powder, diatomaceous earth, cement, ink dyes, carbon black, powdered milk, dextrose, powdered sugar, or anything similar, exemplify bulk solids that are "Floodable". (See Figure 5.)

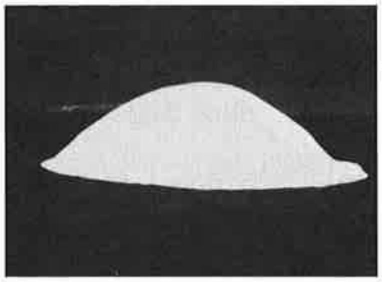


Fig. 5: "Floodable" materials are very fine and dry.

   To avoid impact abrasion and creating dust by aeration, purposely utilize a minimal operating stroke and proportionately increase the mat depth as much as practical to achieve the wanted TPH capacity. Also, it is best to keep the interfacing inlet chute continuously "backed up" with an appropriate level of incoming material.

3. **Generally Granular** - Bulk solids that do not qualify as being either a "Flake" or "Floodable" are in this group. The particles are typically granular in texture and often have lumps in their size distribution. Coal, limestone, gypsum, sawdust, bottom ash, rice grits, salt, bone meal, corn gluten, soybean meal, granulated sugar, fertilizer beads, molding sands, and potash denote the General classification of bulk solids. (See Figure 6.)

Fig. 6: A granular texture, usually with lumps, denotes a "Generally Granular" type of bulk solid.

To minimize impact type of abrasive wear, or if the material is sticky and adhesive, avoid dropping it onto an empty feed plate at the Screen's inlet. To accomplish the needed TPH capacity, convey the incoming supply of material as slowly as possible and let the mat depth proportionately increase. The incoming supply in the interfacing inlet chute should be continuously "backed up" with an appropriate level of temporarily stored material. If this lower operating stroke causes the openings in the screen to excessively plug or blind, utilize the "pulsing" kind of operation to keep the apertures reasonably clear.

C. Rinsing, Washing, or Wet Screening

Some crushing and shredding operations utilize water sprays to clean the resulting larger lumps or pieces of clinging particles (Figure 7). When they do, the discharged material can often have an excess amount of water. If the installation is outside and subjected to the weather conditions, precautions must be taken to avoid the "freezing" of the liquid to the top of the Screen or the conveying trough surfaces during the winter months.

Since a liquid such as water cannot be conveyed by a vibratory action, the underside conveying trough is purposely declined at least 2 degrees. This downward slope permits the liquid to flow and drain along the length of this conveying trough.

Fig. 7: Liquid sprays are added for washing, wet screening, desliming, rinsing or anything similar

D. Deliquefying Slurries

When deliquefying slurries, it is best to accumulate an appropriate mat depth at the inlet end to enable the retained solids to better convey over the screen's surface. The more deep mat depth is needed to overcome the "surface tension" of the liquefied surfaces of the screen. (Particularly when perforated plate or polyurethane screening squares are being used).

Therefore, the usual operating stroke is relatively short. This allows the accumulation of retained solids on the screen. The added retention time from the slow movement of screened particles permits better drainage of the liquid.

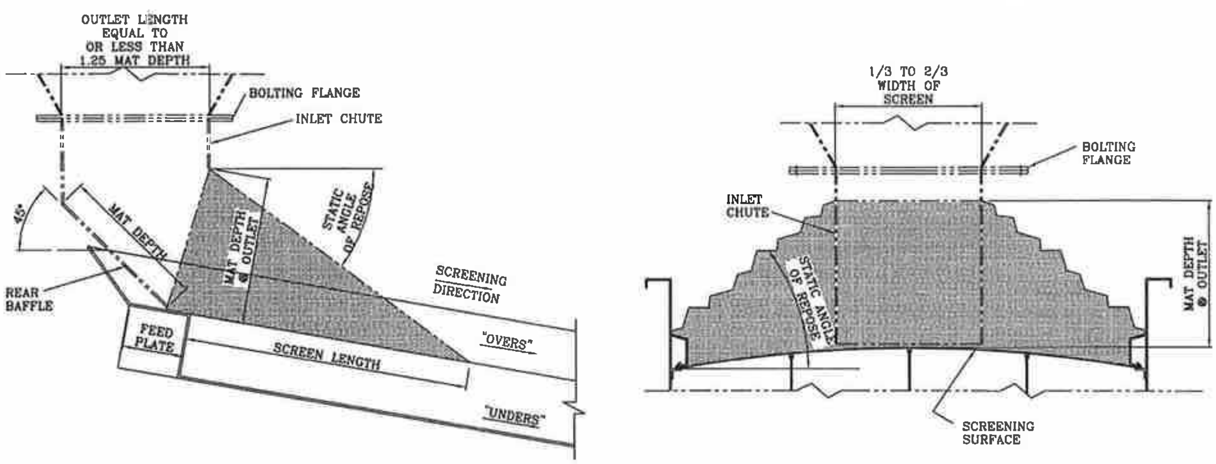
A higher stroke will occasionally be needed to keep the screen's openings more clear or to improve the deliquefying. Therefore, the deliquefying screen should be operated with an electrical, automatic "pulsing" kind of vibratory action.

VI. INTERFACING WITH OTHER EQUIPMENT

This involves the proper coordination of the Vibrating Screen into the Material Handling System. It almost always involves the adjoining equipment at its inlet or its outlet. The incoming material must be spread across the width of the screen's surfaces. Often this innately occurs as the material conveys forward. The discharge of each deck of the Vibrating Screen should freely flow on to the receiving equipment. In other words, **the resulting combination should not be detrimental to the performance or maintenance of any of the "interfaced" equipment.** If specified in writing and the necessary information is provided, Kinergy will prepare the proper interface drawings. Otherwise, it is the responsibility of the installation designer (purchaser or "others") to properly coordinate the interface of the Vibrating Screen to the adjoining equipment at its inlet and outlet.

A. Interfacing with an Inlet Chute, Hopper, Bin, or Silo

The inlet of the Vibrating Screen is often "interfaced" with a supply Chute, Hopper, Storage Bin, or Silo. The "interface" described below, and as diagramed in Figure 8A & 8B, is recommended. Particularly, **if impact abrasion or the adhesion of "sticky" materials is to be minimized**.



A. Elevation View **B. End View**

Fig. 8: Interfacing with a storage means such as Hopper, Bin, or Silo. This kind of interface is also recommended to minimize the adhesion of "sticky materials" or to avoid excessive wear from impact abrasion. When needed, it will achieve the wanted "spread" across the width of the inlet.

The installation can be horizontal, or slightly declined to 12.5°. However, if the decline exceeds 12.5°, it tends to wear the screen media from the increased "sliding" abrasion.

The slant length of the 45° sloped, rear baffle accommodates the outlet above and can be up to the expected mat depth at the inlet to the Vibrating Screen as shown in Figure 8A. The 1/4″ (preferred) to 3/8″ vertical clearance with the Screen's feed plate must be maintained. The longitudinal sides of the inlet have the same vertical clearance with the Screen's feed plate as denoted in the same diagram.

This "Interfacing Chute" is located directly over the length of the screen's feed plate. It is designed to be purposely filled or "backed up" with incoming material. The deep mat depth flowing forward and sideways from the outlet of this chute innately "spreads" the material across the width of the Vibrating Screen.

1. **Width:** The width of the inlet chute should be at least one-fourth (25%) to two-thirds (67%) the usable width of the screen.

2. **Rear Baffle:** A rear diverting baffle is required across the upstream width of the inlet chute to guide the incoming flow down the screen. It is sloped at 45° from the vertical and should project down to within 1/4″ to 3/8″ of the feed plate. The length of this rear baffle is as long as practical, but no more than the length of the sides of the chute. And, it is fixed to the bottom of the inlet chute.

3. **Aft Bin Clearances:** The rear or back end wall of the screen body should laterally clear the inlet chute by at least 1″.

4. **Longitudinal Skirtboards:** On each side of the inlet chute, longitudinal skirtboards may be needed to project forward to the beginning of the "top" screening deck, with 1/4″ to 3/8″ vertical clearance at the most upstream point with a diverging opening at the downstream end. These longitudinal skirtboards must be rigid enough to prevent bulging or bending outboard.

5. **Mat Gate:** If it is wanted, the downstream edge of the inlet chute can be equipped with an adjustable gate to establish the material's mat depth. This gate should allow a plus or minus 25% adjustment to the specified mat at the inlet that is shown on the outline drawing. This mat gate allows some adjustment to actual operating conditions. **Once adjusted at start-up, this gate usually remains fixed for the duration of the application.**

   IMPORTANT NOTE: When big **"Unit Pieces"** or large **"Flake"** type bulk solids are being screened, a sliding vertical plate type of mat depth gate may not be practical. In this kind of application, the vertical wall across the width of the downstream side of the inlet chute will almost always be omitted. For guidance on how to control the incoming mat depth of these kinds of materials, contact Kinergy. Usually, it is accomplished by either mechanically adjusting the Screen's stroke or by using the electrically adjustable control, or both.

6. **Electrical Sensors:**

For an automatic operation, Electrical Sensors will be needed in the incoming Chute, Hopper, Bin, or Silo to detect the "High" (filled) or "Low" (near empty) levels.

Normally, the "High" prompts the Vibrating Screen to operate at its rated TPH capacity. The "Low" sensor changes the TPH capacity to a minimum amount or it shuts down the Screen. When the chute re-fills to the "High" level, the capacity of the Screen returns to its normal amount.

7. **Vibrating Feeder that provides "spread" at the inlet.**

When used, the discharge of the Vibrating Feeder should be within 3″ of vertical fall to the feed plate. Otherwise, adhesive particles will tend to stick to the surface at that point. Or, if the discharge particles are abrasive, a vertical fall from a greater height will tend to cause more abrasive wear from the continued "impacting" on the surfaces of the inlet.

B. Interfacing the Inlet of Deliquefying Screens

If a slurry is being deliquefied, such as gold ore, a "weir box" with a 76mm (3 inch) vertical fall is preferred (152mm or 6 inches is a maximum) to minimize "Impact" abrasion (Figure 9). When water saturated, lumpy material is being screened, a sieve bend might be installed at the inlet (Figure 10).

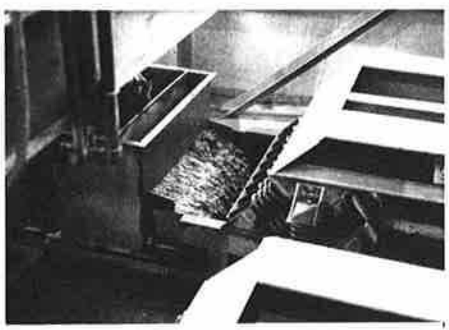


Fig. 9: The "weir box" on the left smoothes the slurry feed to a Deliquefying Screen. Sometimes it is used in conjunction with a "sieve bend" or replaced by it.

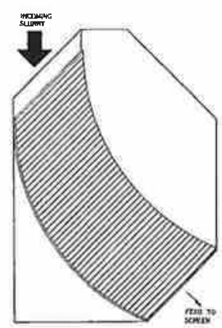


Fig. 10: A typical "sieve bend" which is a stationary screen that might be used at the inlet end of a deliquefying unit that vibrates.

C. Interfacing the Outlets

On the downstream end, the screened material should be able to discharge without any restrictive obstruction.

VII. ABRASION, CORROSION, AND LINERS

Each of these subjects deserves a brief discussion.

A. Abrasion

Abrasive wear from "impacting" needs to be differentiated from abrasion caused by "sliding".

Impact abrasion occurs when the incoming material strikes an exposed metal surface. When this repeatedly happens, the resulting amount of wear will be considerable. This is why liners are used at the inlets of some Vibrating Screens. To minimize this type of abrasion, the material's vertical free fall can be eliminated by using a properly "interfaced" inlet chute. When this chute is "backed up" with incoming material, any impact abrasion at the inlet to the Vibrating Screen is virtually eliminated. It impacts on its own particles as is cleverly done with the use of a so-called "rock box".

As a material is being conveyed over the Screen, minimal "sliding" abrasion takes place because of the gentle "pitch and catch" action of the vibratory movement. This is the reason Vibrating Screens are preferred when very abrasive materials are to be screened.

B. Corrosion

If the material being screened can be corrosive, the internal surfaces of the Screen's body need to be properly protected. Consequently, the liners must be completely sealed. When this corrosion is coupled with "sliding" abrasion, the potential of the abrasive wear compounding the corrosive action needs to be taken into account. It would be the same as continually rubbing the rust off a corroded water pipe. **Therefore, when the material is both abrasive and corrosive, the corrosion dictates the trough construction or liner selection and not the abrasive characteristic.**

An example is screening wet coal that has some sulfur content. If an A.R. liner is used, it will appear to excessively wear. Actually, the difficulty stems from the coal's moisture combining with the sulfur in the coal to form a weak solution of sulfuric acid. This acid corrodes the surfaces of the A.R. Consequently, it rubs off very easily. Therefore, a stainless steel liner that is sealed by welding at the mating seams and around the edges would be the correct choice because it eliminates the corrosion, and the hardness of its surface easily contends with the minimal sliding abrasion. **This is the reason a thin stainless steel liner may not require replacement throughout the life of the Screener in many coal handling applications.**

C. Liners

The conveying troughs of the Screener can be lined with "abrasion resistant" (A.R.) plate or other alloys such as stainless steel. Ceramic brick, rubber, polyurethane, UHMW, or the like are also available.

When the liners are made of metal, they are always recommended to be "plug" welded through relatively small holes, as compared to being bolted. The life expectancy of the Vibrating Screen is well beyond 20 years. Over this time period, a bolt holding a liner can come loose. When it does, the screening unit is usually filled with material so it isn't readily accessible to maintenance personnel. Consequently, and as a practical solution, the flat heads of the bolts and the fastening nuts are eventually welded. When this is done, it is virtually the same as plug welding the liner initially, and therefore eliminating the need for any maintenance follow over the long term.

In most instances, and as a benefit of the gentle conveying action, the original metal liner will probably not be replaced over the life of the Screener because of the minimal "sliding" kind of abrasive wear associated with vibratory conveying. However, "impact abrasion" is much more consequential and should be minimized in every application as described in paragraph "A" in this Section VII (above).

VIII. PERFORMING AS A FEEDER

This is often called a "Screeder".

When the "Feeding" function is also going to be required, confirm the inlet is "Interfaced" as listed in paragraph "A" of Section VI, and the adjustable control with the automatic, electrical "Pulse" feature is being utilized.

It is often best to temporarily ignore the Feeding function during the beginning of the "start-up". Proceed to mechanically adjust the Screener to achieve the wanted TPH capacity. After that has been accomplished, connect the electrical control with its full range of adjustment and its "Pulsing". Typically, the "Pulse" will be very short to avoid disturbing the feed rate. (Probably 5 to 10 seconds). Apply it as often as needed to keep the openings in the screen clear. Then observe the screened material being fed over the needed range of adjustable rates.

IX. SAFETY PRECAUTIONS

The Kinergy Driven Vibrating Screen must be installed, operated, and maintained in accordance with the provided outline drawing(s) and this Instruction Manual. With respect to any auxiliary type items from another manufacturer that are also supplied by Kinergy, the respective engineering drawings and the Instruction Manual provided for that item by that manufacturer will apply.

Even though the Vibrating Screen is a very safe machine, some of the safety practices that should be observed are:

1. **When performing maintenance work,** the machine should be de-energized and electrically "locked out". Particularly, when working on the vibratory motor or its eccentric weights.

2. **The rotating eccentric weights** on the vibratory motor should always be covered when the Screener is in operation.

3. **When high shock or large impacting loads** can occur at the inlet sometime during the tenure or life of the application, try to avoid suspending the Vibrating Screen on cables. Instead, support the Screen from underneath on an adequate structure.

   When a large Storage Bin or Pile is being screened and fed, confirm the design avoids a "funnel flow" kind of vertical flow pattern. The high and deep "rat hole" can collapse. When it does, the falling mass of material could damage any overhead suspension and possibly the Screener.

4. **If suspension cables are appropriately used** for overhead support, make sure an adequate secondary support, by means of structural "stops" on the Screener's under side or some type of non-vibrating "safety slings" are also used. (See Figure 16).

5. **When "Floodable" materials are being screened,** some method of quickly shutting off an uncontrolled flow must be available. Particularly, when a Storage Bin with a large volumetric capacity is being utilized at the inlet of the Vibrating Screen.

   For example, use a quick closing gate at the outlet of the storage bin or at the discharge end of the "dust-tight" screening unit, or both.

6. **If screening a very hot material,** an open-holed grating type of fence should appropriately enclose the heated screen body to protect personnel from being inadvertently burned.

   Another option is to adequately insulate the surfaces.

   Otherwise, declare the vicinity in which the Screener is installed to be a "restricted" area to all unescorted or unauthorized personnel.

7. **For ecological reasons, and when the screened material is "dusty"** or otherwise in need to be contained, a "dust-tight" screen body is recommended. Appropriate flexible connections will be used at both the inlet(s) and outlet(s).
   (See Figures 23 and 25.)

X. <u>INITIAL START-UP "NO LOAD"</u>

This Vibrating Screen was thoroughly tested in the "no load" or empty condition before it was released for shipment. Therefore, only "checks" are usually performed. For this phase of the "start-up", mechanical adjustments should not be needed.

Before energizing the unit, make each of the following checks:

A. Confirm the vibratory motor's mounting bolts, eccentric weights, and bolted covers on each end are all tight or securely mounted. Also, confirm the conduit box is firmly secured to the motor's center frame.

B. Confirm the eccentric weights have a total thickness as shown in the component list of the provided outline drawing on each of the double extended motor shafts.

C. The vibratory motor's conduit box is totally stuffed with packing, and the size of the overload heater protection is in agreement with the ampere rating shown on the Screener's outline drawing. Also, the rotation is in the direction of conveying as indicated on the outline drawing.

D. If utilized, confirm the inlet chute has the appropriate "interface" configuration. For example, check for the sloping, rear baffle and its correct clearances across the bottom of its width. (See Section VI).

Inspect the discharge end of the Vibrating Screen to ensure the screened material can easily flow to the adjoining unit.

E. It is good practice to electrically bypass the adjustable rate control for the initial start-up and during the mechanical tuning. After confirming the unit's proper vibratory action, the motor can then be connected to the adjustable rate controller. If a VFD (Variable Frequency) or a Variable Voltage SCR is used, locate and refer to the separately provided instruction manual for that kind of electrical control.

F. Locate and have "on hand" the extra eccentric weight adders, tuning plates, and/or drive springs shipped "loose" with the Screener. These items may be needed when load is applied, as outlined in the next section.

G. Note any modifications that have been made to the Vibrating Screen to better adapt it to its installation.

H. The unit is free of loose gear and obstructions. This includes checking the underside of the counterbalance to confirm nothing will obstruct its vibratory movement.

After the above points are confirmed, energize the Screen in the empty or no load condition at full voltage and at the rated 50 or 60 hertz for about 30 seconds and "read" the stroke plate (see Figures 17 and 18).

If the Screen body's stroke exceeds the amount shown on the outline drawing, symmetrically remove tuning plates or add drive springs. Repeat removing tuning plates or the addition of drive springs until the proper stroke is obtained. (See Fig. 21.)

The unit should be allowed to vibrate for about 30 minutes in the "no load" or empty condition. Note the stroke and the operating sound level. If the stroke creeps upward, confirm that all the drive spring bolts and the flat bar stabilizer bolts are tight. If all the bolts are snug, remove a tuning plate or add a drive spring as required to bring the stroke back to the proper level. No noise other than the "whine" of the motor should be heard. If an unusual noise exists, a bolt is probably loose or the Vibrating Screen is rubbing an obstruction. Trace the source of this noise and eliminate it. (Sometimes the steel coil isolation springs can have a slight chatter which is permissible.)

Connect the electrical, adjustable, feed rate speed control (if supplied). As the dial is turned down, the unit will simultaneously decrease the stroke and frequency smoothly and quietly. "zero feed rate" will occur at a relatively high setting on the VFD or the Variable Voltage Control and the motor will still be rotating. Zero feed does not agree with the zero setting on either control. Please see the manual for this control, which was separately provided.

Stabilizer

Drive Spring

Vibratory Motor

Fig. 11: The Kinergy Drive System has only three component parts. The strong and "stiff" steel coil drive springs that produce "Kinergy", the flat bar stabilizers to guide it, and the motor that supplies the needed heat energy to sustain the vibratory motion. Light weight Screens will often omit the steel coil drive springs as shown in Figure 13.

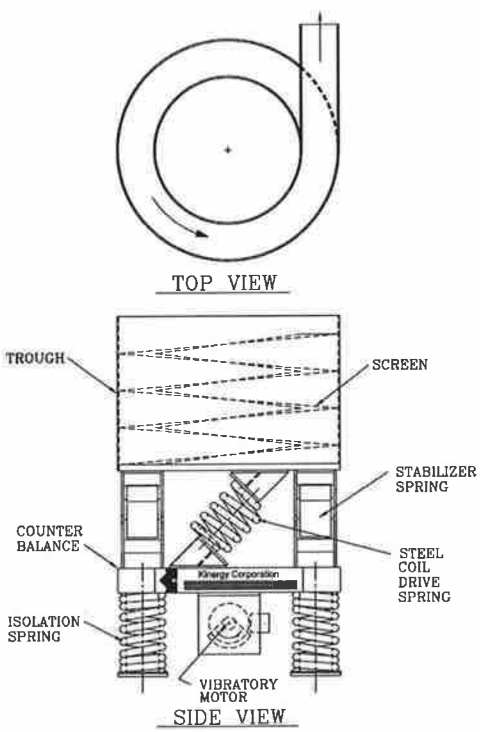


Fig. 12: A Circular Screen

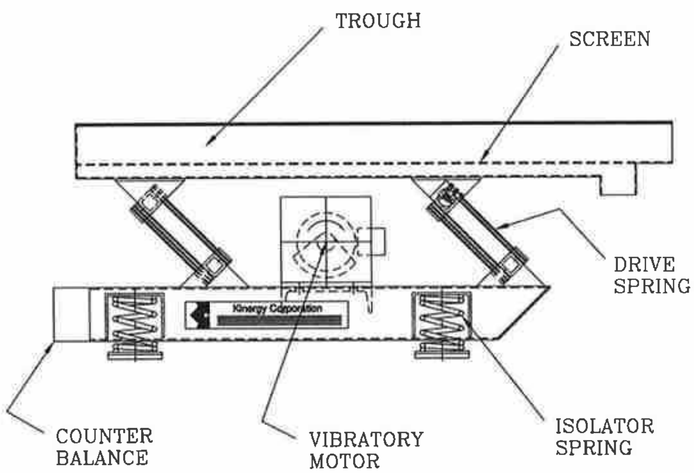


Fig. 13: A small, Light Duty Screen.

Note: All the above Screen designs either add or remove flat bar type stabilizers to respectively decrease or increase the "no load" stroke.

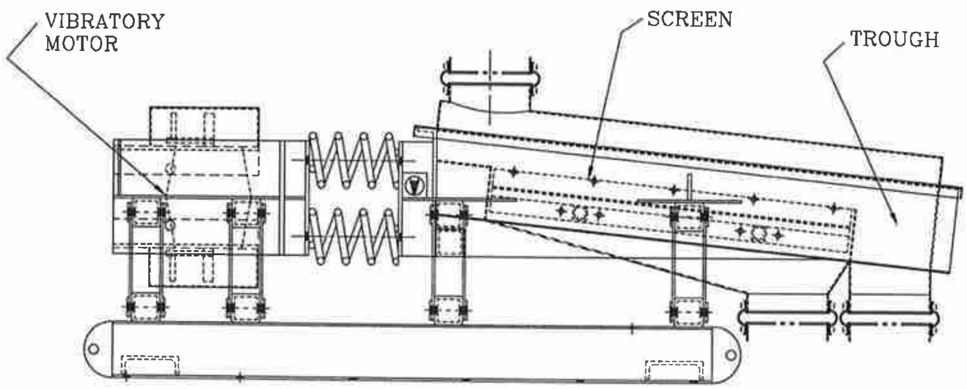


Fig. 14: An End Drive, Sifter Stroke Screen.

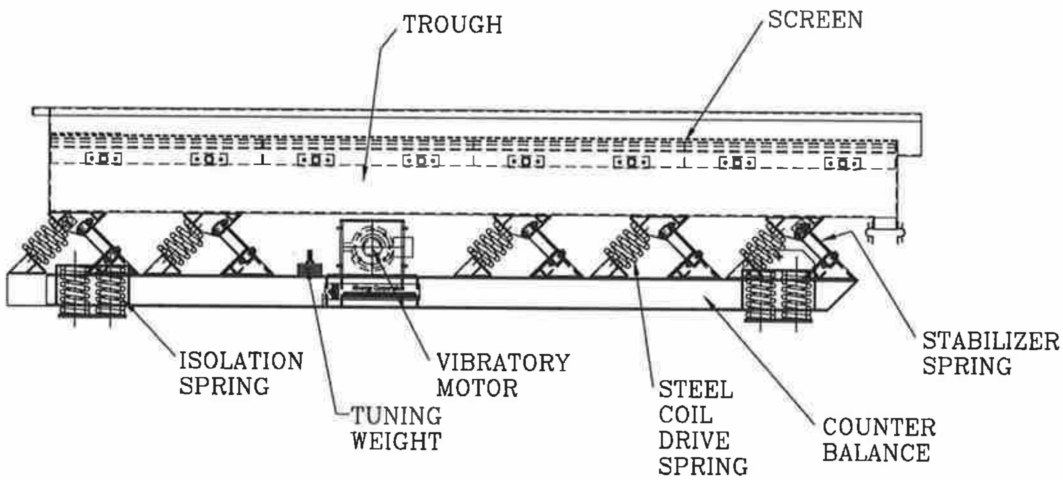


Fig. 15: Horizontal with one screening deck.

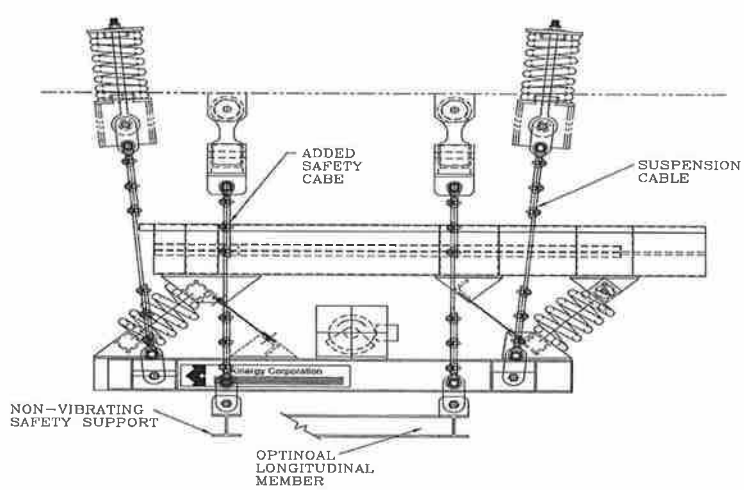
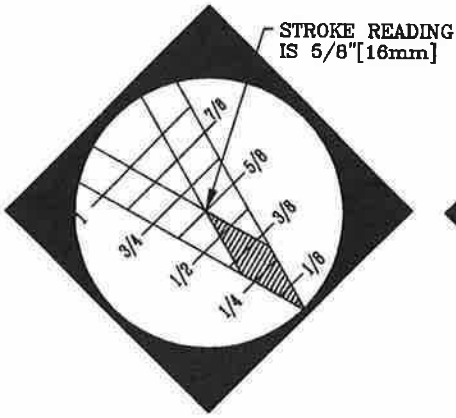


Figure 16: Screens suspended on cables need non-vibrating safety cables or structural stops positioned under the counterbalance.



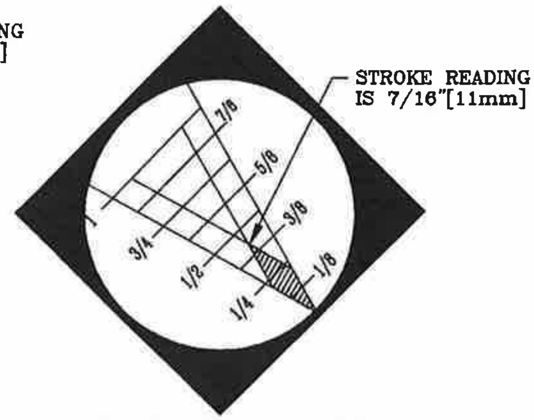


Fig. 17: The vibratory movement intersects the 5/8″ line. Therefore the stroke reading is 5/8″ or 16mm.

Fig. 18: The vibratory movement is halfway between 3/8″ and 1/2″. Consequently, the stroke is judged to be 7/16″ or 11mm.

HOW TO READ A STROKE PLATE

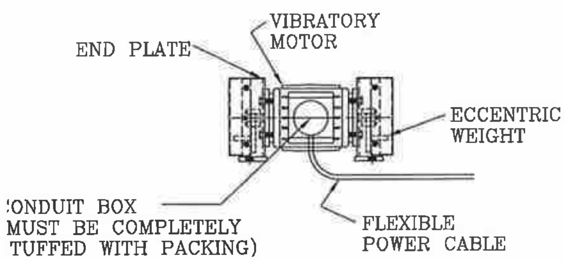


Figure 19: Illustration of the vibratory motor.

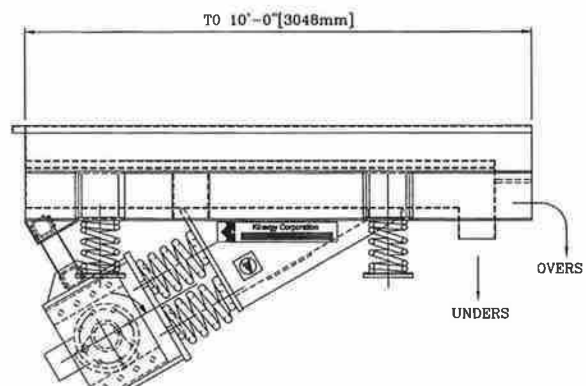


Figure 20: A Vibrating Screen with a concentrated drive.

Fig. 21: Illustrates the bolted "tuning plate" adjustment

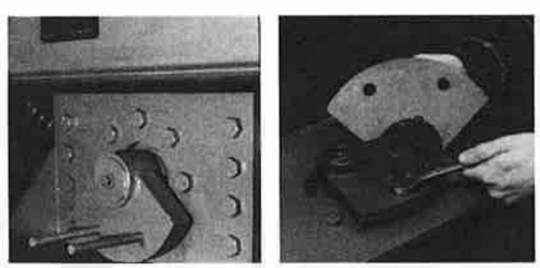


Fig. 22: Shows the bolted adjustment of the motor's eccentric weights. Caution: Do not arbitrarily add eccentric weights to the motor.

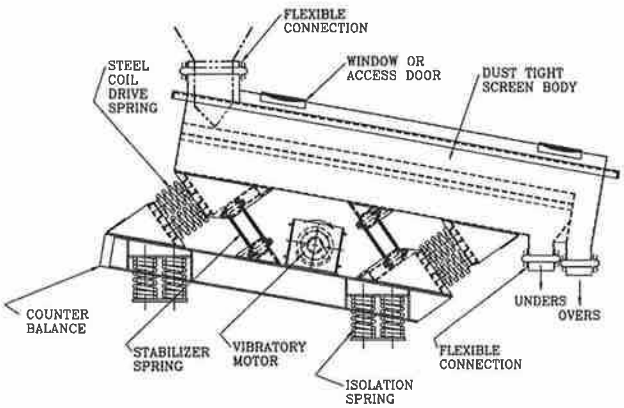


Fig. 23: A Vibrating Screen with an enclosed and "dust-tight" trough.

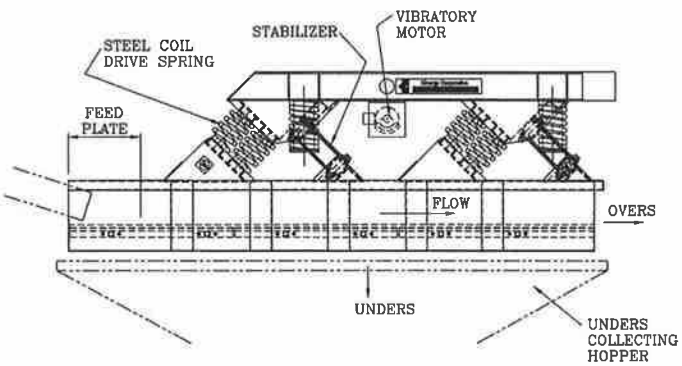


Fig. 24: The vibratory drive is located above the Screen. Therefore, a steep walled collecting hopper for the passed "unders" is required.

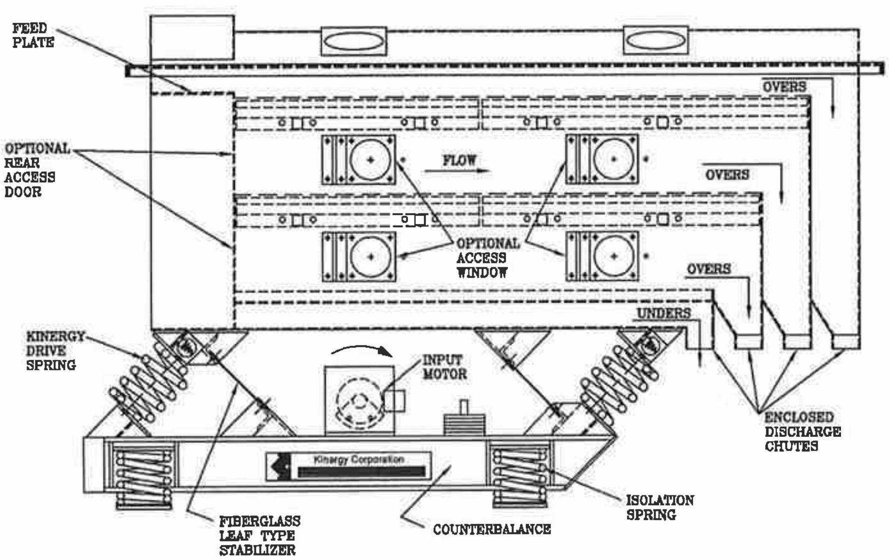


Fig. 25: "Dust-Tight" with three screening decks.

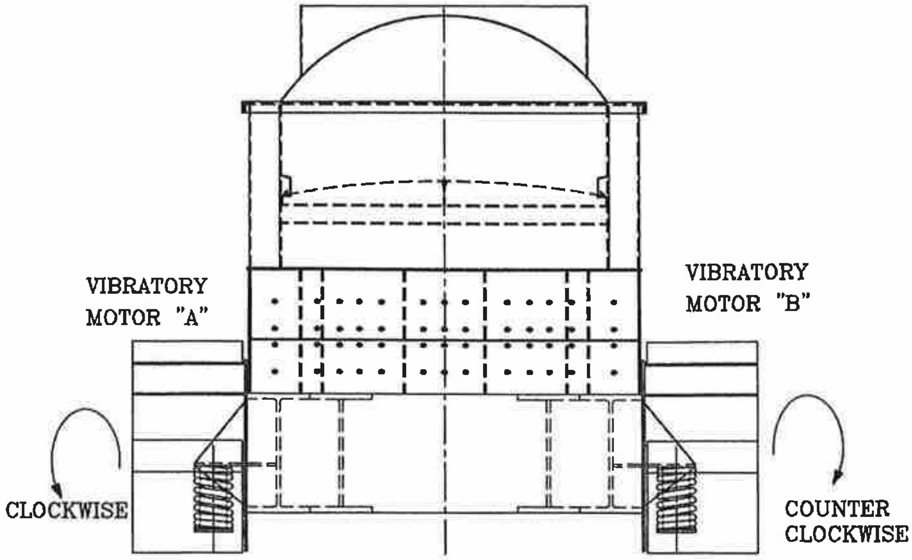


Fig. 26: When two motors are utilized, the rotation is in the opposite direction.

XI. INITIAL APPLICATION OF THE LOAD

To achieve a successful application, the design of the Vibrating Screen will usually be only part of the assignment. Another important factor will be how the Vibrating Screen is operated. In some applications, this could make the difference between success and failure.

The best operating method is accomplished by first making any needed mechanical adjustments during the "start-up" stage to better adapt the machine to the actual screening conditions. When it's needed, the simple method of electrical control can be utilized to manually or automatically change the discharge rate while the Screen is in operation. Another would be the use of this kind of control to automatically "pulse" the Vibrating Screen periodically with a more vigorous vibratory action to improve its performance.

After all the "No Load" checks of Section X have been accomplished, and after noting the maximum stroke limit shown on the Screen's outline drawing, the unit is ready for the material load.

The usual objective is to satisfactorily screen the rated capacity at an appropriate mat depth which requires the least amount of trough stroke when full voltage at the rated 50 or 60 hertz is being applied to the motor. The desired capacity should be accomplished with an adequate thickness of eccentric weights installed on the motor, but be sure this input force is not arbitrarily excessive. **Once these mechanical adjustments have been completed, they should remain "fixed" for the duration of the use of the Screen in this specific application.**

Observe the stroke (at full voltage) as the material load is applied. The unit should not lose more than 20% of its "no load" value. If it does, check for:

A. Incorrect interfacing of the inlet chute with the outlet of the transfer chute, hopper, bin, silo, or other means of storage. For example, the presence of the rear 45° sloping baffle and the wanted clearances. (See Section VI).

B. The Vibrating Screen's assembly is rubbing against something fixed or is striking an underside obstruction. (Particularly under the counterbalance.)

Fig. 27: **SUMMARY OF THE MECHANICAL "TUNING" ADJUSTMENTS FOR ANY KINERGY DRIVEN VIBRATORY MACHINE**

IMPORTANT: All of the adjustments are made with 100% or the rated voltage being applied to the motor. If an electrical variable voltage control is used with the unit, temporarily disconnect it while these changes are being made or confirm full voltage is at the motor of the machine.

THE ADJUSTMENTS

Function	Adjustment (Bolted)	Typical Increment	ADD	REMOVE
Minimizes Maintenance by Limiting the Machine's "No Load" Stroke	Tuning Plates	1/2 inch thickness	Increases the unit's "No Load" stroke	Decreases the unit's "No Load" stroke
	Drive Springs	One at a time	Decreases the unit's "No Load" stroke	Increases the unit's "No Load" stroke
Adjusts the Machine's Maximum Output (TPH) Capability	The Motor's Eccentric Weights	1/4 inch thickness to each shaft	Increases capacity by increasing the unit's stroke under full load	Reduces output by decreasing the unit's stroke under load

INFORMATIVE COMMENTS:

Since all units are "Mechanically Tuned" in the "No Load" condition at the factory prior to shipment, only minor adjustments will usually be required.

OBJECTIVE: The goal is to ensure the motor's Eccentric Weights are adequate, but not excessive to achieve the specified output, and to "back check" the machine to confirm it has the proper "No Load" stroke.

All the adjustments are made symmetrically or evenly about the machine. It is a procedure of "Adjust and Observe". The steps should be repeated as necessary to adapt the unit to the conditions of its "actual use". Once the adjustments have been completed, they should remain "fixed" for the life of the machine in that application.

"NO LOAD" STROKE: Allowing an excessive amount of "No Load" stroke will normally cause unnecessary maintenance to be required by the machine. If all the Tuning Plate have been removed and the stroke is still too high, add a Drive Spring.

ECCENTRIC WEIGHTS: These are often adjusted while the machine is fully loaded. Add eccentric weights in increments to increase the machine's output. Remove the eccentrics to decrease the output. After the addition has been completed, purposely schedule the machine to become empty and make the necessary adjustments to achieve the proper "No Load" stroke.

ADJUSTING DRIVE SPRINGS: Sometimes the addition or removal of a "Drive Spring" will markedly change the unit's stroke. If this occurs, diligently pursue the addition or removal of the bolted "Tuning Plates" until the required "No Load" stroke has been re-established.

MODIFICATIONS: If any approved modification is made to the unit, the "Mechanical Tuning" will normally need to be readjusted. This compensates for any change in the machine's overall weight.

STROKE LIMIT: The prescribed stroke length for any unit is shown on its submitted outline drawing. The actual "No Load" stroke can be less, but not more than 1/32 of an inch of the specified amount to avoid unnecessary maintenance.

C. Confirm the correct motor rotation.

D. Confirm all the discharges are clear.

E. An incorrect power supply voltage or hertz.

F. All the drive springs and flat bar stabilizer bolts are snug tight.

If the above are all correct, and the stroke still dampens excessively under load, add eccentric weights to the motor in appropriate increments. This is more quickly accomplished by de-energizing the Screener with a full load being screened. After adding incremental eccentric weights to the motor, energize the Screener and observe the results. Continue this incremental procedure until the Screener's output is adequate. Then, empty the Screener to re-check the "no load" stroke. Most likely it will be excessive. Remove tuning plates or add drive springs until the stroke returns to the desired amount. **Please see "Summary of the Mechanical Tuning Adjustments" shown in the chart of Figure 27.**

After the unit has been placed on line, a check for particle adhesion or "build-up" on the surfaces of the screen and the conveying trough underneath should be made. If build-up exists, the "no load" (empty) stroke should be rechecked. If the adhesion is excessive and it needs to be minimized or eliminated, refer to the "Trouble Shooting" section of this manual.

Also, the screening of high temperature material (above 250° F) could cause a slight rise in stroke when the Screener becomes hot. Monitor the Vibrating Screen (and other related equipment) for at least two hours with hot product. Re-check the "no load" stroke while the Vibrating Screen is in the hot or heated condition. If the stroke is excessive, remove tuning plates or add a drive spring to better accommodate this hot operating condition.

Remember, all tuning checks are observed at full voltage or hertz to the motor and at "no load". Do not tolerate any unusual noise; track and correct the source of the noise (usually it is a loose bolt).

The electrically adjustable feed rate feature is accomplished by varying the applied voltage or the rated 50 or 60 hertz to the A.C. squirrel cage motor. Note when the vibratory action will stop discharging, the motor will still be running. **Namely the "zero conveying speed" does not align with "zero hertz" or zero voltage.** Instead, it occurs at a higher setting on the dial.

If the material output is excessive at full voltage (or hertz) and causes continual operation at low settings, remove an increment of eccentric weights from the motor. This will permit running at higher settings with less material output and provide a wider range of adjustments on the dial.

The flexible, electrical cable to the vibratory motor should again be checked for unwanted rubs, whip, or any potential wear. The flexible cable or conduit should be first fixed to the motor's mounting frame and then pass over to the conduit box.

For any other difficulty experienced with either the start-up or excessive maintenance, refer to the "Trouble Shooting" section of this manual.

XII. TROUBLE SHOOTING

The following points should be helpful if operating, performance, or excessive maintenance difficulty is experienced.

A. The Vibrating Screen excessively dampens in stroke under load.

1. The Vibrating Screen is striking or rubbing against a fixed object as it settles downward under load. Check along the trough length and under the Screen's counterbalance for any obstruction.

2. When installed under an inlet chute that "backs up", or a Bin, Hopper, Silo, or any other storage means, the 45° rear baffle plate at the outlet is not installed or it has excessive vertical clearance with the Screen's feed plate. This clearance should be limited to 3/8″, with 1/4″ preferred. (See Interface - Section VI.)

3. When the inlet is combined with a filled chute, Bin, Hopper, or similar storage means, the mat depth is not deep enough when compared to the length of the opening in the outlet. Consequently, the upstream portion of the material's vertical flow is dormant. Check the slant length of the rear baffle to confirm it is long enough. This condition will be prevalent when the length of the outlet exceeds 1.25 times the material's mat depth. (See Interface - Section VI).

   If all the above is reasonably correct and the packing of the material at the Screen's inlet still persists, then consider automatically "pulsing" the operating stroke of the Vibrating Screen.

4. The input configuration to a covered or "dust tight" unit is arbitrary (Figures 23 and 25). See the unit's outline drawing for the proper inlet chute arrangement and the interfacing instructions in Section VI.

5. After confirming all of the above is reasonably correct, increase the thickness of the rotating eccentric weights installed on the motor until the proper stroke under load is achieved. Usually, they are added in 1/4″ (6.35 mm) increments. When the needed amount has been applied, let the Screener run empty to recheck its "no load" stroke. Chances are, the stroke will be excessive and either tuning plates will need to be removed or drive springs added to reduce it to its proper length.

B. **The Vibrating Screen's capacity (TPH) is not adequate.**

1. Confirm the rotation of the vibratory motor is correct. When a single motor is used, it should be rotating in the direction of screening. For example, the rotation is clockwise when the viewed conveying direction is from the left to right.

   If two motors are utilized the rotation must be opposite to one another.

2. Confirm the proper "no load" stroke is being reasonably achieved. This may require adding tuning plates or removing drive springs.

3. If excessive stroke dampening is occurring, check the trough (and the underside of the counterbalance) for striking or rubbing against an obstruction as the Vibrating Screen settles downward under load.

4. Confirm the proper interface layout of the Vibrating Screen at both the inlet and the outlets. (See Section VI).

5. If the Vibrating Screen has a top cover, confirm the material's entry through the cover is an appropriate design (Figures 23 and 25). See the Screen's outline drawing or the "Interfacing" and the instructions in Section VI.

6. After confirming all of the above is reasonably correct, increase the thickness of the rotating eccentric weights installed on the motor until the proper stroke under load is achieved. Usually, they are added in 1/4″ (6.35 mm) increments. When the needed amount has been applied, let the Screen run empty to re-check its "no load" stroke. Chances are, the stroke will be excessive and either tuning plates will need to be removed or drive springs will need to be added to reduce it to its proper length.

C. **The screening rate is too fast.**

1. Equally remove eccentric weights from each end of the vibratory motor shafts. The rate will decrease in direct proportion. That is, if 25% thickness is removed, the feeding speed will also diminish by about 25%.

   Another option is to remove tuning plates or add drive springs to reduce the trough's stroke.

2. If applicable, decrease the angle of declination.

3. When it is beneficial, place the Vibrating Screen on an uphill incline by shimming under the supports at the discharge end of the trough.

D. **The material does not feed because it is either coated or saturated with a liquid.**

1. If installed horizontally, and a liquid saturated bulk solid is being screened, consider declining the Vibrating Screen at least 2°. This allows the excess liquid to flow or drain down the Screen's trough length.

2. Reduce the operating stroke to allow the mat depth to increase. Then, use the automatic, repetitive, momentary, electrical "pulsing" of the Screen's vibratory conveying action to achieve the required TPH capacity.

3. If liquid coated unit pieces with large flat surfaces are being screened, an appropriate liner to break the fluid's surface tension may be needed. (Contact Kinergy).

E. **Excessive particle adhesion to the surfaces of the Vibrating Screen**

To minimize or avoid adhesion, the objective is to have the incoming material "impact" against its own particles at the inlet of the Vibrating Screen. (The particles should not impact against an exposed surface). Further, the screened mat depth should become as deep as is practical by reducing the operating stroke, which slows the conveying speed. If needed, add the momentary "Pulsing" action to achieve the TPH capacity and to "break loose" thick layers of adhesion.

Provided the Screen's inlet is properly "interfaced", note the following:

1. If it is acceptable, use an operating practice of shutting down the Vibrating Screen with a full load. Consequently, the inlet section is filled with material. (Do not empty the screening unit).

   Try to avoid starting the Screen when its inlet section is completely empty. Instead, purposely delay the "start-up" of an empty trough until the incoming particles have sufficiently accumulated to cover the surfaces of the inlet section. An electrical, time delayed start could accomplish this wanted condition.

   Another option is to maintain a stored level in the incoming chute or the surge hopper at the Vibrating Screen's inlet by the use of high and low level electrical sensors.

2. Increase the screened mat depth by decreasing the operating stroke. Add drive springs or remove tuning plates until the minimum effective stroke is achieved.

3. Utilize the electrical control to achieve the automatically repetitive, momentary "pulsing" of the Vibrating Screen's conveying stroke and frequency. Minimize the adhesion with a low conveying stroke and then "break loose" the adhered particles with the occasional higher vibratory pulse.

4. If the screened particles have moisture, a liner may be ultimately needed. It will usually be of SS-304, but it could be made of polyurethane. (Contact Kinergy).

F. **The screened material generates too much noise.**

The Screen's stroke is excessive. Therefore, reduce the operating stroke by removing tuning plates or adding drive springs. If necessary, allow the material's mat depth to proportionately increase to further quiet the machine.

G. **The screened material is being damaged.**

The Screen's stroke length is excessive. Therefore, reduce the operating stroke by removing tuning plates or adding drive springs and allow the conveyed mat depth to proportionately increase.

H. **When a storage means is utilized at the inlet, the material packs above the feed plate.**

1. Check the 45° rear baffle plate to ensure that it has an appropriate slant length (which could be equal to the initial mat depth). Its vertical clearance with the Vibrating Screen's feed plate is limited to 3/8″ (1/4″ preferred).

2. If a Bin's outlet length is excessive, try to increase the initial mat depth. (See Interface - Section VI). If the outlet length to mat depth ratio is still greater than 1.25, convert to a "long slot" type of "interface". (Contact Kinergy).

I. **The screen media or the "unders" trough excessively wears.**

Important Note: Sometimes the material being screened is mildly corrosive. Consequently, the slight sliding action over the chemically attacked surface will appear to be the result of abrasion. In this situation, install a chemically inert trough liner, such as one made of SS-304.

Any excessive wear at the Screen's inlet can almost always be traced to the incoming particles or pieces repeatedly striking an exposed metal surface. This is called "Impact Abrasion", which is not the same as the wear derived from "sliding" over a surface. The corrective measures would be dedicated to decreasing or eliminating this repeated impact of the incoming material on the inlet's exposed surfaces. The mat depth should become as deep as practical by reducing the screening stroke.

Therefore, the adjustments would be:

1. Increase the screened mat depth by decreasing the operating stroke. The volumetric screening capacity (TPH) will remain the same.

   To reduce the stroke, either remove tuning plates or add more drive springs as needed. Most likely, the revised conveying speed will be reduced by at least half and the conveyed mat depth will double.

When the Vibrating Screen is in the empty condition, purposely delay the "start-up" to permit an adequate, initial accumulation of material that totally covers the surfaces of the inlet section. An electrically, time delayed start could accomplish this wanted condition. An alternative is to always shut the Screen down under load with its inlet section filled with material. Another possibility is to consider the use of a small surge hopper at the Vibrating Screen's inlet that maintains a reasonable level of stored material in it.

The operating goal is to have the incoming material impact against its own particles as they vertically drop into the Vibrating Screen's inlet.

2. When it is acceptable, utilize an electrical cycle timer to automatically turn the Vibrating Screen "on" and "off" on a repetitive basis. This would permit the inlet to become filled when the supply is intermittent or not very consistent. This same kind of operation can be achieved with a Variable Frequency or a "Variable Voltage" control performing an appropriate "Pulsing" kind of vibratory action.

3. If none of the above is practical, then a replaceable trough protecting liner at the Screen's inlet should be considered.

   It can be thick, bonded rubber for absorbing energy, polyurethane, stainless steel if corrosion is a factor, or hard surfaced abrasion resisting steel. Some times A.R. plate with a thick rubber pad sandwiched underneath is beneficial. (However, excess abrasion is best resolved "operationally" than it is "mechanically" with liners).

   If it is needed, contact Kinergy for more assistance.

J. <u>Premature vibratory motor failure.</u>

NOTE: When a vibratory motor appears to have failed, **make the following checks before removing it from the Screen**. Chances are, the incoming flexible, electrical power cable to the motor's conduit box connections is all that needs to be repaired.

1. An electrical arc occurred in the conduit box because it was not properly packed. Therefore, the motor leads either fatigued or the insulation failed from rubbing against the rough surfaced inner wall of the conduit box (see Figure 19).

2. After turning the conduit box to the wanted position, it was not made secure to the motor's center frame. When vibrated, it became loose and damaged a wire.

3. The incoming flexible cable is not made of rubber sheathed, stranded wire, or it is not fixed to the motor mounting assembly. Therefore, the incoming solid wire in a flexible metal conduit either broke from metal fatigue or it rubbed against the inner surface until the insulation failed (see Figure 19).

4. An improper greasing schedule was followed or grease utilized does not tolerate a vibratory action. Therefore, the bearings failed. See the greasing schedule located in the back of this manual, or utilize a more appropriate lubricant.

5. The vibratory motor has been repaired by an unauthorized repair station. Consequently, the incorrect winding securing methods, bearings, or bearing fits were not obtained. Have the repair shop contact Kinergy for the proper repair instructions if it is necessary.

6. Incorrect wiring connection to the incoming power supply.

7. If two motors are used, their electrical overloads were wired in parallel instead of being connected in series. Consequently, one motor still runs while the other is stopped. The vibration will create “flat spots” in the spherical rollers of the bearings of the motor that has “tripped out”. This will cause a premature bearing failure.

8. The thickness of the eccentric weights installed on the motor is arbitrarily excessive. Reduce the thickness to an amount that is adequate, but not excessive.

9. If the small center frame bolts are failing, the motor is installed with too much tension in its mounting assembly. Loosen the larger bolts that secure the end brackets. Then, appropriately shim between the face of the motor and the one end plate to ensure the motor is installed in compression when the flange bolts are made snug tight.

K. <u>Excessive drive spring failure.</u>

1. The Vibrating Screen is not mechanically adjusted to maintain essentially the same stroke from No Load to Full Load. Therefore, the unit overstrokes when empty, but dampens to an acceptable amount under load. Correct by following the tuning procedures outlined in the Initial Start-Up (Section XI).

2. An incorrect clamping washer is being used to bolt either end of the spring. Utilize the round washer provided by Kinergy.

3. The “seating” of the spring’s circular, bolting washer is incorrect. Loosen the bolt and move that end of the drive spring until the clamp evenly and concentrically seats. **Do not strike the coils of the drive springs directly with a steel head hammer.** This damages their peened surfaces, which will cause premature failure at that spot.

4. The drive spring bolts are not kept tight. Use only self-locking nuts and Grade 5 bolts with standard threads.

   To identify a bolt with damaged threads, try to turn it on one end after tightening. If it turns, the threads are damaged and the bolt must be replaced.

5. Incorrect drive spring installation. Either the drive spring coils are rubbing against the coils of one next to it, or the bolt has damaged threads. Move the spring slightly to avoid a rubbing contact or remove the bolt with the damaged threads and replace it.

6. The Vibrating Screen is repeatedly allowed to run empty and then is subjected to unexpected high impact or shock loads dropped from excessive heights. Correct this by maintaining a level of material at the inlet when the load is dumped. (For example, a properly Interfaced inlet chute as described in Section VI).

7. The Vibrating Screen is arbitrarily continued in operation with a failed stabilizer or steel coil drive spring. This can cause multi-spring and stabilizer failures.

8. The Vibrating Screen is electrically controlled by a "Variable Frequency" type of control and its operating frequency can exceed the rated 50 or 60 Hertz or CPS. This will cause an "overstroke" and the drive springs could fail. Either limit the operating frequency to a maximum of 50 or 60 Hertz or replace the control with the "Variable Voltage" type, which avoids this situation.

L. When overhead suspended, excessive failure of the eye bolts or the isolation springs.

1. The isolation springs are not carrying the same load; thus, they vibrate laterally and excessively. To correct this, adjust the eye bolts until the suspension cable stands steady.

2. The clevis type connection is not centered. Add washers as needed to better align that connection.

3. The Vibrating Screen is being subjected to repetitive high impact type loading. Consider changing to an undersupport with the isolators in compression.

M. Excessive electrical control failure or fuse blowing.

1. Incorrect wiring connection.

2. One of the leads in the conduit box of the motor sparked or faulted because it was not properly packed.

3. An SCR controller is being used, but the "minimum" voltage is set too low. Consequently, the motor stalls and draws high amps. Please see the separately provided SCR Instruction Manual, which is a separate booklet sent with the Screen.

4. The enclosure is not suitable for the surrounding atmosphere.

5. The conduit box is not secured to the motor's center frame.

N. **<u>Difficulty with the hertz varying VFD or the SCR type of "Variable Voltage" controller.</u>**

See the separately provided Instruction Manual for the selected kind of electrical control.

O. **<u>Insufficient spread at the Screen's inlet.</u>**

1. Confirm the "interface" with the chute supplying the incoming material agrees with what is shown in Section VI, paragraph A.

2. If the incoming supply is a "pant leg":

   a. Shut down the Screen and allow that pant leg (or both pant legs) to fill with the material. When that is done, vibrate the Screen. (The bottom of each leg should have a 45° rear baffle as described in Section VI).

   b. Put inserts inside the pant leg to create a chute that has a smaller width. The lower portion of this inner chute should be interfaced in accordance with Section VI, paragraph A. This inner chute should align with the longitudinal centerline of the Screen. This includes the 45° rear baffle and a vertical opening that is deep enough to provide the needed "spread".

P. **<u>The screening efficiency needs to be improved.</u>**

1. Confirm the incoming material vertically falls directly on the feed plate and not the first portion of the screen. If it vertically falls on the screen, it will gradually "plug" the openings and reduce the screening efficiency.

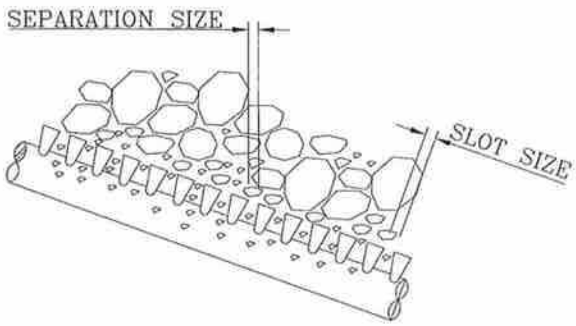
2. Improper spread of the material at the inlet. Provide the proper spread by checking the "Interface" outlined in section VI, paragraph A.

3. If the Screen is declined, decrease the amount of slope. This makes the length of the opening in the Screen appear to be larger. (See Figure 28)

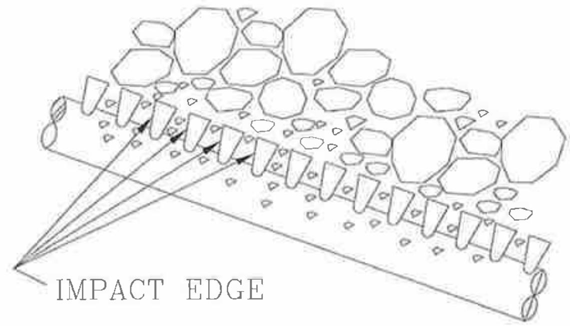
4. Incorrect opening size or incorrect shape.

   For example, if the screen has been changed from woven wire with square holes to perforated plate with round holes of the same diameter, it will reduce the screening efficiency. For example, if a 1″ square opening is replaced with one that is 1″ in diameter, it will reduce the amount of large size being passed.

   To increase the screening efficiency, the diameter of the opening in the perforated plate should be increased in accordance with the diagram shown in Figure 29 or made at least 1.18 times the side dimension of the square opening.



The slope of the screen affects the separation. The more steep the slope, the more narrow the openings appear to be.



In productive use, the downstream edge will be impacted and wear. The upstream edge will be sharpened.

Figure 28: Illustrates the effects of the angle of decline on screening.

A steep decline takes advantage of the Force of Gravity to move the bulk solid over the Screen's surface. Thus, the required power is less. But, the screening efficiency can be reduced and the abrasive wear increased.

Using horizontal Screens or those only declined to shallow angles will require more power. However, the quality of the screening is better and the screen media lasts longer. It also reduces the headroom required.

5. The screen media may be "blinded" or coated with particle adhesion.

   Reduce the normal operating stroke and utilize the automatic, electrical "pulsing" to keep the screening surfaces more clean.

Q. Improving a Deliquefying Screen

This includes de-watering, de-sliming, washing, and draining applications.

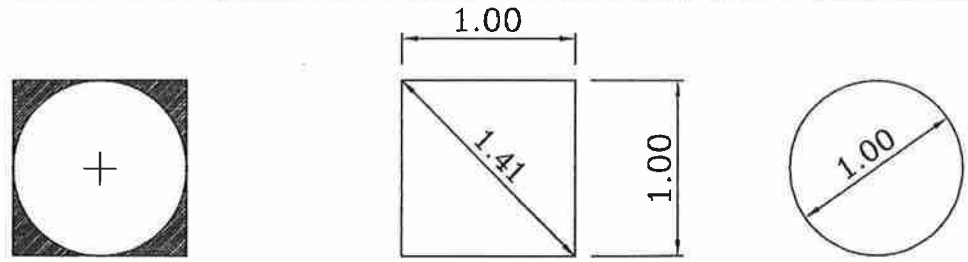
1. Method of Operation

   Use the electrical "Pulsing" action to convey the accumulated depth of deliquefied particles.

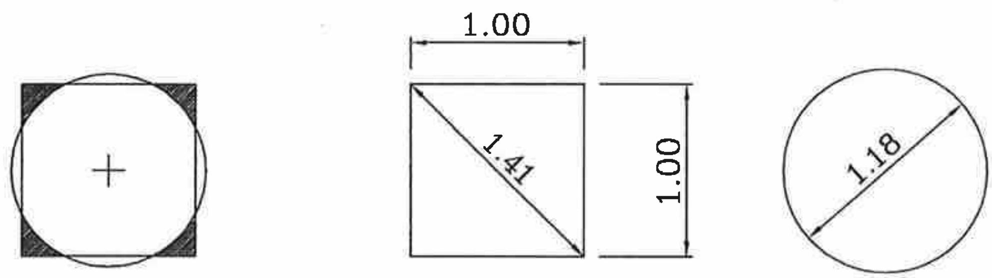
   The minimal stroke should be timed to allow at least a reasonably deep mat depth to accumulate at the Screen's inlet. (Usually, about 2 minutes). The higher stroke pulse should only move the particles a short distance (about 3″ or 76 mm). (Typical duration of 5 to 10 seconds).

2. Interface at Inlet

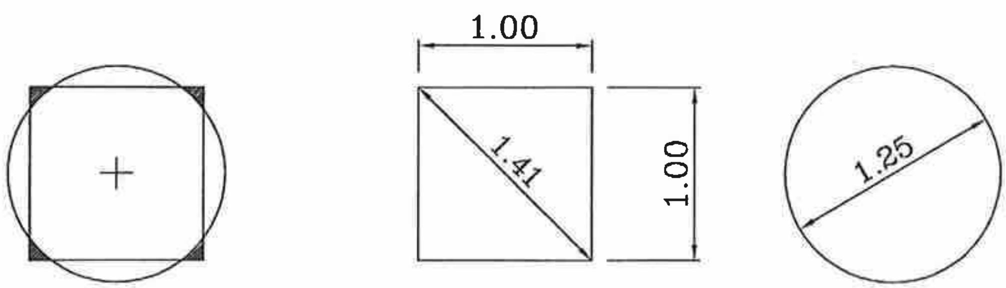
   A "weir box" with a 76mm (3 inch) vertical fall is preferred (152mm or 6 inch as a maximum) to minimize "impact" abrasion (see Figure 9). Or, the appropriate "interface" with a non-vibrating, stationary "sieve bend" (Figure 10).



CASE "A" : THE SIDE OF THE SQUARE EQUALS THE DIAMETER OF THE ROUND OPENING. ONLY A SPHERICAL PARTICLE EQUAL TO THE SIDE OF THE SQUARE WILL PASS THROUGH THE ROUND OPENING



CASE "B" : THE DIAMETER OF THE ROUND OPENING IS 1.18 TIMES LARGER THAN THE SIDE OF THE SQUARE. THE PARTICLE PASSING IS MORE DIMENSIONALLY EQUAL WHEN COMPARING ROUND TO SQUARE OPENINGS.



CASE "C" : THE DIAMETER OF THE ROUND OPENING IS 1.25 TIMES LARGER THAN THE SIDE OF THE SQUARE. THIS REPRESENTS THE LARGEST COMPARISON OF A ROUND TO A SQUARE OPENING THAT PROVIDES NEAR EQUAL SCREENING.

REV.	DATE	DESCRIPTION	FILE DATA	Kinergy Corporation	
1	--		DRAWN ...	COMPARISON OF ROUND TO SQUARE OPENING FOR SCREENING	
2	--		CHECKED	FOR USE IN COMPARING PERFORATED PLATE	
3	--		ENGINEER ...	TO WOVEN WIRE SCREEN MEDIA	
4	--		SCALE ...	...	
5	--		FILE NO. ...	DWG. NO. A-KDS-390-6-1	REV. NO. ...
6	--		P.O. NO. ...	THIS DRAWING IN DETAIL AND DESIGN IS THE PROPERTY OF KINERGY CORPORATION AND IS LOANED WITH THE UNDERSTANDING THAT IT IS NOT TO BE USED IN ANY WAY THAT IS HARMFUL TO KINERGY CORPORATION AND IT IS TO BE RETURNED UPON REQUEST.	
7	--		SERIAL NO. ...		
8	--		S.O. NO. ...		

Figure 29

3. Screen Media

Woven wire will pass the most amount of liquid per unit of area. However, the small diameter wire usually needs to be replaced more often.

Changing to a perforated plate or profile bar increases the durability of the screen.

Polyurethane "squares" improve the life of the screen, but more surface area may be required.

4. Efficiency

This can be improved by changing from a horizontal screen to one that is inclined uphill. (Usually about 2°). This allows the excess liquid to flow back towards the Screen's inlet.

5. The spray bars used for "rinsing" are appropriately positioned. The spray bars should be "fixed" and non-vibrating.

R. <u>Premature Screen Failure</u>

1. The screen is not kept tightly secured along its length.

Therefore, tighten the longitudinal clamping bars. (With practice, these holding bolts can be tightened while the screening unit is in productive use). See Figure 30.

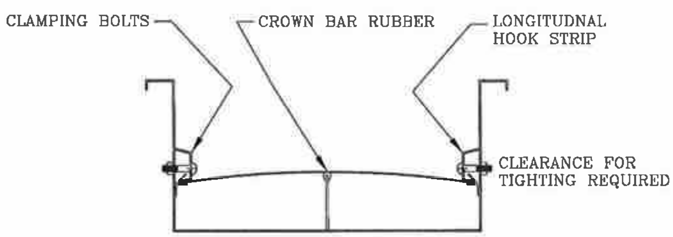


Fig. 30: The typical procedure for installing a replacement screen.

1. **Confirm there is adequate access to the fasteners of the bolts that tension the screen. (See illustration above.)**
2. **Some screens may need time to completely seat into place. Install the new screen under tension without a load and allow it to vibrate for a brief period of time to seat properly (say, 30 minutes). Then, check to tighten with the proper tension. A loose installation could cause premature screen breakage.**
3. **The crown bar rubber strips should be checked each time the screen is changed. A reminder that the rubber wears from the inside out from a movement with the top of the crown rails, thus the wear is not always readily visible.**
4. **Confirm the opening sizes and shape of opening of all screen sections being installed. Also check to make sure screens have hook strips parallel. Tighten uniformly to maintain screens in parallel.**

2. The particles being screened are abrasive.

   (a) Confirm the incoming particles do not fall directly on to the first section of the Screen. This repeated "impacting" will abrasively wear the Screen. Correct by changing the "Interface" to be as described in Section VI.

   (b) If wear on the downstream wire of each opening is excessive, consider changing any wire mesh screen to perforated plate. This will improve the life of the Screen. For the appropriate opening, note Figure 29.

   (c) Change to A.R. plate, polyurethane, or rubber type screen media.

3. The particles being screened are corrosively attacking the surface.

   Change the screen to SS-304, SS-316, polyurethane, or rubber.

XIII. MINIMIZING MAINTENANCE

A properly tuned Vibrating Screen will vibrate very smoothly and quietly at a "given" amount of stroke. By observing the "no load" stroke occasionally to confirm it is within the proper limit, greasing the motor as scheduled (usually every 4 months), and tracing any unwanted noise to its source and eliminating it, the Vibrating Screen is properly maintained. In short, **just "look and listen" to the Vibrating Screen to maintain it**. The repeated "looking" and "listening" could be done by a cooperative operator that regularly patrols the area in which the Screen is installed. When an unwanted condition is observed by the operator, it can be promptly reported to the maintenance personnel for immediate correction.

The Kinergy Driven Vibrating Screen should provide long term, maintenance-free operation. When high maintenance is experienced, do not tolerate it. The trouble can usually be traced to these most common causes of unnecessary trouble:

1. Overstroke of the unit caused by it not being properly adjusted to maintain the same stroke from "No Load" to "Full Load". (That is, the stroke is over its limit empty, but dampens to the proper limit under load.)

2. Overstroking caused by arbitrarily adding eccentric weights to the motor without regard to holding the stroke essentially the same "No Load" to "Full Load". While the eccentric weights should be adequate, they should not be excessive.

3. Overstroking being derived from not adjusting the "no load" stroke of the Screener after particle build-up on the trough surfaces has been experienced. Remove tuning plates or add drive springs to compensate for the particle build-up. Also see Section XII, Troubleshooting, entry "E".

4. Overstroking derived from arbitrarily adding "fixed" weight to the trough such as a cover, wear plates, etc. Compensate by removing tuning weights or adding a drive spring(s). If possible, remove the modification.

5. Incorrect installation of the drive springs, their bolting clamps, using bolts with damaged threads, or prolonged operation of the unit with a failed (broken) drive spring or flat bar type stabilizer.

To prevent these common reasons for failures, the following checks should be made. As said, it simply amounts to "looking and listening" to the Vibrating Screen.

1. **Observe the stroke plate at least once per week.** All checks should be made with full voltage (100%) applied to the motor. If the stroke of the unit has crept upward, it means the drive springs have become loose (provided all trough build-up has already been compensated). Always tighten the drive springs first when creep is experienced.

   Once the drive springs have "broken in" and back-checked for tightness (48 hours initial operation), they should only require occasional tightening. If, by chance, creep still persists, it is most likely being derived from particle build-up on the trough. To correct for this situation, see Section XII, Troubleshooting, entry "E". If this adhesion is allowed to go uncorrected, the unit will gradually increase in stroke and pass into an overstroking condition.

2. **The input motor should be lubricated as prescribed.** Motor failure should seldom be experienced. However, if it occurs, **the motor should be returned to the manufacturer's authorized repair shop**. This is a must for warranty repairs. Any repair by an unauthorized repair station will void the warranty of the manufacturer.

The vibratory motors are unique from the standpoint of the kind of bearings, bearing fits, insulation, the method of securing the motor leads as they pass from the inner frame to the conduit box, and the like. Therefore, it is always a good practice to return a failed motor to the manufacturer's authorized shop because they have specific instructions about the proper repair of vibratory motors.

3. **Any unusual sound indicates trouble.** A properly operating Vibrating Screen will make little or no noise. Usually, any noise will be traced to a loose drive spring or stabilizer bolt.

A loose drive spring can be detected by sliding a screwdriver under the end of the spring at its bolted connection. The loose spring will make a slight chattering sound. By inserting the screwdriver, the noise will be reduced which locates the loose spring. If the threads of a bolt are damaged, it will still turn after it appears to have been tightened. **Therefore, to confirm the threads are not damaged, try to turn one end of a tightened bolt with a wrench.**

With respect to the fiberglass stabilizers, the loose leaf spring bolt will usually generate more heat than the others. Therefore, it can usually be found by passing the hand over the face of the bars and detecting the one with the most heat. (Pass the hand over the area adjacent to the leaf spring's top and bottom bolting bar.)

4. **Avoid welding on the Vibrating Screen unless it is directly grounded.** For example, the vibrating trough, when mounted atop isolators, could be well insulated from the ground. Therefore, if not directly grounded, any welding on the trough will cause the welding current to pass through the vibratory motor and could damage it.

5. **Inspect the drive springs visually.** The open coils of the drive springs should be kept clean. Particularly at the clamping or bolting point.

6. **Replacing the drive springs.** It is a good practice to use a new bolt and a self-locking nut whenever a drive spring is replaced. Only use Grade 5 bolts with flat washers. Do not use "lock washers" which have a split ring.

XIV. RECOMMENDED SPARE PARTS

The recommended spare parts that should be stocked are as follows:

1. One vibratory motor.

2 At least two steel coil drive spring assemblies (includes clamps, bolts, and lock nuts).

3. At least one isolation spring.

4. At least two fiberglass stabilizer, leaf type springs.

* Many parts are common to all Kinergy driven "Induced Conveying" units. This is so even though their actual function may be markedly different.
Refer to the outline drawing for the proper item identification. Always refer to the Serial Number shown on the nameplate or the outline drawing when ordering parts. Your local KINERGY Representative will help to select and identify the parts.

XV. FACTORY SERVICE

A qualified service engineer from Kinergy is available. All plant visits are charged on a per diem basis, plus all transportation costs. Therefore, the trip should be covered by a purchase order and best scheduled through your local KINERGY Representative. This is recommended to confirm the proper full load production capacity at the actual operating conditions and to acquaint the plant personnel with the unit's mechanical tuning procedures, adjustable feed rate control, and the "Look and Listen" principle of maintenance.

KINERGY CORPORATION

Louisville, Kentucky 40219

VIBRATORY MOTOR LUBRICATION & MAINTENANCE

EXCITOR SERIES	FRAME	SPEED	INITIAL GREASE PER BRG.	0 - 16 HRS./DAY	24 HRS./DAY	AMT. OF GREASE PER BEARING
KES-145	145	All	*0.2 oz.	6 mos.	3 mos.	*0.10 oz.
KEI-184	184	All	*1.6 oz.	6 mos.	3 mos.	*0.15 oz.
KEH-184	184	All	*1.6 oz.	2 mos.	1 mos.	*0.25 oz.
KEI-215	215	All	*1.6 oz.	6 mos.	3 mos.	*0.15 oz.
KEH-215	215	All	*2.5 oz.	2 mos.	1 mos.	*0.50 oz.
KEI-256	256	All	*2.0 oz.	6 mos.	3 mos.	*0.4 oz.
KEH-256	256	All	*6.0 oz.	2 mos.	1 mos.	*1.0 oz.
KEI-286	286	All	*5.0 oz.	6 mos.	3 mos.	*1.0 oz.
KEH-286	286	All	*8.5 oz.	2 mos.	1 mos.	*1.5 oz.

The vibratory motor is double flanged, with a double shaft extension, A.C. squirrel cage type induction motor. It has specific bearings, bearing fits, end brackets, shafts, and the needed securing methods for the electrical windings.

The following points must be observed:

(1) Recommended greases include Chevron SRI-2 (preferred), Texaco Premium RB, and Unirex N-2 (Humble Oil). Darina EP-1 (Shell Oil) and Rykin EP-2 (American Oil) can also be used, but greasing interval will be decreased by at least one-half. (i.e. grease twice as often). Do not overgrease the bearings.

(2) Warranty repairs are honored only at the motor manufacturer's authorized repair stations.

(3) All motor holding bolts should be SAE Grade 5 and "torqued" as follows: (Values are in foot-pounds.)

BOLT SIZE	TORQUE	BOLT SIZE	TORQUE
3/8-16	32	3/4-10	250
1/2-13	75	1-8	585
5/8-11	150	1-1/4 -7	1100

Any replacement bolt should be Grade 5 and should be installed using "Loctite #262".

(4) Removable top or end bolting plate cannot be warped or bent (use shims to hold the motor in slight compression).

(5) Conduit box of excitor must be totally stuffed with suitable packing. Johns-Manville dux-seal is recommended.

(6) All vibratory motors are originally supplied with minimal grease. Before the "start-up", the grease plug should be removed and the locally available grease pumped into each bearing until the grease emits though the relief plug.

Note: Small motors that are less than frame 145 are normally supplied with non-greasable bearings. Therefore, these motors will not be greased.

Kinergy Corporation
7310 Grade Lane
Louisville, Kentucky 40219
Phone: 502/366-5685
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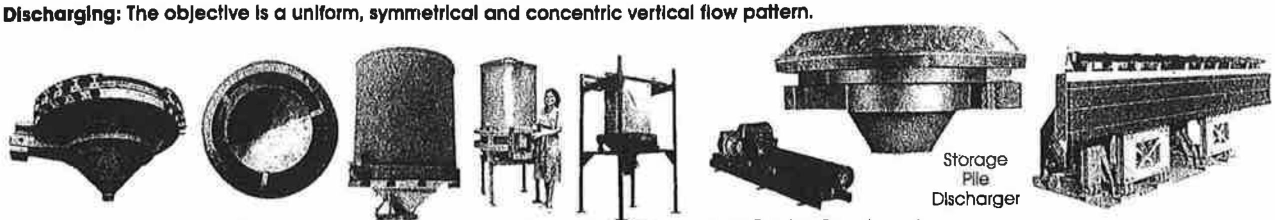
Induced Vertical Flow
Induced Conveying

Kinergy's Many Vibratory Machines

The most complete line of vibratory machines for "Inducing" bulk solid materials to either Vertically Flow or Convey.

Induced Vertical Flow: The vibratory action supplements the forces of gravity.

Discharging: The objective is a uniform, symmetrical and concentric vertical flow pattern.



Bin Activator · Sanitary Finishes · Activated Bin · Container Activator · Bulk Bag Discharger · Screw Feeders Complement Discharging Units · Storage Pile Discharger · Rail Car Discharger

Densifying: Accomplishes "Inherent Densification" at the point of loading.

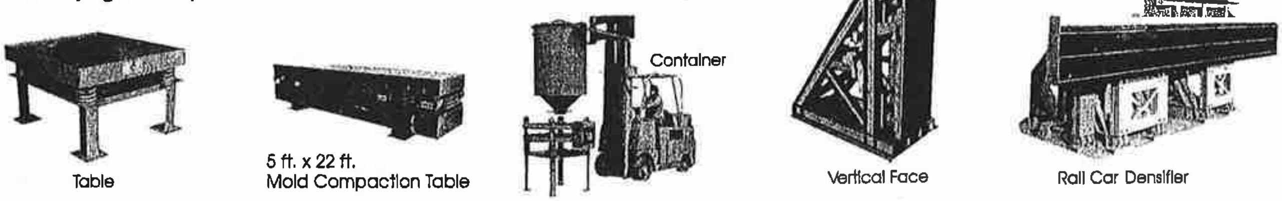
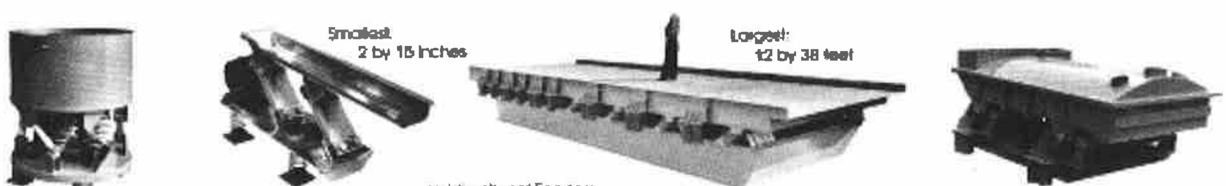


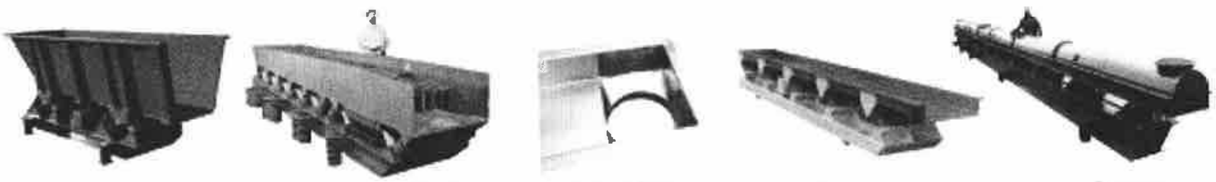
Table · 5 ft. x 22 ft. Mold Compaction Table · Vertical Face · Rail Car Densifier

Induced Conveying: The intentional vibration is the prime mover of the bulk solid or unit pieces.

For the first time in the history of "Induced Conveying" machines, all these different units of various functions are powered by the same type of drive which inherently includes a full range of adjustable output by a simple method of electrical control.



Circular Feeder · Unidirectional Feeders · Dust-Tight Trough



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Fluidized Bed/Transferring Heat · Spiral Elevator · Shakeout Feeder · Shakeout Table · Attrition Mill/Sand Reclaimer

Headquarters and production facilities:

Kinergy Corporation in U.S.A.
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Phone: (502) 366-5685
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Induced Vertical Flow
Discharging/ Densifying

DISCHARGING "Inducing" a uniformly expanded vertical flow pattern in bins, silos, containers, storage piles, and rail cars.

DENSIFYING Accomplishing "Inherent densification" while loading containers, molds, and rail cars.

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Circular & Unidirectional

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