Feeding Concepts, Inc

Vibratory Feeding Equipment Troubleshooting Manual

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VIBRATORY PART HANDLING SYSTEM TERMINOLOGY

BASIC BOWL

An untooled bowl consists of a vertical band and a domed bottom with either an external helical track or an internal helical track. The internal track can also be inverted.

ANGLE SKIRT

A conic section, calculated to fit at the required angle, attached between the bottom side of the track and the bowl wall to prevent parts from stacking and causing jams between the tracks.

VIBRATORY FEEDER BOWL

The vibratory feeder bowl is the basic bowl complete with internal or external tooling custom designed to meet feed rate, part orientation and other specifications as required.

ORIENTATION

The correct position of the piece part at the discharge exit as required by the assembly or placing operation.

RATE

The number of parts discharged per minute or hour, as needed to maintain production requirements.

EXTERNAL TOOLING

Any construction outside of the vertical band which separates, orients, selects, confines, or relieves pressure buildup on oriented parts.

RETURN PAN

The structure attached to the outer band for the purpose of re-circulating parts, to the inside of the bowl, that have been rejected by the orienting and selection devises.

FINAL SELECTOR

A tooled section designed specifically to segregate only those parts that are in the correct attitude.

ADJUSTABLE NARROW TRACK SECTION

A short section of interior track that can be set at various widths. The length depends on the size of the part. This can also be an external type. (After exit to the outside of the bowl.) This may be either a stainless or tool steel insert that can be adjusted to either orient or limit parts to a single file.

SWEEP (OR CAM)

A stainless or tool steel insert placed inside or outside the bowl to control the part level or orientation.

FLANGE MOUNT

This is a continuation of the band of the bowl to hold it to the cross arms of the base drive unit. Clamp nuts are used to attach small diameter bowls to the top member. On large diameter bowls, clamp nuts, along with a center bowl, are provided.

CORD SECTION

A straight section of either stainless or tool steel used to select or orient parts. (Can be inside or outside of the bowl.)

BAFFLE

A stainless steel deflector placed on the inside of the bowl bottom to guard the return hole thus allowing parts to flow evenly back up the track from the return pan.

AIR JET

A small diameter tube bolted or welded in place which is sometimes used to assist in moving parts. It is adjusted in the process of development to assist in orientation or final selection with the minimum amount of air pressure.

PARALLEL BLADE SECTION

An area with a stationary or adjustable gap which orients parts (bolts, screws, etc.) to a "hanging attitude"

PRE-ORIENTOR

Properly placed tooling to change the attitude of a part to the proper position for final selection. A per-orientor will generate higher feed rates and minimize re-circulation of the parts, thus extending the life of the bowl, especially with regard to metal or abrasive parts.

BACK PRESSURE RELIEF (OR "BUBBLE")

An area of the bowl tooling just prior to the entrance to confinement where the parts will buckle if the discharge is full and re-circulate in the bowl. This relieves part pressure which would otherwise cause jamming conditions or miss-oriented parts to bridge across the bowl tooling.

FULL TRACK SENSOR

A means of providing a pressure relief when the parts will not efficiently bubble-off of their own accord. This device can be either a proximity, photo-cell, L.E.D. fiber optic, or pneumatic type sensor to signal the feeder to start or stop. Also a sensor can activate an air jet to eject excess parts from the entrance to confinement, in which case the bowl would continue to run (the latter is most generally used with multiple track bowls).

DISCHARGE CHUTE (HORIZONTAL OR DOWN ANGLE)

A short section of track that is mounted tangent to the centerline of the bowl. The discharge chute controls parts in the attitude, or orientation, achieved in the bowl, and , in most cases, conveys them to a horizontal vibratory straight line of gravity track.

CONFINEMENT

A containing section used to control parts through the discharge chute. Confinements are designed in a manner to allow access to the parts by removal of bolted-on sections in most cases.

SCRAP CHUTE

A scrap chute is used to discharge small particles of foreign material from the bowl without interfering with flow of the piece parts.

QUICK DUMP CHUTE

A quick-opening "window" that is provided to facilitate changing from one part to another when multiple styles or sizes of parts are being fed from the same bowl.

RUNNING SURFACE

That portion of the basic bowl, pre-orientor, final selector or discharge chute with which the part makes contact. This is a variable dimension, depending upon the particular piece part.

COUNTER-BALANCE WEIGHT

A solid steel block of predetermined size and weight that is added to the exterior of the bowl. The location is determined on a static counter-balance wheel, in order to off-set the weight of the external tooling, etc.

FEEDER BOWL BASE DRIVE UNITS

The force used to power the drive unit is accomplished by using one or more electromagnetic coils which act upon pole face plates. These plates are constrained by leaf springs attached to the cross arms, causing a tortional vibration and translating the vibrations in a horizontal direction (resultant angle of approximately 12 degrees from horizontal). When the drive unit moves the parts at a maximum efficiency with minimum current effort the unit is said to be tuned to a natural frequency of the power source. The mass and diameter of the feeder bowl is the determining factor in tuning the unit. As this mass or diameter is increased, more leaf springs must be added. The rubber feet of the base drive play an important part in tuning and must be of the proper durometer.

COIL CLATTER

A warning sound which indicates that the coil gap is set too close causing the pole faces to strike. This condition will result in damage to the drive unit if not corrected.

CLAMP NUTS

A machined block at the end of each cross arm of the base drive unit which must be properly torque to assure maximum transfer of vibration to the bowl. Failure to do so will result in failure or malfunction of the feeder system.

TUNING

Proper tuning is an important factor in achieving maximum spring energy level. When a drive unit is improperly tuned (over or under-sprung) the spring tension does not correspond with the natural frequency of the feeder mass. Either condition prevents the mass from returning to its neutral position before the next magnetic pulse takes over thus restricting the full motion each 1/120 second. Normal 60 HZ current produces 120 magnetic cycles per second, and transmits 120 mechanical cycles per second to the bowl.

It may be seen here that to tune the unit to a natural frequency of either 60 HZ or 120 HR, thus achieving a good balance between coil assembly energy development and spring tension, is of utmost importance to a smooth and efficient feed system. At this balance point it should be noted that parts will feed at maximum efficiency with minimum current effort. The addition or removal of springs on the base drive may be necessary to obtain the balance needed. The same principles apply for 60 HR except one-half or the magnetic pulse is cut out, leaving only 60 mechanical movements per second (sometimes referred to as 1/2 wave or rectified current). The air gap between the coil assembly and armature plate is important. If the air gap needs to be reset, adjust it so that the pole face are as close as possible without striking. This will generate maximum power with minimum amperage draw. If the air gap is too small, the coil will clatter; If too large, all the energy will not be used and the coil will overheat.

STORAGE HOPPER

A storage hopper is used to hold extra parts for replenishing the supply in the bowl. Hoppers are set to operate automatically by a signal from a level control switch, thus eliminating either a deficiency or an over-supply of parts in the bowl.

GRAVITY TRACKS

Gravity tracks and vertical magazines are methods of conveying parts. This type track must be set on an angle great enough that gravity will convey the parts from the discharge of the feed system. A magazine is a track in which oriented parts are stacked. This device is usually preloaded; the feeder maintains a full stack.

STRAIGHT LINE VIBRATORY FEEDER

A straight line drive unit is designed to produce linear vibratory motion. It is used to power tracks that convey parts horizontally from the feeder bowl discharge to a dead nest or mechanism.

OVERHANG

Overhang refers to the amount of straight track tooling that extends beyond either end of the inline drive top member.

ESCAPEMENT

A mechanical device placed at the end of the feeder discharge, horizontal straightline, or gravity track to isolate the end part.

PLACING DEVICE (HEAD)

A mechanical means of placing an escaped part into a nest or onto another piece part.

INSTALLATION AND TROUBLE-SHOOTING GUIDE FOR VIBRATORY BOWLS AND DRIVE UNITS

When the vibratory drive unit will not transmit power to the vibratory bowl, it is often caused by one of the following reasons:

1. The power supply to the control may be inadequate.
2. The cord from the feeder to the control may be improperly connected or damaged.
3. A fuse may be blown in the drive unit controller.
4. A coil may be shorted out in the drive unit.
5. The gap between the coil and armature may be closed or too wide.
6. A piece part or foreign object may be lodged between the coil and armature.
7. The feeder bowl may be in contact with a rigid track, or the bowl and/or base drive unit may be making contact with other equipment.

When a vibratory feeder has an insufficient amount of vibration or slow, sporadic or irregular parts movement, it is usually due to one of the following reasons:

1. One or more springs, in the drive unit, may be cracked or broken.
2. It may be mounted on a base plate that is too thin which can cause an "oil can" effect, or flexing, that will absorb useful vibration.
3. The base plate may be mounted improperly, lacking rigidity. The feeder may be mounted on a common base plate that overhangs the machine base, thus generating insufficient vibration for parts movement. (The top plates on column-type stands or tables should be a minimum of 1-1/2" thick, so that they will not absorb vibration. Column-type stands should have Gusset reinforcements to add strength.)
4. The table may not be level or lagged down properly.
5. There may be an accumulation of foreign material on the bowl tracking surfaces.
6. The coil gap may be improperly set. The gap should be set as close as possible without the pole faces striking (pole faces should be parallel).
7. The machine may be cycling or indexing so sharply that it causes parts to fall from the tooling of the vibratory bowl.
8. The voltage to the controller may be fluctuating.
9. The base drive unit may need re-tuning to the power supply that is available in the area.
10. The parts may be out of tolerance, have burrs on them, be bent or warped or have oil, mold release or some type of lubricant on them which prevents proper movement.
11. The bowl clamp nuts which fasten the bowl to the cross-arms may not be tight or the bowl may not be properly seated in the clamp nuts. This is very important.
12. The bowl may be overloaded with parts. If overloaded, the vibratory motion will be erratic. There is a load range in vibratory feeding equipment that, if exceeded, will cause a loss of efficiency. Due to differences in part size, weight and configuration, the load for a feeder must be established by adding layers of parts to the bottom of the bowl until

the proper level is found for the most efficient operation. (Part level can be automatically maintained by a properly installed and adjusted auxiliary supply hopper.)

13. The bowl may not be tuned properly. Vibratory feeder tuning consists of the addition or removal of springs in the base drive unit. This balances the spring tension in proportion to the weight of the bowl that is mounted on it.

14. Occasionally after receiving a feeder, the piece part will be altered. Changes of part configuration will require new tooling on the bowl and re-tuning of the drive unit.

15. The use of air jets presents problems when they are not set properly (pressure set too high or too low). some things to look for: is the air supply contaminated? Does the air line contain water or oil? If so, this contamination will accumulate on the running surfaces of the bowl and create a condition that will slow down part movement or actually stop it. All air to a feeder system must be dry, filtered and regulated to achieve peak efficiency. A regulator must be used, to provide a consistent flow eliminating the high and low pressure factor and each air jet should be metered with a separate flow control valve. Attaching rigid lines or hard plastic tubing must be avoided as it dampens vibration and will cause problems with feed rates, as well as other tuning problems. Flexible nylon tubing or other soft, material tubing should be used to prevent interference with vibration from a base drive unit.

16. The power supply from the controller may not be the proper frequency. (Make sure that the switch on the power board is in the correct position.)

The following procedure should be used to check the tuning of any 60 or 120 HZ base drive unit:

With the variable speed controller on and the proper level of parts in the bowl, set the dial at 35% to 40% of the in-put voltage. Some parts movement should be detected at this point. If the feed rate is too slow, increase the controller setting slowly until the desired feed rate is attained. When 80% of the in-put voltage has been used without reaching the desired amplitude or there is excessive or violent vibration, check for interference points where something may be contacting the bowl or base drive unit, then follow these tuning techniques to achieve maximum efficiency:

1. Loosen a bolt on any one of the spring clamp blocks (preferably a lower bolt), very gradually, until the unit either speeds up or slows down. If the unit speeds up, it is over-sprung. If the unit is over-sprung, the thinnest spring from two opposing hangers must be removed. When replacing the springs they must be torque as specified on page 6.
2. If after this change, there is an under-sprung reading (if unit slows down when a bolt is loosened), thinner springs must be added back to the two opposing hangers. IMPORTANT! To maintain consistent, even feed motion, the number of springs in opposing spring packs must be equal.
3. The base unit should be slightly under-tuned, but the degree of under tuning must be established.
4. Springs tend to work-harden on the base drive unit that has been in operation for a period of time, causing it to be over-tuned. The same procedure as described in (1.) should be used to determine if this condition exists.
5. If a unit indicates that it is still under-sprung after a spring has been added, check for a spring that may be cracked or broken. This usually happens on the bottom portion of the spring, at the top of the spring clamp hanger. In some cases, the crack cannot be seen because of paint or because it may not be all the way through to the point where it is easily visible. The springs then should be removed and struck on a hard surface. If cracked, they will then break.
6. When looking for a broken spring, check the thickest spring first.
7. Make sure the bolts are long enough to fasten the springs to the spring hangers. For example, if a 5/16" thick spring has been added, there will be 5/16" less of the threads to hold the springs. When tightened, the threads may strip and the unit will give a false tuning reading. The same also applies to the bolts holding the armature or the bowl clamp nuts. The holes for these bolts are blind, therefore if a long bolt is used that bottoms out, it will seem to be tight when it actually is not. It is very difficult to check the tuning of a unit until this factor has either been ruled out or remedied.
8. Another factor that affects tuning is the stretching of the bolts that fasten the springs. We us grade "5" bolts, which are specially hardened for durability to prevent this from occurring.

9. The tuning of a base drive unit is affected when a weld is either broken or cracked in:
    a. The mounting flange of the bowl.
    b. The track or skirts
    c. The bottom of the return pan
    d. The braces, pan wall, discharge area (as a general rule, these condition will create a foreign noise and be easily detected.)
10. Another condition, that occasionally develops and is very difficult to detect, is when the bolts that hold the rubber feet onto the base drive are not properly tightened and back out. causing solid contact between the drive unit and mounting surface. This can cause the tuning to be mis-read. The way to check for this condition is to disassemble the unit from the common base plate, lift the unit up so that the feet are exposed and tighten the mounting screws.
11. It is very important that the clamp nuts that hold the bowl to the base drive are tight. When remounting or relocating a bowl on a base drive unit, use a 12" to 15" pipe on 9" to 15" units and one 36" to 48" long for 18" to 36" units. This give the necessarily leverage to really tighten the bolts. (For the best results, use a torque wrench.)
12. Also, never pull a bowl out, even slightly, from the clamp nuts to line it up with an existing track. Instead, level the drive unit itself. If the bowl is not level, parts may fall off or drift from the track prior to entering a selector causing track jams, mis-oriented parts and/or a loss of feed rate. A feeder must be level in order to maintain proper feed motion.
13. Another problem can result by omitting the thin shim (spring spacer) between the springs when springs are changed or added. These spacer shims are very important. If one is omitted, it has the same effect on a base drive's operation as adding springs, thus tuning cannot be checked properly. If a shim is not available, one should be made and installed. Don't take the easy way out and try to get by without it. This will only cause more problems later.
14. The feed rate will be affected if the base drive unit has been installed on a machine and all bolts that attach the rubber feet to the mounting plate are not securely located. These bolts are to prevent the unit from rotating on the plate4. When the drive unit is securely mounted to the plate, optimum feed motion will be transferred to the vibratory bowl. Also, make sure that the holes are drilled on center and that the rubber feet are not stretched when tightened. This will prevent tuning problems.
15. If the gravity or inline track is connected to the vibratory feeder to obtain vibration the feed motion of the bowl will be adversely effected. The solution is to use an independent inline base drive on the track to move either parts.
16. If a feeder bowl has "dead spots" most often, the problem can be found by looking 180 degrees from the location of these "dead spots". As a general rule, mass had been added without counter-balancing the bowl, the gap in the coil has been improperly set, there is a broken weld, broken spring; or a loose spring ;bolt. Any of these conditions may contribute to the problem.

BASE UNIT TORQUE REQUIREMENTS

	Clamp Nut Bolts		Spring Mount Bolts	
Bowl Dia	Bolt Size	Torque	Bolt Size	Torque
6	1/2-20	Wrench Tight	1/4-28	Wrench Tight
9	3/8-24	" "	1/2-20	80 Ft. Lbs.
12	" "	50 Ft. Lbs.	5/8-18	165 Ft. Lbs
15	" "	" "	" "	" "
18	5/8-18	165 Ft. Lbs.	7/8-14	351 Ft. Lbs.
22	" "	" "	" "	" "
28	" "	" "	" "	" "
36	" "	" "	" "	" "

USE A MINIMUM OF A CLASS '5' HEX HEAD BOLT.
TORQUE REQUIREMENTS USING A SOCKET ON A BREAKAWAY TYPE TORQUE WRENCH.

INSTALLATION AND TROUBLE-SHOOTING GUIDE FOR VIBRATORY STRAIGHT LINE DRIVERS

When the vibratory straight line driver will not transmit power to the horizontal vibratory track, it is often caused by one of the following reasons:

1. The power supply to the control may be inadequate.
2. The cord from the driver to the control may be improperly connected or damaged.
3. A fuse may be blown in the straight line driver controller.
4. A coil may be shorted out.
5. The gap between the coil and armature may be closed or too wide.
6. A piece part or foreign object may be lodged between the coil and armature or top member.
7. The straight line driver may be making contact with the vibratory bowl or other equipment such as the escape and placement station.

When a straight line driver has an insufficient amount of vibration or slow, sporadic or irregular parts movement, it is usually due to one of the following reasons:

1. One or more springs in the straight line driver may be cracked or broken.
2. It may be mounted on a base plate that is too thin which can cause flexing that will absorb useful vibration.
3. The base plate may be mounted improperly, lacking rigidity. The straight line driver may be mounted on a common base plate that overhangs the machine base, thus generating insufficient vibration for parts movement. (The top plates on column-type stands or tables should be at least 1-1/2" thick so that they will not absorb vibration. Column-type stands should also have gusset reinforcements to add strength.)
4. The bolts which attach the track to the aluminum top member of the straight line driver may be loose.
5. The table may not be level or lagged down properly.
6. There may be an accumulation of foreign material on the track surface.
7. The coil gap may be improperly set. The gap should be set as close as possible without the pole faces striking (pole faces should be parallel).
8. The voltage to the controller may be fluctuating.
9. The straight line driver may need re-tuning to the power supply that is available in the area.
10. The parts may be out of tolerance, have burrs on them, be bent or warped or have oil, mold release or some type of contamination on them which prevents proper movement.
11. Changes of part configuration may require new track tooling and re-tuning of the straight line driver.
12. The use of air jets presents problems when they are not set properly. (Pressure set too high or too low.) Some things to look for; is the air supply contaminated? Does the air line contain water or oil? If so, this contamination will accumulate on the running surfaces of the track and create a condition that will slow down part movement or

actually stop it. All air to a feeder system must be dry, filtered and regulated to achieve peak efficiency. A regulator must be used, to provide a consistent flow, eliminating the high and low pressure factor, and each air jet should be metered with a separate flow control valve. Attaching rigid lines or hard plastic tubing must be avoided as it dampens vibration and will cause interference with part pressure as well as other tuning problems. Flexible nylon tubing or other soft, flexible tubing should be used to prevent interference with vibration from a vibratory straight line driver.

13. The vibratory straight line driver may not be tuned properly. The tuning consists of the addition or removal of springs. This balances the spring tension in proportion to the weight of the track that is mounted on it.
14. Power supply from the controller may not be the proper frequency (make sure switch on power board is in correct position).

The following procedure should be used to check the tuning of straight line drivers:

With the variable speed controller on and the track full of parts, set the dial at 35% to 40% of the in-put voltage. Some parts movement should be detected at this point. If the feed rate is too low, increase the controller setting slowly until the desired feed rate is attained. When 80% of the in-put voltage has been used without reaching the desired amplitude or there is excessive or violent vibration, check for interference points where something may be contacting the track or driver, then follow these tuning checks for peak performance.

1. Loosen a bolt on any one of the spring clamp blocks (preferably a lower bolt), very gradually, approximately one-half turn until the straight line driver either speeds up or slows down. If it speeds up, it is over-sprung. If it is over-sprung, the thinnest spring from the spring pack with the most springs must be removed. If after this change, there is an under-sprung reading (if the unit slows down when a bolt is loosened), thinner springs must be added back to the spring pack with the least number of springs. It should be slightly under-tuned, but the degree of under-tuning must be established.
2. If the straight line driver indicates that it is still improperly tuned after a spring has been added, or removed, repeat #1 until the proper tuning is achieved (it is not necessary to have the same number of springs in each pack).
3. Make sure the bolts are long enough to fasten the springs to the spring hangers. If springs have been added, there will be less threads to hold them. When tightened, the threads may strip and the unit will give a false tuning reading. Most of the holes for these bolts are blind, therefore if a long bolt is used, that bottoms out, it will seem to be tight when it actually is not. It is very difficult to check the tuning of a straight line driver until this factor has either been ruled out or remedied.
4. Another factor that affects tuning is the stretching of the bolts that fasten the tuning springs. We use grad '5' bolts, which are specially hardened for durability. Make sure that all spring bolts and "hold down" bolts and nuts are tight.
5. Another problem can result by omitting the thin shim (spring spacer) between the springs when springs are changed or added. These spacer shims are very important. If one is omitted, it has the same effect as adding springs, thus tuning cannot be checked properly. If a shim is not available, one should be made and installed. Don't take the easy way out and try to get by without it. This will only cause more problems later.
6. If a vibratory straight line has a dead spot at either end, it may be eliminat4d by placing extra spring spacers between the spring and the casting. If the front end of the driver is running too slow, add spacers under the lower end of the front spring pack. If the rear of the driver is running too slow, add spacers under the top end of the rear spring pack. Sometimes by changing the number of springs in the lower spring packs (the vertical springs), the feed motion can be improved.

INSTALLATION AND TROUBLE-SHOOTING GUIDE FOR VIBRATORY HOPPERS

When the vibratory hopper drive unit will not transmit power to the hopper bin, it is often caused by one of the following reasons:

1. The power supply to the control may be inadequate.
2. The cord from the driver to the control may be improperly connected or damaged.
3. A fuse may be blown in the hopper driveunit controller.
4. A coil may be shorted out.
5. The gap between the coil and armature may be closed or too wide.
6. A piece part or foreign object may be lodged between the coil and armature or top member.
7. The hopper driver may be making contact with the vibratory bowl or other equipment such as the escape and placement station.

When a hopper drive unit has an insufficient amount of vibration or slow, sporadic or irregular parts movement, it is usually due to one of the following reasons:

1. One or more springs in the hopper driver may be cracked or broken.
2. It may be mounted on a base plate that is too thin which can cause flexing that will absorb useful vibration.
3. The base plate may be mounted improperly, lacking rigidity. The hopper driver may be mounted on a common base plate that overhangs the machine base, thus generating insufficient vibration for parts movement. (The top plates on column-type stands or tables should be at least 1-1/2" thick so that they will not absorb vibration. Column-type stands should also have gusset reinforcements to add strength.)
4. The bolts which attach the bin to the top member of the hopper driver may be loose.
5. The table may not be level or lagged down properly.
6. There may be an accumulation of foreign material on the bin surface.
7. The coil gap may be improperly set. The gap should be set as close as possible without the pole faces striking (pole faces should be parallel).
8. The voltage to the controller may be fluctuating.
9. The hopper driver may need re-tuning to the power supply that is available in the area.
10. The parts may be out of tolerance, have burrs on them, be bent or warped or have oil, mold release or some type of contamination on them which prevents proper movement.
11. Changes of part configuration may require bin reconfiguration or re-tuning of the hopper driver.

12. The use of air jets presents problems when they are not set properly. (Pressure set too high or too low.) Some things to look for; is the air supply contaminated? Does the air line contain water or oil? If so, this contamination will accumulate on the running surfaces of the track and create a condition that will slow down part movement or actually stop it. All air to a feeder system must be dry, filtered and regulated to achieve peak efficiency. A regulator must be used, to provide a consistent flow, eliminating the high and low pressure factor, and each air jet should be metered with a separate flow control valve. Attaching rigid lines or hard plastic tubing must be avoided as it dampens vibration and will cause interference with part pressure as well as other tuning problems. Flexible nylon tubing or other soft, flexible tubing should be used to prevent interference with vibration from a vibratory hopper driver.
13. The vibratory hopper driver may not be tuned properly. The tuning consists of the addition or removal of springs. This balances the spring tension in proportion to the weight of the track that is mounted on it.
14. Power supply from the controller may not be the proper frequency (make sure switch on power board is in correct position).

The following procedure should be used to check the tuning of hopper drivers:

With the variable speed controller on and the hopper full of parts, set the dial at 35% to 40% of the input voltage. Some part movement should be detected at this point. If the delivery rate is too low, increase the controller setting slowly until the desired proper rate is attained. When 80% of the input voltage has been used without reaching the desired amplitude or there is excessive or violent vibration, check for interference points where something may be contacting the bin or driver, then follow these tuning checks for peak performance.

1. Loosen a bolt on any one of the spring clamp blocks (preferably a lower bolt), very gradually, approximately one-half turn until the hopper driver either speeds up or slows down. If it speeds up, it is over-sprung. If it is over-sprung, the thinnest spring from the spring pack with the most springs must be removed. If after this change, there is an under-sprung reading (if the unit slows down when a bolt is loosened), thinner springs must be added back to the spring pack with the least number of springs. It should be slightly under-tuned, but the degree of under-tuning must be established.
2. If the hopper driver indicates that it is still improperly tuned after a spring has been added, or removed, repeat #1 until the proper tuning is achieved (it is not necessary to have the same number of springs in each pack).
3. Make sure the bolts are long enough to fasten the springs to the spring hangers. If springs have been added, there will be less threads to hold them. When tightened, the threads may strip and the unit will give a false tuning reading. Most of the holes for these bolts are blind, therefore if a long bolt is used and it bottoms out, it will seem to be tight when it actually is not. It is very difficult to check the tuning of a hopper driver until this factor has either been ruled out or remedied.
4. Another factor that affects tuning is the stretching of the bolts that fasten the tuning springs. We use grad '5' bolts, which are specially hardened for durability. Make sure that all spring bolts and "hold down" bolts and nuts are tight.
5. Another problem can result by omitting the thin shim (spring spacer) between the springs when springs are changed or added. These spacer shims are very important. If one is omitted, it has the same effect as adding springs, thus tuning cannot be checked properly. If a shim is not available, one should be made and installed. Don't take the easy way out and try to get by without it. This will only cause more problems later.
6. If a vibratory hopper has a dead spot, it may be eliminated by placing extra spring spacers between the spring and the casting. If the front end of the driver is running too slow, add spacers under the lower end of the front spring pack. If the rear of the driver is running too slow, add spacers under the top end of the rear spring pack. Sometimes by changing the number of springs in the lower spring packs (the vertical springs), the feed motion can be improved.