

**INSTALLING ROTATING MACHINES  
ON FLOORS, PIERS, AND MACHINE TABLES**

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**2. GENERAL**

**2.1 Scope**

2.11 This section describes methods for installing rotating machines on floors, piers, and machine tables. These machines must be installed in accordance with this section before they are run.

2.12 Any machines that are relocated or reinstalled must meet the requirements in this section.

**2.2 General Information**

2.21 Rotating parts of a machine are never perfectly balanced and some vibration is present in every machine. Transmission of this vibration to the supporting surface is prevented by mounting machines on flexible supports known as "vibration isolators". These isolators may be springs, rubber pads, rubber vulcanized to metal, or a combination of spring and

rubber. As the name implies, these supports merely prevent transmission of vibration of the machine. On the contrary, if not properly selected these isolators can amplify the machine vibration. The isolator must have a natural frequency of vibration well below the machine frequency of vibration. The isolators are normally rated in pounds load they will carry and this is how a commercial isolator is usually selected.

2.22 The machine designer is expected to position the isolators under the base so that each isolator supports the same amount of weight. After installation of the machine the isolators should be equally loaded and depressed unless there are high or low spots on the floor under isolators or the floor is considerably out of level. High spots under an isolator supporting a rigid machine base are especially bad because the machine may tend to "teeter" with the high isolator as the center point. This allows some parts of the machine to travel farther with each

vibration than it normally would and may cause eventual destruction of the machine or some of its parts. High spots under nonrigid bases are also bad as the base may be warped enough to change bearing clearances which can cause excessive wear or breakage of a shaft.

2.23 Grout should not be used under rotating machines to make up for floor irregularities. The floor must first meet the slope requirements in Paragraph 5 before the machine can be placed. Minor irregularities are then compensated for by the use of shims. Compressible floor coverings such as asphalt tile or linoleum must be cut out under the isolators, Paragraph 6, so that the isolator or base plate supporting the isolator rests directly on the floor.

### 2.3 Associated Information

2.31 Refer to Handbook 30 for method of laying out machine locations on floors and for information concerning installation in Earthquake Areas.

2.32 Refer to Drawing H-269-352 for vibration isolator locations for engine-alternators. Drawing H-269-352 should be furnished as one of the job drawings.

### 2.4 Precautions

2.41 Handle the 48 inch Level in the R-3223 Level Set with great care. After any jar it should be checked for adjustment. Do not use it as a straight-edge.

2.42 Do not overload the R-3099 Jack and lifting Toe. The maximum weight that can be raised with the Jack is 3,000 pounds. This means that the Jack can be used to raise one end of any standard motor generator set, exhaustor, two-motor alternator, and engine-alternators up to and including 100 KW.

## 3. INSTALLING EQUIPMENT

### 3.1 Tools

| Code   | Description               | Note |
|--------|---------------------------|------|
| R-3223 | 48" Adjustable Level Set  | 1,2  |
| R-1370 | Level, Bench (12" or 18") | 2    |
| R-3099 | Jack and Lifting Toe      | 3    |
| R-1516 | Tinner's Snips            |      |
| R-1060 | Knife, Putty              |      |
| R-2135 | Knife, Linoleum           |      |
| R-3105 | Torch, Propane            | 4    |
| R-3134 | Cylinder, Propane         | 4    |

### 3.2 Supplies

| Code      | Description              | Note |
|-----------|--------------------------|------|
| R-3096    | Shims, 4" x 8"           | 5,6  |
| RM-646726 | Varnish, Shellac, Orange | 7    |
| KS-7860   | Spirits, Petroleum       |      |
| R-1384    | Line, Chalk              |      |

## 3.3 Test Sets

| Code                        | Description             |
|-----------------------------|-------------------------|
| ITE-4137<br>or<br>ITE-4137A | Continuity Test Set (7) |

### NOTES:

- (1) For floor or pier mounted equipment such as engine-alternators, motor generator sets, two motor alternators, etc. Contains 48 inch adjustable Level, a Cross Test Level and two parallel bars.
- (2) May be used for leveling power room tables.
- (3) May be used to raise one end of floor-mounted rotating machines. Do not use on engine-alternators rated more than 100 KW.
- (4) Used for removing asphalt tile from a concrete floor. (In No. 3 Kit)
- (5) For engine-alternators rated 20 KW or more with rubber pad isolators. (Refer to Table 1). Order one package for sets rated 20-120 KW, inclusive; two packages for 170 KW sets; three packages for 300 KW sets.
- (6) May be used for shimming under isolators of motor generator sets with three support points. Or, as only a few shims may be required, these may be obtained locally.
- (7) Used in installing rubber pad isolators.

### 3.4 Test for Adjustment of 48 Inch Level

3.41 Place level on a rigid flat surface where it does not rock. Pick a surface where the slope is such that one end of the bubble falls within the group of five marks at one end of the vial. Mark location of the level on the surface with chalk or pencil. Note slope indicated by the position of the bubble in the vial. Turn level end-for-end and place it on the marks previously made on the surface. Again note position of bubble. If end of bubble is at the same mark for both positions of the level the adjustment is correct. Otherwise, adjust the level vial as in Paragraph 3.5.

### 3.5 Adjustment of 48 Inch Level

3.51 Loosen the locknuts at one end of the vial with the 417A Wrenches. Raise or lower this end of the vial by turning the nuts until the slope is indicated for both positions of the level in Paragraph 3.41. When this adjustment is reached carefully tighten the locknuts. Recheck the adjustment by turning the level end-for-end to make certain the level is still in adjustment.

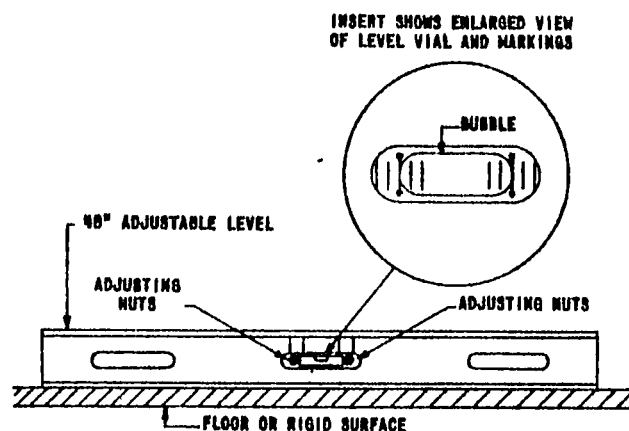


FIG. 1 METHOD OF CHECKING 48 INCH LEVEL ADJUSTMENT (PAR. 3.4)

#### 4. SEQUENCE OF INSTALLING OPERATIONS

##### 4.1 General

4.11 Before any engine-alternator, except KS-5667-01, motor generator set, two-motor-alternator centrifugal exhaustor or other floor or pier-mounted machine is placed in position, check floor slope, Paragraph 5. Ask the customer to correct the condition if the mounting area slopes more than 1/4 inch in ten feet in any direction.

4.12 Cut out compressible floor coverings under isolator locations as in Paragraph 6 before proceeding with any further leveling or installing operations. The floor coverings should be cut out before placing the machine whenever possible as it will be quite difficult to do the cutting with the machine in place.

4.13 Whenever possible have the riggers move the machine into place and install the vibration isolators. The riggers may also install the shim groups under each isolator, if isolator support areas were previously shimmed and shim groups removed from the floor for storage.

#### 4.2 Engine-Alternators

4.21 Refer to Table 1 for the various operations required for installing and leveling standard engine-alternators. Table 1 is a suggested sequence of operations and takes into account the type of isolators used on the machine and the leveling operations required.

4.22 While it is possible to perform the necessary leveling operations required on rubber pad isolators with the machine in place it is difficult and hazardous. Therefore, Table 1 indicates leveling for these isolators to be done before the machine is placed.

TABLE 1 ENGINE-ALTERNATOR LEVELING OPERATIONS

| KS NO.  | Vibration Isolator               | Check Floor Slope - Par. 5 | Remove Floor Covering Par. 6 Size of Cutout | Level Isolator Support Areas Paragraph 8.2 | Install Isolators | Adjust Isolators |
|---------|----------------------------------|----------------------------|---------------------------------------------|--------------------------------------------|-------------------|------------------|
| 5574-01 | Rubber Pad                       | Yes                        | 4" x 8"                                     | Yes                                        | Paragraph 8.7     | No               |
| 5665    | Rubber Pad                       | Yes                        | 4" x 8"                                     | Yes                                        | Paragraph 8.7     | No               |
| 5667-01 | Springs                          | No                         | -                                           | No                                         | Note 1            | No               |
| 5750    | Rubber Pad                       | Yes                        | 4" x 8"                                     | Yes                                        | Paragraph 8.7     | No               |
| 15521   | Rubber Pad                       | Yes                        | 4" x 8"                                     | Yes                                        | Paragraph 8.7     | No               |
| 15622   | Rubber Pad                       | Yes                        | 4" x 8"                                     | Yes                                        | Paragraph 8.7     | No               |
| 15717   | Rubber Pad                       | Yes                        | 3-1/4" x 6"                                 | No                                         | Paragraph 8.7     | No               |
| 15777   | Vibration Mountings Inc., SF6-80 | Yes                        | 7" x 16"                                    | No                                         | Paragraph 9       |                  |
| 15884   | GM Part                          | Yes                        | 5-1/2" x 8-1/2"                             | No                                         | Paragraph 11      |                  |
| 15890   | 5129907                          |                            | Note 2                                      |                                            |                   |                  |
| 15899   | Korf LKE-57                      | Yes                        | 5" x 12"                                    | No                                         | Paragraph 10      |                  |
| 15954   | Korf LKE-47                      |                            |                                             |                                            |                   |                  |
| 15929   | GM Part                          | Yes                        | 5-1/2" x 8-1/2"                             | No                                         | Paragraph 11      |                  |
|         | 5129907                          |                            | Note 2                                      |                                            |                   |                  |

NOTE 1: Bolt spring retainers to the base, insert top ends of springs in the retainers and lower the set. Springs are usually tagged to indicate on which end of the set they are used. If not identified, springs for the alternator end of the set are usually stiffer than those for the engine end.

NOTE 2: These isolators are 3" x 8-1/4" with a 5" x 8-1/4" base plate. Figure 7 illustrates this isolator.

## 5. CHECK OF MOUNTING AREA SLOPE

5.1 The floor or pier mounting area for engine-alternators, motor generator sets, two motor alternators and other floor-mounted rotating machines shall slope not more than 1/4 inch in ten feet in any direction. This is a requirement in BSP AA618.401. If the mounting area slopes more than this the telephone company should be asked to correct the condition. Check slope as follows:

5.11 Make sure the 48 inch Level in the R-3223 Level Set is in adjustment. Information for testing and adjusting the level is covered in Paragraphs 3.4 and 3.5 as well as on the chart in the shipping case.

5.12 Place one of the parallel bars found in the R-3223 Level Set at a corner of the mounting area or pier or just outside the base of the machine if it is already in place. Place the bar with the 3/4 inch face on the floor and the 6 inch dimension parallel to or along a boundary line. Ten feet away along the same boundary line, or an extension of it, place the other parallel bar in the same manner as the first bar. Place a straight edge, such as a piece of auxiliary framing or 2 x 4, on edge on the parallel bars. Place the 48 inch Level on top of this straight-edge.

5.13 Add shims (R-3096 or other material) at the low end of the straight-edge under the parallel bar at that end until the bubble in the level vial is centered. The maximum shim thickness that can be added at one end of the straight-edge is 1/4 inch when the distance is ten feet. On a pier where the supports for the straight-edge may be less than ten feet apart, the maximum shim thickness that can be added at any edge of the pier and still meet the requirement is:

pier dimension (feet)  $\times$  1/4 inches.  
10

5.14 Perform the operations in Paragraphs 5.12 and 5.13 for the other side of the mounting area or pier. For a pier that is not more than 48 inches wide use the level directly on the parallel bars without the straight-edge.

## 6. REMOVAL OF FLOOR COVERINGS

**NOTE:** When the machine is in place it will be necessary to raise the base of the machine several inches off the floor to remove floor coverings. The lifting screws furnished with engine-alternators can be used to raise their bases (see Paragraph 7) or appropriate jacks can be used for engine-alternators or other machines. Before working under the base of a machine block it securely with 2 x 4's.

6.1 Any compressible floor covering such as linoleum or asphalt tile shall be cut out at vibration isolator locations of engine-alternators, motor generator sets and other floor-mounted rotating machines.

6.11 **Marking:** Lay out centers for vibration isolators. Engine-alternator isolator locations are shown on Drawing H-269-352 or, in some cases, in the engine-alternator test section. The size of the rectangles are shown in Table 1. The size and location of motor generator isolators may have to be obtained from the machine when it arrives, or from a similar machine. It may be necessary to place the machine, mark around the isolators, and then move the machine so that floor coverings can be removed.

6.12 **Linoleum:** Cut around the marked areas with the R-2135 Linoleum Knife and pry up the pieces to be removed with the R-1060 Putty Knife. Remove any matting or other material directly under the covering.

6.13 **Asphalt Tile:** Heat the asphalt tile areas to be removed with the Propane Torch. The covering can then be scraped away in the marked area with the Putty Knife.

6.14 **Final Operations:** Remove any mastic or adhesive under the covering. (It may be necessary to soften this with KS-7860 Petroleum Spirits) Scrape the area thoroughly. A 1/16 inch thick shim makes a good scraping tool.

## 7. USE OF LIFTING SCREWS

7.1 If the base is to be raised with the lifting screws locate the screws in the box of loose parts. The KS-15899 engine-alternator will generally be shipped with them already mounted in the base. Steel plates about 1/8 inch thick should have been placed on the floor under the tapped holes in the base so that the lifting screws will not cut into the floor. The KS-15899 set has eight two-inch thick plates furnished which should be stacked two high (four inch total thickness) under each lifting screw.

7.2 To raise the base with the screws, thread each lifting screw into a tapped hole in the base and turn the screw down until it makes contact with the steel plate on the floor. Take one turn on each lifting screw in succession around the base until the base is raised to the desired height.

7.3 To lower the base with the lifting screws turn each screw in succession around the base in the direction to lower the base until the base rests on the vibration isolators or is at the desired level.

7.4 After lifting screws are no longer needed, they should be turned over to the customer. Coat threads of tapped holes in the base with grease to prevent rusting of threads. Do not leave lifting screws in the base unless requested to do so by the customer. In this case make certain that the bottom of the screws clear the floor by at least 1/4 inch.

## 8. LEVELING ENGINE-ALTERNATORS WITH RUBBER PAD ISOLATORS

**CAUTION:** If the machine has been placed and piping or conduit connected it will be necessary to loosen any exhaust piping or conduit before raising the base so that neither they nor their supports are damaged. Flexible water or fuel connections usually can take this movement without damage, but any rigid connections must be loosened.

### 8.1 General

8.11 Proceed with these operations after floor slope has been found satisfactory and floor coverings have been removed at isolator locations. If the machine is in place it will be necessary to raise the base about two inches off the floor. This can be done with the jack screws (See Paragraph 7) or with appropriate jacks and the base blocked up before proceeding with the following operations.

8.12 Machines with these rubber pad vibration isolators are not actually leveled but the supports for the isolators are leveled. Base plates 1/8 inch thick are furnished to support the isolators. These plates are individually leveled, using a cross-test level, by placing shims under the corners of the plates. Then all base plates are brought into the same level plane by using an accurate 48 inch Level and adding the required thickness of shims on top of the base plates. The general method will be the same whether the machine is in place or not but the measurements with the machine not in place are much simpler as can be seen by comparing the examples in Figures 3 and 4.

### 8.2 Level Individual Support Areas

8.21 Place 1/8 inch thick plates found in the R-3096 package of shims at each isolator location. These will be leveled as follows:

**NOTE:** Base plates and shims purchased locally should be made of low carbon steel and size should be 4" x 8".

8.22 Cut 1" x 2" shims from various thicknesses of R-3096 shim plates with the R-1516 Tinner's Snips. These shims will be used under the corners of the 1/8 inch plates to level each plate individually. Flatten these small shims in a vise and round off any rough corners and edges. It is not expected that base plate corners will have to be shimmed as much as 1/8 inch so that it will probably not be necessary to cut small shims of this thickness.

8.23 Place the R-95333 Cross Test Level found in the R-3223 Level Set on top of the 1/8 inch plate at one of the positions. (See Figure 2) Place the 1" x 2" shims, as required, under the corners of the plate until the bubbles in

the Cross Test Level are centered between the black lines on each vial. Place the shims at the corners of the plates with the 2 inch dimension along the 8 inch dimension of the plate as shown in Figure 2.

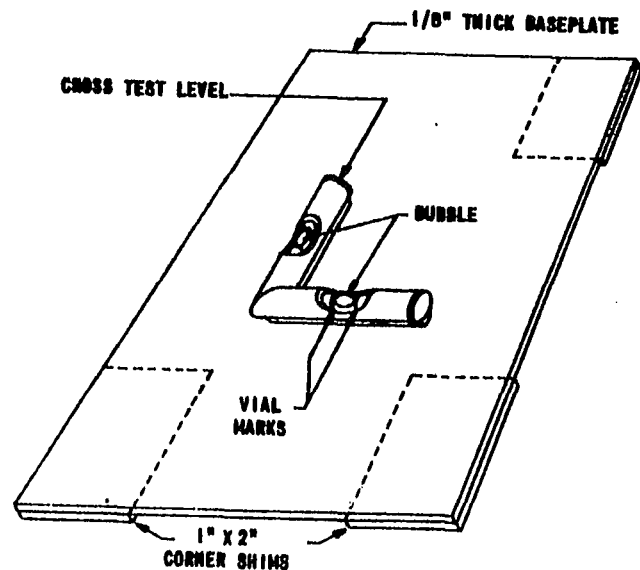


FIG. 2 METHOD OF INDIVIDUAL BASE PLATE LEVELING, USING CORNER SHIMS (PAR. 8.2)

8.24 After shimming to make the plate level it should not rock and at least one corner of the plate should touch the floor. It may be necessary to either readjust the number of shims at the corners or scrape a high spot on the concrete under a corner so that one corner of the plate will contact the floor.

8.25 Proceed in accordance with Paragraphs 8.23 and 8.24 to level the 1/8 inch plates at the other isolator locations.

8.26 After individually leveling all the 1/8 inch plates each group of shims required at a corner of a plate must be shellacked together and then shellacked to the corner of the plate. Take one position at a time. Turn the 1/8 inch plate over at this location. Carefully remove one group of corner shims from the floor at a time. Coat each shim with RM-646726 Shellac, slide the shims together, coat the correct corner of the plate with shellac and then slide the group of corner shims onto the corner. Hammer the shims lightly to squeeze out any air between the shims.

8.27 Replace each plate, with corner shim attached, in its correct location on the floor. Check that each plate is properly leveled individually by placing the Cross Test Level on top of the plate. These plates will not have to be disturbed again unless they are taken up and stored until the machine is placed in position.

### 8.3 Level All Isolator Support Areas

**FOREWORD:** Test the 48 inch Level for correct adjustment and adjust, if necessary. Information for test and adjustment of this level is in Paragraphs 3.4 and 3.5 as well as on the chart in the shipping case.

8.301 Choose a corner isolator location as Position No. 1. (See Figures 3 and 4) Number the other isolator locations consecutively around the mounting area in a clockwise direction from Position No. 1.

8.3011 Machine Not In Place: If isolator support areas are more than 48 inches apart (the length of the level) place 1/8 inch thick plates on the floor (directly on the covering) midway between these positions. Level these plates individually by corner shimming in accordance with Paragraph 8.2. Mark these added points in some way to distinguish them from isolator locations, such as Point A, Point B, etc. Mark the location on the floor with pencil or chalk.

8.3012 Machine In Place: If isolator locations are more than 48 inches apart place a parallel bar on the floor or floor covering midway between the isolator locations. Place the bar on its 3/4 inch face, at right angles to the machine base and with about two inches of the bar extending outside the base. Mark the location of the bar on the floor with pencil or chalk.

8.302 Begin a clockwise traverse with the 48 inch Level. Place one parallel bar on the base plate at Position No. 1 and the other bar on the plate at the next point or position in the clockwise direction around the mounting area. This is Position No. 2 in Figures 3 or 4.

8.3021 Machine Not In Place: Place each bar with its 3/4 inch face on the plate and center the bar along a diagonal of the plate.

8.3022 Machine In Place: Place the bars with their 3/4 inch face on the base plate and with the six inch dimension of the bar across the four inch dimension of the plate at the middle so that about two inches of the bar extends outside the base of the machine. When the floor has a covering that is cut out around the base plate it will be necessary to add a 1/8 inch thick plate on top of the base plate and place the parallel bar on top of the extra plate in order for the bar to clear the floor covering. Place sufficient weight on that part of the bar resting on the base plate or extra 1/8 inch plate so that the bar will support one end of the level.

8.303 Place the 48 inch Level on top of the bars at the two points being compared.

8.3031 Machine Not In Place: Position the level so that the vial is about centered between the base plates and the center line of the level is over the centers of the plates. At the low end of the level lift the parallel bar and place enough 4" x 8" shim plates on the base plate (under the parallel bar) to center the bubble in the vial of the level. The shims added at either of the two plates being compared indicates the difference in height between them. Record this difference in height and the direction; for example, Position No. 2 in Figure 3 is 1/64 inch higher than Position No. 1.

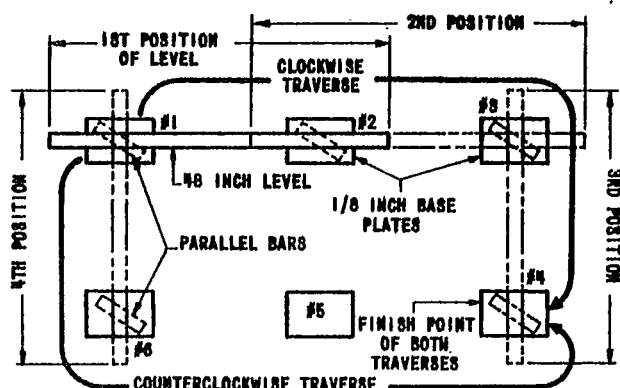
8.3032 Machine In Place: Position the level so that the vial is about centered between the bars and with the level itself parallel to the edge of the base and about 1/4 inch away from it. Under the low end of the level place small pieces of shim stock on the parallel bar to center the bubble in the vial. The shims added at either end of the level indicate the difference in height between the points being compared, provided no extra 1/8 inch plates were added at either point or 1/8 inch plates were added at both points to clear floor covering. The exception will be when a base plate having a 1/8 inch added plate is compared to an extra point consisting of a parallel bar laid on the floor covering. An example of this is shown in Figure 4 for the measurement between Position No. 3 with a 1/8 inch added plate and Point A, where Point A is 5/64 inch lower than Position No. 3 with the extra 1/8 inch plate. The actual difference in height between the two is:  $8/64 - 5/64$ , or  $3/64$  and Point A is  $3/64$  higher than the base plate itself at Position No. 3. Note and record differences in height and direction for the two points just compared.

8.304 At some measurement between a pair of points in a traverse a condition may occur where addition of a 1/64 inch shim raises the low end of the level too much. When this first occurs in a traverse the 1/64 inch shim may or may not be added, whichever provides the closer measurement. However, at the next occurrences of this condition in the same traverse the omission or use of the 1/64 inch shim must be alternated, no matter which provides closer adjustment to level. This includes measurements at any extra points as well as at isolator positions.

8.305 Remove the level. Remove any loose shims used under or on the parallel bars at either of the points just compared. Shift the parallel bars to the next pair of positions or points to be compared in the clockwise direction.

8.3051 Machine Not In Place: Place the parallel bars on the base plates in accordance with Paragraph 8.3021 and determine height difference and direction between the plates as in Paragraph 8.3031.

**EXAMPLE:** Assume an engine-alternator with six isolator locations. Machine is not in place. Floor covering has already been cut out at isolator support areas and 1/8 inch base plates have been placed and individually leveled. **PROBLEM:** Level all isolator support areas.

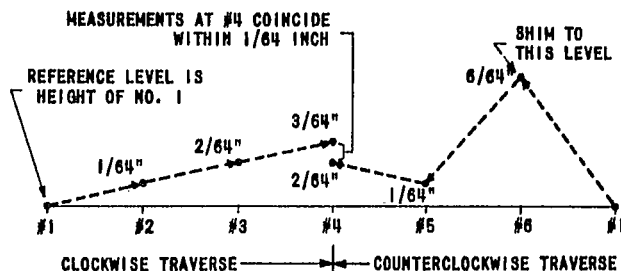


(a) Method of Making Clockwise and Counterclockwise Traverses of Isolator Positions

**Position**      **Height Differences**

#1 Start Clockwise Traverse  
 #2 is 1/64 inch higher than #1  
 #3 is 1/64 inch higher than #2  
 #4 is 1/64 inch higher than #3 (FINISH)  
 #1 Start Counterclockwise Traverse  
 #6 is 6/64 inch higher than #1  
 #5 is 5/64 inch lower than #6  
 #4 is 1/64 inch higher than #5 (FINISH)

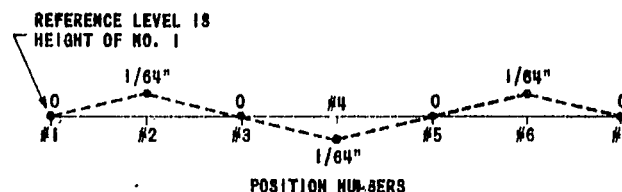
(b) List of Height Relations Determined by the Traverses



(c) Sketch of Isolator Position Heights and List of Full-Size Shims Required at Each Position

**Position**      **Height Difference**

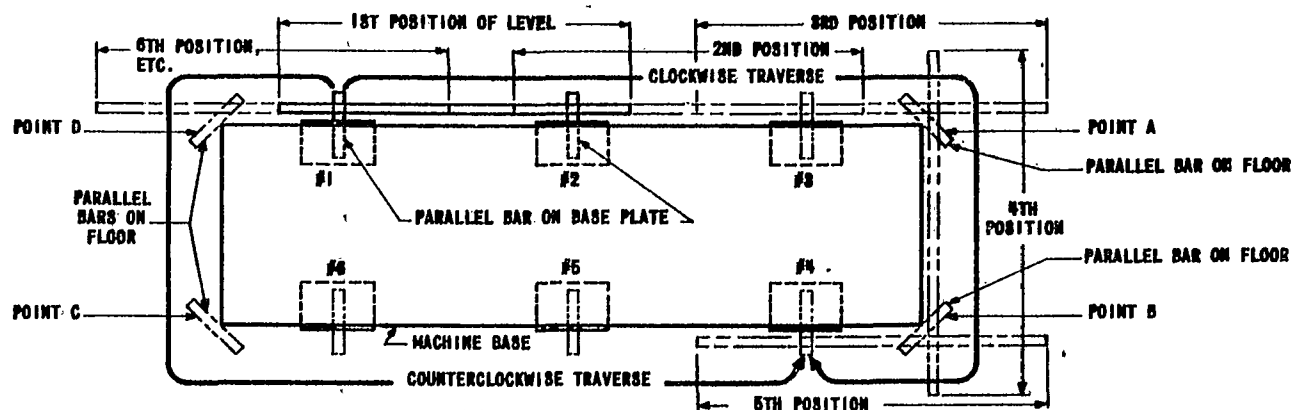
#1 Start Complete Traverse  
 #2 is 1/64 inch higher than #1  
 #3 is 1/64 inch lower than #2  
 #4 is 1/64 inch lower than #3  
 #5 is 1/64 inch higher than #4  
 #6 is 1/64 inch higher than #5  
 #1 is 1/64 inch lower than #6 (FINISH)



(d) List of Height Relations from Complete Traverse for Check of Leveling Operations and Sketch Made from these Height Relations

FIG. 3 EXAMPLE OF SUPPORT AREA LEVELING - MACHINE NOT IN PLACE (PAR. 8.3)

**EXAMPLE:** Assume an engine-alternator with six isolator locations. Machine is in place. Base has been raised about 2-1/2 inches, floor covering has been cut out at isolator locations and 1/8 inch base plates have been placed and individually leveled. **PROBLEM:** Level all isolator support areas.



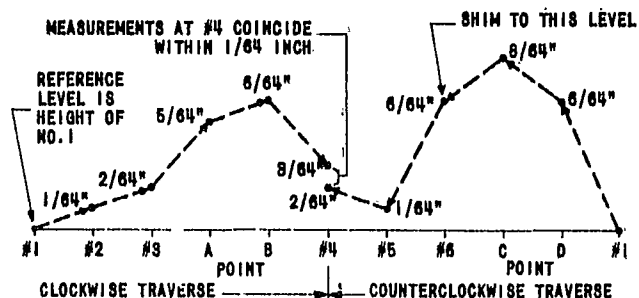
(a) Method of Making Clockwise and Counterclockwise Traverses of Isolator Positions with Machine In Place

Position

Height Differences

- #1 Start Clockwise Traverse  
 #2 is 1/64 inch higher than #1  
 #3 is 1/64 inch higher than #2  
 Point A is 5/64 lower than #3 + 1/8" or, 3/64 inch higher than #3  
 Point B is 1/64 inch higher than Point A  
 #4 + 1/8" is 5/64 higher than Point B or, #4 is 3/64 inch lower than Point B (FINISH)  
 #1 Start Counterclockwise Traverse  
 Point D is 2/64 inch lower than #1 + 1/8" or, 6/64 inch higher than #1  
 Point C is 2/64 inch higher than Point D  
 #6 + 1/8" is 6/64 inch higher than Point C or, #6 is 2/64 inch lower than Point C  
 #5 is 5/64 inch lower than #6  
 #4 is 1/64 inch higher than #5

(b) List of Height Relations Determined by the Traverses



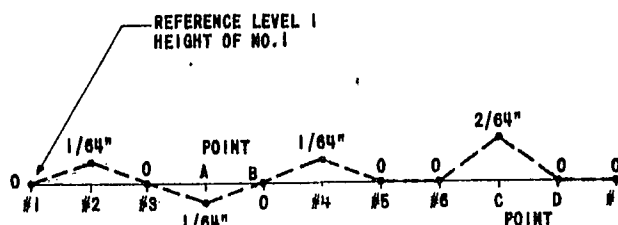
| Position | Difference in Height from #6 | Full-Size Shims Required |
|----------|------------------------------|--------------------------|
| #1       | 6/64 inch                    | 1/16 + 1/32              |
| #2       | 5/64 inch                    | 1/16 + 1/64              |
| #3       | 4/64 inch                    | 1/16                     |
| #4       | 3/64 or 4/64 inch            | Use 1/16                 |
| #5       | 5/64 inch                    | 1/16 + 1/64              |
| #6       | 0                            | 0                        |

(c) Sketch of Isolator Position Heights and List of Full-Size Shims Required at Each Position

Position

Height Difference

- #1 Start Complete Traverse  
 #2 is 1/64 inch higher than #1  
 #3 is 1/64 inch lower than #2  
 Point A is 1/64 inch lower than #3  
 Point B is 1/64 inch higher than Point A  
 #4 is 1/64 inch higher than Point B  
 #5 is 1/64 inch lower than #4  
 #6 is same level as #5  
 Point C is 2/64 inch higher than #6  
 Point D is 2/64 inch lower than Point C  
 #1 is same level as Point D (FINISH)



(d) List of Height Relations from Complete Traverse for Check of Leveling Operations and Sketch Made from these Height Relations

FIG. 4 EXAMPLE OF SUPPORT AREA LEVELING - MACHINE IN PLACE  
 (PAR. 8.3)



**8.3052 Machine In Place:** Shift the parallel bars as well as the extra 1/8 inch plate, if used on a base plate, to the next pair of positions or points in the clockwise direction. (Positions No. 2 and 3 in Figure 4). Place the parallel bars as indicated in Paragraph 8.3022 and proceed in accordance with Paragraph 8.3032 to determine the height relation between them. Note and record actual difference in height and direction for the points just compared.

**8.306** Proceed as in Paragraph 8.305 to determine and record height relations between each consecutive pair of points or positions in the clockwise direction around the mounting area until the finish point of the traverse (isolator position diagonally opposite the starting, or No. 1 position) is reached. This is position No. 4 in Figures 3 and 4.

**8.307** In order to complete the traverse around the end of the machine base place the parallel bars directly on the floor or floor covering at the corner of the base so that the bar makes a 45 degree angle with both edges of the base and the center of the bar is at the corner. Place the bar on its 3/4 inch face. (Points A, B, C and D in Figure 4 are required for this purpose). Mark the location of the bars with pencil or chalk on the floor or floor covering.

**8.308** Return to Position No. 1 and start a counterclockwise traverse around the mounting area. Place one parallel bar on Position No. 1 as in Paragraph 8.302 and one at the next position or point in the counterclockwise direction around the base. See Paragraphs 8.301 and 8.307 for establishing extra points to complete the traverse. Make height comparisons between the first pair of points in accordance with Paragraph 8.303 and record. Observe Paragraph 8.304 concerning the use of a 1/64 inch shim.

**8.309** After making the first height comparison in the counterclockwise traverse, shift the bars and level to the next pair of points or positions to be compared in the counterclockwise direction in the manner shown in Paragraph 8.305.

**8.310** Proceed as in Paragraph 8.309 to determine and record height relations between each consecutive pair of points or positions in the counterclockwise direction around the mounting area until the finish point of the traverse (isolator position diagonally opposite the starting, or No. 1 position) is reached. This is again Position No. 4 in Figures 3 and 4. See Paragraphs 8.301 and 8.307 for establishing extra points to complete the traverse.

**8.311** Make a sketch of isolator position heights from the information obtained in the two traverses. The sketch is plotted with No. 1 position as the base line or reference line. The

height of all extra points included in the traverse have to be plotted also in order to plot all position heights. A sample sketch, which does not have to be to scale, is shown in Figures 3 and 4(c). This sketch must show that the height of the last point in each traverse, which is the same point, coincides within 1/64 inch.

**8.312** Determine from the sketch of Paragraph 8.311 which isolator support area is the highest and the amount of shims required at the other isolator support areas to bring these areas up to the same level as that of the highest area. The highest point selected on the sketch must be an isolator support area and not an extra point, should an extra point be higher than the isolator positions.

**8.313** Temporarily add the required shims determined from the sketch of Paragraph 8.311 to each isolator position on top of the base plate. Proceed to check the leveling in accordance with Paragraph 8.4.

#### **8.4 Check of Leveling Operations**

**8.41** Check the completed leveling operation (shimming) by making a complete traverse of all base plates. Beginning at Position No. 1, with the 48 inch Level compare height of each pair of base plates (to which have been temporarily added the required shims) or added points completely around the mounting area and end up the traverse on Position No. 1. Note and record height difference and direction between each consecutive pair of positions or points. The actual operations used in this comparison will be the same as used in the clockwise traverses in Paragraph 8.3 whether the machine is in place or not. The extra points used in the complete traverse are the same ones previously used and marked in accordance with the paragraphs referred to. Examples of these complete traverses are shown in Figures 3(d) and 4(d).

**8.42** Make a sketch as shown in Figures 3(d) or 4(d) from the results obtained in the complete traverse of Paragraph 8.41. The sketch is plotted with No. 1 position as the base line or reference line and does not have to be to scale. The sketch has the following requirements:

**8.421** No isolator position, with its shims added, should appear more than 1/64 inch higher or lower than the reference line, which is the height of Position No. 1. Neglect the extra points used in the traverse.

**8.422** Adjacent pairs of isolator positions should not appear more than 1/64 inch apart on the sketch. Adjacent pairs of isolators in Figures 3 and 4 are: #1 & #2, #1 & #6, #2 & #3, #2 & #5, #3 & #4, #4 & #5, and #5 & #6.

**8.43** If the sketch indicates that requirements under Paragraph 8.42 are not met, the leveling is not satisfactory. Remove all the shims added on the base plates and repeat all the operations in Paragraph 8.3.

### 8.5 Final Leveling Operations

8.51 After leveling operations have been completed and the check in Paragraph 8.4 has been satisfactory, the full-size shims required at each isolator position should be shellacked together and then shellacked to the base plate. Take one position at a time. Carefully remove each group of full-size shims from the base plate. The thickest full-size shim should be placed at the top of the pile with the thinner shims next to the base plate. Coat each shim with RM-646726 Shellac, slide the shims together as a group press to remove any air bubbles, and then coat the bottom shim in the group with shellac and slide the group onto the base plate, taking care not to displace the base plate.

8.52 If the machine is not in place the shims may be removed from the floor and stored in accordance with Paragraph 8.6. If the machine is in place or moved in immediately after the support areas have been leveled proceed with applicable operations under Paragraph 8.7.

### 8.6 Storage of Shims:

8.61 If desired, the shim groups may be removed from the floor and stored until the machine is received.

8.62 Mark around each shim group on the floor before removing the shims. Mark isolator position numbers on each shim group and, after removing the shim group from the floor, mark the isolator position number on the floor on the support area. Also mark an arrow on each shim group with the head pointing toward one end of the mounting area, such as toward the engine end.

8.63 Remove each shim group from the floor and carefully wrap each group with paper. It would be well to make a sketch of all shims used in each group in case the shims ever become separated.

### 8.7 Installing Rubber Pad Isolators

8.71 Raise the base about three inches off the floor in order to have sufficient room to install isolators and shims on most sets. The Hercules Motors Corp. 20 KW set only has one thickness of rubber at each support point and needs to be raised only about two inches.

8.711 The R-3099 Jack and Lifting Toe may be used to raise one end of engine-alternators rated 20 to 100 KW. Machines rated higher than 100 KW will overload the jack.

8.712 Bases of standard engine-alternators rated 20 KW or higher have lifting screws provided. The screws are furnished as loose parts. The bases can be raised with these screws. See Paragraph 7.

8.72 Place the vibration isolator pads in the metal cups provided, put a metal cover on the top of the pads in the

cup and position the isolator assembly at the proper location under the base and on its leveled support area. A boss on the metal cover of the isolator assembly fits into a hole in the base of the machine. Isolator location holes are blind on Hercules 120 KW sets but isolator positions are marked on the side of the base with vertical red lines.

8.721 It makes no difference whether the rubber pads are placed with holes up or down. It is a good idea to be consistent, such as placing all pads in the cups with the holes in the same direction.

8.722 Metal cups and covers used to enclose the rubber vibration isolators must not be bent, dented, or otherwise damaged. Flatten or bend cups or covers into shape with a hammer or in a vise, if necessary. If it is impossible to reshape a cup or cover, or if they appear to be the incorrect size, order new ones.

8.723 Some isolator cups and covers are furnished with internal bosses that fit the center hole in the isolator pad. When these are furnished care must be taken that the holes in the center of the isolator pads fit over these positioning bosses.

8.73 Lower the machine with the jack screws (see Paragraph 7) or appropriate jacks so that it rests entirely on the vibration isolators. At this time the metal covers on each isolator shall not touch the isolator cup.

Check for contact between cup and cover with the buzzer test set.

8.74 If an isolator cup and cover make contact, raise the base of the machine, reposition the isolator cover on the cup, and lower the base. Again check for contact between cup and cover of the isolator assembly with the buzzer test set.

8.8 Painting of Shims: For the sake of appearance any bare shim or base plate area exposed around the vibration isolator assemblies may be painted with the touchup paint furnished with the engine-alternator.

## 9. LEVELING KS-15777 ENGINE-ALTERNATORS

9.01 Check mounting area slope. Paragraph 5, and remove floor covering, Paragraph 6, before proceeding. Vibration isolator locations are shown in Section 220 in this handbook.

9.02 The jack screws have to be used in this adjustment whether isolators are already under the base or not. Refer to Figure 5 which is a sketch of the isolator showing its assembly. Remove leveling bolts and lock nuts from all isolators. If isolators are not under the base place the loose isolators outside the base next to their proper locations indicated by the untapped holes in the base.

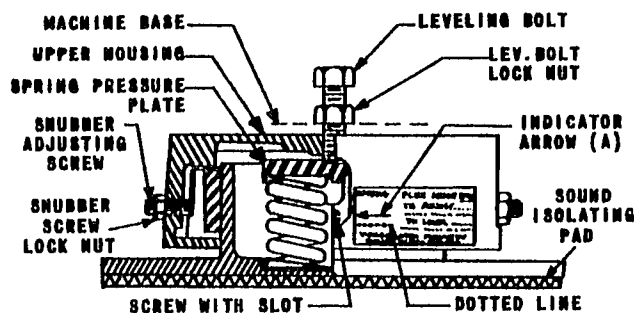


FIG. 5 SKETCH OF VIBRATION ISOLATOR (PAR. 9)

9.03 Using the jack screws raise the base of the machine until it will clear all the isolators, or, if isolators are already under the base, until they are free enough to be moved by hand.

9.031 Insert jack screws, found in the loose parts, into the eleven tapped holes in the base and turn the screws down until screw ends contact steel plates laid on the floor. The plates should be about 1/8 inch thick and can be obtained locally or from an R-3096 package or shims.

9.032 Raise the base by taking one turn on each screw in succession, beginning at one corner of the base and proceeding entirely around the base. Repeat this operation until the base clears the isolators. As the base is raised isolators already under the base will extend to their free (unloaded) height of about 5-1/8 inches. The loose isolators outside the base will already be extended to this height and will be used as feeler gauges to determine if the base is raised high enough.

9.04 After the base clears the isolators place a level such as the R-1370 Bench Level on top of the base, first along its length and then across it. Raise the low end and low side as necessary with the jack screws until the base is level in both directions.

**NOTE:** In order not to flex the base when raising the low end it will be necessary to turn the jack-screws on either side of the base an amount in proportion to their distance along the base. For example, if the low end is leveled by taking 1 turn more on the jackscrew, which should be done on both sides of the base, take 3/4 turn on jackscrews which are three-fourths of the distance from the fixed end and so on.

9.05 After the base is level find the minimum gap between any isolator and the base. Use R-3096 Shim material or the 1/16 inch thick shims furnished with the machine. After finding isolator with minimum gap to the base, lower the base until it

just touches the top of the isolator. Begin at one corner of the base, turn out the jackscrew there about 1/4 turn, and do this on each jackscrew in succession, proceeding entirely around the base. Repeat the operation until the base just touches the isolator that had the minimum gap, or depresses it slightly.

9.06 At this time check the gaps between the tops of the other isolators and the base, using the 1/16 inch thick shims furnished with the machines. Leave shims in place on the top of the isolators to fill the gaps but do not force any in place that will not fit. Lower the base until it rests entirely on the isolators. Take one turn out on each jackscrew in succession until the base rests on all the isolators and jackscrews clear the floor by about 1/2 inch.

9.07 Insert leveling bolts with locknut assembled through the holes in the base and into the tapped holes in the upper housing of isolators. Turn down all these leveling bolts until there is considerable restriction to turning, indicating the bolt end touches the spring pressure plate. Make a mark across the head of each bolt so that number of turns can be easily counted.

9.08 Turn all leveling bolts down two turns making a complete swing around the base. Repeat until indicator arrow (A) on one isolator lines up with slot in screw (B), then complete that trip around the base, taking two turns on the rest of the bolts. Make additional trips around the base, taking only one turn down on each bolt, skipping isolators with arrows lined up, and repeating the operation until arrows on all isolators either line up with the screw slot or are slightly above. If the dotted line on the plate rises above the screw slot on any isolator an additional shim is necessary at the top of the isolator. In this case it will be necessary to raise the base, insert the shim at this isolator, lower the base and adjust the isolator leveling bolt, if necessary. After all isolators are properly adjusted turn down the locknuts on the leveling bolts and tighten securely.

9.09 The snubber adjusting screws shown in Figure 5 are set at the factory for minimum snubbing. Additional adjustment is not required unless the machine moves lengthwise. To correct this condition, release snubber locknuts at each end of the isolator, and turn down snubber adjusting screws 1/4 turn at a time until movement is reduced to acceptable limits. Turn down locknuts to lock the adjustment.

9.10 After vibration isolator adjustment is satisfactory, remove the jack-screws and turn them over to the customer. Put grease in the tapped holes in the base to prevent rusting.

#### 10. LEVELING KS-15899 AND KS-15954 350KW ENGINE-ALTERNATORS

10.01 Check mounting area slope, Paragraph 5, and remove floor coverings, Paragraph 6, before proceeding.

Vibration isolator locations are shown on Drawing H-269-352. A sketch of the isolator is shown in Figure 6.

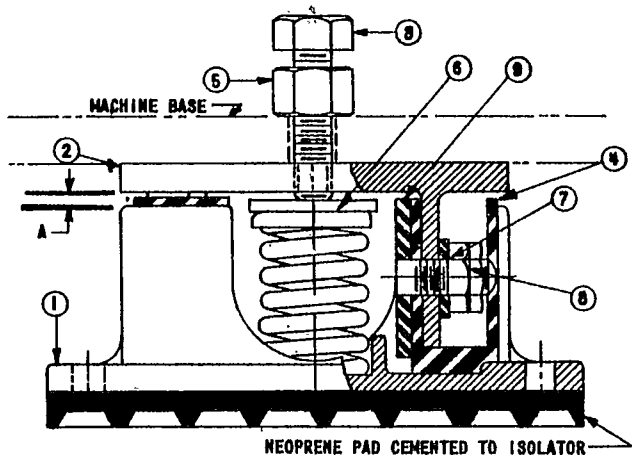


FIG. 6 CUT-AWAY VIEW OF KORFUND ISOLATOR (PAR. 10)

10.02 Place the machine and raise the base approximately four inches so that the isolators can be positioned under the machine. Lifting screws, see Paragraph 7, or appropriate jacks may be used to raise the base.

10.03 Before placing isolators under the machine, release nuts 7 and 8 at each end of the isolator until compression plate 9 does not bind the snubber 4.

10.04 Remove bolt 3 and locknut 5, place isolators in correct position under the machine base and lower machine to rest on top of isolator, plate 2.

10.05 Insert bolt 3, with locknut 5 assembled, through the hole in the machine base and into the tapped hole in the top plate of the isolator. In this way thread all isolator bolts through the machine base and into the top of the isolator and turn down all bolts until they make contact with the compression plate 6 resting on top of the springs.

10.06 Screw down one complete turn on each leveling bolt 3 on each isolator, making a complete circuit of all isolators and continue this procedure, causing the top plate to rise, until there is at least 1/4 inch clearance at "A" on all isolators.

10.07 Check top of machine base for level both lengthwise and across the base using a bench level such as R-1370. If base is not level screw down an equal amount on the leveling bolts on isolators at the low end or low side until top of base is level. The 1/4 inch clearance at "A" can be exceeded, but "A" must be at least 1/4 inch on all isolators.

10.08 When level is satisfactory tighten locknut 5.

10.09 The horizontal adjustment is made with the machine operating. Tighten nut 7 at each end of all isolators until the bolts are finger tight, or until there is no horizontal play in the bolts. Tighten locknut 8.

10.10 If horizontal movement of the machine appears to be excessive, loosen locknut 8 and tighten nut 7 on all isolators 1/4 turn. If movement is still excessive take up an additional 1/4 turn on these adjustments on all isolators. When adjustment is satisfactory tighten locknuts 8.

## 11. LEVELING KS-15884, KS-15890 AND KS-15929 ENGINE-ALTERNATORS

11.1 Check mounting area slope, Paragraph 5, and remove floor coverings, Paragraph 6, before proceeding. Vibration isolator locations are shown on Drawing H269-352. The isolator dimensions J and K on the drawing are 3" and 8-1/4", respectively. However, the base plate on these isolators extends 2" over one edge. See Figure 7 for a sketch of this isolator.

11.2 Place the machine and raise the base (5" for KS-15884 and KS-15890 and 2" for KS-15929) to clear isolators. Lifting screws or appropriate jacks may be used.

11.3 Place all isolators under the machine as follows. Remove adjusting bolt and locknut, position the isolator under the base and insert the adjusting bolt through the hole in the machine base and into the tapped hole in the top of the isolator. When the isolators are not bolted down, the base plate can be turned so that the two holes on the plate are inside the base. Turn down the adjusting bolt until it just makes contact with the compression plate.

11.4 After all isolators have been located under the base as in Paragraph 11.3, lower the set to rest directly on all isolators. (Remove base jack screws) then take one turn down on each isolator adjusting bolt, making a complete circuit of all isolators. Continue this procedure, one turn at a time, until all isolators have at least 1/4 inch clearance at "A".

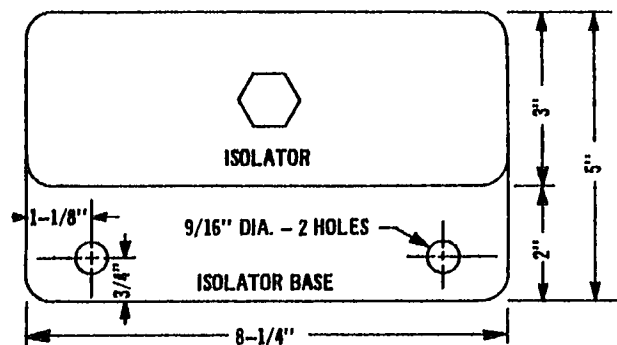
11.5 Check top of machine base for level both lengthwise and across the base using a bench level such as R-1370. If base is not level take additional turns down on the adjusting bolts for the isolators on the low end or low side until the top of the base is level. The 1/4 inch clearance at "A" can be exceeded, but "A" must be at least 1/4 inch on all isolators.

11.6 When level is satisfactory tighten the locknut on the adjusting bolt.

## 12. MOTOR GENERATOR SETS

### 12.1 General

12.11 Before installing any motor generator, the floor slope requirement in Paragraph 5 must be met and floor coverings removed at isolator locations as in Paragraph 6.



NOTE: ISOLATORS WILL NOT NORMALLY BE BOLTED DOWN EXCEPT IN EARTHQUAKE AREAS. TURN MOUNTING HOLES INSIDE THE BASE WHEN NOT BOLTED DOWN.

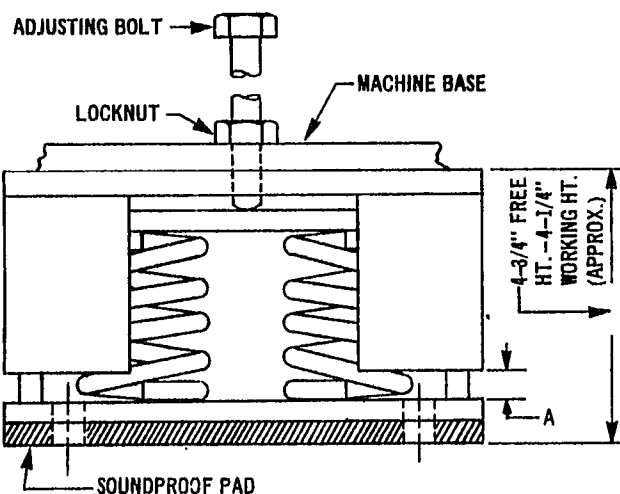


FIG. 7 ISOLATOR FOR KS-15884, KS-15890 AND KS-15929 ENGINE-ALTERNATORS

12.12 After the above operations are completed, proceed with leveling operations in Paragraph 12.21 for machines having three isolators and Paragraph 12.22 for machines having four or more isolators.

12.13 None of the vibration isolators furnished on present machines are adjustable. Machines having four or more isolators will have shims furnished by the supplier for leveling. These shims are placed between the top of the isolator and the base to level the top of the base.

## 12.2 Leveling

### 12.21 Machine With Three Isolators

12.211 No leveling is required for these machines.

12.212 After the machine is installed on the isolators, at least 50% of the base area of each isolator shall contact the floor.

12.2121 Check this requirement by running a card or stiff piece of paper around the outer edges of the base of the isolator.

12.2122 If less than one-half the base area of an isolator appears to be in contact with the floor, add sufficient shim material, purchased locally, under the bottom of the isolator to meet the requirement in Paragraph 12.212.

### 12.22 Machine With Four or More Isolators

12.221 Each isolator support area, including shims, if any, should be level within 1/32 inch with the area, including shims, if any, on which each other pad rests.

12.2211 This requirement may be considered met if shims (furnished by the supplier) are placed at the top of the isolators so that the top of the base slopes not more than 1/32 inch in the length of the base nor more than 1/32 inch in the width of the base.

12.222 Before proceeding further test the 48 inch Level for correct adjustment and adjust if necessary. Information for test and adjustment of this level will be found on the chart in the shipping case as well as in Paragraphs 3.4 and 3.5.

12.223 Place the 48 inch Level on top of the base parallel to the long edge of the base.

12.224 Raise the low end of the base with a bar or the R-3099 Jack and Lifting Toe until the base is level lengthwise. Block the machine in this position and use the shims furnished with the machine to "feel" the gap between the top of the isolator and the underside of the base. Place the shims required for this leveling temporarily in place and then remove the blocking so that the base rests directly on the shims. Mark the position of the level on the base with chalk or tape so that the level can be placed in the same position later.

12.225 Place the 48 inch Level somewhere on top of the base across the base. Raise the low end or low corner of the base with a bar or the R-3099 Jack and Lifting Toe until the base is level crosswise. Block the machine in this position and again "feel" the gaps between the top of the isolator and the underside of the base. Place the shims required for this leveling temporarily in place and then remove the blocking so that the base rests directly on the shims. Mark the position of the level on the base with chalk or tape so that the level can be placed in the same position later.

12.226 Again perform operations in Paragraphs 12.224 and 12.225 placing the level on the positions previously used and marked.

12.227 Check the leveling of the base along the length and width as follows:

12.2271 Place the 48 inch Level on the base along the longer dimension of the base on the position previously marked and used.

12.2272 Under the low end of the level and sufficient shim material (between the base and the level) to center the bubble in the vial. The machine is satisfactorily leveled if this does not require more than a 1/64 inch thick shim to be placed at either end of the level to cause the bubble to be centered in the level vial.

12.2273 Place the 48 inch Level on the base across the narrower dimension of the base on the position previously marked and used.

12.2274 Repeat Paragraph 12.2272 for this position of the level.

12.228 If more than a 1/64 inch shim is required at one end of the level in either direction it will be necessary to repeat the operations in Paragraphs 12.224 and 12.225 and then repeat the check in Paragraph 12.227.

12.229 After checking leveling by the operations in Paragraph 12.227 and finding it satisfactory, tighten isolator bolts or nuts on the studs to hold the isolators securely to the base.

### 13. OTHER FLOOR-MOUNTED MACHINES

13.1 Heavy floor mounted equipment such as two-motor alternators should be leveled in the same way as motor generators with four or more isolators as in Paragraph 12.22 using the shims furnished with the machine or providing shims

→ Arrowed lines indicate new or changed information.

[ Vertical line at side of paragraphs indicates requirements.

of some kind to fit between the top of the isolator and the underside of the base. Floor slope requirement in Paragraph 5 should be met and floor coverings should be removed under isolators as in Paragraph 6.

13.2 Equipment such as centrifugal ex-hausters that are bolted to the floor generally have no leveling requirement beyond a floor slope requirement. The floor mounting area shall slope not more than 1/4 inch in ten feet in any direction. This may be checked by the method in Paragraph 5. If the floor slopes more than this the telephone company should be asked to correct the condition. Shims used under machines bolted to the floor will be used to make up for floor irregularities so that the base of the machine is not warped when bolted to the floor rather than to accomplish leveling as long as the floor meets the slope requirements.

### 14. POWER ROOM TABLES

14.1 The top of a table used for mounting rotating machines should be as level as possible. The top of the table must not slope more than 1/32 inch per foot in any direction. Either the 48 inch Level in the R-3223 Adjustable Level Set may be used for this check, or the R-1370 Bench Level placed on a straight-edge as long as the table side may be used.

14.2 Shim table legs on the floor with shims purchased locally or with R-3096 shims until the top of the table slopes not more than 1/32 inch per foot in any direction. With the level or straight-edge extending along side of the table place shims under the low end of the straight-edge or level at the corner of the table to center the bubble in the level vial. If it requires more shim thickness than 1/32 inch times the number of feet on the side, with a maximum of 1/8 inch allowed on a side, the table has not been properly shimmed. Check the slope of the other dimension of the table top in the same way. Shim table legs until the slope requirement in this paragraph is met for length and width of the table top.

Engineer of Installation

Reason for Reissue:

- (1) To include KS-15929 Engine-Alternator.
- (2) To change information on KS-15884 and KS-15890 Engine-Alternators to show new vibration isolator.

Replaces Section 129 dated 10-20-60.