

VERTICAL DRIVE SHAFTS  
 AND ASSOCIATED APPARATUS

1. GENERAL

1.01 This addendum covers revisions in the requirements covering Location and Alignment of Shafts and Bearings, Starting Torque Test and Mounting of Eccentric Coupling Guard. It also covers changes in the adjusting procedures for Location and Alignment of Shafts and Bearings and Mounting of Eccentric Coupling Guard. It supplements Section A401.701, Issue 3-D and replaces Issue 3-D of the addendum to this section. This addendum is reissued to cover revisions in the requirements covering Location and Alignment of Shafts and Bearings (2.06) and Starting Torque Test (2.11). Detailed reasons for reissue will be found at the end of the parts affected.

2. REQUIREMENTS

2.001 The following requirements replace requirements 2.06, 2.11 and 2.18 of Section A401.701, Issue 3-D.

2.06 Location and Alignment of Shafts and Bearings

(a) Shafts Associated with Sequence Switches The front to rear location of the vertical drive shaft shall be such that the centerline of the shaft is not more than 3/32" from the centerlines of the sequence switch cam shafts. Use the No. 120A gauge.

Exception: On shafts which are associated with 15 sequence switch positions or less (single sided frames) and which are not equipped with a 10 type bearing, the center line of the shaft shall be in front of the center line of the sequence switches.

Min. 1/32"  
 Max. 3/32"

Use the No. 120A gauge.

(b) All Other Shafts The bearings nearest the top and bottom reference holes shall be so located that:

(1) Fig. 1 (A) - The perpendicular distance between the centerline of the vertical drive shaft and the centerline of the reference hole is 2-11/64" ± 1/32".

(2) Fig. 1 (B) - The perpendicular distance between the spot face of the channel and the centerline of the vertical drive shaft is 1-1/4" ± 1/32" measured at a point just beneath the bearings.

Note: When necessary to check requirements (b1) or (b2), the W.E. CO. R-2447 gauge may be used.

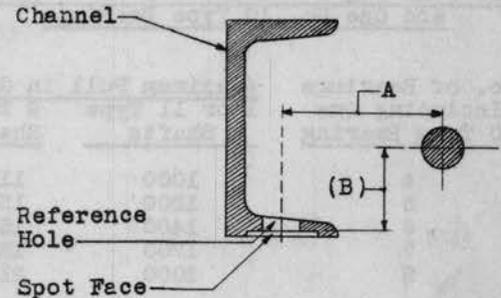


Fig. 1

(c) All Frames The bearings shall be not more than 1/64" from the true alignment.

2.11 Starting Torque Test The pull required to start the rotation of a shaft, from any position of rest about its axis, at the radius of the shaft shall be as follows.

Shafts Having 1 Type Ball Bearings Exclusively

No. of Shaft Bearings	#Max. Pull in Grams
4	700
5	800
6	900
7	1000
8	1100

Shafts Having Graphalloy Bearings Exclusively

No. of Shaft Bearings	#Max. Pull in Grams
4	800
5	1000
6	1200
7	1400
8	1600

2.11 (Continued)

Shafts Having a Combination of 1 Type Ball Bearings and Graphalloy Bearings

No. of Shaft Bearings	#Maximum Pull in Grams						
	No. of Graphalloy Bearings						
	1	2	3	4	5	6	7
4	725	750	775				
5	850	875	925	950			
6	950	1000	1050	1100	1150		
7	1050	1125	1175	1225	1275	1350	
8	1150	1225	1275	1350	1425	1475	1525

Shafts Having a Combination of Graphalloy and One No. 10 Type Bearings

No. of Bearings Including One 10 Type Bearing	#Maximum Pull in Grams	
	1 or 11 Type Shafts	9 Type Shafts
4	1000	1100
5	1200	1300
6	1400	1500
7	1700	1800
8	2000	2100

Note: Add 400 grams to these values for the starting torque of shafts equipped with a 16 type drive. The torque shall be measured on the lower or high speed shaft.

Use the No. 79E gauge.

Before checking this requirement the gear guards shall be removed and any outside cause of friction such as the interrupter gears, the coupling and driving discs touching the driven discs, etc., eliminated.

This requirement may be checked for by the Telephone Company if they require it before the Installation Department has mounted the coupling between the vertical drive shaft and the vertical shaft of the drive.

2.18 Mounting of Eccentric Coupling Guard

(a) Fig. 2 (A) - The vertical clearance between the bottom edge of the eccentric coupling guard and the upper edge of the oil guard shall be  $1/16"$   $\pm$   $1/64"$ . Gauge by eye.

(b) Fig. 2 (B) - The upper surface of the eccentric coupling guard collar shall be approximately flush with the upper surface of the associated No. 100A adapter unless the adapter mounts directly against the No. 5A drive hub in which case the coupling guard collar may extend up above the adapter. Gauge by eye.

(c) Fig. 3 (A) - When the eccentric coupling guard mounts on a No. 5A drive hub it shall overlap the straight sides of the hub by approximately  $5/32"$  except in cases where the No. 100A adapter is mounted directly against it. Gauge by eye.

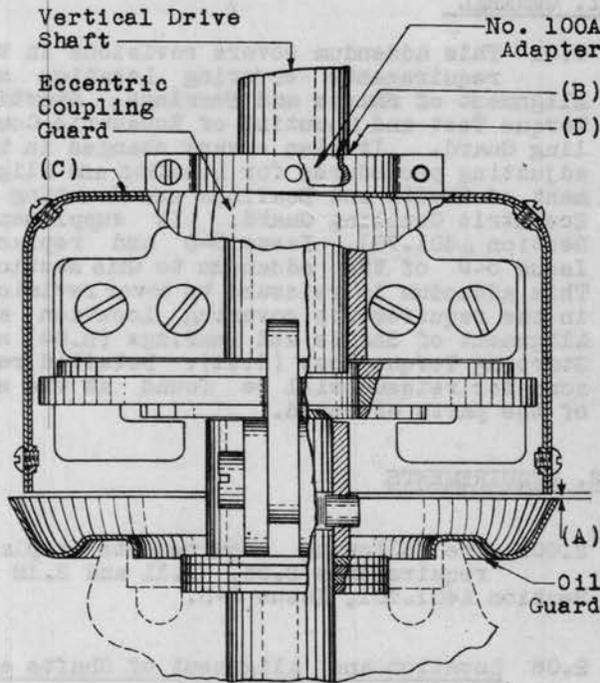


Fig. 2

(d) The following points shall be sealed with KS-6824 sealing compound.

(1) Fig. 2 (C) - The joints where the eccentric coupling guard halves overlap.

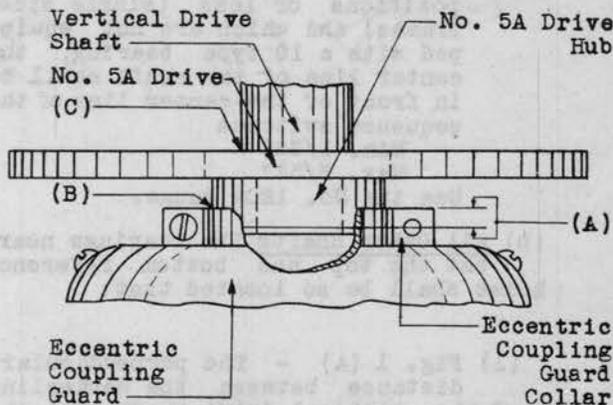


Fig. 3

2.18 (Continued)

- (2) Fig. 2 (D) - The joints between the eccentric coupling guard collar and the No. 100A adapter (where used) and the slots in the collar.
- (3) The slots in the No. 100A adapter and the joint between the adapter and the shaft.
- (4) Fig. 3 (B) - The joints between the eccentric coupling guard collar and the No. 5A drive (where used to mount the coupling guard) and the slot in the collar.
- (5) Fig. 3 (C) - The joint between the No. 5A drive and the shaft.

Note: Eccentric coupling guards are not required on 33, 34, 45, 46, 47, 48 and 1034 type drives.

REASON FOR REISSUE - CHANGES IN REQUIREMENTS

- 1. To revise the requirement covering Locations and Alignment of Shafts and Bearings (2.06).
- 2. To revise the requirement covering Starting Torque Test (2.11).

3. ADJUSTING PROCEDURES

3.001 Additional Tools, Gauges and Materials

<u>Code No.</u>	<u>Description</u>
<u>Tools</u>	
449A (2 required) (or the re-placed R-1648, Detail No. 2)	Cord Holding Detail
450A (or the re-placed R-1648, Detail No. 3)	Substitute Disc
R-1313	Fish Line
<u>Gauges</u>	
120A	Shaft Locating Fixture
<u>Materials</u>	
P-126419	Washers
-	Aluminum Paint
-	Small Paint Brush

3.002 The following procedures replace procedures 3.06 and 3.18 of Section A401.701, Issue 3-D.

3.06 Location and Alignment of Shafts and Bearings (Rq.2.06)

(1) The closer bearings are spaced the more important it is to put the bearings in correct alignment. A small amount of misalignment under such conditions will produce a bind.

(2) Check the location of the vertical drive shaft with respect to the sequence switches as follows: When checking the shaft opposite an "A" type sequence switch, move the slider of the No. 120A gauge to the left as far as possible or if the shaft is checked opposite a "B" type sequence switch, move the slider to the right as far as possible. Place the gauge in position with the "V" prong of the slider on the bearing pin and the large "V" prong on the driven disc spacing collar as shown in Fig. 4. There may be cases where this will cause the prong on the left to touch the "A" cam. In these cases, move the gauge slightly to the left until it clears the cam. Hold the gauge so that it is horizontal. The plunger of the gauge should rest against the vertical drive shaft and the indicator will show the front to rear location of the vertical drive shaft with respect to the sequence switch. If the indicator is within the extreme outside lines, the shaft is satisfactorily located. If however, the indicator is outside these lines and points toward the sequence switches, it is an indication that the shaft is too far forward and conversely if the indicator points away from the switch, it is too far toward the rear of the frame.

(3) When checking vertical drive shafts (short shafts) associated with 15 sequence switch positions or less and not equipped with 10 type bearings, note that the gauge reading as shown in Fig. 5 indicates that the center line of the shaft is in front of the center line of the sequence switches. The shaft is so positioned in order to reduce the possibility of the drive shaft climbing when a number of associated sequence switches are operated simultaneously. In the case of the longer shafts this is not necessary because the weight of the shaft tends to prevent its upward movement.

(4) If misalignment is noted, proceed as follows. If the shaft is too far forward with respect to only four or five switches, insert as many P-126419 washers as required between the sequence switch mounting strap and sequence switch frame. To do this, loosen the upper left-hand and lower right-hand sequence switch mounting screws and remove the lower left-hand mounting screw with the 4" regular screw-driver. Hold the wash-

3.06 (Continued)

er or washers in the fingers and slide them between the sequence switch frame and the strap over the sequence switch mounting screw hole. Tighten the other mounting screws to hold the washer or washers in place. Then grasp the head of the mounting screw with the long nose pliers and insert the screw in the mounting hole. Hold the screw in this position and run it in a few turns with the screw-driver. Then loosen the lower right-hand screw and remove the upper left-hand screw with the screw-driver and insert the washer or washers between the strap and the frame as outlined above. Tighten the lower mounting screws securely holding the washer or washers in place. Insert the mounting screw and tighten it securely. Remove the lower right-hand screw with the 4" regular screw-driver and insert the washer or washers between the strap and the frame as outlined above. Insert the mounting screw and tighten it securely. Recheck the location of the shaft as outlined in (2). If the shaft is too far forward opposite more than four or five switches or if the shaft is too far back give consideration to realigning the shaft.

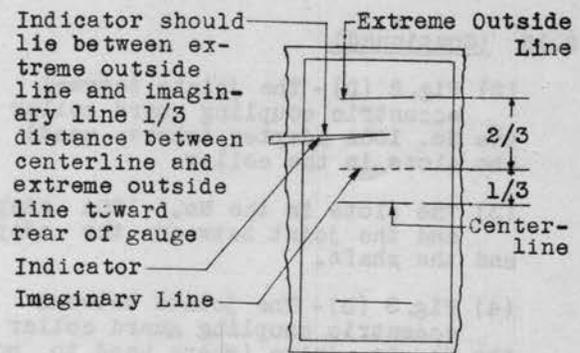


Fig. 5 - Gauging Limit When Checking Short Shafts

switch adjacent to the bearing bracket to be realigned and note the position of the shaft with regard to the average position. On all bearings except Nos. 1B, 1F and 1H bearings, loosen the bracket mounting screws or bracket clamping bolts with the No. 245, 246 or 305 wrench. On the No. 1B, 1F and 1H bearings, use the 4" regular screw-driver to loosen

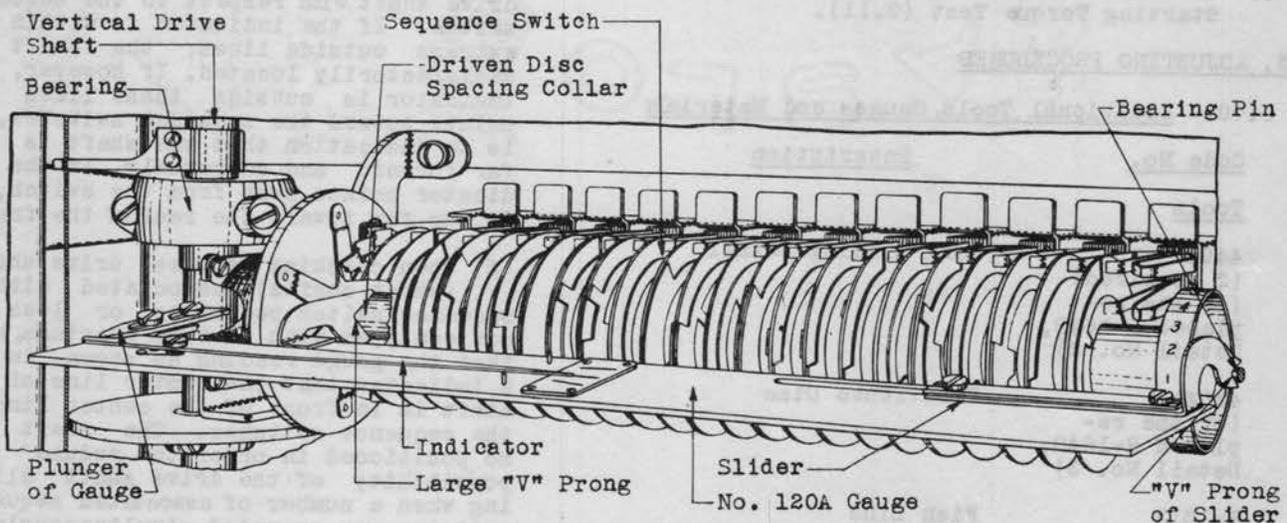


Fig. 4 - Method of Checking Alignment of Bearings

(5) Before realigning a shaft, note whether the misalignment is in one direction. Also, note whether that portion of the shaft which is satisfactorily aligned, leans in the same direction as that portion of the shafts which is not within limits. In this case, determine the best average adjustment within limits and readjust the shaft to this average position as follows. Place the No. 120A gauge against the sequence

the mounting screws. Adjust the aligning screws of 1 type bearings with the No. 245 or 305 wrench or shift the bearing bracket of 13 type bearings as required. Tighten the mounting screws or clamping bolts enough to hold the bracket in place and recheck the position of the shaft with the gauge. After the bracket is satisfactorily aligned, tighten the mounting screws securely. Realign the other bearing brackets on the shaft in the same manner.

## 3.06 (Continued)

(6) If the misalignment is not in one direction, proceed as follows. If the bottom bearing on the shaft is to be adjusted, remove the eccentric coupling as outlined in 3.14 and note the relationship between the vertical drive shaft and the vertical shaft of the drive. Loosen the bracket mounting screws or bracket clamping bolts as outlined in (5). In the case of No. 10B bearings proceed as outlined above for No. 1B, 1F or 1H bearings, and for No. 10A bearings proceed as outlined for other 1 type bearings. Adjust the aligning screws of 1 and 10 type bearings until the lower end of the shaft assumes its proper position with respect to the bottom bearing and the vertical shaft of the drive. After the bottom bearing is satisfactorily located, tighten the mounting screws securely and proceed to realign the other bearings as follows. On 13 type bearings, shift the bearing bracket back and forth or in and out as required until a satisfactory position of the bearing is obtained. Hold the bracket in this position and tighten the bracket clamping

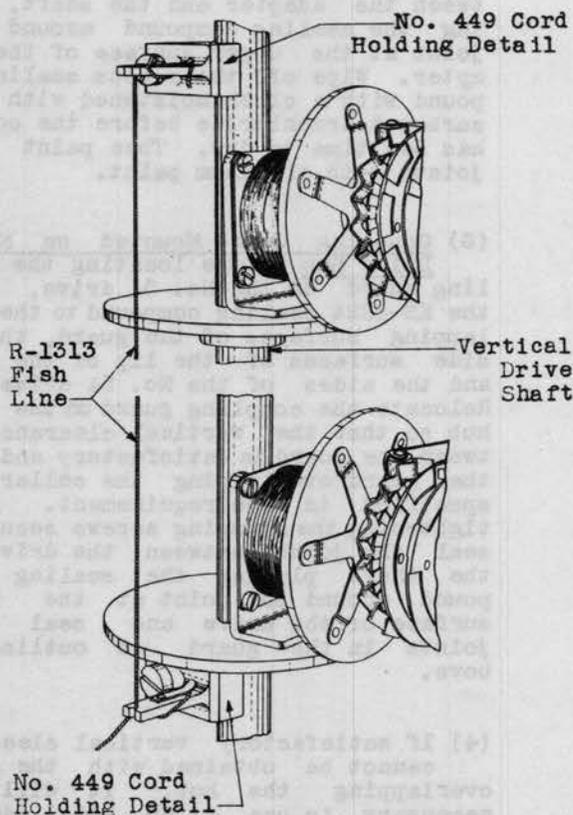


Fig. 6 - Method of Checking for Location of Bearings

bolts securely. After the bottom bearing is satisfactorily located, tighten the mounting screw securely and proceed to realign the other bearings as follows.

(7) Attach the two No. 449A cord holding details to the shaft, one detail above or at the top bearing and one at the bottom end of the vertical drive shaft. Stretch the R-1313 fish line tightly between the two supports as shown in Fig. 6. The fish line will then be parallel to the shaft.

(8) Check the position of the discs immediately above and below each bearing over the entire length of the shaft in relation to the fish line in two positions, approximately 90° apart. There shall be a perceptible clearance between the periphery of these discs and the fish line not to exceed 1/32". All discs must clear the fish line. If the clearance exceeds 1/32" or if the fishline touches the driving disc of the top sequence switch position, it is an indication that the bearing or bearings located above the top sequence switch position are not in satisfactory adjustment and should be realigned. If necessary rotate the shaft to a position in which these discs clear the line and at the same time relocate the cord holding details. To check a bearing where there is no driving disc adjacent to it attach the No. 450A substitute disc to the shaft above the bearing as shown in Fig. 7.

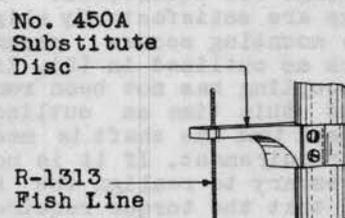


Fig. 7 - Method of Checking for Location of Bearings

Check for a perceptible clearance between the fish line and the edges of the slot in the tool. This detail may be used at any other position on the shaft where there is a question of proper setting.

(9) Check first with the fish line in the extreme right-hand position and then revolve the shaft to the left through an angle of 90° and check again.

(10) If the clearance between the fish line and the discs is not satisfactory adjust the positions of the bearing bracket as follows.

3.06 (Continued)

(11) In case the location of the bearing nearest the top sequence switch position is unsatisfactory and the sequence switch is located at or near the top of the frame, loosen the mounting screws of all bearings mounted above it with the No. 245, 246 or 305 wrench. In case the top sequence switch is not located at or near the top of the frame, do not loosen the mounting screws of any bearing mounted above it, but proceed directly to adjust the bearing as follows:

(12) With the mounting screws loosened, turn the aligning screws with the No. 245 or 305 wrench or shift the bearing bracket as required as outlined in (6) until the driving disc just clears the fish line. Then securely tighten the mounting screws. Then recheck the relation between the drive shaft and the sequence switch as outlined in (2). In aligning a No. 13A bearing, hold the bearing bracket in position and tighten the bracket clamping bolts with the No. 246 wrench.

(13) Loosen the mounting screws of the intermediate bearings and either turn the aligning screws in or out or shift the position of the bracket as required until the bearings are so adjusted that all the driving discs just clear the fish line. Before tightening the mounting screws, check the position of the bearings for squareness. After the bearings are satisfactorily aligned, tighten the mounting screws securely, and recheck as outlined in (2). If the eccentric coupling has not been removed, remove it at this time as outlined in 3.14 and check that the shaft is meeting the torque requirement. If it is not it will be necessary to realign the shaft taking care that the torque requirement as well as the shaft alignment and axial alignment requirements are met. After the shaft is satisfactorily located, reassemble the eccentric coupling as outlined in 3.14.

### 3.18 Mounting of Eccentric Coupling Guard (Rq.2.18)

(1) General If the vertical clearance between the bottom edge of the eccentric coupling guard and the upper edge of the oil guard is not satisfactory, it is probably due to the location of the coupling guard on either the No. 5A drive hub or the No. 100A adapter or to the position of the adapter on the vertical drive shaft. In any case, remove the coupling guard clamping screws from one of the coupling guard halves with the 3-1/2" cabinet screwdriver and remove the eccentric coupling guard. Clean the guard as out-

lined in procedures 3.14 to 3.17 inclusive.

(2) Coupling Guard Mounted on No. 100A Adapter Before locating the coupling guard on the shaft, apply the KS-6824 sealing compound to the overlapping surfaces of the guard, the inside surfaces of the lip of the guard and the sides of the No. 100A adapter. Assemble the halves of the guard in place on the shaft and insert the clamping screws in loosely in the opposite half of the guard. Shift the location of the guard on the No. 100A adapter until the upper surface of the collar is flush with the upper surface of the adapter. If the clearance still is not satisfactory, raise or lower the adapter and the guard on the shaft until the requirement is met. After the guard is satisfactorily located, seal the joints between the lips of the guard and the adapter, the slots in the adapter and around the collar which clamps on the adapter. In sealing the slots of the adapter, several applications of the sealing compound may be required before the slots are filled sufficiently to make a satisfactory seal. Then tighten the clamping screws securely and seal the joint between the adapter and the shaft, placing the sealing compound around the joint at the upper surface of the adapter. Wipe off the excess sealing compound with a cloth moistened with C.P. carbon tetrachloride before the compound has had time to dry. Then paint the joints with aluminum paint.

(3) Coupling Guard Mounted on No. 5A Drive Hub Before locating the coupling guard on the No. 5A drive, apply the KS-6824 sealing compound to the overlapping surfaces of the guard, the inside surfaces of the lip of the guard and the sides of the No. 5A drive hub. Relocate the coupling guard on the drive hub so that the vertical clearance between the guard is satisfactory and with the guard overlapping the collar as specified in the requirement. After tightening the clamping screws securely, seal the joint between the drive and the shaft placing the sealing compound around the joint at the upper surface of the drive and seal the joints in the guard as outlined above.

(4) If satisfactory vertical clearance cannot be obtained with the guard overlapping the hub, it will be necessary to use a No. 100A adapter, mounting it in accordance with the section covering piece part data and replacement procedures for this apparatus and seal it as outlined in (2).

REASON FOR REISSUE - CHANGES IN ADJUSTING PROCEDURES

1. To revise the list of Tools, Gauges and Materials (3.001).
2. To revise the procedures covering location and alignment of shafts and bearings (3.06).

APPROVED:

Bell Telephone Laboratories, Inc.	FAC 2-14-34
Department of Development and Research	GWK 2-14-34