16-A DRIVES
REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section covers No. 16-A drives.

1.02 This section is reissued to incorporate material from the addendum in its proper location. In this process marginal arrows have been omitted.

1.03 Reference shall be made to Section 020-010-711 covering General Requirements and Definitions for additional information necessary for the proper application of the requirements listed herein.

1.04 Part 1, "General" and Part 2, "Requirements" form part of the Western Electric Co. Inc. Installation Department handbook.

1.05 Requirements are marked with an asterisk (*) when to check for them would necessitate the dismantling or dismounting of apparatus, or would affect the adjustment involved or other adjustments. No check need be made for these requirements unless the apparatus or part is made accessible for other reasons or its performance indicates that such a check is advisable.

1.06 One discharge of oil for the purpose of this section is the amount of oil discharged from the No. 431-A oil gun when the piston is depressed to the limit of its stroke.

1.07 For definitions and general information regarding the associated vertical drive shafts, refer to the section covering the apparatus requirements and adjusting procedures for vertical drive shafts and associated apparatus.

2. REQUIREMENTS

2.01 Cleaning The drive housing and adjacent surfaces of the vertical drive shafts shall be kept free of oil and dust.

2.02 Lubrication

(a) Fig. 1 (A) - The Ball Bearings shall be adequately lubricated with KS-6438 oil. When lubrication is necessary one discharge of oil shall be applied.

(b) Fig. 1 (B) - The Gear Teeth shall be adequately lubricated with KS-6438 oil. When lubrication is necessary one discharge of oil shall be distributed evenly over all the gear teeth.

(c) After turnover it is recommended that the bearings and gears be lubricated at intervals of two years. These intervals may be extended if periodic inspections have indicated that local conditions are such as to insure that requirements (a) and (b) will be met during the extended intervals.

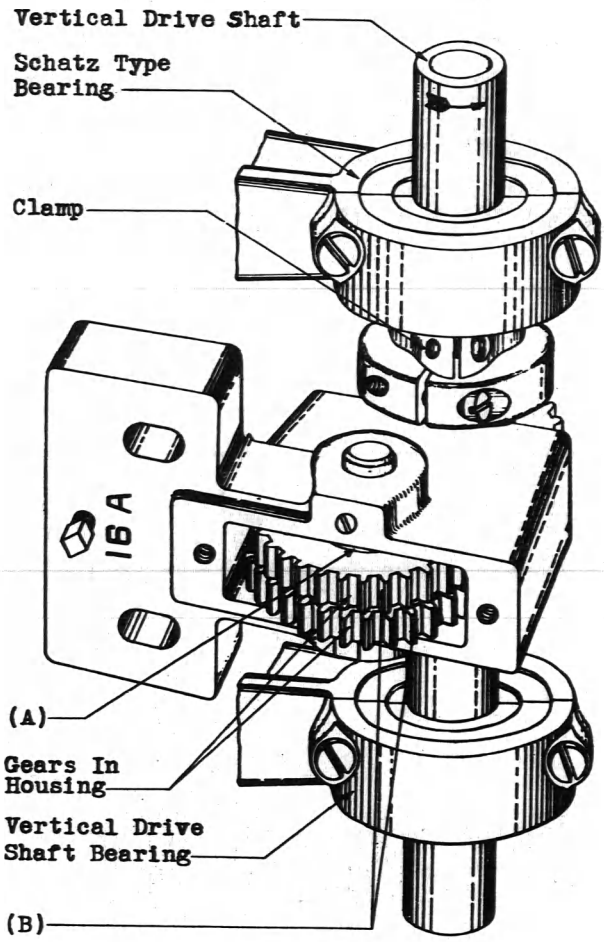

Fig. 1

2.03 Record of Lubrication During the period of installation, a record shall be kept, by date, of the lubrication of the ball bearings and gears and this record shall be turned over to the Telephone Company with the equipment. If no lubrication has been done it shall be so stated.

2.04 Location of Clamp - Fig. 2 (A) - There shall be approximately 1/32" clearance in a vertical direction between the upper surface of the clamp and the lower finished surface of the Schatz type bearing. Gauge by eye.

2.05 Fastening of Clamp - Fig. 2 (B) - The clamp shall be fastened securely to the bearing sleeve so as to prevent the upper or low speed vertical drive shaft from dropping.

2.06 Alignment of Vertical Shafts The two vertical shafts shall be so aligned that there will be approximately the same back lash in the two sets of gears. Gauge by feel.

2.07 Back Lash - Fig. 2 (C) - There shall be as little back lash as possible between the gears in the housing and those on the vertical drive shafts without binding in any position of their rotation. Gauge by feel and eye.

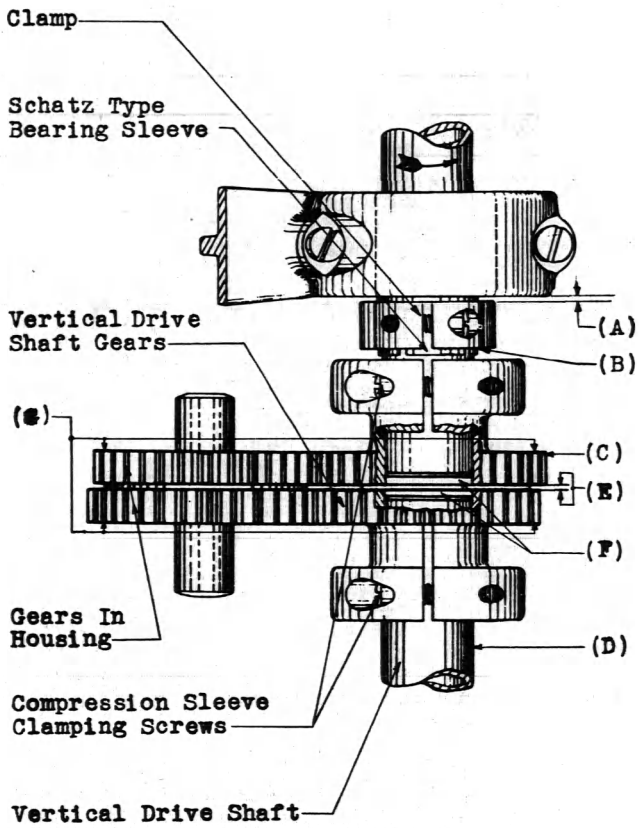

Fig. 2

*2.08 Starting Torque Test - Fig. 2 (D) - The pull required to start the rotation of a shaft, equipped with a No. 16-A drive, from any position of rest about its axis, at the radius of the lower or high speed vertical drive shaft shall be as follows:

Shafts having ball bearings exclusively

No. of Shaft Bearings	Max. Tension
4 or less	1100 grams
5	1200 grams
6	1300 grams
7	1400 grams
8	1500 grams

Shafts having a combination of graphalloy bearings and ball bearings

No. of Shaft Bearings	Max. Tension
4 or less	1200 grams
5	1400 grams
6	1600 grams
7	1800 grams
8	2000 grams

Use the No. 79-E gram gauge.
In checking this requirement the bearings associated with the drive shall be considered as individual bearings and not parts of the drive.
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.

2.09 Rigidity of Mounting The drive shall be rigidly fastened to the frame. Gauge by feel.

*2.10 Gear Clearance - Fig. 2 (E) - There shall be a clearance of approximately 1/32" (within ± .005") between the adjacent surfaces of the vertical drive shaft gears. Gauge by eye.

*2.11 Location of Gears on Vertical Drive Shafts - Fig. 2 (F) - The end of either vertical drive shaft shall not extend beyond the face of the gear mounted on it. Gauge by eye.

*2.12 Alignment of Gears - Fig. 2 (G) - The top and bottom surface of the vertical drive shaft gears shall be approximately in plane with the corresponding surfaces of the gears in the housing. Gauge by eye.

3. ADJUSTING PROCEDURES

3.001 List of Tools, Gauges and Materials

Tools

Code No.	Description
254	Wrench - 1/4" Sq. Socket
305	Wrench - 7/16" Hex. Socket Offset
431-A	Oil Gun
-	Paint Brush, 1/4" Round
-	Bell System Regular Screwdriver 4" per A.T.&T. Co. Drawing 46-X-34
-	Bell System Cabinet Screwdriver 3-1/2" per A.T.&T. Co. Drawing 46-X-40

Gauges

79-E	0-3000 Gram Push-Pull Tension Gauge

Materials

KS-2423	Cloth
KS-6438	Oil
KS-7860	Petroleum Spirits
-	Fish Line
-	Thin Shims for aligning old style drives

3.01 Cleaning (Rq.2.01)

M-1 When necessary, wipe off the drive housing and the adjacent surfaces of the drive shafts with KS-2423 cloth moistened with petroleum spirits.

3.02 Lubrication (Rq.2.02)

Ball Bearings

M-1 When it is necessary to lubricate the ball bearings, remove the gear case cover with the 4" regular screwdriver and proceed as follows using the No. 431-A oil gun as the means of applying the lubricant. Before lubricating, examine the oil gun to see that it is filled and working properly. If the oil gun fails to eject oil properly when the piston is depressed it is an indication that either the gun is empty or there is an air pocket beneath the piston. In this case it will be necessary either to refill the gun or to follow M-3 below.

M-2 To Fill the Oil Gun Remove the barrel by turning it is a counter-clockwise direction. Fill the barrel with KS-6438 oil and replace and securely tighten it on the gun. Wipe off any oil that may have been forced out of the barrel with a KS-2423 cloth moistened with petroleum spirits. Depress the piston several times to make certain that all air is expelled from the nozzle before lubricating the bearings.

M-3 To Remove Air Pocket Depress the piston several times to expel the air from the nozzle until the oil begins to flow again.

M-4 To Lubricate the Ball Bearings Insert the nozzle of the oil gun between the housing and the upper surface of the gear, over the ball bearing and depress the piston to the end of its stroke. Then release the piston.

M-5 Replace the cover and wipe off any oil that may have dropped on the drive housing.

Gear Teeth

M-6 When necessary to lubricate the gears, remove the cover screws with a 4" regular screw-driver and remove the cover. Then examine the gears in the housing.

M-7 If they appear to be coated with dirt, clean them with a 1/4" round paint brush moistened with petroleum spirits. Exercise care to protect the other apparatus while this cleaning process is going on and to prevent the petroleum spirits getting into the ball bearings.

M-8 After the teeth have been satisfactorily cleaned lubricate them as follows: Hold the nozzle of the No. 431-A oil gun near the upper gears and lubricate them with approximately 1/2 charge of KS-6438 oil. Then repeat this operation for the lower gears.

3.03 Record of Lubrication (Rq.2.03) (No Procedure)

3.04 Location of Clamp (Rq.2.04)
3.05 Fastening of Clamp (Rq.2.05)

M-1 If the position of the clamp is not satisfactory, loosen the clamping screw with the 3-1/2" cabinet screw-driver and shift it as required. Then securely tighten the clamping screw.

3.06 Alignment of Vertical Shafts (Rq.2.06)
3.07 Back Lash (Rq.2.07)
3.08 Starting Torque Test (Rq.2.08)
3.09 Rigidity of Mounting (Rq.2.09)

M-1 If the vertical shafts are not properly aligned readjust as outlined in the section covering apparatus requirements and adjusting procedures for vertical drive shafts and associated apparatus.

M-2 Back Lash If the back lash in the gears is excessive, correct by shifting the bearing housing. A 1/4" set screw is provided on the later models of the drive to change the relative position between the housing and the frame. However, on the early models, there is no set screw provided and it will be necessary to use shims between the housing and the frame.

M-3 Slightly loosen the mounting screws with the No. 305 wrench and adjust the housing for its proper position by turning the set screws as required with the No. 254 wrench in the case of the later drives. Use thin shims in the case of the early models to move the housing into the desired position.

M-4 Tighten the mounting screws securely and check to see that the adjustment has not been disturbed by the tightening operation.

M-5 Starting Torque Test Before making the torque test, remove the coupling connecting the vertical drive shaft and the vertical shaft of the drive as follows.

M-6 Where an eccentric coupling is used and it is equipped with a coupling guard it will be necessary to remove the guard and clean it as outlined in the section covering apparatus requirements and adjusting procedures for vertical drive shafts and associated apparatus before removing the coupling. After the coupling guard has been removed and cleaned, remove the upper coupling clamp and lugs of the eccentric coupling before making the torque test. In cases where the rigid type coupling is used, loosen the coupling clamping screws with the No. 254 wrench.

M-7 To make the torque test proceed as follows: If the driving discs have fillister head clamping screws, hook one end of a fish line over the clamping screw of a disc just above or below a bearing and about four feet from the floor and wind several turns of the line around the vertical drive shaft without crossing by rotating the shaft backward. If, however, the driving discs are secured to the shafts by Bristo set screws proceed as follows: Place a piece of fish line around the shaft just above or below a bearing and wind several turns of the line around the vertical shaft by rotating the shaft backwards. Four or five turns of the line should be wound over the end of the line to prevent it from slipping and then an additional four or five turns should be wound around the shaft without crossing or overlapping. Then attach the No. 79-E push-pull tension gauge to the loose end as shown in Fig. 3.

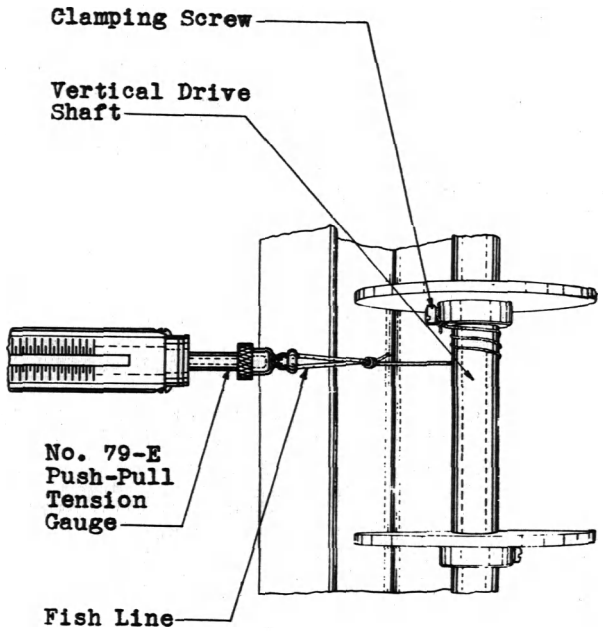

Fig. 3 - Method of Measuring Starting Torque

M-8 Test by starting and stopping (approximately 20 times per revolution) from the point of greatest friction in three complete revolutions of the shaft in its normal direction. If the starting torque at any point does not exceed the amount specified, the vertical drive shaft and the bearing alignment can be considered satisfactory and no further check for alignment need be made. If the starting torque exceeds this requirement lubricate the drive as outlined in procedure 3.02 and the ball bearings as outlined in procedure 3.02 of the section covering apparatus requirements and adjusting procedures for this apparatus and repeat the starting torque test. If the starting torque at any point still exceeds this requirement after being lubricated consider the operation of the shaft unsatisfactory, and remove the source of the bind by realigning the shaft and bearings if they are not in satisfactory alignment or by locating and replacing a bearing having a bind. To detect a binding bearing, refer to the section covering apparatus requirements and adjusting procedures for vertical drive shafts and associated apparatus.

M-9 Also, replace the drive shaft coupling in accordance with this section.

M-10 Rigidity of Mounting After all adjustments have been made, tighten the bracket mounting screws securely with the No. 305 wrench.

3.10 Gear Clearance (Rq.2.10)
3.11 Location of Gears on Vertical Drive Shafts (Rq.2.11)
3.12 Alignment of Gears (Rq.2.12)

M-1 To check for gear clearance, location of the gears on the vertical drive shafts and the alignment of the gears, remove the gear housing cover screws with the 4" regular screw-driver and remove the cover.

M-2 While adjusting for the proper clearance between the two gears mounted on the vertical drive shafts, take care that the requirement for the alignment of these gears with those in the housing is met. It will be noted that if each of the vertical drive shaft gears are lined up with their associated gears in the housing the clearance requirement will automatically be met.

M-3 If the clearance between the gears is not satisfactory, loosen the gear clamping screws with the 3-1/2" cabinet screw-driver and shift the gear on the slow speed vertical drive shaft or on the high speed vertical drive shaft as required. Slide the gear on its shaft by wedging the screw-driver between the two gears to increase the gap or by tapping the gear with the screw-driver to decrease the gap.

M-4 If the end of either shaft extends beyond the face of the gear mounted on it, raise the slow speed vertical drive shaft or lower the high speed vertical drive shaft and then move the associated gear to meet the requirements for gear clearance and alignment.

M-5 To raise the upper or slow speed vertical drive shaft, loosen the screws of the clamp mounted on the skirt of the Schatz type bearing located directly above the drive with the 3-1/2" cabinet screw-driver and slightly raise the shaft. After making the above adjustments, check the location of the driving discs as outlined in the sections covering apparatus requirements and adjusting procedures for sequence switches and power driven rotary selectors.

M-6 Loosen the gear clamping screws with the 3-1/2" cabinet screw-driver and move the gear on the shaft until the requirements for gear clearance and alignment are met.

M-7 Securely tighten the clamping screws and check to see that the position of the gear and shaft has not been disturbed during the tightening operation.