

26/V/76



MAINTENANCE INSTRUCTION

ALIGNMENT OF LOCOMOTIVE ROTATING EQUIPMENT

INTRODUCTION

Machines in a rotating power system, such as a diesel-electric locomotive, generally are connected together by means of direct coupling or a shaft and coupling arrangement. The proper alignment of these interconnected machines is necessary for a number of reasons. In mechanical systems precise alignment reduces stresses in shafts and couplings thereby minimizing vibration, unequal bearing loads, and the bending of shafts. Electrical rotating equipment, such as motors and generators, also requires special consideration because of the critical positioning of the rotor relative to the stator - both axially and radially. Axial positioning is important to avoid rotor thrust loads on the end bearings. Radial positioning or air gap equalization is necessary for the proper interaction of rotor and stator fields which affects the electrical characteristics. This maintenance instruction deals with the alignment of both mechanical and electrical components in the locomotive power system.

ALIGNMENT IN GENERAL

Although alignment in a rotating system is usually performed with respect to the coupling surfaces, the real concern is the alignment of the shafts. It is generally more convenient to attach gauges or indicators on a coupling face or on the edge of a flywheel than to position them directly on the machine shaft. This is particularly true when dealing with large machines such as engines, traction generators, etc., where the main shaft might be physically inaccessible. In a rotating system a measurement of edge variations on a flywheel or coupling face is related to the orientation of the shaft center with respect to a reference point - the other shaft centerline or some fixed surface such as the generator housing

or locomotive deck. In this way indicator readings on the edge of the flywheel or coupling are a valid means of determining shaft rotational alignment.

DIMENSIONS

Alignment techniques make use of a specific set of terms that apply when dealing with rotating systems. Fig. 1 illustrates three of the most significant dimensions, and an explanation of each is provided.

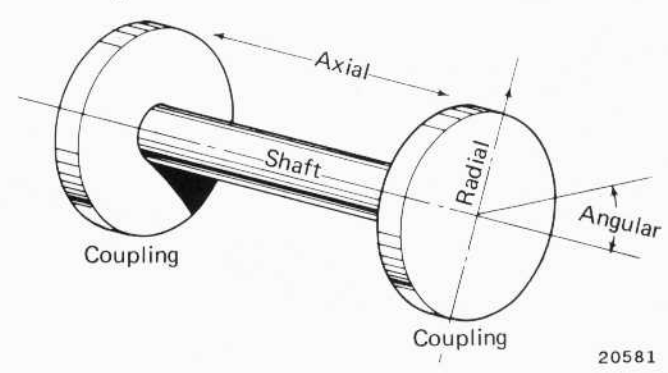


Fig. 1 - Dimensions Used In Alignment Procedure

RADIAL -- This dimension is measured outward from the center of the shaft in a plane perpendicular to the main axis of the shaft. Misalignment in the radial dimension, Fig. 2, means a difference in position of the rotating axis of one shaft from a reference point. Where two shafts are coupled together the reference point is the center of rotation of one of the shafts.

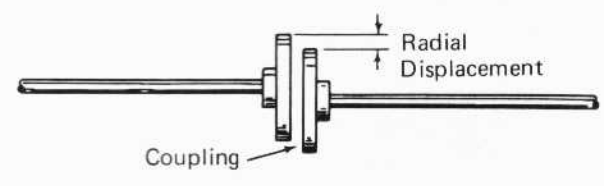


Fig. 2 - Radial Misalignment

*This bulletin is revised and supersedes previous issues of this number.

AXIAL - This dimension is measured back and forth along the rotating axis of the shaft. Axial misalignment illustrated in Fig. 3, means that the position of the whole shaft must be shifted in the direction of its length. This dimension is usually used in reference to shaft thrust on an end bearing - the shaft, because of its offset position, causes an axial load on the bearing.

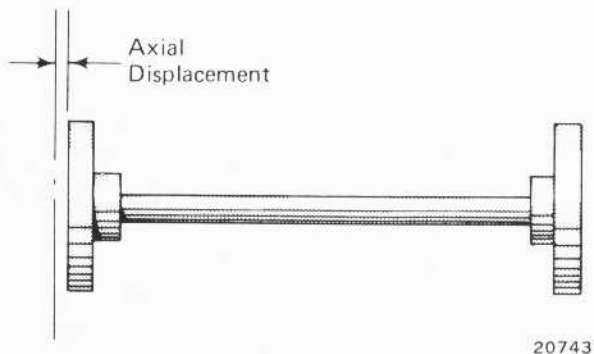
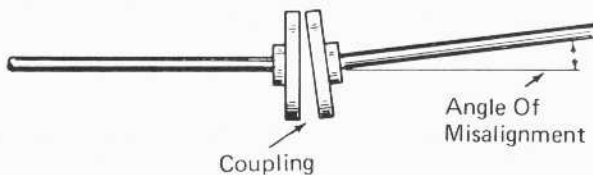


Fig. 3 - Axial Misalignment

NOTE: Misalignment of shafts may be radial or angular or a combination of both.



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Fig. 4 - Angular Misalignment

The dial indicator is the most commonly used instrument in rotational alignment work. These instruments are designed to be as versatile as possible, so their actual application may require some adaptation. Miscellaneous supports and adapters can be obtained to suit individual requirements. Refer to Fig. 5.

ANGULAR - This dimension is measured from a reference axial centerline to the actual shaft or coupling rotational axis. Angular misalignment, Fig. 4, refers to the angle that one shaft makes with another shaft at their coupling interface.

Some dial indicator scales read from 0 up to a number such as 100 and some read plus and minus values on both sides of zero. Refer to Fig. 6.



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Fig. 5 - Universal Type Dial Indicator And Auxiliary Support Rods, Adapters, And Brackets

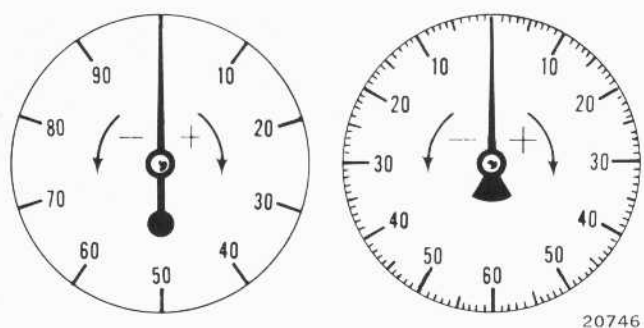


Fig. 6 - Dial Indicator Scales

Dial indicator scales are calibrated to read in thousandths of an inch. The maximum indicator reading refers to the highest reading, plus or minus, attained while performing the measurement. The total indicator reading (T.I.R.) is the whole change in indicator reading disregarding the indicator reference.

SHAFT AND COUPLING ALIGNMENT

COUPLINGS

Couplings are used to connect machines to machines, shafts to machines, and shaft to shafts. Coupling faces may be rigidly bolted together or they may have a rubber bushing between them. Variations in coupling face and bushing design allow couplings to have some freedom of movement in the radial and/or angular dimension. In general, where each shaft to be coupled together has more than one bearing, a coupling must be used that will tolerate some angular and radial movement. This is necessary because of the difficulty in obtaining absolute alignment between two shafts carried in separate housings.

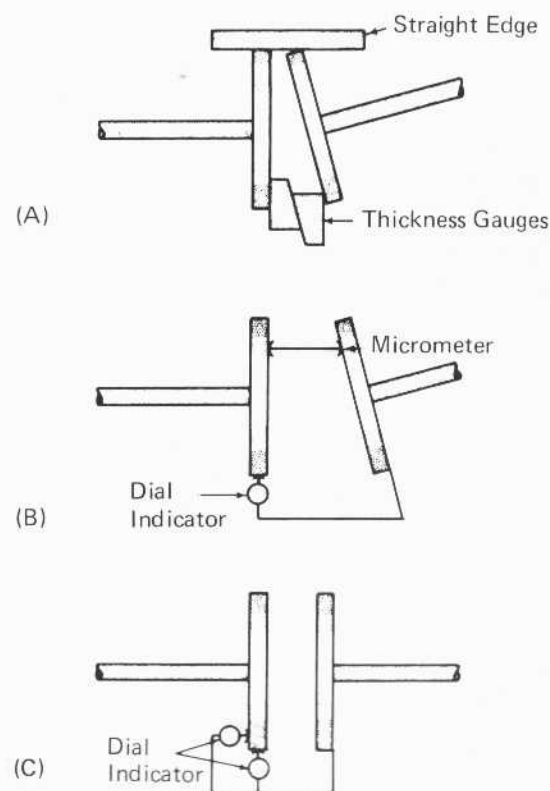
A coupling that has no radial flexibility, but some angular flexibility, must be used when coupling one shaft supported by two or more bearings to another shaft with only one support bearing.

NOTE: Even though a particular coupling can withstand some misalignment, the shafts must still be aligned as accurately as possible.

METHOD OF SHAFT ALIGNMENT

There is a variety of ways to check or measure the alignment of two interconnected shafts. Three different methods are listed below and illustrated in Fig. 7, but only the last one, 7C, is recommended.

- A. Straight edge and thickness gauge.
- B. Dial indicator and micrometer.
- C. Two dial indicators (recommended method).



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Fig. 7 - Methods Of Checking Shaft Alignment

PROCEDURE

Both halves of the coupling must be bolted together before shaft alignment is performed. Refer to the applicable section of this publication to obtain torque values for a specific coupling.

The recommended method uses two dial indicators rigidly attached to one of the coupling faces (usually on the driving shaft) while measuring the surfaces of the other coupling. The plunger of one indicator is placed parallel to the shaft with its button resting on the coupling face. The indicator button should be located on the face of the coupling at a distance beyond the coupling bolts as close to the edge as possible. This indicator will read the angular misalignment of the coupling. The plunger of the other indicator is located against the edge of the coupling, perpendicular to the shaft. This indicator reads the radial misalignment of the coupling.

NOTE: Indicator plungers should be depressed about one half of their total movement when they are being positioned. This allows the indicator to measure the widest range of plus and minus values.

After the indicators are applied, the coupling should be rotated until the indicators are brought up to the top or vertical position. At this position the movable faces of each indicator should be set to zero. This establishes the indicators to a reference setting from which the misalignment can be measured. An easy way to keep track of alignment readings is to use two circles drawn on a sheet of paper. Use one circle to record angular measurements and the other for radial measurements. Refer to Fig. 8. Each circle graphically represents the physical position of the indicators relative to the coupling of the driven shaft. In this way the vertical or top position is designated as the zero reference for the alignment procedure.

The shafts are then rotated one quarter turn (90°) and the readings on both indicators recorded. The indicator on the face or back of the coupling will show the angular displacement of the shaft. If the angular displacement reading is zero through a full rotation of the shaft, then the shafts are aligned in the angular dimension. Usually though there is some variation, plus or minus values, for each alignment operation. If the indicator pointer moves in the direction of increasing numbers (10, 20, 30, etc.) then the reading is recorded as a plus value. If the pointer moves in the direction of decreasing numbers (90, 80, 70, etc.) then the reading is assigned a minus value. These values are recorded on the circles as the shafts are rotated in one quarter turn increments.

When the indicators have travelled the full circle around the coupling, both indicators should read zero as they return to the vertical position. If

both indicators do not return to zero, as they reach their original starting point, then all the readings should be discarded and the source of error investigated. Possibly one of the indicators was not firmly mounted which allowed it to shift slightly changing the indicator reference. Once the reason for the discrepancy is found and corrected, a new set of readings must be taken. A typical set of readings is shown in Fig. 8.

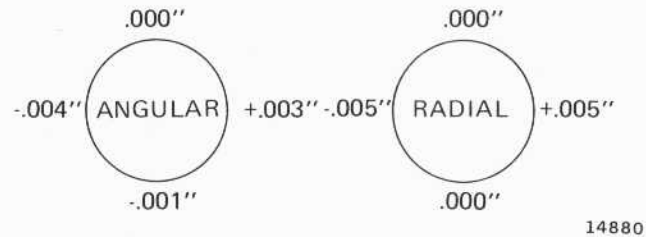


Fig. 8 – Typical Indicator Readings

These readings show a maximum angular misalignment of 0.10 mm (.004") and a maximum radial misalignment of 0.13 mm (.005"). Even though this is within the limits established for this equipment, correction could be attempted to reduce the misalignment as much as possible. The readings in the example show that in the vertical plane the shaft needs no adjustment – it is not necessary to move the shaft up or down. However, if the shaft is moved a distance of 0.13 mm (.005") horizontally toward the side with the minus 0.13 mm (.005") reading, the total indicator reading for radial misalignment should be reduced to zero. Although this degree of alignment is desirable, it is rarely attainable in actual practice.

NOTE: The indicators are usually fixed to the "driving" shaft while measuring the "driven" shaft.

Corrections for angular misalignment are made by moving one end of the driven shaft so that its entire rotating axis is parallel to the rotating axis of the driving shaft.

Most alignment situations make it advantageous to correct for radial and angular misalignment simultaneously.

Circumstances may arise where the radial alignment is satisfactory but the angular alignment is in need of correction. This means that the shaft end being aligned is properly located, but the remote end of the shaft must be repositioned.

If the angular alignment is within the specified limits but the radial alignment is incorrect then

the shaft should be moved in a direction perpendicular to its rotating axis. It must be moved a distance equal to the highest positive dial indicator reading toward the opposite side of the coupling. The proper distance and direction of movement can be determined through careful interpretation of the readings.

If a piece of equipment is replaced, then the replacement part should be mounted on the original shims as a starting point in the alignment process.

AIR COMPRESSOR COUPLING ALIGNMENT

The air compressor drive shaft couplings are installed with the coupling bolts torqued to 136 N·m (100 ft-lbs), as shown in Fig. 9. Two inspections are required when aligning or checking alignment of these couplings. The first inspection is a length measurement, or the distance between the coupling and the shaft. The second inspection is of the angular misalignment which can be checked by either one of two methods. The first method employs a dial indicator, while the second method requires the use of feeler gauges.

LENGTH MEASUREMENT

The distance between the mating faces at the 6 o'clock or bottom vertical position, as shown in Fig. 9, must be held to 12.70 mm +0.51 -0.00 (.500" +.020" -.000") for applications where the compressor is coupled to the generator. The engine should be at room temperature. If the engine crankshaft is hot, that is, if the engine has been running, the measurement will be reduced and may be as low as 11.94 mm (.470") and 12.45 mm (.490") respectively.

ANGULAR ALIGNMENT

USING DIAL INDICATOR

Angular alignment at each flexible member can be measured by attaching a dial indicator, Fig. 9, to coupling flange and indicating against the face of the mating flange. Both indicators should be in the same plane when checking at two couplings.

Mount the indicators on brackets and set the dials to zero with the indicator at the 12 o'clock position. During rotation of the shaft, record the indicator readings every 90° of rotation. Angular

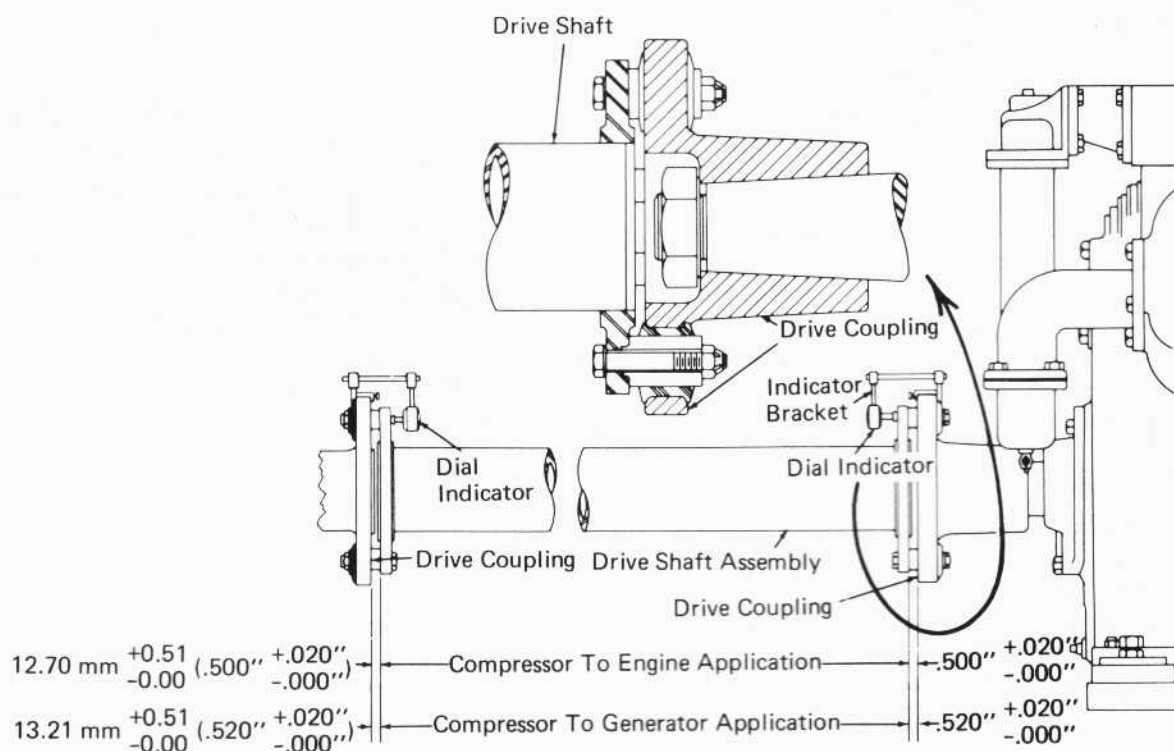


Fig. 9 - Application Of Air Compressor Couplings

misalignment must not exceed 0.51 mm (.020") total indicator reading when indicating point is on not less than a 254 mm (10") diameter.

USING FEELER GAUGES

Angular alignment at each flexible member can be inspected by measuring the distance between the mating flanges at 90° intervals (four points). Rotate the shaft 180° and again measure at 90° intervals. The readings taken (8 for each coupling) must be within 0.51 mm (.020") of each other.

RUBBER BUSHING REPLACEMENT

The air compressor drive couplings, Fig. 9, do not require any routine maintenance or lubrication. However, it may be necessary or desirable to replace the bonded rubber bushings. The need for replacement is evidenced by accumulations of small rubber particles directly under the coupling.

To facilitate the removal and installation of the rubber bushings, a puller tool may be used. As shown in Fig. 10, the tool parts are used on opposite sides of the coupling for removal and installation of the bushings.

When installing the rubber bushings, a small amount of rubber lubricant should be applied on the leading pressed rubber edge of the bushing. This lubricant is mixed with three to five parts of water before use, and should be stirred occasionally while in use. Other lubricants, which are not detrimental to the rubber bushing, may be used.

NOTE: After bushing installation, it is recommended that at least 24 hours elapse before attaching the coupling. This waiting period is required to allow the rubber lubricant to dry. When the lubricant is still wet, the bushing can easily move from its desired location.

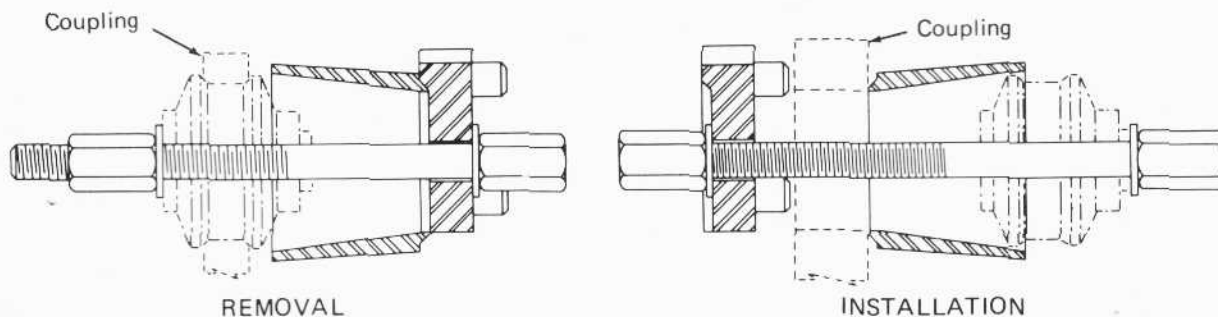


Fig. 10 – Rubber Bushing Puller Tool Application

The bushing must be installed past its normal location to properly seat the lips of the bushing. The bushing puller tool must be reversed and the bushing moved until the 11.94 mm \pm 0.25 (.470" \pm .010") dimension shown in Fig. 11 is obtained, to maintain the bushing faces in the same plane. If a tool is not available, a press may be used.

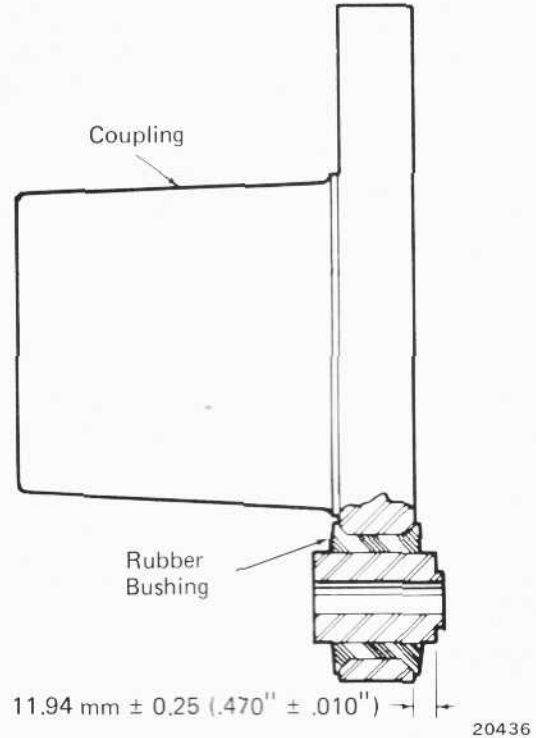
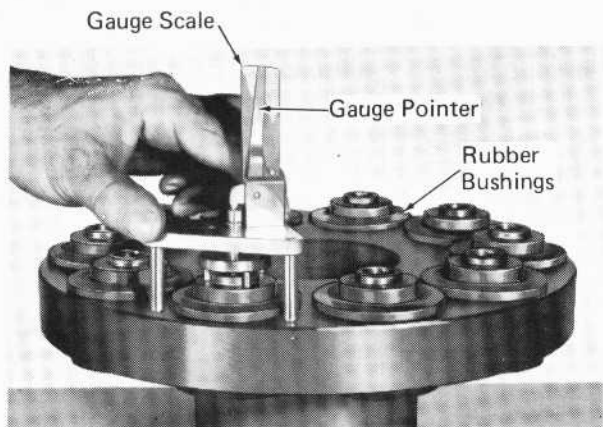


Fig. 11 – Bushing To Coupling Application

A bushing application gauge, Fig. 12, is available to measure the 11.94 mm \pm 0.25 (.470" \pm .010") dimension. This gauge consists of a tripod-legged base supporting a lever indicating arrangement at its center. To measure the 11.94 mm \pm 0.25 (.470" \pm .010") dimension, the gauge is positioned so its large tripod legs rest on the flange of the coupling and its center actuating disc contacts the metal center sleeve of the bushing, inside the locating prongs. If the bushing is



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Fig. 12 -- Bonded Joint Bushing Application Gauge

properly located the pointer of the gauge will be within the limiting scribe marks on the gauge scale.

A calibration fixture having three calibrating discs 11.68 mm (.460"), 11.94 mm (.470") and 12.19 mm (.480") is part of this gauge to provide a check on the pointer accuracy. A large disc simulates the coupling and the smaller discs are placed on the large disc. The gauge is placed on this assembly to check the pointer positioning.

AUXILIARY GENERATOR ALIGNMENT

Before attempting to align the auxiliary generator, the main generator must be coupled and aligned to the engine.

The alignment of the auxiliary generator to the engine is divided into three operations:

1. Thrust - finding the axial position of the coupling with respect to the auxiliary generator drive assembly and the auxiliary generator.
2. Angular - correcting the angularity of the auxiliary generator to the drive assembly.
3. Radial - establish centerline alignment of auxiliary generator to the drive assembly.

BEARING THRUST ALIGNMENT

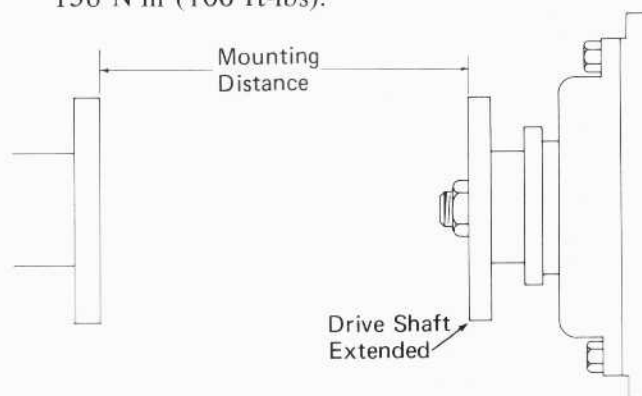
There is an auxiliary generator axial alignment procedure for the different types of auxiliary generator drive assemblies. The types are as follows:

1. Auxiliary generator drive assembly applications on blower-type and turbocharged engines not having stamped axial thrust dimensions.
2. Auxiliary generator drive assembly applications on turbocharged engines having a single axial thrust dimension stamped on the support housing.
3. Auxiliary generator drive assembly applications on blower-type and turbocharged engines having two axial thrust dimensions stamped on the support housing.

Axial alignment procedures for the different types of auxiliary generator drive assemblies are provided.

NON-STAMPED DRIVE ASSEMBLY

1. Pull the driving shaft out from engine to take up end play of the drive assembly.
2. Establish the mounting distance between the coupling flanges of the drive assembly and the auxiliary generator, Fig. 13. See Service Data to find the correct distance for each specific coupling assembly.
3. Secure auxiliary generator to frame and install coupling assembly. Torque coupling bolts to 136 N·m (100 ft-lbs).



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Fig. 13 -- Auxiliary Generator Coupling Measurement

SINGLE-STAMPED DRIVE ASSEMBLY

1. Attach coupling shaft between auxiliary generator and drive assembly. Torque coupling bolts to 136 N·m (100 ft-lbs).
2. Subtract .050" from the number stamped on the support housing and adjust the position of the auxiliary generator to establish this dimension, Fig. 14.

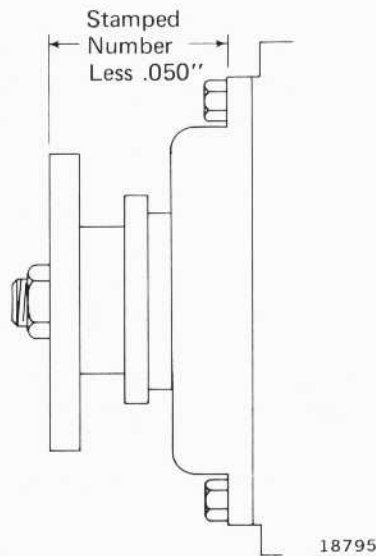


Fig. 14 - Auxiliary Generator Drive Thrust Measurement

NOTE: Only the decimal portion, following 4, of the entire dimension is stamped on the housing. (Example; 4.260" will be stamped .260".)

3. Secure auxiliary generator to frame and re-check thrust measurement. The final thrust measurement must be .020" to .080" less than the stamped number.

DOUBLE-STAMPED DRIVE ASSEMBLY

1. Attach coupling shaft to auxiliary generator and drive assembly. Torque coupling bolts to 136 N·m (100 ft-lbs).
2. Adjust position of the auxiliary generator to obtain a thrust clearance midway between the two numbers stamped on the drive housing.

NOTE: The dust shield on the drive assembly has been reversed to position the cupped surface toward the coupling to enable the thrust measurement to be taken with a feeler gauge, Fig. 15.

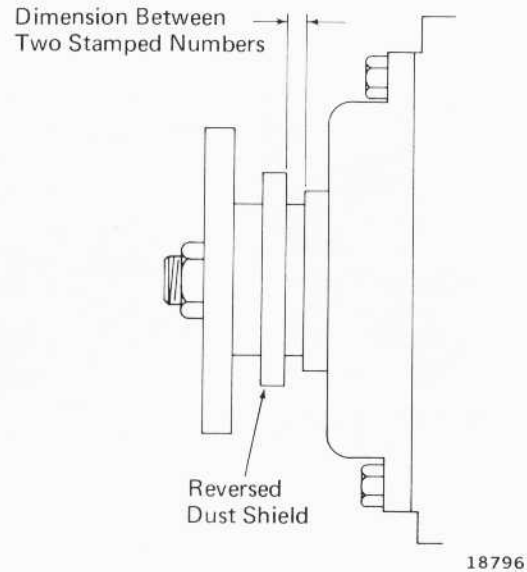


Fig. 15 - Auxiliary Generator Drive Bearing Clearance

3. Secure auxiliary generator to frame and re-check thrust measurement. The final thrust measurement must be between the two stamped numbers.

RADIAL AND ANGULAR ALIGNMENT

Radial and angular alignment is determined simultaneously by the use of a dial indicator as shown in Fig. 16. The indicator is attached to a bracket secured to the drive flange with the indicating button contacting the inner face of the inside coupling flange.

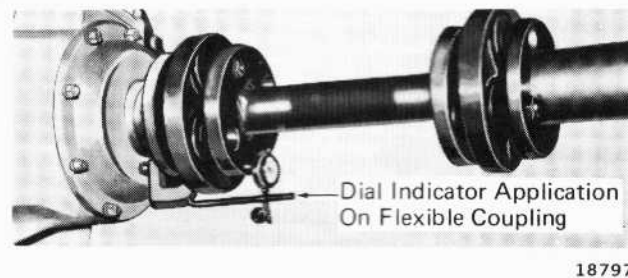


Fig. 16 - Auxiliary Generator Drive Coupling Alignment

Set the dial indicator to zero and rotate the coupling one revolution by turning the engine crankshaft. If the total indicator reading is within 3.81 mm (.150") maximum, the generator is considered aligned.

Since any movement of the auxiliary generator affects alignment, thrust, radial, and angular alignments must be checked after each setting.

RUBBER BUSHINGS

The auxiliary generator couplings do not require any routine maintenance or lubrication. If rubber bushings have torn flanges, excessive stiffness, or cracks, the coupling assembly should be replaced. Do not replace just the rubber bushings.

SPEED INCREASER COUPLING

The speed increaser drive shaft couplings are installed with the coupling bolts torqued to 312 N·m (230 ft-lbs) as shown in Fig. 17. The shaft must be located in the taper bushing to provide the correct distance between shaft flange and face of speed increaser flywheel when the taper bushing is tight. See Service Data for specific model.

Angular alignment should be checked at each flexing member by attaching a dial indicator to the coupling flange and indicating against the face of the mating flange. Angular misalignment should not exceed 0.51 mm (.020") total indicator reading when revolving both shafts together.

RUBBER BUSHINGS

The speed increaser couplings do not require any routine maintenance or lubrication. If rubber bushings have torn flanges, excessive stiffness, or cracks, the coupling assembly should be replaced. Do not replace just the rubber bushings.

FAN AND PEDESTAL ALIGNMENT

Any maintenance performed on a switcher locomotive which requires moving the compressor, or disassembly of the fan and pedestal assembly, will require an alignment check of the fan and pedestal assembly.

When the air compressor has been moved, it must be realigned so that the finished surfaces of the compressor drive sheave, and the fan and idler sheaves of the fan and pedestal assembly, are in the same plane within 1.52 mm (.060"). If this alignment cannot be achieved without disturbing the alignment of the air compressor to the engine, it may be necessary to reposition the pedestal to accomplish the proper alignment.

When maintenance requires disassembly of the fan and pedestal assembly, the drive shaft shall be measured for lateral movement between the inner and outer races of the bearings. On older switcher locomotives with ball bearings supporting the fan drive shaft, this is accomplished by attaching a dial indicator to the pedestal with the plunger against the face of the fan drive sheave. Alternately push and pull shaft with 45 kg (100 lbs) of force, reading total shaft movement. Total movement shall be 0.13 mm (.005") minimum. This amount of movement indicates that the bearing is not preloaded – a condition caused by improper assembly or mounting.

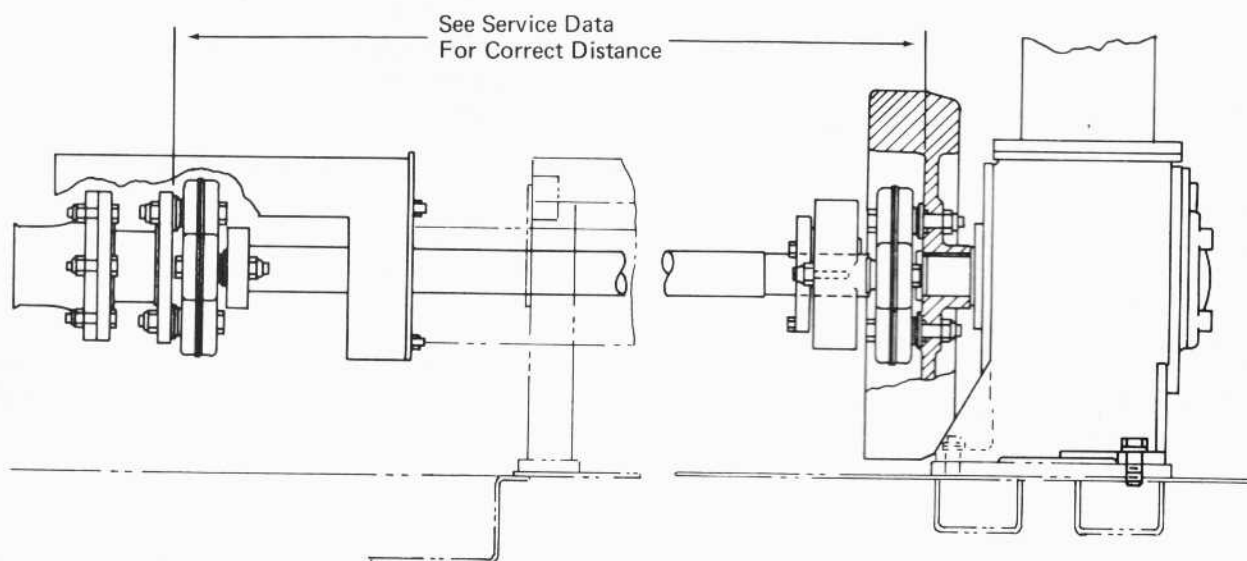


Fig. 17 – Speed Increaser Drive Coupling Alignment

Newer switcher locomotives have a roller bearing at one or both ends of the fan drive shaft. The sheave end roller bearings have 9.5 mm (3/8") axial free play between the inner and outer races. Alignment consists of positioning the drive shaft in the middle of the 9.5 mm (3/8") axial free play at the sheave end before torquing down the bearing. Align the fan drive sheave and the idler sheave in the same plane with the drive sheave on the air compressor within 1.52 mm (.060"). If this alignment cannot be achieved, it may be necessary to reposition the pedestal to accomplish the proper alignment.

GENERATOR TO ENGINE ALIGNMENT

To make the engine and generator revolve true and comparatively free from vibration, the alignment through the coupling must be exact. In order that the generator may perform correctly in its electrical phase of operation, the air gap between the main poles and the armature or rotor must be held to the correct dimension and be evenly distributed at all poles.

The generator armature or rotor is, in effect, the flywheel for the engine and is joined to the engine crankshaft by means of a flexible coupling. An engine coupling disc and a generator coupling disc comprise the flexible coupling. Each disc is mounted at its center to its respective part by mounting bolts and both discs are joined at the rim or outer circumference by coupling bolts. The engine coupling disc rim has degree markings around its circumference and holes provided for an engine jack or turning bar for rotating the crankshaft.

All flexible couplings connecting the engine and generator are basically the same. Minor differences in construction are incorporated to provide specialized applications or increased interchangeability between models.

Current couplings have a "V" channel in the engine coupling disc and a "V" serration in the generator disc. Mounting bolts, both rim and center have clearance holes at the couplings. This design provides for interchange between earlier units with body bound or reamed fit mounting bolts. However, the following recommendations should be adhered to in the application of the serrated coupling.

After installation of the generator, the generator coupling disc is mated to the engine coupling disc

and the rim bolts applied and properly torqued to 400 N·m (295 ft-lbs). The coupling is then checked as follows:

1. The gap between the engine and generator coupling disc at the rim bolts should not be less than 0.038 mm (.0015"). Care should be taken to tighten all coupling bolts uniformly to avoid cocking the coupling on the serrations.
2. The recessed indicator surface and the serrations on the coupling are held concentric with the center bore. The entire rotating assembly is balanced about the same center. Runout of the indicator surface is a measure of out of balance. Concentricity is not held at the outside rim of the coupling disc, except at the fan pilot on generators equipped with fans.

GENERATOR ALIGNMENT INFORMATION

The alignment of generator with engine is divided into three operations:

1. Thrust - finding the axial position of armature or rotor with respect to the generator frame.
2. Angular - correcting the angularity of generator to engine coupling.
3. Radial - balancing and setting the air gap between the generator armature or rotor and field poles.

Angular and radial alignment are carried out simultaneously.

GENERATOR BEARING ALIGNMENT

After the generator is coupled to the engine, it is very important to locate the generator frame axially to avoid a thrust load on the bearing from either direction. The bearing float (total end play) for each generator is stamped on the bearing cover or the end housing depending on the type of generator.

1. Take out all crankshaft thrust at generator end of engine by prying the crankshaft toward the generator end of the engine. This may be done by removing one oil pan hand-hole cover and prying against a crankshaft web and a crankcase "A" frame.

2. Locate the "x" measurement number stamped on the generator with 13 mm (1/2") numbers at the location indicated in Table 1. This measurement is determined during final generator assembly with the armature or rotor (depending on the type of generator) positioned so end play is taken up in the direction of the engine coupling.
3. Move the generator frame either away from or toward the engine to obtain a measurement, which is the total of the "x" measurement plus the bearing thrust dimension listed in Table 1.

GENERATOR ALIGNMENT

The proper operation of the power plant requires that the generator armature or rotor shaft and generator frame be in line with the engine crankshaft, and that the air gap be equally spaced. It is equally important that eccentricity at the coupling be held to a minimum as this directly affects balance, brush and bearing wear.

The air gap of the generator must be uniform under each main pole, as well as under each commutating pole and, also from the front to rear of each pole, to obtain the proper electrical characteristics of the generator.

Since the generator has only one roller bearing, the recommended method for aligning the air gap and coupling is at the engine end of the generator.

The radial and angular alignment can be accomplished by using two dial indicators mounted on support rods. Mounting and positioning of the

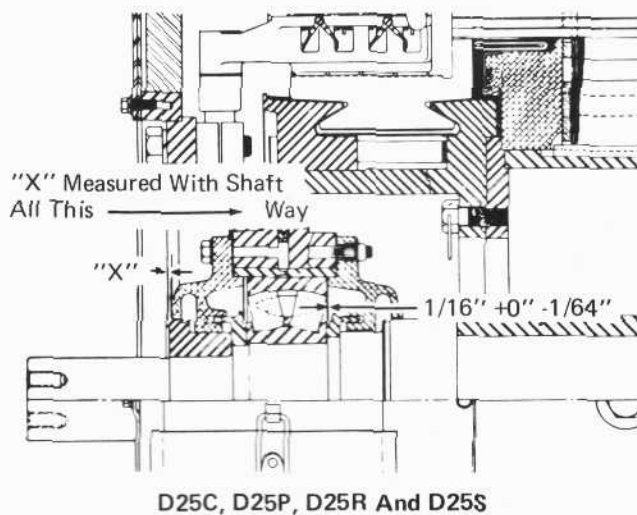
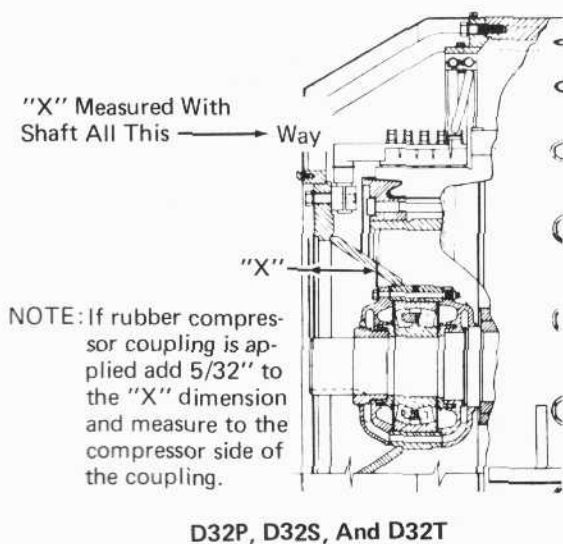
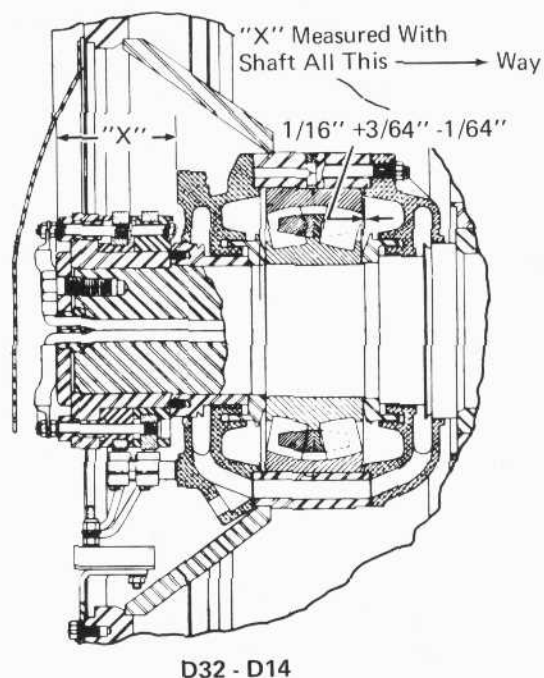
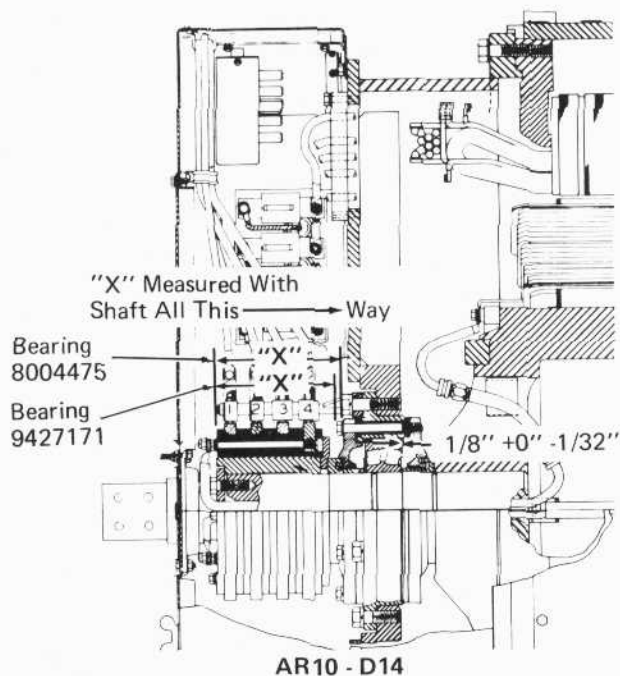
dial indicators will vary for specific generator models. See Fig. 19 for dial indicator location.

Any generators equipped with guard over the rotor must have the guard removed before applying the dial indicator rods. A special indicator with an offset pickup arm will be required to permit rotation on turbocharged engines.

1. Mount and position dial indicators, Fig. 19. Both dial indicators will revolve with the armature shaft.
2. With the engine turning jack assembly, the flywheel should be turned so that the indicator rod is in a vertical position. This will place both indicators near the top of the generator.
3. After clamping the indicators on the rod, the indicator buttons are brought to bear upon the surfaces on which they will ride. To set the indicators, depress the plungers about half of the total travel. This will permit the indicator to show plus or minus readings as the coupling is rotated.
4. With the indicator set, turn the flywheel with the engine turning jack, 180° in a clockwise direction, when facing the bearing end of the generator. Then rotate the flywheel 270° in a counterclockwise direction. The counterclockwise rotation instead of continued clockwise rotation is necessary to prevent the indicators from striking the alternator terminal board, if so equipped. As the indicators revolve around the generator, readings should be taken at each 90° increment. When the indicators return to the original starting point they should register zero. If they do not register zero, reset and make another check or replace indicators if defective.

TABLE 1 ALIGNMENT DATA

Generator	"x" Dimension Measured From (See Fig. 18)	Stamped "x" Dimension Location	Bearing Thrust Dimension	
			Inches	Millimetres
AR10-D14 Thin Engine Coupling	Bearing housing bolt head at 1 o'clock position to outer face surface of collector ring assembly. (Generator equipped with bearing 8004475)	End Housing	1/8+0-1/32	3.2+0-0.8
AR10-D14 Thick Engine Coupling	Bearing housing bolt head at 1 o'clock position to outer face surface of collector ring assembly. (Generator equipped with bearing 8004475)	End Housing	1/8+0-1/32	3.2+0-0.8
AR10-D14 Thin Engine Coupling	Machined face of bearing housing to outer face surface of collector ring assembly. (Generator equipped with bearing 9427171)	End Housing	1/8+0-1/32	3.2+0-0.8
AR10-D14 Thick Engine Coupling	Machined face of bearing housing to outer face surface of collector ring assembly. (Generator equipped with bearing 9427171)	End Housing	1/8+0-1/32	3.2+0-0.8
D32-D14	Top right spot face surface of outer bearing cover to outer end surface of collector ring assembly.	End Housing	1/16+3/64-1/64	1.6+1.2-0.4
D32P (Fan)	Top right spot face surface of outer bearing cover to end surface of armature shaft.	Top of horiz. spoke of end housing	1/16+3/64-1/64	1.6+1.2-0.4
D32S	Top right spot face surface of outer bearing cover to end surface of armature shaft.	Top of horiz. spoke of end housing	1/16+3/64-1/64	1.6+1.2-0.4
D32T	Top right spot face surface of outer bearing cover to end surface of armature shaft.	Top of horiz. spoke of end housing	1/16+3/64-1/64	1.6+1.2-0.4
D25C (Fan)	Bearing cover face or chisel marks to outside end face of bearing retainer.	End housing under one of commutator covers.	1/16+0-1/64	1.6+0-0.4
D25P	Bearing cover face or chisel marks to outside end face of bearing retainer.	End housing under one of commutator covers	1/16+0-1/64	1.6+0-0.4
D25R	Bearing cover face or chisel marks to outside end face of bearing retainer.	End housing under one of commutator covers	1/16+0-1/64	1.6+0-0.4
D25S	Bearing cover face or chisel marks to outside end face of bearing retainer.	End housing under one of commutator covers.	1/16+0-1/64	1.6+0-0.4



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Fig. 18 - Thrust Alignment Cross-Section

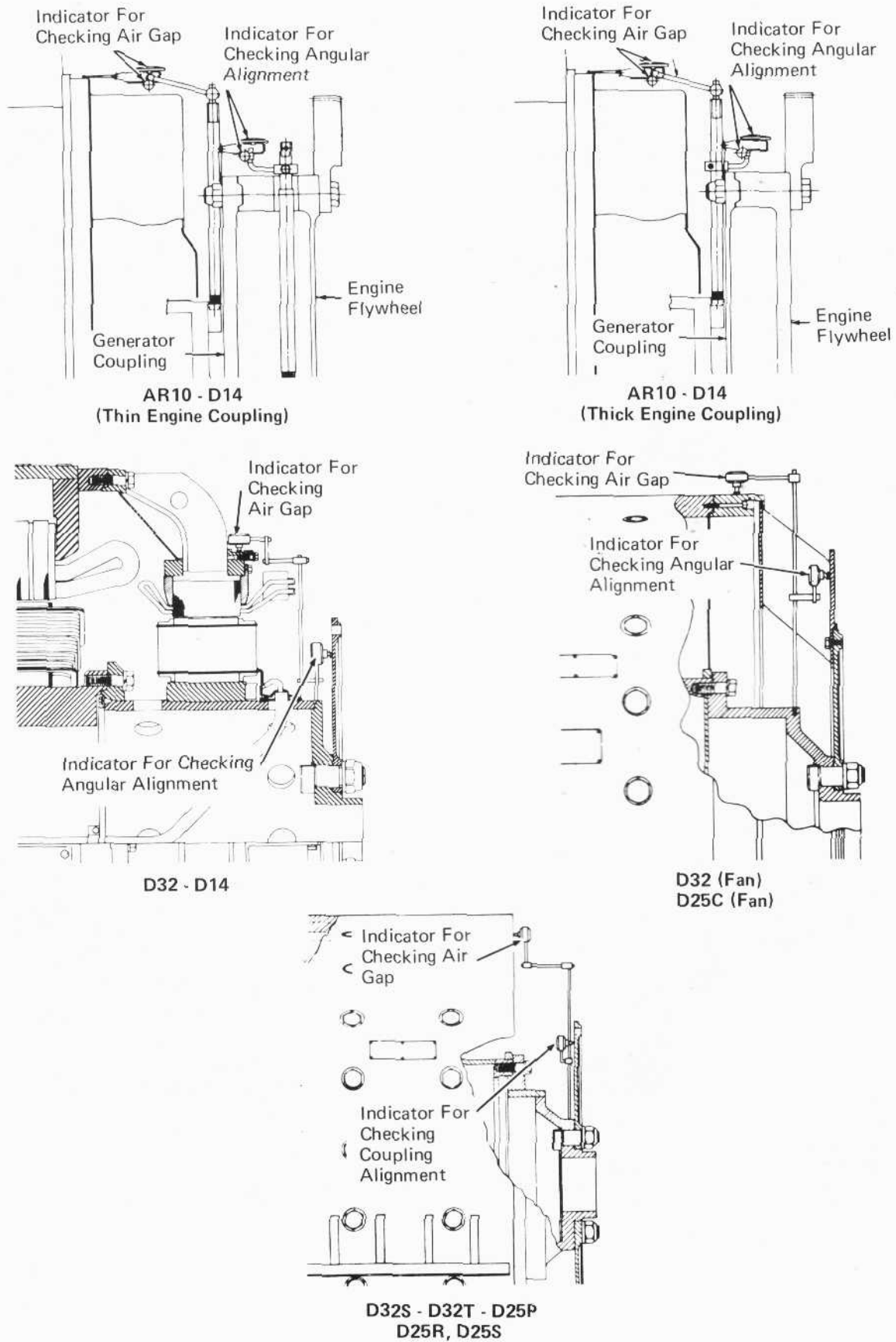


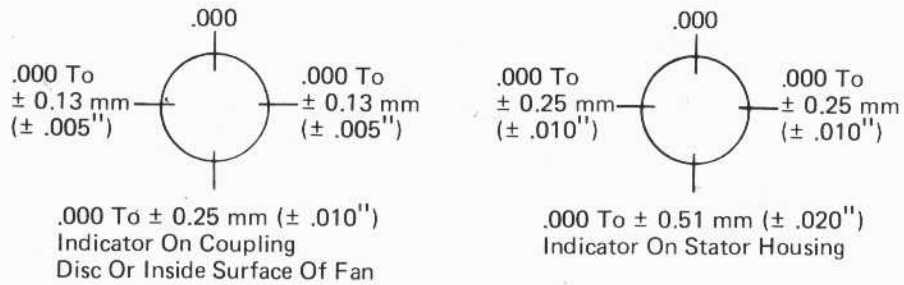
Fig. 19 - Alignment Indicator Locations

If the indicator readings are within the limits shown in Fig. 20, the generator is considered aligned and the mounting and coupling bolts can be tightened to the specified torque.

Since any movement of the generator frame affects both the coupling and air gap, readings for both must be taken after each setting.

Experience will indicate the proper shim thickness to bring the readings within the specified limits. Full length shims should be used when possible, although spot shims may be necessary to conform to the limits.

Upon completion of main generator alignment the auxiliary generator must be aligned.



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Fig. 20 - Dial Indicator Alignment Tolerances

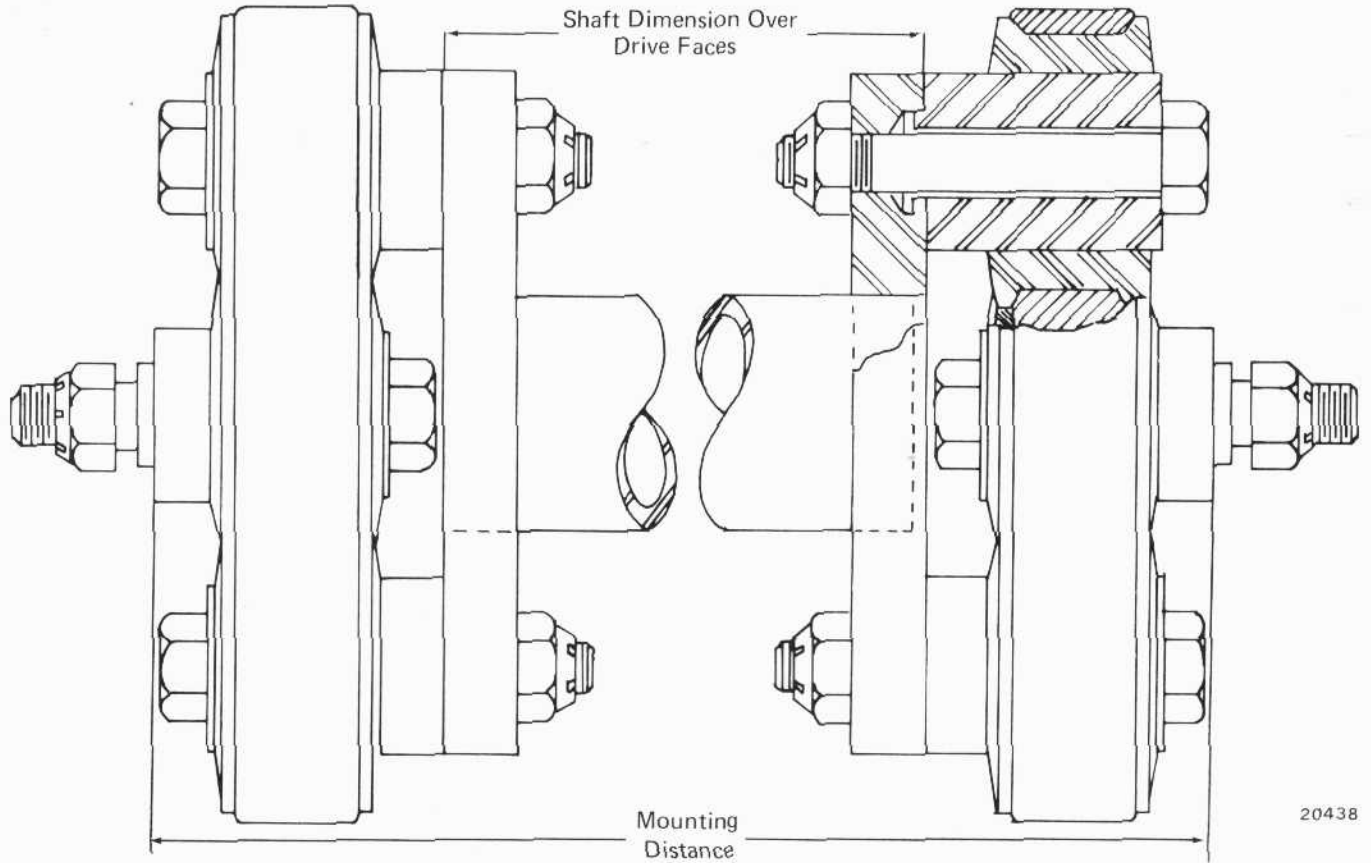
SERVICE DATA

Coupling Assembly Number*	Mounting Distance		Drive Shaft Number	Shaft Dimension Over Drive Faces	
	Inches	Millimetres		Inches	Millimetres
8082348	10-3/4±1/16	273±1.6	8184471	5.875±.010	149.23±0.25
8144824	24±1/16	610±1.6	8184472	19.125±.010	485.78±0.25
8179815	16-5/16±1/16	414±1.6	8184473	11.437±.010	290.50±0.25
8198385	21-1/2±1/16	546±1.6	8204546	16.625±.010	422.28±0.25
8203185	30-5/32±1/16	766±1.6	8203232	25.281±.010	642.14±0.25
8215545	9±1/16	229±1.6	8215544	4.125±.010	104.77±0.25
8227098	15-31/32±1/16	406±1.6	8227021	9.344±.010	237.34±0.25
8227099	14-7/32±1/16	361±1.6	8227020	11.094±.010	281.79±0.25
8253885	14-3/4±1/16	375±1.6	8253884	9.870±.010	250.70±0.25
8263653	22-1/8±1/16	562±1.6	8263652	17.250±.010	438.15±0.25
8268343	19-1/2±1/16	495±1.6	8268344	14.625±.010	371.48±0.25
8273769	16-9/16±1/16	421±1.6	8273768	11.687±.010	296.85±0.25
8290092	12-3/8±1/16	314±1.6	8290091	7.500±.010	190.50±0.25
8318348	21-1/8±1/16	537±1.6	8318349	16.250±.010	412.75±0.25
8324611	20-21/32±1/16	525±1.6	8324610	15.781±.010	400.84±0.25
8336942	31-29/32±1/16	810±1.6	8336941	27.000±.010	685.80±0.25
8337051	13-5/16±1/16	338±1.6	8337050	8.437±.010	214.30±0.25
8342084	30-17/32±1/16	775±1.6	8342083	25.656±.010	651.66±0.25
8365007	23-13/16±1/16	605±1.6	8365012	18.938±.010	481.03±0.25
8368151	27-1/2±1/16	699±1.6	8368150	22.625±.010	574.67±0.25
8376054	13-3/4±1/16	349±1.6	8376053	8.870±.010	225.30±0.25
8376234	26-1/2±1/16	673±1.6	8376233	21.620±.010	549.15±0.25
8420621	32-7/32±1/16	818±1.6	8420620	27.343±.010	694.51±0.25
8426510	26-27/32±1/16	682±1.6	8426509	21.969±.010	558.01±0.25
8432314	36-17/32±1/16	928±1.6	8432313	36.656±.010	931.06±0.25
8449583	14-21/32±1/16	372±1.6	8449582	9.781±.010	248.44±0.25
8476945	20-17/32±1/16	521±1.6	8476944	15.625±.010	396.87±0.25
8481592	28-9/16±1/16	725±1.6	8481591	23.687±.010	601.65±0.25
8484230	27-7/16±1/16	697±1.6	8484229	22.562±.010	573.07±0.25
8484483	20-3/8±1/16	518±1.6	8484484	15.500±.010	393.70±0.25
8486494	22-9/32±1/16	566±1.6	8486493	17.406±.010	442.11±0.25

*Shown on power plant equipped mounting assembly drawing supplied to customer.

SERVICE DATA (Cont'd)

AUXILIARY GENERATOR COUPLING ASSEMBLY



SPEED INCREASER

Distance between shaft flange and speed increaser flange or flywheel

G22	2.0518 m (6' 8-25/32")
G26	2.2685 m (7' 5-5/16")

EQUIPMENT LIST

	<u>Part No.</u>
Bushing puller	8239562
Rubber lubricant	8251651
Bushing application gauge	8254465
Gauge set, master (base plate and .460", .470", .480" pointer calibration discs	8254466
Dial indicator	8255423
Dial indicator (AR10-D14 only)	8460472