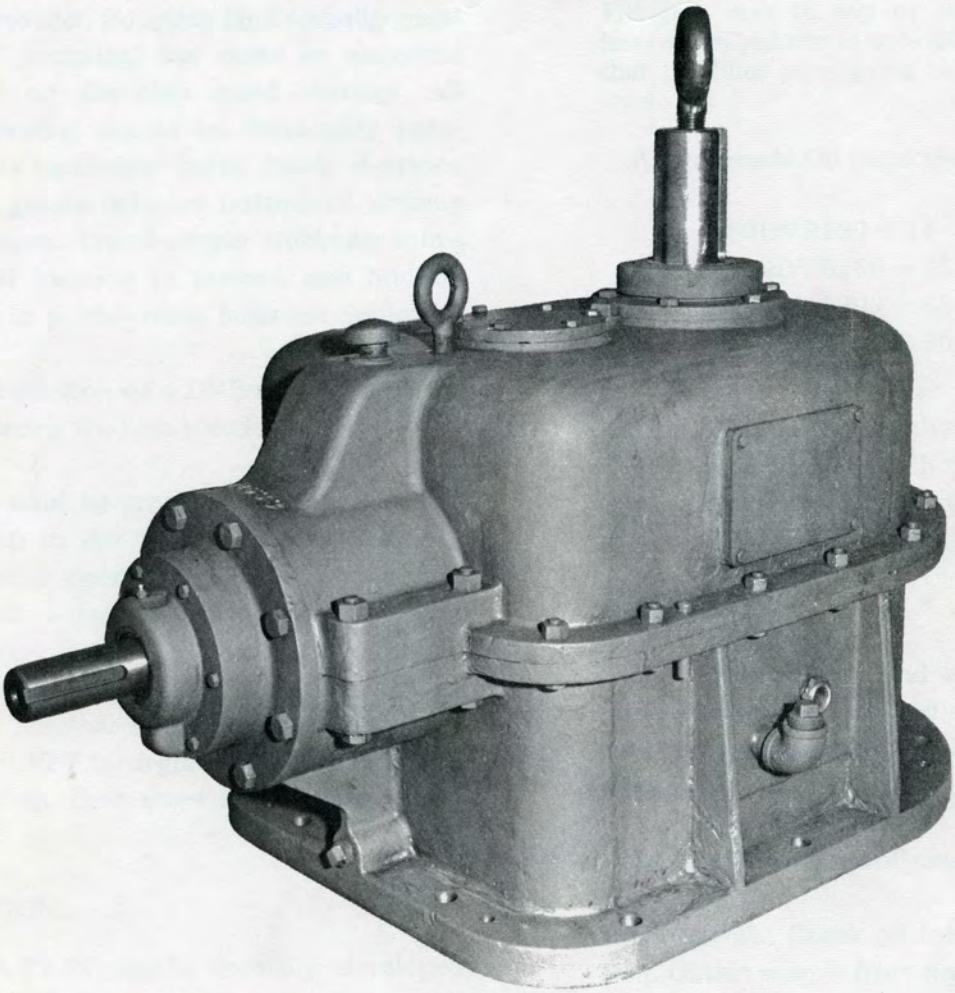
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LUFKIN

DOUBLE REDUCTION SPIRAL BEVEL GEAR REDUCERS TYPE DVB



INSTALLATION LUBRICATION MAINTENANCE

DVB-1
8-72

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INSTALLATION – LUBRICATION – MAINTENANCE

LUFKIN SPIRAL BEVEL GEAR REDUCERS

TYPE DVB

INSTALLATION

The reducer should be mounted on a substantial foundation. Heat coupling halves or hubs in oil for assembly on reducer shafts--do not drive onto shafts. Align flexible couplings both radially and axially. If necessary, be sure couplings are greased. Always use a flexible coupling between motor and reducer. Coupling bind (misalignment or a "dry" coupling) can cause an abnormal thrust load on the high speed bearings. All structural bolting should be thoroughly tightened. Before tightening bolts, check clearance with feeler gauges between bottom of housing and foundation. Install proper thickness shims at each bolt location to prevent gear housing from being in a bind when bolts are tightened.

The normal rotation of a DVB reducer is clockwise while facing the high speed shaft.

An air vent must be provided to prevent a pressure build-up in the gear box when the unit warms up after operation. The DVB reducer is shipped with a breather installed in the gear housing cover. It is recommended for cooling tower service to remove the breather and then install a 1" breather line outside the fan stack. Provide a 1" NPT 90 degree elbow with the outlet pointing up, then screw the breather cap in the elbow.

LUBRICATION

Interior: LUFKIN uses a specially developed break-in oil which leaves a residual film on all interior surfaces. With reasonable exterior conditions, this film will last six months. The film will be compatable with the lubricating oil.

Oil: Use a premium, turbine type, mineral oil with rust and oxidation inhibitors, and anti-foam agent.

Surrounding Air Temperature	AGMA No.	Viscosity - SSU at 100 degrees F.
15 to 60 degrees F.		
Cone Dist. up to 12"	2	284—347
Cone Dist. over 12"	3	417—510
50 to 125 degrees F.		
Cone Dist. up to 12"	4	626—765
Cone Dist. over 12"	5	918—1122

Fill gear case to top of sight glass. Check oil level when reducer is not operating. Make certain that oil filler pipe going to outside of stack is level.

Approximate Oil Capacities (Gallons)

80DVB120 — 14
100DVB160 — 35
120DVB200 — 65
150DVB240 — 90

After two weeks: Drain the gear case, flush out the interior and refill with fresh oil (the original oil may be used if it is filtered). Re-check coupling alignment and retighten all the bolting.

MAINTENANCE

Every week: Check and maintain proper oil level. Inspect reducer (and related components) for abnormal temperatures, noise, movement, or vibration.

Note item "Shut Down" described below.

Every month: Check oil for possible contamination. Obtain sample from near the bottom of the gear case.

Every six months: Remove old oil. Flush interior of box. Visually inspect interior gear elements (through inspection cover opening). Add new oil. Re-grease cavities between high speed seals and slow speed seals.

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CAUTIONS

(1) KEEP OIL CLEAN — Contamination is the biggest enemy of proper lubrication.

(2) SHUT DOWNS — Operate the reducer for a few minutes once a week during shut down periods. This will assure a redistribution of oil and help prevent interior rusting.

(3) REPAIRS — Should major repairs be needed, it will be best to return the reducer to the factory. If time is not available for factory repairs, LUFKIN has available capable field service men who can go to the job site. If the customer desires to repair the equipment himself, note the "CONSTRUCTION AND FIELD REPAIR"section of this pamphlet.

--CONSTRUCTION AND FIELD REPAIR--

CONSTRUCTION OF THE DVB REDUCER

The LUFKIN Type DVB Spiral Bevel Gear Reducer is a right angle double reduction gear drive incorporating a spiral bevel gear set in the first reduction and a single helical gear set in the second reduction. The spiral bevel gear sets are cut on Gleason machines from SAE 4620 steel heat treated and case hardened after cutting. Gear and pinions are lapped in pairs and furnished as a set. The single helical gear sets are generated on precision hobbing machines.

In general, all shafts are mounted on tapered roller bearings for radial and thrust loads. The input pinion shaft for the 150DVB240 reducer is provided with TDO double taper bearings on the outer part of shaft. A straight roller type bearing is used near the pinion.

Shaft bearing surfaces are ground to the tolerances as recommended by the bearing manufacturer to insure proper bearing fit. Oil troughs are provided for delivering oil to each bearing and a flinger is mounted on pinion shaft, between pinion head and inner bearing, for splash lubrication. It is important that oil flinger dip in oil. Under no circumstances should gear unit be allowed to run without flinger dipping in oil.

Efficiency of the LUFKIN Double Reduction Spiral Bevel DVB Reducer is 96%.

ASSEMBLY OF BEVEL GEARS

In the mounting of spiral bevel gears and pinions, provisions are made for shims located under flange of each bearing carrier for adjustment.

The spiral bevel pinion is a separate sub-assembly with its bearings, carrier, etc., assembled initially as a unit independent of the gear. The bearing adjustment should be made before assembling the pinion carrier in place in the housing. (In the case of the 150DVB240 reducer no bearing adjustment is required as the bearing is furnished with steel spacer ground to thickness to provide proper bearing clearance.)

Make certain that the bearings and bearing seats are thoroughly clean. The oil flinger which goes behind the pinion teeth should be pressed firmly against the back of the pinion and the inside bearing cone should be firmly against the flinger.

The cones should be heated in oil at about 250 degrees F. for easy assembly onto the shaft. The outer cone is mounted last after the pinion has been inserted in the carrier.

Adjustment of the bearing is made by lock nut with lock washer. The bearings and nut should be adjusted so that after the nut has been securely tightened against the lock washer, there is a slight preload on the bearings. The bearings should offer a slight resistance to rotation by hand.

This preload of resistance to rotation should be measured as accurately as possible, varying torque recommendations as per following schedule will be required to move the shaft with bearings well oiled but not run-in. This preload test is made before seal caps are installed.

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80DVB120	12—15 Inch Lbs.
100DVB160	12—15 Inch Lbs.
120DVB200	12—15 Inch Lbs.
150DVB240	12—15 Inch Lbs.

MOUNTING DISTANCE

The axial position of a bevel gear or pinion in assembly is given by a dimension called the mounting distance. This is the linear dimension from the axial locating surface of a given member to the intersection point of its axis with the axis of its mate. This surface is usually the backface of the pinion or gear.

Frequently, it is more convenient to make measurements in assembly to the front of the pinion. In such cases, a flat reference surface is provided at the front for measuring purposes. The mounting distance is etched on the end of the pinion.

BACKLASH

Bevel gears are cut to have a definite amount of backlash which varies according to the pitch and operating conditions. This backlash is necessary for the safe and proper running of the gears. If there is insufficient backlash, the gears will be noisy, wear excessively, and possibly score on the tooth surfaces or even break. The amount of backlash required is usually etched or stamped on one or both members of a pair. If no markings are given, use the values listed in the following table:

Table of Normal Backlash For Spiral Bevel Gears

Diametral Pitch	Normal Backlash
1	0.020" to 0.030"
2	0.012" to 0.016"
3	0.008" to 0.011"
4	0.006" to 0.008"
6	0.004" to 0.006"
10	0.002" to 0.004"

This table gives the recommended normal backlash for gears assembled ready to run. Backlash for pitches other than those listed may be obtained by interpolation. In certain applications, the backlash tolerance may have to be altered to meet specific requirements.

Normal backlash, that is, backlash in a direction perpendicular to the tooth surface should be measured at the tightest point. In order to make this measurement, hold the pinion solidly against rotation, rigidly mount a dial indicator against a gear tooth, being sure that the indicator stem is perpendicular to the tooth surface at the extreme heel. The normal backlash will be shown by the indicator when the gear is turned back and forth.

In the case of fine pitch gears, it is often easier to check the backlash by means of a boom arrangement attached to the gear shaft. The indicator reading is taken at a radius approximately equal to the pitch radius of the gear. This method gives a direct reading of backlash in the plane of rotation.

This checking of the backlash is an important step in the mounting of the gears. When the requisite backlash is not obtained, the gear should be adjusted axially until it is obtained. This adjustment is made by either adding and/or removing bearing carrier shims at top and bottom of gear unit.

INSTALLING THE SPIRAL BEVEL GEARS

Before assembling a pair of bevel gears, look them over, observe all markings, and read any tags which may be attached. The mounting distance is indicated as "M.D." followed by the dimension. Backlash is indicated as "lash" followed by the amount.

LUFKIN strongly recommends that gages be used to set the pinion at its correct mounting distance and that the gear be then set to have the requisite backlash as measured by a dial indicator, and as explained in following paragraphs. This is most important in the case of ratios 2:1 and higher, because a change in the axial location of the pinion affects the tooth

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bearing much more rapidly than a comparable change in the gear. In some case, where direct measurement in mounting is difficult, the larger bevel gears have their teeth cut to run best with the back cone surfaces flush. These gears can be satisfactorily assembled by setting them to have the back cone surfaces flush and with the proper backlash.

The tooth bearing should always be checked before putting in the lubricant and running under load. The mounting is correct only when the proper tooth bearing and required amount of backlash are obtained. To check the gears, paint the teeth with a mixture of marking compound and a few drops of light oil, and run the gears under a light load. The tooth bearing will then show painly. Correct tooth bearing will show contact near the center of the teeth.

MARKED TEETH

Spiral bevel gears of exactly even or multiple ratios, which have been lapped, have certain teeth marked "X". These gears should always be assembled with the marked teeth together. This should be done whenever such gears are put together after having been disengaged.

LOCATING THE SPIRAL BEVEL PINION

The position for mounting the pinion should be determined by measuring from the shaft of the mating gear. The distance from the locating surface on the pinion to the gear shaft will be equal to the mounting distance minus the radius of the gear shaft.

The measurement may be made by means of micrometer gages, gage blocks, or by special gages prepared for that purpose. It is often more convenient to measure to the front of the mounted pinion rather than to its back. In this way the mounting distance can be readily checked, after the pinion is in place.

LOCATING THE SPIRAL BEVEL GEAR

After the pinion is in place, the correct position of the gear may be accurately determined by moving the gear axially and into mesh with the pinion until the specified backlash is obtained, as previously explained. It is then locked in place.

CHECKING THE INSTALLATION OF THE SPIRAL BEVEL GEAR SET

When both gear and pinion are fastened in place, the tooth bearing should be checked as already mentioned.

Inaccuracies in mounting or assembling will change the location of the tooth bearing on properly cut bevel gears. The deviation from the proper tooth bearing indicates the nature of the error.

When the bearing is too high on the pinion and too low on the gear, the pinion is too near the center of the gear. This is corrected by increasing the pinion mounting distance. In the opposite case, with the bearing low on the pinion and high on the gear, the pinion mounting distance should be decreased.

If the shafts are not accurately located in the same plane, a cross bearing will result -- the contact will be concentrated at one end of the tooth on one side and the opposite end on the other side. The shafts must be lined up to correct this.

TOOTH BEARING

Spiral bevel gears are produced to run with a localized tooth bearing. Since the area of contact does not cover the whole tooth, a slight tolerance in positioning the gears in assembly and some displacement under operating loads is possible -- without concentration of the load on the ends of the teeth.

The ideal tooth bearing is slightly high on the pinion and low on the gear. Its length under light load is usually about one-half of the tooth length so as to provide sufficient adjustability consistent with smoothness. Moreover, since the

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tooth bearing under heavy load will generally shift toward the heel (outer end of the tooth), the gears are cut so as to place the bearing, with the gears mounted in correct position, slightly near the toe (inner end of the tooth). The resulting bearing is called a central toe bearing.

INSTALLING SPIRAL BEVEL GEAR SET

1. Always keep matched or lapped gears in their original sets or pairs.
2. Always replace both members of a pair.
3. Assemble lapped gears of even ratio with the teeth marked "X" together.
4. See that gears are a close fit on gear hub.
5. Make sure that there is the correct amount of backlash.
6. Check the tooth bearing.
7. Make sure that lock nuts, bolts, etc., are tight. In the case of spiral bevel, be sure that both pinion and gear are locked against axial thrust in both directions.
8. Lubricate gears properly before operating under power.

INSTALLING AND ADJUSTING SINGLE HELICAL SLOW SPEED GEAR SET.

After the spiral bevel gear set and slow speed pinion is installed and adjusted, the slow speed gear and slow speed shaft assembly can then be installed after removal of gear housing cover. The lower bearing cup and bearing retainer cap with shim pack should first be in place with cap screws tightened. Lower slow speed shaft and gear assembly into place. Install gear housing cover and tighten all flange bolts. The upper bearing retainer with bearing cup and shim pack should be installed and tightened. Check the clearance between upper outer bearing cup and bearing rollers with feeler gage through the side inspection cover. Remove or add necessary shims until clearance between bearing rollers and bearing cup is .0015 to .002 inch. Before installing the slow speed oil seals and slow speed shaft baffle, a final check should be made for proper backlash and tooth contact. After this final check, install slow speed shaft seals, being sure to grease cavity between oil seals. Install slow speed shaft baffle.

OIL SEALS

Sealing at the pinion shaft is accomplished by two individual seals. The outboard seal lip is pointed out and the inboard seal lip is pointing inward with a small grease cavity in between which is filled at the factory. A hydraulic fitting is on the outside diameter of the cap (which supports the seals) and a small amount of grease should be injected into this cavity about every six months.

The sealing at the slow speed shaft is also done by two individual oil seals, back to back, with the inner, or lower, seal lip pointing inward and the outer, or upper, seal lip pointing outward. The cavity between the two seals is filled with grease at the factory and a small amount should be injected into this space once every six months. To give additional protection, a baffle is pressed on the slow speed shaft which gives direct protection to the seals. The baffle becomes a labyrinth as it fits close to a mating ring which is part of the seal-bearing retainer. The cavity formed by the baffle-seal has grease placed in it at the time of assembly.

When installing new seals at either the slow speed shaft or high speed pinion, a piece of thin shim stock should be wrapped around the end of the shaft and around the shaft at the keyseat to avoid cutting or damaging the lip of the seal as it is being installed.

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