Copied from an original at The History Center, Diboll, Texas. www.TheHistoryCenterOnline.com 2013:023

2C84

LUFKIN

SPIRAL BEVEL GEAR

SPEED REDUCERS

INSTRUCTIONS

for

Installing, Lubricating

and

Operating

LUFKIN

VB GEAR UNITS

LUFKIN FOUNDRY & MACHINE CO. LUFKIN, TEXAS

Branch offices: Dallas, Houston, Tulsa, Los Angeles, New York, Oklahoma City, Corpus Christi, Kilgore, Wichita Falls, Casper, Wyo., Great Bend, Kan., Odessa, Tex., Seminole, Okla., El Dorado, Ark., Effingham, Ill., Lafayette, La., Sidney, Mont., Edmonton, Alberta, Canada, Bakersfield, Denver, Regina, Pampa, Hobbs, Midland, Natchez

Copied from an original at The History Center, Diboll, Texas. www.TheHistoryCenterOnline.com 2013:023

INSTRUCTIONS FOR OPERATION OF THE LUFKIN VB REDUCER

CONSTRUCTION OF THE VB REDUCER

The Lufkin Spiral Bevel Gear Reducer is a right angle vertical spiral bevel gear drive primarily designed for driving cooling tower fans. The gears and pinions are cut in Gleason machines from SAE 4620 steel heat treated and case hardened after cutting. Gears and pinions are lapped in pairs and furnished as a set.

All shafts are mounted on tapered roller Timken Bearings for radial and thrust loads. Shafts are ground to a tolerance of .0005''.

General oil troughs are provided for delivering oil to each Timken 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 Spiral Bevel VB Reducer is 98%.

INSTALLATION

Correct installation is essential for proper operation. The gear should be mounted on a rigid and substantial foundation as possible so that vibration will be at a minimum and proper alignment will be maintained.

COUPLING

Power should be transmitted by means of a flexible coupling between prime mover and high speed shaft. Do not drive coupling on shaft as an endwise blow may cause damage to the gears and bearings. Bore flexible coupling to the same tolerance as shaft, then heat in a bath of oil and shrink on the shaft. Couplings should be lined up within .005''. Never use a rigid flanged coupling.

ROTATION

The normal rotation of a Lufkin standard VB reducer is clockwise facing high speed shaft. The unit will operate in a counter clockwise rotation but is not recommended for continuous duty because of the thrust action of the pinion. A normal clockwise rotation facing the high speed shaft on a standard VB reducer will result in a clockwise rotation of the slow speed shaft looking down on the fan.

LUBRICATION

See attached Lubrication Instructions for Lufkin type VB Cooling Tower Gears.

To check the oil level, stop the unit and note sight level gauge. Oil is at maximum level when the oil level is at the top of the sight window in a stationary position of the gear. Oil cannot be checked for proper level when gear is in operation. The gear unit should never be operated when the oil falls below the sight window. Add oil if needed to obtain proper level.

Copied from an original at The History Center, Diboll, Texas. www.TheHistoryCenterOnline.com 2013:023

To check for emulsification, contamination or deterioration, oil sample must be removed from drain plug near bottom of case, and not from oil filter elbow.

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 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 carrier in place in the housing.

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 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 two lock nuts with lock washers. The bearings and nuts should be adjusted so that after the outer 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.

20VB	5-6 In. Lbs.
25VB	5-6 In. Lbs.
30VB	6-8 In. Lbs.
40VB	8-10 In. Lbs.
50VB	8-10 In. Lbs.
60VB	8-10 In. Lbs.
70VB	10-12 In. Lbs.
80VB	10-12 In. Lbs.
90VB	10-12 In. Lbs.
100VB	10-12 In. Lbs.
110VB	12-15 In. Lbs.
115VB	12-15 In. Lbs.
120VB	12-15 In. Lbs.
150VB	12-15 In. Lbs.
DVB-80	12-15 In. 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 back face 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 and on a smooth surface on the perimeter of the gear.

Copied from an original at The History Center, Diboll, Texas. www.TheHistoryCenterOnline.com 2013:023

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

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''
20 and finer	0.001'' to 0.003''

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.

INSTALLING THE 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 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

Copied from an original at The History Center, Diboll, Texas. www.TheHistoryCenterOnline.com 2013:023

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 plainly. 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 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 GEAR

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

CHECKING THE INSTALLATION

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.

Copied from an original at The History Center, Diboll, Texas. www.TheHistoryCenterOnline.com 2013:023

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 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 GEARS

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 shaft.
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.

OIL SEALS

The sealing lip of the pinion shaft oil seal rides on the hub of an oil slinger to avoid grooving the pinion shaft. When making replacement of this seal, a new slinger should also be used if the old one has been grooved.

The seals on the slow speed shaft consist of two individual seals. The baffle above the slow speed seal consists of close running stationary and rotating metal parts and there is provision for a grease fitting or grease pipe to be screwed into the top bearing retainer to inject grease into the cavity above the double oil seals and these close fitting parts. The close fit between the mating parts and the grease are intended to provide a barrier to the entrance of moisture and outside contaminants. A few ounces of grease should be injected into this cavity something like every three months. The quantity should be sufficient to purge the old grease from the cavity.

When installing new seals a piece of thin shim stock should be wrapped around the end of the shaft and around the shaft at the keyseat to avoid damage to the lip of the seal.

AIR VENT

An air vent must be provided to prevent a pressure build-up in the gear box when the unit warms up after operation. The VB reducer may be shipped with a breather in-

Copied from an original at The History Center, Diboll, Texas. www.TheHistoryCenterOnline.com 2013:023

stalled or the gear reducer may be shipped with a pipe plug in the breather hole for the purpose of installing breather line outside fan stack. If no breather is provided on gear unit, remove pipe plug in top of gear housing cover and provide 1/4" or larger pipe to outside of fan stack. A 1" pipe tap is provided on 30VB reducers and larger, and a 1/4" bushing is provided in 1" pipe tap for this purpose.

LUBRICATION INSTRUCTIONS

BEFORE STARTING UNIT, fill gear case with oil to point near top of glass gage indicated by arrow as HIGH OIL LEVEL (quantity of oil shown on name plate is only approximate). Make certain that oil filler pipe going to outside of stack is level. Operate for five days, check oil level, then drain and refill with new lubricant of same type. Thereafter, oil must be changed at least every six months. Oil should be checked for proper level and for contamination every thirty days.

WARNING:

For proper operation of the unit close attention must be paid to the oil level and to the regular changing of the oil. This is very important and failure to follow proper instrutions invalidate Lufkin's Warranty.

CHECK OIL LEVEL

Oil level is too low and new oil must be added when oil level is near the bottom of the glass gage, at the point indicated by arrow as LOW OIL LEVEL, with the reducer idle.

OIL CAPACITY LUFKIN VB REDUCER

	GALLONS
20VB	.25
25VB	.25
30VB	.5
40VB	1.25
50VB	2
60VB	3
70VB	5
80VB	6
90VB	11
100VB	12
110VB	19
115VB	21
120VB	28
150VB	30
DVB80	14

If Oil Shows Any Sign of Emulsification, Contamination or Deterioration, Replace Immediately With Fresh Oil.

To check for emulsification, contamination or deterioration, oil sample must be removed from drain plug near bottom of case and not from oil filler elbow.

HIGH QUALITY TURBINE GRADE LUBRICATING OILS CONFORMING TO THE FOLLOWING SPECIFICATIONS ARE RECOMMENDED FOR SPIRAL BEVEL GEAR REDUCERS:

Copied from an original at The History Center, Diboll, Texas. www.TheHistoryCenterOnline.com 2013:023

AMBIENT AIR TEMPERATURE SURROUNDING REDUCER

15 F to 60 F	
Viscosity Range SUV Secs. at 100 F	AGMA NO.
280 - 360	2

50 F to 125 F	
Viscosity Range SUV Secs. at 100 F	AGMA NO.
700 - 1000	4

The above is a high grade, high quality, well refined petroleum oil of the straight mineral type with the addition of oxidation and rust inhibitors and anti-foam agent.