SECTION 4 - SPEED INCREASING GEAR INFORMATION

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SPEED REDUCING AND INCREASING GEARS

TYPES HG-A TO HG-F

GENERAL DESCRIPTION - The parallel axis gears are of the single speed reducing or increasing, double helical precision type, designed as shown on the gear assembly drawing.

The gear casing is designed to form a rigid support for the rotating elements. It is split horizontally in the plane of the shaft axes to afford ready access to the interior and to facilitate dismantling and assembling operations. Metal to metal case joints are used between the case and the case cover.

The involute form gear teeth with modified profile are precision hobbed and shaved. The complete gear assembly and the pinion are dynamically balanced.

Both rotating elements are supported in babbitt lined, steel backed split sleeve type bearings which are installed with their joints in the horizontal plane and are prevented from turning by pins. *In most applications, the low speed gear bearings serve to locate the gear elements and will absorb a limited amount of external thrust. In cases of higher thrust loads, tapered land or pivoted shoe thrust bearings are used.

Efficient non-rubbing labyrinth type seals prevent oil leakage and dust entrance where the pinion and gear shafts extend through the casing.

LUBRICATION - Pressurized lubrication is supplied to the gear either from an attached oil pump driven by the pinion or gear shaft, from the main lube system of the entire unit, or from a separate lube oil system.

The oil for lubrication of the gear teeth and bearings is delivered under pressure to the oil inlet of the casing as shown on the Gear Assembly Drawing. Nozzles fitted in the casing direct sprays of oil onto the gear teeth. Oil passages in the casing carry oil to the bearing housings, thorough radial openings in the bearing shells, and is distributed over the journal surfaces. The oil returns to the reservoir by way of a common drain connection in the gear case. The drain line to the reservoir should be vented with an adequate breather adjacent to the gear casing.

*When required, stabilizing type bearings are used for the pinion.

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The lubricant used in the system must be in accordance with "Lubrication" pages following Page HG-4.

OPERATION - To assure successful operation of the gear, review the instructions on all systems until thoroughly understood. The operating procedure outlined below should be integrated with existing plant operating procedures.

PREPARATIONS FOR STARTING - Before attempting to start the gears initially or following an extended shutdown or an overhaul, the following operations should be performed.

1. Check the alignment of the gear and the machines it is coupled to as explained below. Refer to outline drawing for Alignment Data.

2. The rust preventive compound with which all exposed machined surfaces were coated at the factory should be removed. This can be accomplished by using any ordinary solvent. All internal surfaces of the gear were slushed at the factory with a special rust-preventive compound. This compound is soluble in and will be removed by the lubricant specified for the gear.

3. Drain and refill the oil system with a new charge of the oil specified for the gear.

4. Check the oil temperature. The initial oil temperature for starting should not be less than 60°F. Operate the reservoir heaters if necessary.

RUNNING - The following checks should be made periodically during the operation of the unit.

1. If vibration, rubbing, unusual noise or any other abnormal condition should develop, shut down immediately and investigate the cause. Operators should become thoroughly acquainted with the normal operating sounds of the unit to facilitate the detection of abnormal sounds. No unusual noise is too trivial to be neglected.

2. Check the oil pressure. It should in accordance with that specified on the nameplate.

3. The oil temperature rise through a cylindrical sleeve type bearing may be 25° to 35° F. The oil temperature rise through a stabilizing type bearing may be 50° to 60° F.

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SHUTTING DOWN - The unit should be kept clean at all times. When the gears are not in service, every precaution should be taken to prevent the accumulation of moisture in the casing if trouble due to corrosion is to be averted.

Examine the oil, and if there is any evidence of contamination, drain the oil system and recharge it with fresh oil.

The gears should be run and warmed up every 2 to 3 days or turned over through at least one revolution of the gear while operating the oil pump to coat the gears with oil and to bring them to rest in a new position.

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ALIGNMENT AND PARALLELISM - Alignment is a factor of vital importance in the operation of the gears. It is essential not only that the pinion and gear shafts be in line with the shafts of the driving and driven elements under operating conditions but also that the gear rotors be parallel.

The shaft alignment should be checked in accordance with the outline drawings.

The parallelism of the gears can be checked by examining the normal running marks on the gear teeth, or by coating the gear teeth with Prussian Blue or its equivalent, rotating the unit to make simulated running marks. There should be uniform contact across the face of the teeth.

Burrs or dirt in the bearings or unequal wear of the bearings are the most frequent causes of non-parallelism. If a check of the bearings does not satisfy the tooth contact requirements, the gear case should be checked for distortion. Distortion can only be caused by some change in the supporting structure, assuming of course that the gears have not been seriously damaged in some way. The nature and extent of the change in the supporting structure must be determined before corrective measures can be applied.

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MAINTENANCE - Given proper lubrication and normal operation, the gears are designed to run indefinitely without any attention. As a routine precaution the gears should be opened for inspection and cleaned every two years or whenever any sign of trouble such as a change in the sound of the gears occurs.

Extreme care should be exercised in the dismantling operations to avoid bruising or otherwise marring the surfaces of the gear teeth, journals, and bearings. Slings used for lifting the rotating elements should be well padded with clean wiping cloths. Check and carefully clean the oil spray nozzles.

Before assembly operations are started make certain that the interior of the casing is clean and that all tools or other foreign objects which have found their way into the casing have been removed. The rotating elements, bear-

ings and other parts should be carefully cleaned and inspected before they are installed.

The joints between the main sections of the gear casing and between the bearing caps and the gear case are metal to metal. For these joints only a sealing compound such as Indian Head Gasket Shellac, Permatex Form-A-Gasket #2 or equivalent should be used and under no circumstances are gaskets of any kind permitted. Other joints shown on the assembly drawing marked "W" use Permatex Form-A-Gasket #2 or equivalent.

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LUBRICATION

GENERAL - Lubricants derived from petroleum are a mixture of chemical compounds contained in the crude oil, others resulting from the refining and those added to impart specific properties.

A specification giving only physical and chemical properties does not assure satisfactory performance of a lubricant, consequently types of lubricant are usually specified with the vendor supplying his particular brand.

It is not the intention of De Laval to restrict the recommendation for lubricants to any particular brands, and any recommendations made are given only to serve as a guide in the selection of a suitable grade of lubricant for the service intended. Conformance to these recommendations, therefore, should not relieve the vendor of the lubricant from the responsibility of supplying a satisfactory product.

The substitution of aqueous base or non-aqueous base fire resistant fluids for oil requires detailed knowledge of the machinery design and characteristics as well as knowledge of the characteristics of the fluid. In those installations in which it is desired to use a fire resistant fluid for lubrication, the manufacturer of each unit involved should be consulted and give approval of the selection.

In general, the use of chlorinated lubricants should be avoided; since they have been found to promote metal damage in bearings.

A lubricating oil should be a petroleum oil of uniform high lubricating quality and should provide adequate protection against rust and oxidation. It should be free from acids, alkali, asphaltum, pitch, soap, resin and water. The oil must not have any solid matter or materials that will injure the oil itself or the parts it contacts. Lubricating oil should not foam, form permanent emulsions, oxidize rapidly or form sludge. It may contain additives or inhibitors if their use supplements but does not adversely affect the desirable properties and characteristics of the oil.

Normally, the use of oils having EP characteristics is not necessary for other than geared units. If it becomes desirable to have these characteristics, the manufacturer of each unit involved should be consulted and approve the selection.

No additive should be put in a lubricating oil without approval of the original lubricant supplier.

Greases should be suitable for application by hand, pressure gun or hand compression cup. They should remain in the solid state at operating temperatures and should not separate on standing or when heated below their dropping point. Grease components should not separate under the action of centrifugal force. Greases should resist oxidation and must not gum, harden or decompose. They must not contain dirt, fillers, abrasive matter, moisture, free acid or free lime.

The lubricating system must be kept clean and free from impurities at all times. The use of an oil purifier is recommended; however, since some purifiers can alter the properties of lubricating oils, especially inhibited oils, the manufacturer should be consulted before the purifier is selected.

LUBRICATING OIL SPECIFICATION

TYPE: Light turbine oil, rust and oxidation inhibited.

VISCOSITY:	SSU at 100F	140-180
	SSU at 210F	42 minimum
RUST TEST (ASTM D665 Procedure A)		Pass
FLASH POINT (ASTM D92)		350F minimum

GREASE SPECIFICATION

NLGI No.	2
WORKED PENETRATION (ASTM D217)	265-295
DROP POINT (ASTM D566)	350 minimum
FEDERAL TEST METHOD STD. 791 (Method 5309.2) ...	Pass