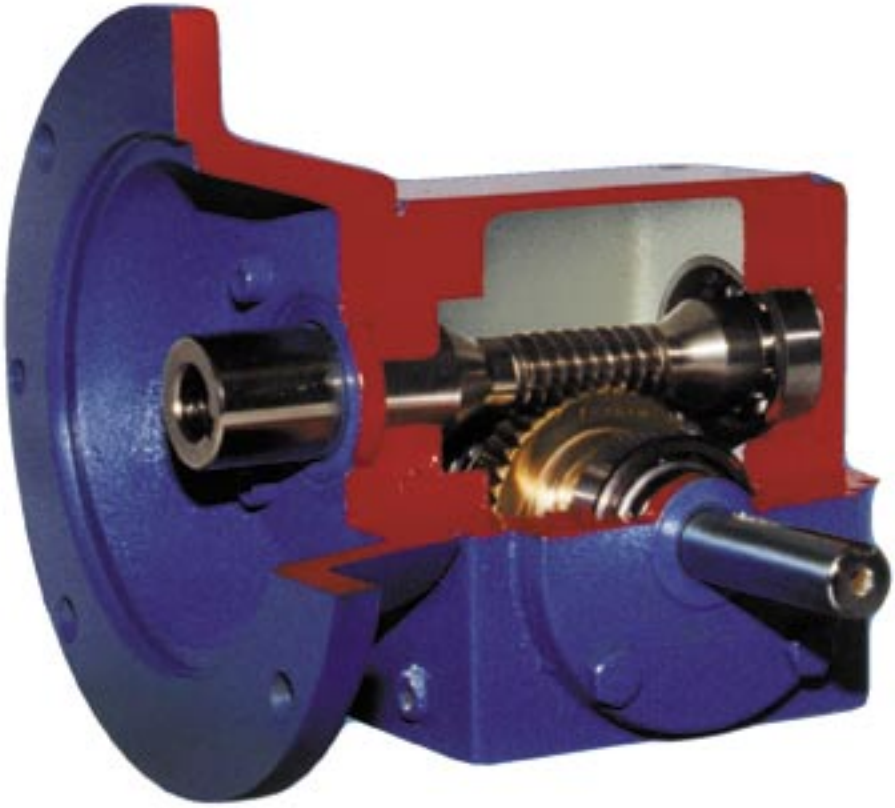
Cleveland Modular
Worm Gear Speed Reducer

Cleveland Gear Company - First in Gears. - First in excellence.

Lubrication Installation Operation And Maintenance Instructions



Engineering Data Manual S-400

LUBRICATION

All Cleveland units are shipped dry. They are, however, given a short run before shipment, with a rust-resisting oil which is distributed over all internal surfaces and to prove that the bearings are free and properly adjusted. Before starting the unit it must be filled to the level indicated and with the grade of oil called for by the application. Any supplier of industrial oil can meet these specifications with a standard product.

Worm gearing has a high slide to roll ratio when compared with other types of gearing. With a high sliding component it relies heavily on the generation of an oil wedge between the worm and gear.

For most worm gear applications a AGMA 7 compounded oil is satisfactory. For low speeds a higher viscosity, AGMA 8 compounded, will provide better service. Both are petroleum base, mineral oils compounded with 3% to 10% fatty oils. These are sometimes referred to as steam cylinder oils. The compounded lubricant provides a lower co-efficient of friction and better wear characteristics than a straight mineral oil. At the high temperatures and pressures prevailing in the contact area a chemical reaction occurs on the bronze tooth surface. An unstable, copper oleate film will form a protective skin.

Extreme pressure oils (EP oils) are another type of lubricant that uses a surface acting chemistry. Most EP oils use sulfur, phosphorus and/or chlorine additives. The EP oils are designed to work in steel on steel applications. When these oils are used with bronze under conditions of high temperature and pressure the surface acting chemistry can damage the surface of the bronze.

Synthetic lubricants are very common. Synthetic lubricants are more viscosity temperature stable than mineral oils. This allows one lubricant to provide adequate service over a broader temperature range. They have a longer life in service, increasing the oil change interval. They reduce wear and friction, increasing the life of the gear box. Efficiency increases of 25% of the lost power are possible. Under severe service, properly selected synthetics are outstanding. Many companies have found that due to the advantages of synthetic lubricants it is actually cheaper to buy the more expensive oil, even for normal applications.

OIL LEVEL

The oil level in a reducer can be checked only when it is at rest and it must be maintained at the proper level. Overfilling is to be avoided as it causes excessive churning losses and may result in overheating.

OIL CHANGES

Oil in a new unit should be drained out at the end of two weeks and the case thoroughly flushed with a light oil to remove any foreign substances that may be detrimental to good operation. The original oil may be reused if good filtering facilities are available; otherwise, new oil should be used to refill the housing. After this, a change of oil every six months or 2,500 hours, whichever occurs first, is recommended. Extremely severe or dirty conditions, as well as high humidity, will require more frequent oil changes. The use of synthetics can extend this period. At least one filling of the grease fittings between oil changes is recommended on all units equipped with grease fittings. In general, grease fittings are found on units having a vertical shaft and either one of two fittings are required, depending upon the internal construction.

IDLE TIME

Cleveland units which are to stand idle for a long period of time before being used should be completely filled with oil to prevent corrosion due to internal condensation. Units in intermittent service should be operated for brief periods of time at least once a month to redistribute the oil and thereby protect the bearings and ground parts from rusting. This short run will also lubricate the shaft oil-seals and thereby prolong their life measurably.

SPEED

High speeds above 1800 RPM usually require a change in oil level.

LUBRICATION

The following tables are Cleveland Gear's recommendations for worm gear lubricants. A general table such as this can not cover all possible applications. If your application seems out of the ordinary please contact the factory

CENTER DISTANCE	WORM SPEED R.P.M.	AGMA LUBRICANT NUMBER[1] AMBIENT TEMPERATURE 15ºF TO 50ºF[2]	50ºF TO 125ºF
UP TO 12"	BELOW 600	#7 COMPOUNDED	#8 COMPOUNDED
	ABOVE 600[3]	#7 COMPOUNDED	#7 COMPOUNDED
OVER 12"	BELOW 300	#7 COMPOUNDED	#8 COMPOUNDED
	ABOVE 300[3]	#7 COMPOUNDED	#7 COMPOUNDED

[1] AGMA Lubricant Number Per AGMA 250.04

[2] For ease of start up, heaters or use of synthetic oil may be required at low temperatures.

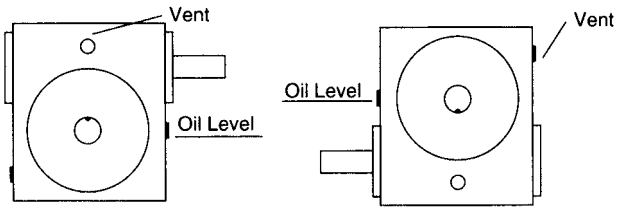
[3] At rubbing speeds over 2500 fpm a spray lubrication system and/or synthetic lubricants may be required. Contact the factory for specific recommendations.

RECOMMENDED PRODUCT

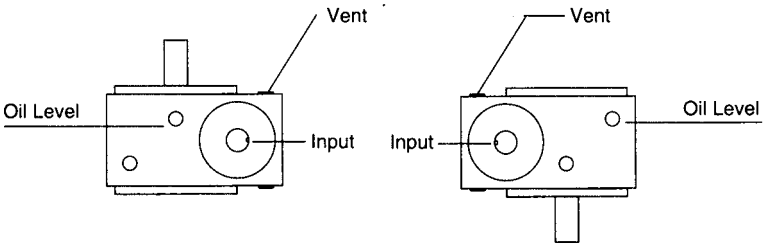
AGMA NUMBER	MINERAL	SYNTHETIC
#7 COMPOUNDED	MOBIL 600W CYLINDER OIL	MOBIL SHC 634
#8 COMPOUNDED	MOBIL 600W SUPER CYLINDER OIL	MOBIL SHC 634

LUBRICATION

1.33", 1.75", 2.06", & 2.62" Solid Output Shaft

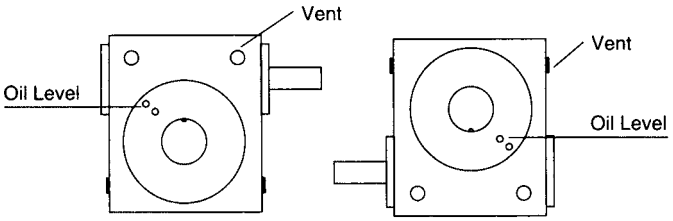


	Oil Capacity in Ounces	
Center Distance	Worm Over	Worm Under
1.33	6.7	8.5
1.75	13.5	19.1
2.06	14.8	22.1
2.62	29.4	40.7

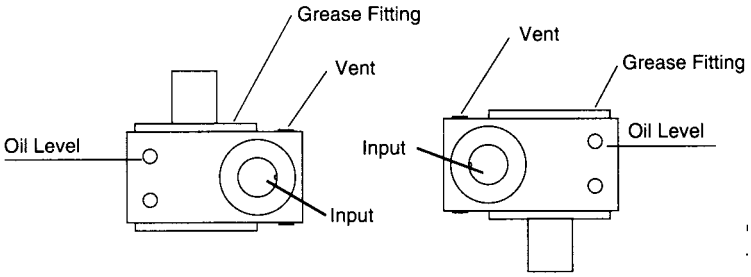


Center Distance	Oil Capacity in Ounces
1.33	9.4
1.75	20.6
2.06	23.8
2.62	43.1

3.00", 3.25", & 4.00" Solid Output Shaft



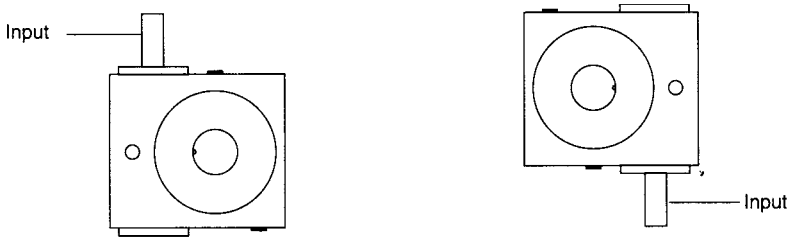
	Oil Capacity in Ounces	
Center Distance	Worm Over	Worm Under
3.00	61.2	55.8
3.25	83.4	72.3
4.00	113.8	102.7



Center Distance	Oil Capacity in Ounces
3.00	58.2
3.25	88.1
4.00	118.5

Oil Capacities shown are approximate. On installation, fill to plug level indicated. For non-vented operation consult factory for oil capacities.

For applications requiring a vertical input, contact factory for recommendations.



LUBRICATION

VISCOSITY RANGES FOR AGMA LUBRICANTS[a]

Rust and Oxidation Inhibited Gear Oils	Extreme Pressure Gear Lubricants[d]	Viscosity Range[b]	Equivalent ISO Grade[c]
AGMA Lubricant No.	AGMA Lubricant No.	mm²/S (cSt) at 40ºC	
1		41.4 to 50.6	46
2	2 EP	61.2 to 74.8	68
3	3 EP	90 to 110	100
4	4 EP	135 to 165	150
5	5 EP	198 to 242	220
6	6 EP	288 to 352	320
7 Comp[e]	7 EP	414 to 506	460
8 Comp[e]	8 EP	612 to 748	680
7 A Comp[e]	8 A EP	900 to 1000	1000

NOTE: Viscosity ranges for AGMA Lubricants are identical to those of ASTM 2422.

a. Extracted from **AGMA** "Specification-Lubrication of Industrial Enclosed Gear Drives" (AGMA 250.05) with the permission of the publisher, the American Gear Manufacturers Association, Suite 1000, 1901 North Fort Myer Drive, Arlington, Virginia 22209.

b. "Viscosity System for Industrial Fluid Lubricants, ASTM 2422." Also British Standards Institute, B.S. 4231.

c. "Industrial Liquid Lubricants - ISO Viscosity Classification." International Standard, ISO 3448.

d. Extreme pressure lubricants should be used only when recommended by the gear drive manufacturer.

e. Oils marked Comp are compounded with 3% to 10% fatty or synthetic fatty oils.

INSTALLATION AND OPERATION INSTRUCTIONS

ALL SIZES AND TYPES

Upon receipt of a unit it should be inspected for damage in shipment and any injury reported to the carrier and a claim made to them at once.

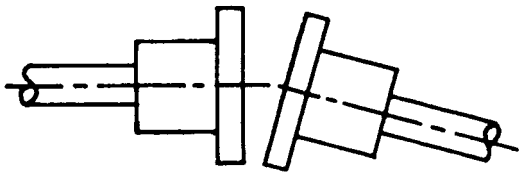
FOUNDATIONS

The importance of a solid foundation for a speed reducer to rest upon cannot be overemphasized. The alignment of both its high and low speed shaft is jeopardized if the unit does not have a firm foundation. The alignment of both high and low speed shafts should be checked after a few weeks operation to be sure the foundation has not settled and thrown them out of line.

Rigid cast iron or welded steel bedplates are of great help in maintaining good alignment. A standard line of bedplates is available for all Cleveland units. All four feet of the units are machined at the same time to provide flatness, and the base they are bolted to must be flat also.

ALIGNMENT

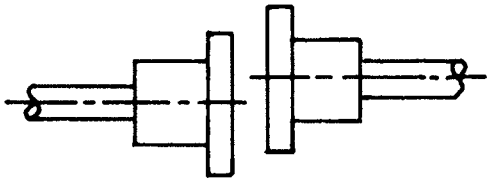
Accurate alignment of both high and low speed shafts is a necessity. Lack of good alignment may cause excessive shaft stresses, overloaded bearings, noise and leaking oil seals. The initial setting of the reducer is, therefore, important and its alignment with the motor and connected machine must be checked after it is securely bolted down. Misalignment can be caused later by a settled foundation or movement of the connected machine.



Angular Misalignment

Two forms of misalignment, or a combination of them, is possible on each shaft. The effects resulting from the shaft misalignment are evident on the high speed shaft or coupling before they show up on the low speed end of the drive, but the need for good alignment on both shafts cannot be overemphasized. The figures below illustrate each form of misalignment, greatly exaggerated, and a combination of both can exist as well.

When correcting coupling misalignment by placing metal shims under a reducer, the angular misalignment should be corrected first. It can be checked by inserting a tapered gauge at 900 positions. When a tapered gauge enters the space between the coupling halves an equal distance at four places 90° apart, the angular misalignment has been removed.



Parallel Misalignment

Parallel misalignment is corrected by placing a straight edge on the outside diameter of the coupling halves. Either the reducer, or the driven machine, must then be moved in a vertical and/or a horizontal plane to correct this form of misalignment.

The necessity of good alignment cannot be overemphasized. When possible dowels should be used to preserve alignment once it is obtained.

MOUNTING COUPLINGS OR SPROCKETS

Most installations can be made with a light driving fit. Any nicks or burrs present should be carefully removed, but no attempt to actually change a diameter by hand filing should be made. Tighter fits for heavier loads can be obtained by heating the coupling half. They must not be pounded into place without properly backing up the opposite end of the shaft. This can be done on a single shaft extension by removing the plate on the opposite side of the reducer. If this plate is not removed and the shaft properly backed up, the effect of the hammer blow is absorbed by an anti-friction bearing and damage to the rolls or the races may result. However, care must be used to reassemble the plate shims in exactly the same manner to avoid disturbing the setting of the gear and the adjustment of the bearing.

REPAIR PARTS

Contact factory with name plate model number.

Cleveland Gear Company, Inc.
Subsidiary of Vesper Corp.
3249 East 80th Street
Cleveland, Ohio 44104 U.S.A.
Phone: 216-641-9000 Fax: 216-641-2731