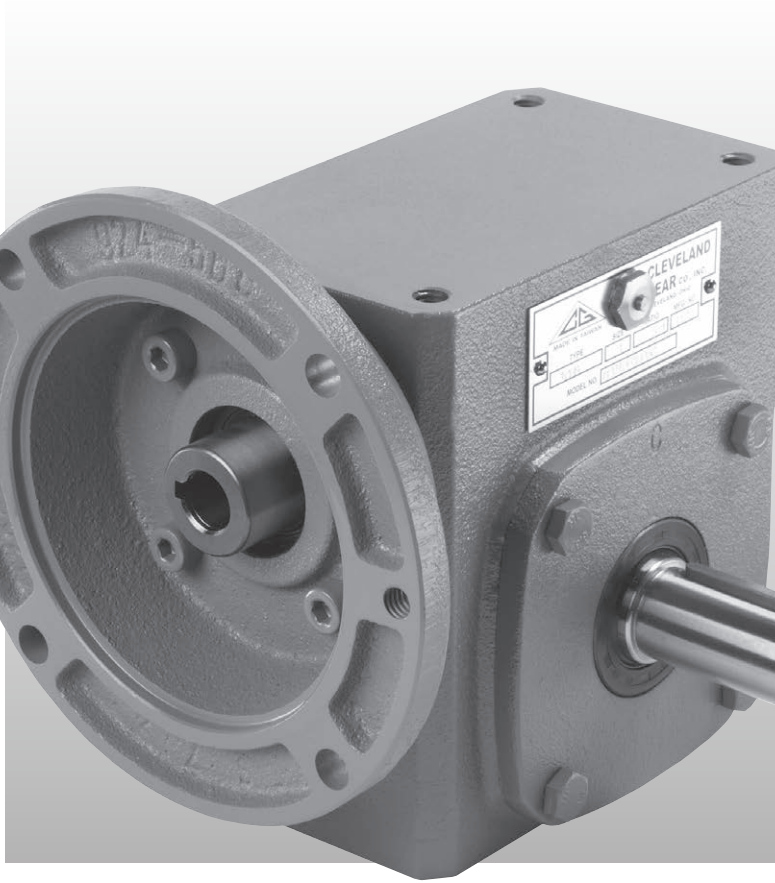
CLEVELAND GEAR COMPANY, Inc
3249 East 80th Street
Cleveland, Ohio 44104 U.S.A.
216.641.9000
www.clevelandgear.com

MODULAR "M" SERIES SPEED REDUCER

Installation, Lubrication & Service Instructions



Engineering Data Manual S-410

LUBRICATION AND OIL CAPABILITIES

CLEVELAND UNITS ARE SHIPPED DRY AS STANDARD. A mineral based oil, synthetic oil, or foodgrade oil (H1), is available upon customer request. When shipped dry, 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, an AGMA 7 oil is satisfactory. For low speeds, a higher viscosity, AGMA 8 will provide better service. Synthetic lubricants provide a lower co-efficient of friction and better wear characteristics than a straight mineral oil.

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

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. When these oils are used with bronze under conditions of high temperature and pressure, the surface acting chemistry can cause damage to the surface of the bronze. EP oils should **not** be used with worm gears.

Synthetic lubricants are very common today. Synthetic lubricants provide adequate service over a broader temperature range. They normally have a longer life in service, thereby increasing the oil change interval. They also can reduce wear and friction, increasing the oil change interval, and increasing the life of the gear box.

With the use of synthetic oils, efficiency increases of 10% are often possible. Many companies have found that, due to the advantages of synthetic lubricants, it is actually more cost effective to buy the more expensive oil, even for normal applications.

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.

SPEED
High speeds above 1800 inputRPM may require a change in oil level. **Contact Cleveland Gear for information on input speeds in excess of 1800 RPM.** The same is true if the input RPM is 700 RPM or less, **consult factory**.

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

WORM SPEED R.P.M.	AGMA LUBRICANT NUMBER AMBIENT TEMPERATURE 15° TO 50°F‡	50° TO 125°F
BELOW 700	#7	#8
ABOVE 700*	#7	#7
RECOMMENDED PRODUCT		
AGMA NUMBER	**MINERAL**	**SYNTHETIC**
#7	MOBIL 600W SUPER CYLINDER OIL	MOBIL SHC 634
#8	MOBIL 600W EXTRA HECLA SUPER CYLINDER OIL	MOBIL SHC 636
Viscosity Ranges for AGMA Lubricants[a]		
Rust and Oxidation Inhibited Gear Oils	Viscosity Range	Equivalent ISO Range
AGMA Lubricant No.	mm^2/S (cSt) at 40° C	ISO Number
#7	414 to 506	460
#8	612 to 748	680

a Extracted from AGMA "Specification-Lubrication of Industrial Enclosed Gear Drives" with the permission of the publisher, The American Gear Manufacturers Association, 1001 N. Fairfax St., Ste 500 Arlington, Virginia 22314.

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

* At rubbing speeds over 2,500 fpm, a spray lubrication system and/or synthetic lubricants may be required. Contact the factory for specific recommendations.

OIL LEVEL
The oil level in a reducer can be checked only when it is at rest. 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 CAPACITIES
When units are installed in standard mounting positions, the user needs simply to add lubricant until oil comes out of the oil level plug hole location before operation–while the unit is not rotating. These units must be operated with the vented spring loaded plug provided.

Oil capacities will vary when units are placed in special mounting positions. For planning purposes, use the following table to find approximate capacities

MODULAR SPEED REDUCER

CLEVELAND GEAR REDUCERS 1.33″ to 5.25″
AVAILABLE FROM FACTORY STOCK

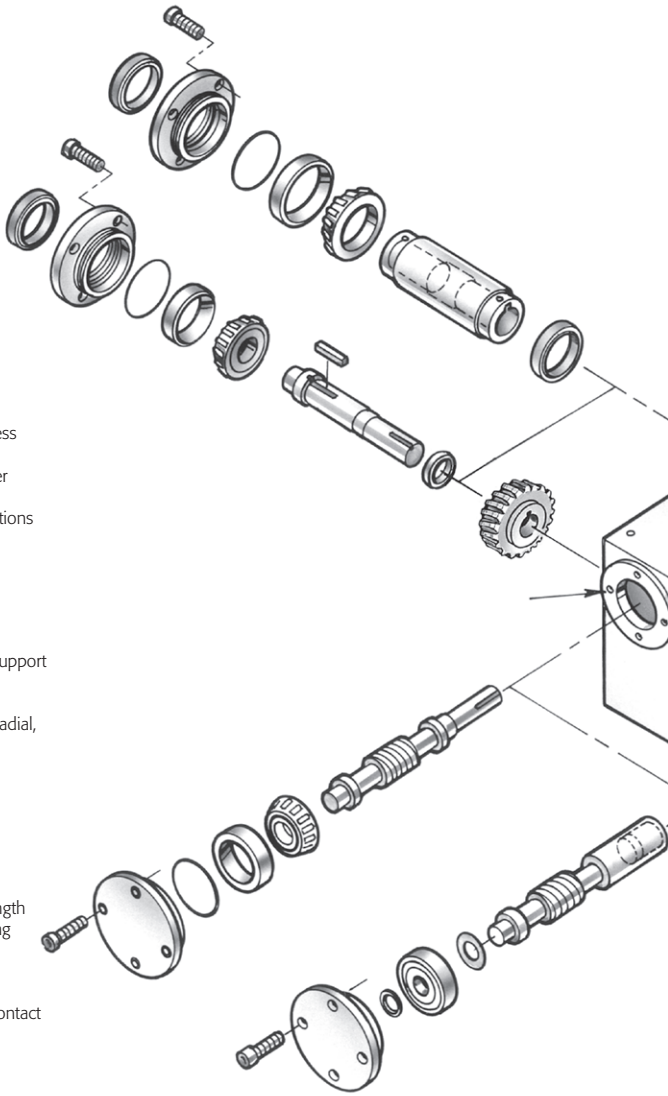
SEALS
- **Dual lip shaft seals** improve sealing potential
- **Standard commercial designs** replacements widely available

OUTPUT SHAFT
- **Medium Carbon steel** provides superior strength
- **Step shaft design** prevents pressed bearing seal surface scarring
- **Solid or hollow output shafts** modifiable per customer/application requirements

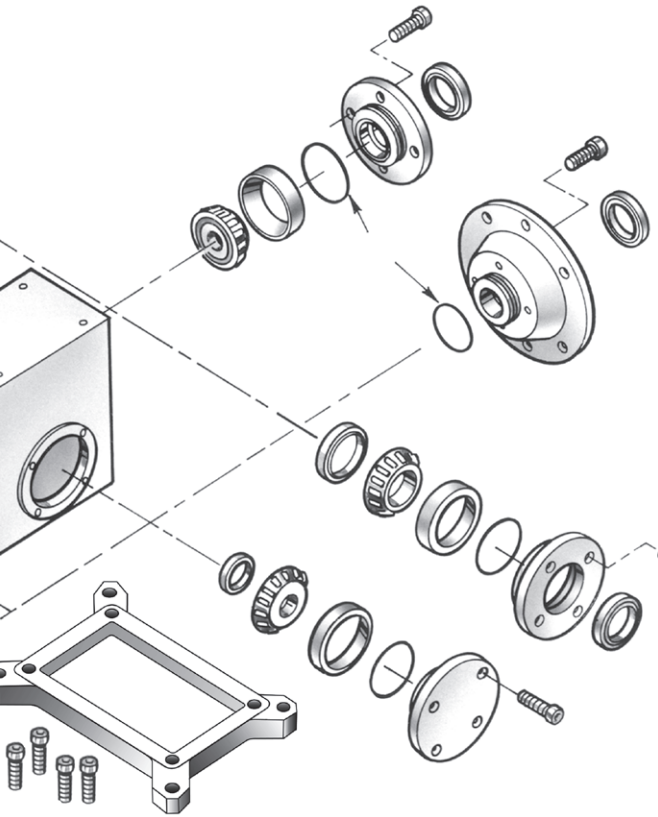
WORM GEAR
- **Centrifugally cast bronze alloy** minimum stress 71,00 psi
- **Keyed to shaft** ensures positive torque transfer
- **Rated per AGMA standards:**
  - Designed for high reliability in critical applications
  - Based on 25,000 hours of service

BEARINGS
- **Worm shafts** large single/double row ball to support the radial loads. Size 42 & 52 use tapered roller bearings (back-to-back)
- **Gear shafts** tapered roller bearings to accept radial, thrust and overhung loads
- **All are standard commercial designs** replacements widely available

WORM
- **Integral worm shaft/quill** yields optimal strength
- **Optimized pressure & lead angles** maximizing efficiency and tooth strength
- **Case hardened teeth** optimizing service life
- **Ductile core** maximizes shear capacity
- **Ground thread** ensures accuracy for proper contact & torque transmission



All weights, dimensions and ratings in this catalog are subject to change.
For construction use certified prints, weights and ratings only, available from factory.



HOUSINGS

- **Modular design** improves cost & availability
- **Large lubrication capacity** ensures low operating temperatues
- **One piece close grain cast iron** improves quality
- **No cover drill thru holes** eliminates leakage opportunities
- **Large surface area** improves heat dissipation

MOTOR ADAPTER

- **Multiple sizes** to accept all NEMA frame motors
- **Quill motor adapters:**
  - External surface cast without cavities for food industry service
  - Designed with "jacking holes" for ease of motor removal

COVERS

- **Close grain cast iron** improves quality
- **O-ring cover seals** insures positive sealing
- **Hard shims:**
  - eliminates gasket creep relaxation
  - easily measured and replaced when changing assembly

  Bolt-on designs:
  - provides accurate gear mesh shimming
  - Minimizes changes of assembly problems

MOUNTING BASE

- **Machined cast iron** for horizontal or vertical mounting
- **Can be adapted** to match existing mounting arrangements

LUBRICATION Cont.

LUBRICATING PROCEDURES: We recommend the following procedures:

1. FILL. The unit should be filled with appropriate lubricant until oil comes out of the oil level plug hole BEFORE OPERATING. DO NOT OVERFILL. Excessive oil levels are as undesirable as using too little oil. If a grease zirc fitting is present, grease it before operations.

2. 100 HOUR FLUSH. After approximately 100 hours of operation, the reducer must be drained, flushed thoroughly with a light oil, and refilled with fresh recommended oil.

3. 2500 HOUR FLUSH. This flushing and refilling should be repeated every 2500 hours.

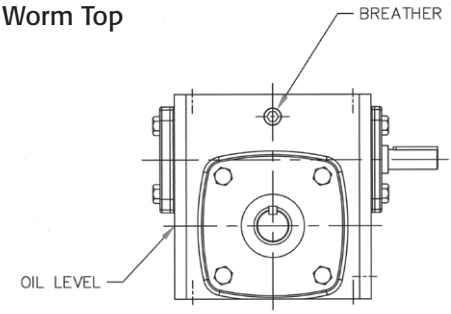
Extremely severe or dirty conditions, as well as high humidity, will require more frequent oil changes. The use of synthetics can extend the period. At least one filling of the grease fittings between oil changes is recommended on all units equipped with grease fittings. In general, grease fittings are often found on units having a vertical shaft, and either one or two fittings are required, depending upon the internal construction.

SIZE	WORM TOP	WORM BOTTOM	VERTICAL OUTPUT	VERTICAL INPUT
13	4	7.5	6.5	5.5
15	8	16	13.5	11.5
17	9.5	18.5	16.5	13.5
20	14	24	22	18.5
20G	14	24	22	18.5
23	16.5	29	26	22
26	29.5	46	41.5	35.5
26G	29.5	46	41.5	35.5
30	43	70	62	55
32	51	92	80	73.5
32G	51	92	80	73.5
42	89	119	111.5	107.5
52	168	282.5	242	232

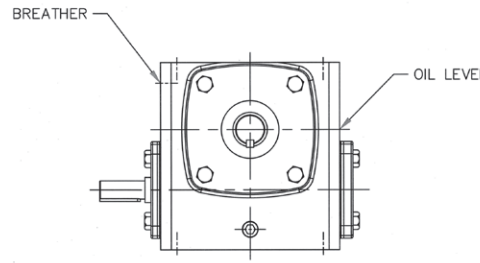
Note: All figures are shown in ounces.

	Recommended lubricants must meet or exceed these standards:		
Ambient Temperature	15° to 50° F (-9° to 10° C)	AGMA 7	cSt@104F (40C): **414-506**
	50° to 125° F (10° to 52° C)	AGMA 8	cSt@104F (40C): **612-748**

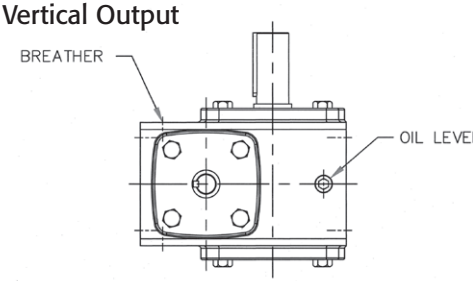
Worm Top



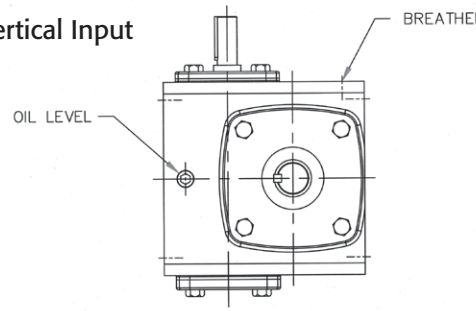
Worm Bottom



Vertical Output



Vertical Input



INSTALLATION & OPERATING INSTRUCTIONS

ALL SIZES AND TYPES
Upon receipt of a unit it should be inspected for damage in shipment. Any damage found should be 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 proper alignment. All four feet of the unit are machined at the same time to provide flatness, and the base they are bolted to must be flat also.

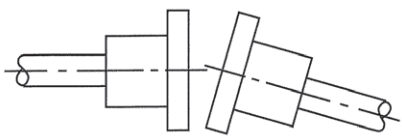
ALIGNMENT
Accurate alignment of both high and low speed shafts is a necessity. Lack of proper alignment may cause excessive shaft stresses, overloaded bearings, noise and leaking oil seals. The initial setting of the reducer is, therefore, important and its alignment with the motor and connected machine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

Two forms of misalignment, or a combination of them, are 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 accurate alignment on both shafts cannot be overemphasized.

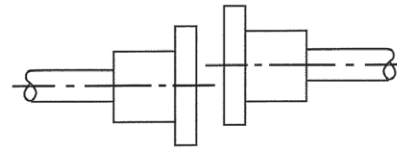
The figures shown illustrate each form of misalignment, greatly exaggerated, and a combination of both can exist as well.

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 four places, 90° apart. 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.

ANGULAR MISALIGNMENT



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 horizontal plane to correct this form of misalignment.

The necessity of proper 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.

COUPLINGS
Installation of couplings with tighter fits for heavier loads can be obtained by heating the coupling half. The coupling 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 blows are absorbed by the anti-friction bearing and damage to the rollers or the races will likely result. However, care must be used to reassemble the plate shims in exactly the same manner to avoid disturbing thesetting of the gear and the adjustment of the bearing.

SPROCKETS
Should be mounted with the hu side outboard whenever possible. Sprocket teeth should be mounted as close to the reducer as possible without causing interference.