SERVICE INSTRUCTIONS

FOR MB SERIES MIXER

Customer Name:
Tag:

Serial No.: **Size/Type:**

Reduction Ratio:

Motor HP: **Input RPM:**

Output RPM:

AGMA S.F.:

Hayward Gordon Ltd.

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How to Use This Manual

This Manual provides detailed instructions on installation and maintenance of units and couplings. Use the table of contents below to locate required information.

Table of Contents

INTRODUCTION

The MB reducer is a right angle gear drive with vertical and horizontal output shaft designed for mixer service. The basic drive is designed for pedestal or baseplate mounting. The standard unit is furnished with a solid output shaft. A low speed shaft drywell feature is standard on vertical units with solid shaft extension down. Upper low speed bearings of all vertical units and lower low speed bearings of units with drywells are grease lubricated.

The low speed shaft extension ends of solid shaft units are drilled and tapped (2 holes) for thrust coupling keeper plates, refer to Page 3 on couplings.

Credit for long service and dependable operation of a gear drive is often given to the engineers who designed it, or the craftsmen who constructed it, or the sales engineer who recommended the type and size. Ultimate credit belongs to the mechanic on the job who worked to make the foundation rigid and level, who accurately aligned the shafts and carefully installed the accessories, and who made sure that the drive received regular lubrication. The details of this important job are the subject of this manual.

WARRANTY -- Hayward Gordon Mixers warrants that, for a period of one year from the date of shipment, the product described herein will deliver successfully its rated output as indicated on the nameplate, provided, it is properly installed and maintained, correctly lubricated and operated in the environment and within the limits of speed, torque or other load conditions for which it was sold.

CAUTION

Consult applicable local and national safety codes for proper guarding of rotating members. Lock out power source and remove all external loads from unit before servicing unit or accessories.

WELDING -- Do not weld on the gear unit housing or accessories without prior approval from Hayward Gordon Mixers. Welding on the unit may cause distortion of the housing or damage to the bearings and gear teeth. Welding without prior approval could void the warranty.

NAMEPLATE -- Operate unit only at horsepower, speed and ratio shown on nameplate. Before changing any one of these, submit complete nameplate data and new application conditions to the factory approval.

INSTALLATION INSTRUCTIONS

CAREFULLY FOLLOW THE INSTRUCTIONS IN THIS MANUAL FOR OPTIMUM PERFORMANCE AND TROUBLE FREE SERVICE.

The following instructions apply to all standard MB gear units. If a unit is furnished with special features, refer to the supplementary instructions shipped with the unit.

MOUNTING -- CAUTION: Mount the unit only in the position for which it was ordered, i.e., horizontal base for MB series.

CAUTION

Use Grade 5 fasteners for mounting.

The MB reducer is designed for pedestal mounting with a bolt circle on the housing underside that is concentric about the low speed shaft. The lower low speed seal cage or end cover has a close tolerance machined outside (register) diameter for accurate positioning of the drive on the pedestal. Refer to Table 1 for housing mounting bolt circle data. The Hayward Gordon supplied baseplate (optional) is registered on the lower L.S. seal cage or end cover and uses the same bolting as used for pedestal mounting.

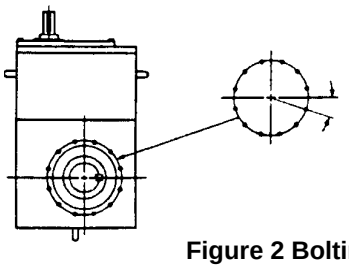


Figure 2 Bolting Pattern

TABLE 1- Unit Housing to Pedestal/Adapter Base Bolting Data

Unit Size	Qty	Fastener Size Dia. -UNC	Bolt Circle (in.)	Register Dia. - Nom. (in.)	Housing Thread Depth (in.)
MB-53	8	.500-13 UNC	11.50	8.500	.72
MB-54	8	.625-11 UNC	12.00	9.500	.90
MB-55	12	.625-11 UNC	13.00	10.250	.90
MB-56	12	.625-11 UNC	15.00	11.500	1.12
MB-57	12	.750-10 UNC	17.00	13.000	1.12
MB-58	12	.875-9 UNC	20.00	15.000	1.12
MB-59	12	.875-9 UNC	20.00	15.000	1.12

FOUNDATION, GENERAL -- To facilitate oil drainage, elevate the unit foundation above the surrounding floor level. If desired, replace the unit oil drain plug with a valve, but provide a guard to protect the valve from accidental opening or breakage.

FOUNDATION, STEEL -- When mounting unit on structural steel, it is recommended that an engineered design be utilized for a pedestal, adapter base or bed to provide sufficient rigidity, to prevent induced loads from distorting the housing and causing gear misalignment. In the absence of an engineered design, it is recommended that a baseplate, with thickness equal to or greater than the thickness of the unit base, be securely bolted to steel supports and extend under the entire unit. Refer to Page 4 for fastener tightening torques.

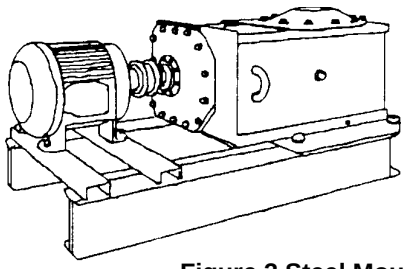
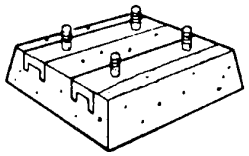


Figure 3 Steel Mounting

FOUNDATION CONCRETE -- If a concrete foundation is used, allow the concrete to set firmly before bolting down the unit. For the best type of mounting, grout structural steel mounting pads i the mounting base, as illustrated rather than grouting e the unit directly into the concrete.



Motors and other components mounted on motor plates may become misaligned during shipment. ALWAYS check alignment after installation. Refer to section (3) for coupling alignment instructions.

UNIT ALIGNMENT -- Align unit by placing broad, flat shims under all mounting pads. Start at the low speed shaft end and level across the length and then the width of the unit. Check with a feeler gauge to make certain that all pads are supported to prevent distortion of housing when unit is bolted down. After unit is aligned and bolted down, align prime mover to unit input shaft. See Page 4 for coupling alignment.

If equipment is received from Hayward Gordon mounted on a bedplate, the components were accurately aligned at Hayward Gordon with the bedplate mounted on a large, flat assembly plate. Shim under the bedplate foot pads until the unit is level and all feet are in the same plane.

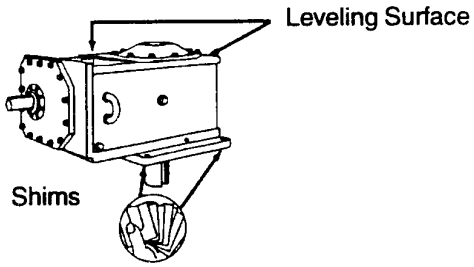


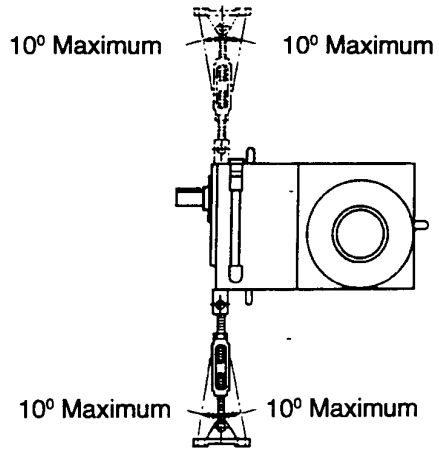
Figure 4 Shimming units

Check the high speed shaft coupling alignment. If the coupling is misaligned, the bedplate is shimmed incorrectly. Reshim bedplate and recheck high speed coupling alignment. If necessary, realign motor.

HORIZONTAL OUTPUT SHAFT -- When the unit is mounted for horizontal output, the torque reaction can be transmitted through the adapter base, pedestal, tie rod or a combination thereof. The tie rod may be mounted above or below the unit and its angular position may vary as shown. For other positions, refer to the factory. If it is necessary to shorten the tie rod, cut off the excess from either threaded end.

The support to which the clevis bracket is to be fastened must sustain the torque reaction shown in Table 2. Use Grade 5 fasteners to anchor the clevis bracket; tighten to torques specified on Page 4.

Bolt the tie rod to both the clevis bracket and the drive anchor bracket and tighten bolts until seated against the brackets. DO NOT bend the brackets. Clearance between the clevis brackets and tie rod is required.



For "Horizontal Output Shaft"

TABLE 2 - Load Reaction Through Tie Rod

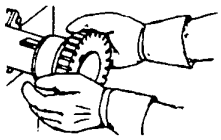
Unit Size	Load (lbs.)
MB-53	5,000
MB-54	7,000
MB-55	9,000
MB-56	10,000
MB-57	14,000
MB-58	17,000
MB-59	17,000

MOTOR BRACKETS -- The weight, location and starting torque of the motor will cause some brackets to deflect downward and to twist. This movement is within allowable engineered limits for unit-motor selections by Hayward Gordon. If the customer considers the movement excessive, jackscrew supports for the bracket extension are available. To compensate for deflection caused by heavy motors AND to get CORRECT COUPLING ALIGNMENT, use more shims under the rear motor feet than the front feet.

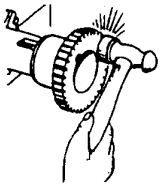
Motors and other components (whether mounted on motor plates or motor brackets) may become misaligned during shipment. ALWAYS check alignment after installation. Refer to coupling alignment instructions below.

SHAFT CONNECTIONS

COUPLING CONNECTION -- The performance and life of any coupling depends largely upon how well the coupling is installed and serviced. Refer to the coupling manufacturer's manual for specific instructions.



CORRECT METHOD
Heat interference fitted coupling hubs, pinions, sprockets or pulleys to a maximum of 275°F (135°C) and slide onto unit shaft.



INCORRECT METHOD
DO NOT drive coupling hub, pinion, sprocket or pulley onto the shaft. An endwise blow on the shaft may damage gears and bearing.

-CAUTION-
Do Not Hammer

Provide suitable guards in accordance with OSHA standards

The low speed shaft extension ends of the solid shaft units are drilled and tapped to accommodate the thrust coupling keeper plates. Keeper plate fastener size and bolt circle data are shown in Table 3.

TABLE 3 - Rigid Coupling Selection and Keeper Plate Fastener Data

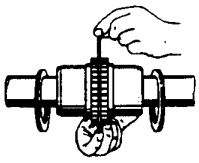
Unit Size	Fastener Size	Data* Bolt Circle (in.)
MB-53	.500-13 UNC	2.00
MB-54	.500-13 UNC	2.50
MB-55	.625-11 UNC	2.75
MB-56	.625-11 UNC	3.75
MB-57	.750-10 UNC	4.00
MB-58	1.125-7 UNC	4.50
MB-59	1.125-7 UNC	4.50

*Torque to Table 4 metal to metal values.

TABLE 4 - TIGHTENING TORQUES - lb-in. -Do Not Lubricate Fasteners

Thread Dia.-UNC	Metal to Metal	Metal to Concrete	Thread Dia.-UNC	Metal to Metal	Metal to Concrete
.250-20	90	70	.875-9	4560	3750
.3135-18	185	145	1.000-8	6800	5600
.375-16	330	255	1.125-7	8900	7000
.500-13	825	640	1.250-7	12600	10000
.625-11	1640	1280	1.375-6	16500	13000
.750-10	2940	2290	1.500-6	22100	17500

FLEXIBLE COUPLINGS -- Detailed installation and lubrication requirements for the coupling supplied with your mixer are provided elsewhere.

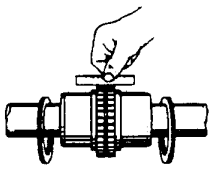


Steelflex Illustrated

The following instructions apply to coupling alignment:

Gap and Angular Alignment -- If possible, after mounting coupling hubs, position the driving and driven units so that the distance between shaft ends is equal to the coupling gap. Align the shafts by placing a spacer block, equal in thickness to required gap, between hub faces, as shown above and also at 90° intervals around the hubs. Check with feelers.

Offset Alignment -- Align shafts of driving and driven units so that a straightedge will rest squarely on the right and also at 900 intervals, Tighten foundation bolts of the connected equipment and recheck alignment and gap



Steelflex Illustrated

TIGHTENING TORQUES

Use the values specified in the following table for fastening motors and MB units and accessories to their mounting surfaces with SAE Grade 5 non-lubricated fasteners. DO NOT use these values for "torque locking" fasteners or for fastening components with aluminum feet or with soft gaskets or vibration dampers on the mounting surface. If the tightening torque exceeds the capacity of the torque wrench, use a torque multiplier.

LUBRICATION

UNIT LUBRICATION -- Read and carry out all instructions on lubrication plate and heed all warning tags. Determine output RPM and minimum and maximum ambient temperatures in which the drive is to operate. Read the AGMA lubricant number for those temperature conditions from the lubrication plate on the unit or from Table 5. Select a R & O oil from Table 6 or an extreme pressure lubricant from Table 7 corresponding to the AGMA lubricant number. **Lubricants listed in this manual are typical products ONLY and should not be construed as exclusive recommendations.** Mineral oils (R & O) and extreme pressure (EP) lubricants must have a minimum viscosity index of 90. See Table 8 for proper viscosity index of synthetic lubricants.

TABLE 5 - VISCOSITY RECOMMENDATIONS

Ambient Temperature	AGMA No.	Viscosity at 104ºF (40ºC) SSU	cSt
Output RPM 80 and Above			
+15º to 60ºF (-9º to +16ºC)	4	626-765	135-165
+50º to +125ºF (+10º to +52ºC)	5	918-1122	198-242
Output RPM Below 80			
+15º to +60ºF (-9º to +16ºC)	4	626-765	135-165
+50º to 125ºF (+10º to +52ºC)	6	1335-1632	288-352

OPERATING TEMPERATURE -- If the unit is operated in an area where the temperatures vary with the season, change the oil viscosity to suit the season. For cold weather operation, use a light oil that will circulate freely at all times. The pour point of the oil should be at least 9°F (5°C) less than the minimum external temperature encountered. During hot weather, use a high viscosity oil that will not thin out and lose its lubricating qualities.

TABLE 6 - PETROLEUM BASED R & O GEAR OILS (Maximum operating temperature of lubricants 200°F [93°C])

AGMA Viscosity Grade		3	4	5	6	7
ISO Viscosity Grade		100	150	220	320	460
Viscosity at	SSU	417-510	626-765	918-1122	1335-1632	1919-2346
104°F (40°C)	cSt	90-110	135-165	198-242	288-352	414-506
Manufacturer		Lubricant	Lubricant	Lubricant	Lubricant	Lubricant
Amoco Oil Co.		Ind. Oil #100	Ind. Oil #150	Ind. Oil #220	Ind. Oil #320	Ind. Oil #460
Ashland Oil, Inc.		100H ISO 100	100H ISO 150	100H ISO 220	100H ISO 320	---
BP Oil Co.		Turbinol T-100	Turbinol T-150	Energol HL 220	Energol HL 320	Energol HL 460
Chevron U.S.A., Inc.		AW Machine Oil 100	AW Machine Oil 150	AW Machine Oil 220	AW Machine Oil 320	---
Citgo Petroleum Corp.		Citgo Pacemaker 100	Citgo Pacemaker 150	Citgo Pacemaker 320	Citgo Pacemaker 320	Citgo Pacemaker 460
Conoco Inc.		Dectol R&) Oil 100	Dectol R&O Oil 150	Dectol R&O Oil 320	Dectol R&O Oil 320	Dectol R&O Oil 460
Exxon Company, U.S.A.		Teresstic 100	Teresstic 150	Teresstic 320	Teresstic 320	Teresstic 460
Gulf Oil		Harmony 100	Harmony 150 or 150D	Harmony 320	Harmony 320	Harmony 460
E.F. Houghton & Co.		Hydro-Drive HP 500	Hydro-Drive HP 750	---	---	---
Imperial Oil Ltd.		Teresso 100	Teresso 150	Teresso 320	Teresso 320	---
Kendall Refining Co.		Kenoil R&O 0650EP	Kenoil R&O 080EP	---	---	---
Keystone Div. Pennwalt Corp.		KLC-30	KLC-40	---	---	---
Lyondell Petrochemical (ARCO)		Duro 100	Duro 150	Duro 320	Duro 320	---
Mobil Oil Corp.		DTE Oil Heavy	DTE Oil Extra Heavy	DTE Oil AA	DTE Oil AA	DTE Oil HH
Petro-Canada Products		Premium Hyd. Oil 100	Premium Hyd. Oil 150	Premium Hyd. Oil 320	Premium Hyd. Oil 320	---
Phillips 66 Co.		Magnus Oil 100	Magnus Olil 150	Magnus Oil 320	Magnus Oil 320	Magnus Oil 460
Shell Oil Co.		Turbo Oil 100	Turbo Oil 150	Turbo Oil 320	Turbo Oil 320	Turbo Oil 460
Shell Canada Limited		Covil Oil 100	Covil Oil 150	Covil Oil 320	Covil Oil 320	Covil Oil 460
Sun Oil Co.		Sun R&O L100	Sun R&O L150	---	---	---
Texaco Inc.		Regal Oil R&O 100	Regal Oil R&O 150	Regal Oil R&O 320	Regal Oil R&O 460	Regal Oil R&O 460
Texaco Canada Inc.		Regal R&O 100	Regal R&O 150	Regal R&O 220	Regal R&O 460	Regal R&O 460
Union Oil Co. of Calif. (East)		Unax RX100	Unax RX 150	Unax RX 220	Turbine Oil 460	Turbine Oil 460
Union Oil Co. of Calif. (West)		Turbine Oil 100	Turbine Oil 150	Turbine Oil 220	Turbine Oil 460	Turbine Oil 460

If the drive operates in a typical indoor environment where the ambient temperature is within 70° to 125°F (21°to 52°C), the oil viscosity may be increased one AGMA grade above that shown for the 50° to 125°F (10°to 52°C) range. That is, an AGMA Number 6 or 7 may be substituted for a 5 or 6 respectively, under this ambient condition.

If a unit operates in the sun at ambient temperatures over 100°F (38°C), then special measures should be taken to protect the unit from solar energy. This protection can consist of a canopy over the unit or reflective paint on the unit. If neither is possible, a heat exchanger or other cooling device may be required to prevent the sump temperature from exceeding the allowable maximum of 200°F (93°C).

EXTREME PRESSURE LUBRICANT -- Units sometimes are overloaded due to a change in design of the mixer or a change in the nature of the material that is being agitated. This also occurs when power requirements are in excess of that originally estimated. As a result, the gear teeth may show signs of distress in the nature of scuffing, scoring or pitting. For applications of this nature, an extreme pressure lubricant is recommended. This gives added protection to the gear teeth and may retard scoring and scuffing. Applications which are severely overloaded should be refered to Hayward Gordon for further study and recommendations.

VISCOSITY (IMPORTANT) -- The proper grade of Extreme Pressure Lubricant for use in a particular unit should have the same viscosity as the proper grade of R & O oils as specified in Table 6 and the viscosity recommendations in Table 5.

CAUTION

EP LUBRICANTS IN FOOD PROCESSING INDUSTRY -- EP lubricants may contain toxic substances and should not be used in the food processing industry without the lubricant manufacturer's approval.

OIL CHANGES -- For normal operating conditions change R & O and EP lubricants every six months or 2500 hours, whichever occurs first. Lubricant suppliers can test oil from the unit periodically and recommend economical oil change schedules.

TABLE 7 - EXTREME PRESSURE LUBRICANTS
Maximum Operating Temperature 200°F(93°C)

Manufacturer	Lubricant
Amoco Oil Co.	Permagear/Amogear EP
Ashland Oil, Inc.	AGMA/EGC ISO
BP Oil Co.	Energear EP
Chevron U.S.A., Inc.	NL Gear Compound
Citgo Petroleum Corp.	Citgo EP Compound
Conoco, Inc.	Gear Oil
Exxon Co. U.S.A.	Spartan EP
Gulf Oil	Ultralube EP Lubricants
E.F. Houghton & Co.	MP Gear Oil
Imperial Oil Ltd.	Spartan EP
Kendall Refining Co.	Kendall NS-MP
Keystone Div. Pennwalt Corp.	Keygear
Lyondell Petrochemical (ARCO)	Pennant NL
Mobil Oil Corp.	Mobilgear
Petro-Canada Products	Ultima EP
Phillips 66 Co.	Philube SMP Oil
Shell Oil Co.	Omala Oil
Shell Canada Ltd.	Omala Oil
Sun Oil Co.	Sunep Gear Oils
Texaco Inc.	Meropa
Texaco Canada Inc.	Meropa
Union Oil Co. of Calif.	Extra Duty NL GL EP

SYNTHETIC LUBRICANTS -- Synthetic lubricants of polyalphaolefin base stock are recommended for cold climate operation, extended temperature range (all season) operation and/or extended (up to 10,000 hours) lubricant change intervals.

Recommended viscosity range for synthetic lubricants at selected ambient temperature ranges are listed in Table 8. Determine the required viscosity from Table 8 and select a synthetic lubricant from Table 9.

CAUTION

SYNTHETIC LUBRICANTS IN FOOD PROCESSING INDUSTRY *-- Synthetic lubricants may contain toxic substances and should not be used in the Food Processing Industry without the lubricant manufacturer's approval.*

SYNTHETIC LUBE CHANGES -- Synthetic lube change intervals can be extended to 8000-10,000 hours based on operating temperatures and lubricant contamination. Laboratory analysis is recommended for optimum lubricant life and gear drive performance. Change lube with ambient temperature change if required. Refer to Table 8.

TABLE 8 - VISCOSITY REQUIREMENTS -- SYNTHETIC LUBRICANTS

Ambient Temp. Range	Viscosity Range		Viscosity Index (Min.)
	SSU at 104°F	cSt at 40°C	
-30° to +10°F (-34° to -12°C)	135-164	28.8-35.2	130
-15° to +50°F (-26° to +10°C)	284-347	61.2-74.8	130
0° to +80°F (-18° to 27°C)	626-765	135-165	130
+20° to +125°F (-7° to +52°C)	918-1122	198-242	140

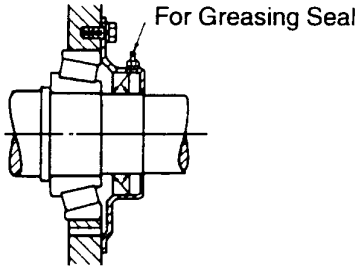
GREASE LUBRICATED BEARINGS -- All upper low speed shaft bearings and the lower low speed shaft bearings of units with drywells are grease lubricated. When changing oil in the unit, grease bearings with a NLGI #2 bearing grease selected from Table 10. Regrease these bearings as part of the standard maintenance program. Before installing a unit, note the location of all of the bearing grease fittings and grease labels for future maintenance reference. Note that some fittings may be ABOVE the oil level line and others BELOW. If a grease fitting will become inaccessible after the unit is installed, replace the fitting with a pipe extension (and the fitting) so that the grease fitting will be in an accessible location after the unit is installed.

GREASE LUBRICATED SEALS -- The high speed shafts are furnished with grease purged seals which minimize the entry of taconite and other abrasive dusts into the unit. Normally, units are shipped without grease in the seal housing cavity.

TABLE 9 - POLYALPHAOLEFIN TYPE SYNTHETIC LUBRICANTS+

AGMA Viscosity Grade		---	2	4	6
ISO Viscosity Grade		32	68	150	220
Viscosity at	SSU	135-164	284-347	626-765	918-1122
104°F (40°C)	cSt	28.8-35.2	61.2-74.8	1.5-165	198-242
Manufacturer		Lubricant			
Mobil Oil Corp.		SHC 624	SHC 626	SHC 629	SHC 630
		---	---	---	Mobilgear SHC 220*
Chevron U.S.A., Inc.		---	---	---	Tegra Syn-gear 220*
Conoco, Inc.		Syncon 32	Syncon 68	---	---
CPI Engineering Services, Inc.		CP-4620-32	CP-3620-68	CP-4620-150	CP-4620-220
		CP-4630-32*	CP-4630-68*	CP-4630-150*	CP-4630-220*
Exxon Co. U.S.A.		---	---	Spartan Synthetic EP 150*	Spartan Synthetic EP 220*

+ 225°F (107°C) maximum operating temperature unless otherwise noted.
*200°F (98°C) maximum operating temperature (contains sulphur phosphorous EP).



TYPICAL HIGH SPEED SHAFT

The option of adding grease is the customer's. The use of this feature is recommended for units operating in abrasive atmospheric conditions, but is NOT RECOMMENDED where grease could contaminate the product as in the food and drug industries.

At least once every six months, or when the grease becomes contaminated, pump fresh NLGI #2 bearing grease into the seal housing cavity through the seal grease fitting to flush out the old along the shaft extension where it can be wiped off. Select a grease from Table 10.

TABLE 10 - GREASES FOR GREASE LUBRICATED BEARINGS AND GREASE PURGED SEALS 0°F TO 200°F (-18° TO 93°C)**

Manufacturer	Lubricant
Amoco Oil Co.	Amolith Grease No. 2
Ashland Oil, Inc.	Multilube Lithium EP Grease
BP Oil Co.	Energrease LS-EP2
Chevron U.S.A. Inc.	Industrial Grease No. 2
Conoco Inc.	EP Conolith Grease No. 2
Exxon Co. U.S.A.	Unirex N2
Gulf Oil	Gulfcrown Grease No. 2
E.F. Houghton & Co.	MultiPurpose Lithium Grease L-421
Keystone Div. Pennwalt Corp.	Zeniplex-2
Lyondell Petrochemical (ARCO)	Litholine H EP 2 Grease
Mobil Oil Corp.	Mobilith 22
Petro-Canada Products	Gulfcrown Medium
Phillips 66 Co.	Philube Blue
Shell Oil Co.	Alvania Grease 2
Shell Canada Limited	Alvania Grease R2
Sun Oil Co.	Ultra Prestige EP2
Texaco Inc.	Premium RB Grease
Texaco Canada Inc.	Marfak MP2
Union Oil of Calif.	Unoba EP

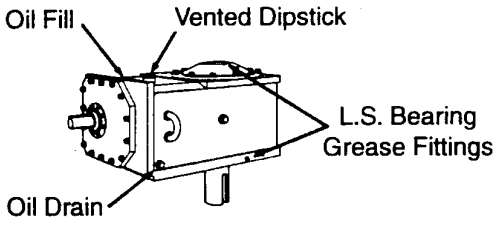
**Some of these products are of the EP type and may contain toxic substances not allowed in the food processing industry. A grease that meets the FDA "AA" classification is suitable for food processing aplications.

OIL LEVELS -- Fill the unit with oil to the level indicated on the oil level dipstick. Approximate oil capacities (for ordering oil) are listed in Table 11.

Before starting, if conditions permit, rotate the input shaft by hand to check for any obstruction. Then start the unit and allow it to run without a load for several minutes. Shut down and recheck oil level. **Add oil to compensate for cooler, filter, etc., oil capacities. If everything is satisfactory, the unit is ready for operation.**

TABLE 11 - Approximate Oil Capacity -- Gallons

Unit Size	Top Entry
MB-53	7
MB-54	9
MB-55	13
MB-56	19
MB-57	24
MB-58	44
MB-59	45



NOTE: Oil Fill and Dipstick Positions Reversed on Sizes MB-58 and MB-59

All standard MB units are splash lubricated. The lubricant is picked up by the revolving elements and distributed to all bearings (except grease lubricated low speed shaft bearings) and gear meshes.

Units with Water Cooled Heat Exchanges -- Install a shut-off or control valve in the water-line to the heat exchanger to regulate the water flow through the exchanger. Also install a water flow gauge between the control valve and the exchanger to determine actual flow rate. Discharge water to an OPEN DRAIN to prevent back pressure. If unit is equipped with an external pump, check immediately after starting to see that pump is circulating oil properly.

NON-STANDARD MOUNTING -- For units with nonstandard mounting, including tilted, refer to instructions provided with the unit for oil levels and bearing lubrication.

PREVENTIVE MAINTENANCE

AFTER FIRST WEEK -- Check alignment of the total system and realign where necessary. Also, tighten all external bolts and plugs where necessary. DO NOT readjust the internal gear or bearing settings in the reducer; these were permanently set at the factory.

AFTER FIRST MONTH'S SERVICE -- Proceed as follows:

1. Operate unit until old sump oil reaches normal operating temperature. Shut the unit down and drain immediately.
2. Immediately flush unit with an oil of the same type and viscosity grade as the original charge (warmed to approximately 100°F (38°C) in cold weather). Rapidly pour or pump a charge equal to 25-100% of the initial fill through the unit or until clean oil flows through the drain.
3. Close the drain and refill the unit to the correct level with new or reclaimed oil of the correct type and viscosity. If determined to be in good condition by the supplier, reclaimed oil may be reused if it is filtered through a 40 micron or finer filter.

PERIODICALLY -- Carefully check the oil level of the unit when it is stopped and at ambient temperature, add oil if needed. If the oil level is ABOVE the high level mark on the dipstick or the oil level plug, have the oil analyzed for water content. Moisture in the oil may indicate that the heat exchanger or a seal is leaking. If so, replace the defective part immediately and change the oil. DO NOT fill above mark indicated as leakage or undue heating may result. Also check coupling alignment to make certain that foundation settling has not caused excessive misalignment. If unit is equipped with a fan, periodically clean accumulated foreign matter from the fan, fan guard and deflector to allow adequate oil flow.

OIL CHANGES -- For normal operating conditions, change gear oils every six months or 2500 operating hours, whichever occurs first. Compounded oils may require more frequent changes. In dusty areas or where temperatures are high, more frequent changes may be required. Lubricant suppliers can test oil samples from the drive periodically and recommend economical change periods based on the rate of lubricant contamination and degradation.

If the drive is operated in an area where temperatures vary with the seasons, change the oil viscosity grade to suit the temperature.

GREASE LUBRICATION -- All MB units have one or two grease lubricated low speed shaft bearings and all units have a grease purged high speed shaft oil seal. Regrease bearings and seal when changing oil in the unit. Refer to Page 6, Grease Lubricated Bearings and Seals.

TABLE 12 - L.S. SHAFT BEARING REGREASING CAPACITY (ounces)*

Size	Bearing Location	Output Ext. Down	Shaft Ext. Up
MB-53	Upper	3	3
	Lower	3	3+
MB-54	Upper	3	3
	Lower	3	5+
MB-55	Upper	4	4
	Lower	3	5+
MB-56	Upper	4	4
	Lower	3	6+
MB-57	Upper	6	6
	Lower	5	11+
MB-58	Upper	12	12
	Lower	10	16+
MB-59	Upper	12	12
	Lower	10	16+

* The quantities of grease (in ounces) listed in the table are for relubrication of the bearings which have been originally packed with grease in assembly and are an approximate guide. The actual requirements are dependent upon load, speed and operating conditions and can only be determined from experience of the equipment operator.

\+ These bearings are normally oil lubricated. Quantity listed is for grease lubrication option.

COUPLINGS -- Lubricate flexible couplings in accordance with instructions.

DISMANTLING -- CAUTION: Lock out power source and remove all external loads from unit before servicing unit or accessories. Service manuals and parts guides are available from Hayward Gordon. When writing, please give complete data from the nameplate on the unit; Model, Serial Number, RPM and Ratio.

SPARE AND REPAIR PARTS -- When ordering parts, always give complete date from the nameplate on the MB drive. This complete nameplate data will assure you of receiving the correct parts. If a new nameplate is received with the new parts (for example, when the drive ratio is changed), replace the old nameplate on the drive with the new nameplate for future reference.

STORED AND INACTIVE UNITS

Each drive is spin-tested with rust preventative oil that will protect parts against rust for a period of four months in an outdoor shelter or twelve months in a dry building after shipment from the factory.

If a drive is to be stored or is inactive after installation beyond the above periods, drain oil from housing and spray all internal parts with a rust preventive oil that is soluble in lubricating oil or add "Motorstor"* vapor phase rust inhibitor at the rate of one ounce per cubic foot of internal unit space (or 5% of sump capacity) and rotate the shafts several times. Before operating, units which have been stored or inactive must be filled to the proper level with oil meeting the specifications given in this manual.

Periodically inspect stored or inactive units and spray or add rust inhibitor every six months or more often, if necessary. Indoor dry storage is recommended.

Units ordered for extended storage can be treated at the factory with a special preservative and sealed to rust-proof parts for periods longer than those cited above, if specified on the order. The vented dipstick is replaced with a plug (vented dipstick assembly attached to unit) so that the protective rust inhibiting atmosphere is sealed inside the unit. Replace plug with vented dipstick when preparing unit for operation.

See next page for more details.

*Product of Daubert Chemical Company, Chicago

Long Term Storage Instructions

These procedures are designed to protect your Hayward Gordon Mixers or Aerators from atmospheric corrosion or other harmful effects during periods of inactivity -- the one before the mixer is ever run, and prolonged idle periods thereafter.

The storage instructions for gear drive protection can be valid for periods of up to two years – for equipment stored under ideal conditions. If a longer period of storage is required, contact the Service Department of Hayward Gordon Ltd. for additional information. Any costs for storage materials or labor required after shipment will not be paid by Hayward Gordon Ltd. unless specifically contracted for at the time of purchase.

Specific storage procedures to be followed are meant to maintain the Mixers or Aerators as close to their "as shipped" condition as possible. Failure to properly store and protect the equipment as outlined in the following may void any warranty -- either expressed or implied. It is advisable for the user to keep a detailed log to record the results of inspections and maintenance performed on each aerator or mixer.

We strongly recommend that the gear reducers and motors be kept in a dry, temperature-controlled indoor area. We do not recommend outdoor storage. If indoor storage is impossible it is recommended that our procedures are followed to minimize damage. Storage of special equipment supplied by Hayward Gordon Ltd. such as motors, controls panels, etc., must be done in accordance with the manufacture's recommendations. We attach a typical motor manufacture's Service Bulletin showing "Recommendations for long term storage of Gearmotors, Motordrives, and Motors". These instructions should be carefully reviewed and acted upon before storing Aerators or Mixers with motors mounted.

RECEIVING THE EQUIPMENT

A. Check the impeller and the impeller shaft for obvious shipping damage. Should such damage be found, immediately report the details to the carrier who delivered the equipment, and the Hayward Gordon Ltd. Service department.

   Carefully move these components to a storage area where damage by contact with fork trucks, machinery, etc is least likely to occur. Carbon steel components, whether painted or not, should be protected. Protective coatings against atmospheric corrosion, as applied for shipping, should be checked for damage – renewed or patched as necessary. Periodic checks (preferably at no more than 30-day intervals) should be made, to ensure that no rusting or other damage has occurred. Should this be noted, corrective action should be quickly initiated. Contact Hayward Gordon Ltd. Service Department for guidance.

B. Mixer/Aerator drives should have been shipped completely sealed from the atmosphere – plugs are installed for shipment in place of the breathers required for operation (breathers are shipped separately, for field installation prior to startup). Carefully check to assure that the plugs are in place and all other openings to the atmosphere sealed before putting the unit into storage.

C. If the duration of storage for a newly manufactured unit, does not exceed 6 months, the gear reducer, if properly prepared, will not require additional protective procedures. Check to assure that long-term preservation procedures were applied to the drives at the factory. This should be indicated by a tag attached the drive which will say: "This mixer/aerator has internal rust protection which is considered adequate under normal INDOOR storage conditions **FOR SIX(6) TO TWELVE (12) MONTHS** from date of preservation". Application of proper rust-protective compound can be verified by removing the inspection plate from the side of the gear drive, and – with the aid of a flashlight – verifying that all surfaces are coated with a compound (such as Houghton Cosmoline 1102 – see following). If any question remains about the presence of proper protective coatings in all drive internals, contact Hayward Gordon Ltd. Service Department.

PHONE: 905 567-6116
FAX: 905 567-1706

How to Use This Manual

This Manual provides detailed instructions on disassembly and assembly of Type MB mixer drives. Use the Table of Contents below to locate required information.

Table of Contents

INTRODUCTION

The following instructions apply to standard Type MB right angle mixer drives with vertical output shafts. Drawings are representative of this series of right angle gear drives and may not agree in exact detail with all sizes. When ordering parts or requesting information, specify serial number, unit size, model number, rpm, ratio and date stamped on the drive nameplate. Consult Hayward Gordon BEFORE changing speed or ratio. Operate only at speeds shown on nameplate.

RATIO CHANGE-- Ratio change is accomplished by changing the helical gear ratio in the high speed end of the unit without disturbing the bevel gearset. Reduction changes (i.e., double to triple reduction) require new high speed heads on Sizes MB-54 to MB-59 and new helical gearing on all sizes.

CAUTION

Consult applicable local and national safety codes for proper guarding of rotating members.

Lock out power source and remove external loads from unit before servicing unit or accessories.

RECOMMENDATIONS

When replacing a pinion, replace the entire assembly (pinion, shaft, bearings, spacers, etc.) and the mating gear. Bevel pinion and bevel gear must be replaced as a set if either element requires replacement. Also replace oil seals and shim gaskets when reassembling units.

LIFTING INSTRUCTIONS

Disconnect all attached equipment and drain oil. Sling unit from lifting lugs (3) and lift from foundation.

REQUIRED EQUIPMENT

In addition to standard mechanic's tools, the following equipment is required: hoist, sling, arbor press, wheel puller, torque wrench, spanner wrench, special eyenut (for lifting bevel pinion assembly), feeler gauges, dial indicator with stand and inside & outside micrometers.

GENERAL INSTRUCTIONS

1. PRE-DISASSEMBLY--To prevent dirt from falling into the unit, clean all external surfaces of reducer before disassembly. Record mounting dimensions of couplings and accessories for reference when reassembling.

2. OIL SEALS--Replacement is recommended. However, if seals are not to be replaced, refer to steps 6A and 6A before starting disassembly.

3. SHIMS AND SHIM GASKETS--During disassembly, wire or tie all shims or shim gaskets to their respective bearing cages, seal cages or end covers for reference when reassembling.

4. **CAUTION: A number of helical pinions on high speed shafts are keyless for triple and quadruple reduction units. The high interference fit makes these assemblies "solid-onshaft" and, for all practical purposes, inseparable. If there is no evidence of a key or keyway, replace the assembly. See Table 7 for a listing of these assemblies.**

5. REMOVAL OF TAPER BORE HELICAL GEARS-see Step 8.

6. OIL SEAL REPLACEMENT ONLY--Figures 1A, 1B and 1C.

The high speed shaft and lower low speed shaft seal cages must be removed for oil seal replacement. The upper low speed seal shaft may be replaced without disturbing the seal cage. If the unit is to be totally disassembled, start with Step 7. If only the seals are to be replaced, proceed as follows:

A. Clean the shaft extensions, but DO NOT ALLOW abrasive materials to mar the shaft surface polished by the seal.

B. Remove seal cages where required, save the shim gaskets for reference when reassembling.

C. Drive out the seals and remove sealing compound and gasket material from seal cage. Replace seal cage if it has been damaged or bent. On upper low speed shaft seal cages, punch or drill holes in the seal case, install sheet metal screws and pry out old seal. Punch method is preferred. CAUTION: Seal cage must be removed from unit to remove seal if seal is driven into bearing cavity.

1. Drill Method -- Wrap several turns of tape around the drill approximately .250" from the drill point to prevent the drill from entering too deeply into the housing and damaging the bearing. Grease or magnetize the drill to help retain the chips. Drill two .125" diameter holes in the seal cage 180° apart. Control the angle of the drill as illustrated in Figure 1 A, to prevent damage to the shaft.

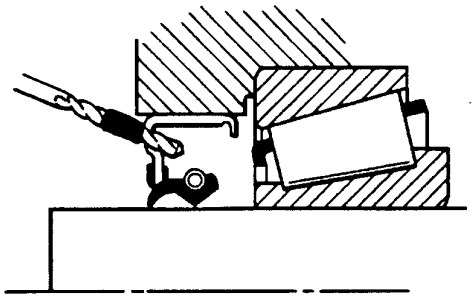


Figure 1A Drill Method

2. Insert two #10-.750" sheet metal screws into the seal leaving .500" of the screw protruding above the seal face. DO NOT drive the screw more than .250" beyond seal face or bearing damage may occur. Use a claw type pry bar under the screw head as shown in Figure 1B and lift the seal out. Remove all chips. Use a magnet to remove the chips that fall into the bore. Remove Permatex from the seal cage bore.

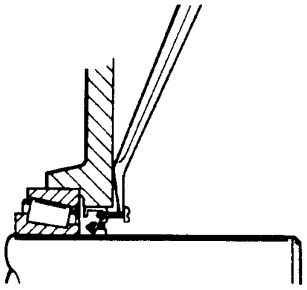


Figure 1B

D. Coat outside diameter of new seal with Permatex #3 or equivalent.

E. Figure 1C--Position seal squarely in seal cage with the garter spring towards the bearing. Place a square ended cylindrical tool against the seal and press or lightly tap the tool (not the seal) until the seal is seated in the seal cage.

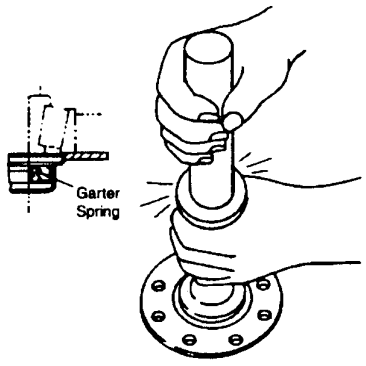


Figure 1C

F. Clean face of unit. Remove old gasket material. For shafts with ball bearings, replace shim gasket with a new one of the same thickness. For shafts with tapered roller bearings, adjust preload or axial float as required. Replace shim gaskets with new ones of the same total thickness and add additional .007" and .009" shim gaskets to ensure axial float on initial check. See Table 1 for shim gaskets available from the factory. Use only one .015" shim-gasket in each shim pack, place that shim-gasket against the seal cage when it is a stamping or against the housing when it is a casting.

TABLE 1 - SHIM-GASKET COMPRESSIBILITY

Thickness	New	.007	.009	.015	.031
Inches	Compressed	.006	.008	.013	.028

G. **CAUTION: Protect seal lips from the sharp edges of the keyway by wrapping thin strong paper around the shaft and coating the paper and seal lips with grease before sliding the seal on or off the shaft. Do not expand the seal lips more than .03" diameter.**

H. High speed seal cages on all Size MB-53 units and Sizes MB-54 through MB-57 double reduction units are unregistered and must be centered on the shaft. To center these cages, tighten fasteners finger tight, check shaft to cage bore clearance at 90° intervals with a feeler cage and lightly tap cage to center within .004"

TABLE 2 - FASTENER TIGHTENING TORQUE* LB-IN

Fastener Location	Fastener Size					
	.312-18	.376-16	.500-13	.625-11	.750-10	.875-9
	Tighten Torque lb.in					
H.S. Seal Cages Int. Shaft End Covers H.S. Head Thrust Plate Internal (Hex Head)	145	255	640	1280	---	---
Oil Dam Mounting (Nylon Pellet)	---	150	---	---	---	---
H.S. Head Thrust Plate Internal (Slotted Head Machine Screw)	---	95	---	---	---	---
L.S. Pinion Bearing Cage (Coated Fasteners) L.S. Shaft Seal Cages and End Covers H.S. Head/H.S. Bearing Plate Mounting Pedestal/Foundation Plate Mounting	185	330	825	1640	2940	4560

J. Install seal cage and fasteners with lockwashers. Center unregistered cages as indicated in Step 6H. Cross tighten fasteners to torque value specified in Table 2.

K. For shafts with tapered roller bearings, check and adjust bearing preload or axial float after new shim gaskets have been installed as explained in Step 6F. Refer to Table 3 for bearing preload and axial float limits. To obtain accurate readings, turn the unit so that the shaft being checked is in the vertical position. Attach eye bolts to the low speed shaft or "C" clamp to the high speed shaft extension to serve as a push/pull device and measure and adjust preload or axial float as instructed in Steps 22, 26, 27 and 31.

TABLE 3 - BEARING ADJUSTMENT - Inches **
(Part reference number and unit reduction from Fig 2.)

UNIT SIZE	Total Shaft Axial Float (Inches)							Preload Inches
	Ref. #1 Couble	Ref. #1 Triple	Ref. #1 Quad.	Ref. #3 Triple	Ref. #2 Quad.	Ref. #3 Quad.	Ref. #4 All Red.	Ref. #5 All Red.
MB-53	*	.011 Min.	---	.011 Min.	.011 Min.	.011 Min.	.001-.003	.001-.004
MB-54	*	*	*	.011 Min.	.011 Min.	.011 Min.	.001-.003	.001-.004
MB-55	*	*	*	.011 Min.	*	.011 Min.	.001-.003	.001-.004
MB-56	.004-.006	*	*	.011 Min.	.011 Min.	.011 Min.	.001-.003	.001-.004
MB-57	.005-.006	*	*	.004-.006	.005-.006	.004-.006	.001-.003	.001-.004
MB-58	.005-.006	.005-.006	.005-.006	.004-.006	.005-.006	.004-.006	.001-.003	.001-.004
MB-59	.005-.006	.005-.006	.005-.006	.004-.006	.005-.008	.004-.006	.001-.003	.001-.004

** Ball bearings above heavy line; tapered roller bearings below heavy line. If the minimum ball bearing float is less than that shown in table, add one gasket to increase shaft axial float.

* One bearing takes all the thrust; the other bearing floats axially.

HIGH SPEED END REMOVAL - Figure 2

Start with the high speed end of the unit and work through to the low speed end. The low speed (bevel gear) shaft may be removed from the unit for service without disturbing the remainder of the unit.

Figure 2 SHAFT ASSEMBLIES

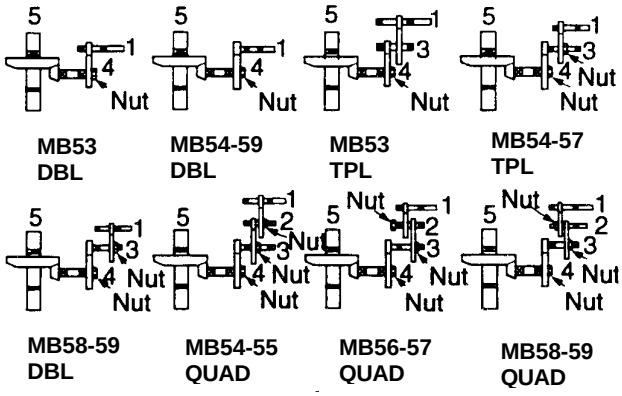
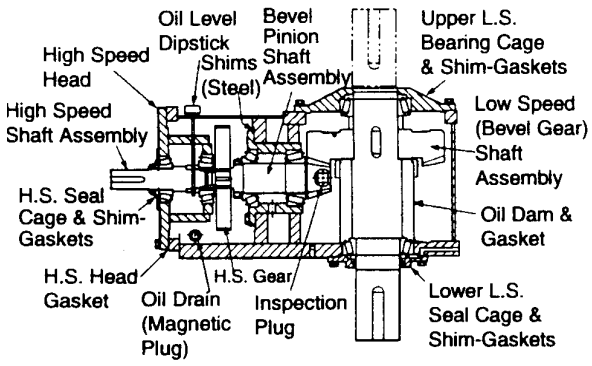


Figure 2A – TYPICAL MB DOUBLE REDUCTION



7. **Size MB-53**

A. Stand unit on end (properly supported) with high speed shaft extension up. Remove high speed seal cage and high speed head (bearing plate fasteners.

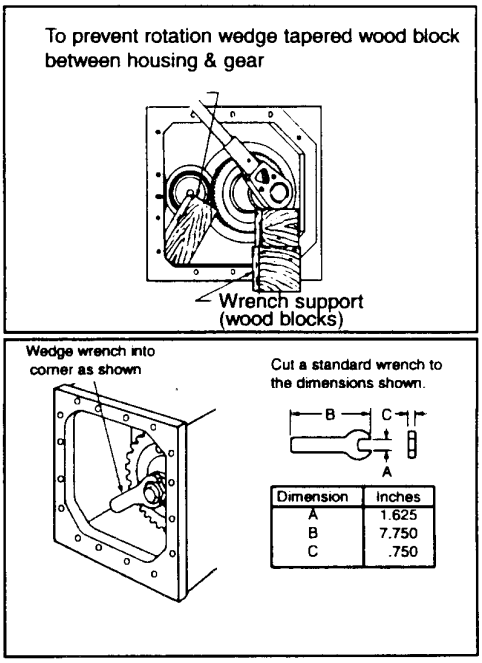
B. Protect the seal lips per Steps 6A and 6G if seal is to be reused. Remove the seal cage (save the shim gaskets). On double reduction unit, remove the retaining ring form the outer high speed bearing.

C. Install two eye bolts into the two lower tapped holes provided in the bearing plate for the seal cage and then, while lifting, tap the edge of the high speed bearing plate with a brass hammer to break it loose from the housing and the high speed pinion assembly.

D. Secure the taper-bored gear locknut with a "short wrench", refer to Figure 3B. Loosely replace the bearing plate to provide stability to the outer high speed bearings. Wrap shim stock or protective material around the high speed shaft and turn the shaft with a spanner wrench to back off the lock nut to the end of the shaft.

   IMPORTANT: TO LOOSEN THE LOCK NUT -- On double reduction units, turn the high speed shaft counterclockwise (when facing the outer end of the high speed shaft); on triple reduction units, turn the high speed shaft clockwise.

Figure 3A – LOCKNUT REMOVAL SIZES MB-54 to 59



E. Remove bearing plate and pull the high speed shaft and intermediate shaft assemblies out of the inner housing wall, do not damage gear teeth. On some unit ratios, it is necessary to remove the taper-bored gear (Step 7F) before the other shaft assemblies can be removed.

F. Remove taper-bore gear from bevel pinion shaft (Figure 4A or 4B). Leave locknut loosely threaded on shaft to prevent gear from •popping" out of unit. If gear is to be reused, protect the gear teeth with copper or brass sheet stock. Using wedges or pry bar, tap wedges behind gear or pry gear away from inner housing wall. While holding pressure on gear, lightly tap locknut on shaft end to loosen gear on shaft. Remove nut, other shaft assemblies (Step 7E) and taper bore gear, work high speed shaft assembly around high speed bearing oil distributor to remove.

8. Sizes MB-54 thru MB-59

A. Stand unit on end (properly supported) with high speed shaft extension up. Remove high speed head mounting fasteners and threaded dowels (threaded dowels used in triple and quadruple reduction drives). Install eye bolts in threaded holes of head, sling and lift head out of unit, tap edge of head to break gasketed joint while lifting. On double reduction drives, the head dowel disengages while lifting. On triple and quadruple reduction drives, the head must be joggled for gear clearance while lifting.

B. Loosen taper bore gear locknut (on bevel pinion shaft). Use 3/4" drive impact wrench (preferred) or socket wrench. The socket wrench method requires wood blocks for locking the gear and wrench head support (Figure 3A) and housing repositioned to accept wrench head without moving. Refer to Table 4 for locknut data.

TABLE 4- BEVEL PINION SHAFT GEAR LOCKUNT DATA (Shaft #4-Fig.2)

Unit Size	Thread Size (in.)	Wrench Size (in.)
MB-53	1.125-12UNF	1.625
MB-54	1.250-12UNF	1.812
MB-55	1.500-12UNF	2.194
MB-56	1.750-12UNF	2.750
MB-57	1.750-12UNF	2.750
MB-58	1.750-12UNF	2.750
MB-59	1.750-12UNF	2.750

C. Remove taper bore gear from bevel pinion shaft: Leave gear locknut loose on shaft to prevent gear from "popping" out of unit upon fit release. Use gear removal methods as shown in Figures 4A thru 4D (wedge or pry bar method on sizes MB-54 thru MB-56 and wheel puller method on Sizes MB-57 thru MB-59). If required, apply heat to gear hub (with removal force applied) to release gear from shaft. Do not reuse gear if gear teeth were heated over 275°F. remove lock nut and gear.

HIGH SPEED HEAD DISASSEMBLY

Sizes MB-54 thru MB-59 -- Refer to Figure 2. Shafts 1, 2 and 3 are supported in the high speed head.

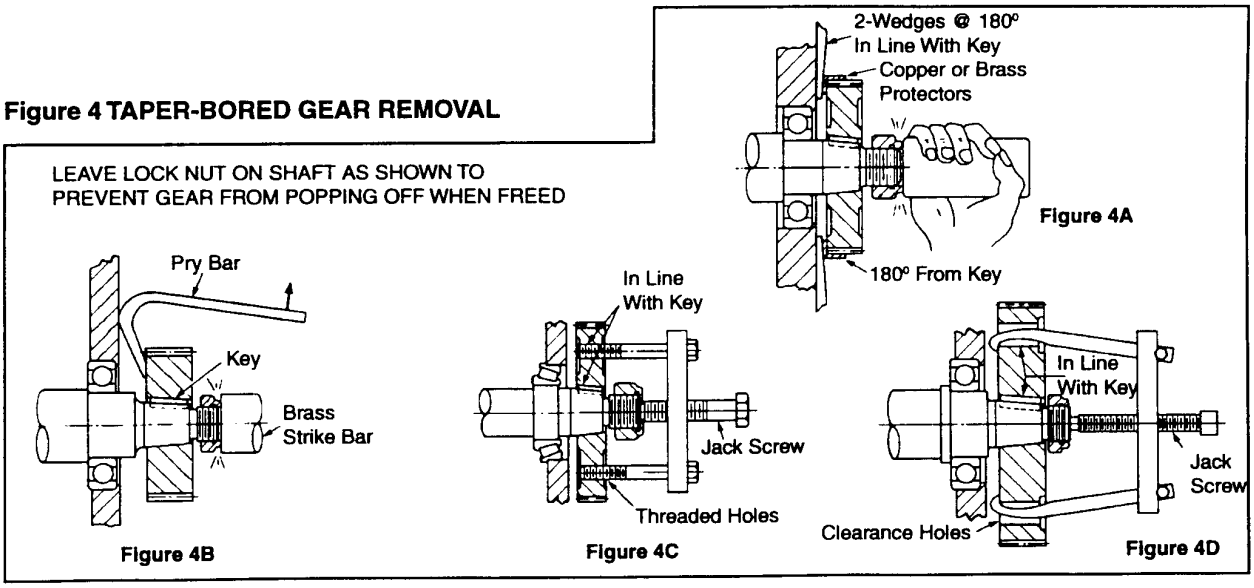
9. DOUBLE REDUCTION UNITS.

A. Remove high speed seal cage.

B. **Sizes MB-54 and MB-55 --** Remove bearing retaining rings. Remove high speed shaft assembly #1 from high speed end toward pinion.

Sizes MB-56 thru MB-59 -- Remove the high speed pinion assembly through the bearing bores toward the shaft extension end. EXCEPTIONS: Heat the following high speed pinions to the temperatures shown. Then, press or pull off the pinion and withdraw the shaft and bearing assembly. Remove inner bearing cup. Discard pinion if teeth are heated over 275°F.

Figure 4 TAPER-BORED GEAR REMOVAL



#1 PINION MAXIMUM TEMPERATURES

Ratios 5.06 and 6.20
Ratios 5.06 through 7.59
Ratios 5.06 through 9.30
} 275ºF (135ºC)

10. TRIPLE AND QUADRUPLE REDUCTION UNITS

A. Start with intermediate shaft assembly #3 and work back toward the high speed shaft.

B. Remove intermediate shaft end cover or covers.

C. Hold the locknut on the intermediate shaft with a wrench and turn the high speed shaft extension with a spanner wrench to remove locknut.

D. Remove intermediate shaft inner bearing retaining ring if so equipped. On sizes MB-57 through MB-59 remove the inner intermediate thrust plate.

E. Place two spacer blocks between the gear face and the wall of the high speed head. Place a brass bar at the shaft end nearest the lock nut and strike the bar a sharp blow with a hammer to free the gear.

F. Remove the shaft assembly and the gear from the high speed head.

G. Remove the high speed seal cage and high speed shaft assembly.

H. If the inner bearing or pinion must be removed from the intermediate shaft (#3), first remove the shaft from the high speed head. For several pinion ratios, the pinion may more easily be removed from the shaft by heating the pinion to a maximum of 275°F (135°C).

I. A number of high speed shaft assemblies have keyless bored pinions and non-removable bearings, refer to Step 13 and Table 7.

LOW SPEED END DISASSEMBLY

11. BEVEL PINION SHAFT -- Figure 5.

A. Remove bevel pinion bearing cage fasteners. Attach special eye nut to shaft end (refer to Table 4 for thread sizes), sling and lift shaft assembly out of unit. Save steel shims for reference at reassembly.

TABLE 5 - LOCK NUT TIGHTENING TORQUE* LB-IN (On tapered shafts with taper-bored gears from Fig 2.)

Unit Size	All Ref. #4	Ref. #3 Triple Ref. #3 Quadruple	Ref. #2 Quadruple
MB-53	1800	---	---
MB-54	1500+30°(2700)	1150	1150
MB-55	1500+45°(3540)	1600	1600
MB-56	1500+60°(2400)	2400	2400
MB-57	1500+60°(6340)	3100	3100
MB-58	1500+75°(9540)	4600	4600
MB-59	1500+75°(9540)	4600	4600

*The complete lock nut must be coated with SAE 20 or heavier oil.

B. Remove bearing locknut, lockwasher and keyed washer. Press bevel pinion out of bearing cage (toward pinion) and outer bearing. Remove bearing cups from bearing cage and remaining bearing cone from shaft.

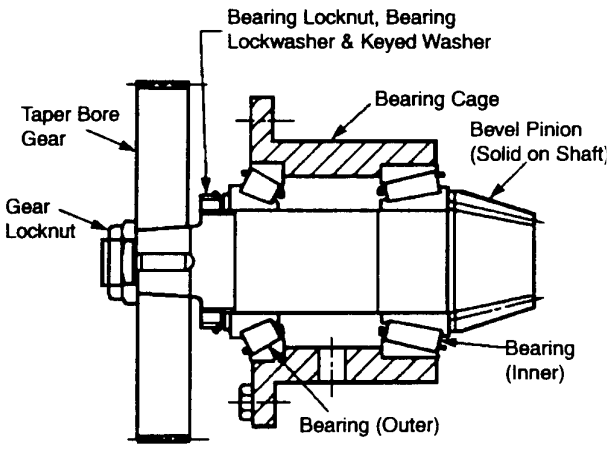


Figure 5 BEVEL PINION ASSEMBLY

TABLE 6 – GEAR NUT TIGHTENING TORQUE AT HIGH SPEED SHAFT – lb-in.

AGMA Ratio	UNIT SIZE					
	MB-53	MB-54	MB-55	MB-56	MB-57	MB-58&9
High Speed Gear on Ref. #3 Shaft Assembly, Figure 2						
38.44	---	625	870	1070	1660	2050
47.08	---	520	700	880	1385	2050
57.66	---	415	580	720	1140	1385
70.62	---	345	460	585	935	1385
86.50	---	275	380	475	935	1125
105.9	---	230	325	385	935	1125
129.7	---	185	255	385	615	735
158.9	---	155	220	385	500	735
194.6	---	155	220	385	500	735
High Speed Gear on Ref. #2 Shaft Assembly, Figure 2						
238.4	---	165	190	220	310	470
291.9	---	135	155	180	310	375
357.5	---	90	100	145	255	310
437.9	---	90	100	145	205	265
536.3	---	50	100	145	205	265
656.8	---	50	60	80	170	205
804.5	---	50	60	80	115	205
985.3	---	50	60	80	115	205
1207	---	50	60	80	115	205
Intermediate Gear on Ref. #3 Shaft Assembly, Figure 2						
238.4	---	100	140	175	225	405
291.9	---	80	110	140	225	325
357.5	---	55	75	115	185	265
437.9	---	55	75	115	150	225
536.3	---	30	75	115	150	225
656.8	---	30	40	65	120	180
804.5	---	30	40	65	85	180
985.3	---	30	40	65	85	115
1207	---	30	40	65	85	115
High Speed Gear on Ref. #4 Shaft Assembly, Figure 2						
5.06	1470	2235	2880	4430	5215	7795
6.20	1190	1785	2340	3630	4350	6160
7.59	965	1450	1915	2990	3475	5175
9.30	805	1205	1580	2435	2845	4290
11.39	660	990	1300	2055	2290	3415
13.95	540	815	1065	1670	1885	2820
17.09	440	650	830	1315	1570	2285
20.93	355	520	700	1090	1280	1830
25.63	290	430	575	905	1025	1565
31.39	240	350	465	740	860	1220
Intermediate Gear on Ref. #4 Shaft Assembly, Figure 2						
38.44	185	285	380	590	685	1020
47.08	150	235	305	485	570	815
57.66	125	190	255	395	470	690
70.62	105	155	200	320	385	550
86.50	85	125	165	260	310	450
105.9	70	105	140	210	260	380
129.7	55	85	110	175	205	290
158.9	45	70	95	145	165	250
194.6	---	60	80	120	140	195
Intermediate Gear on Ref. #4 Shaft Assembly, Figure 2						
238.4	---	45	60	95	115	160
291.9	---	35	50	80	90	130
357.5	---	30	40	65	75	105
437.9	---	25	30	50	60	90
536.3	---	20	25	45	50	75
656.8	---	17	20	35	40	60
804.5	---	13.8	18	30	35	50
985.3	---	11.4	15	25	30	40
1207	---	9.3	12.1	20	25	30

12. LOW SPEED (BEVEL GEAR) SHAFT--Figure 6.

A. Position unit upright and remove upper end cover or seal cage. Attach eye bolt(s) to low speed shaft assembly, sling and lift out of housing. Reposition housing and remove lower seal cage or end cover. Save shim gaskets for reference at reassembly.

B. Remove upper bearing, grease retainer, spacer and bevel gear from shaft as an assembly, use press (umbrella stays on shaft). Upper bearing and grease retainer may be removed separately if service on bevel gear is not required. Remove lower bearing. Remove bevel gear key and umbrella if required.

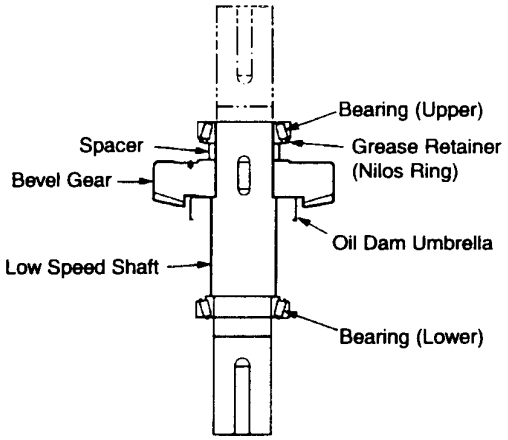


Figure 6 LOW SPEED (BEVEL GEAR) SHAFT ASSEMBLY

CLEANING, INSPECTION AND REPLACEMENT OF PARTS

13. Table 7 lists high speed shaft assemblies that require replacement as assemblies and not individual parts. The following instructions apply to servicing of reusable parts.

TABLE 7 - HIGH SPEED SHAFT KEYLESS BORED PINIONS AND NON-REMOVABLE BEARINGS

Reduction	AGMA Ratio	UNIT SIZE					
		MB-54	MB-55	MB-56	MB-57	MB-58	MB-59
Triple	38.44	Keyless +	Keyless +	---	---	---	---
	47.08	Keyless +	Keyless +	---	---	---	---
	57.66	Keyless +	Keyless +	---	---	---	---
	70.62	Keyless +	Keyless +	---	---	---	---
	86.50	Keyless +	Keyless +	---	---	---	---
Quadruple	238.4	Keyless +	Keyless +	Keyless +	---	Keyless +	Keyless +
	291.9	Keyless +	Keyless +	Keyless +	---	Keyless +	Keyless +
	357.5	Keyless +	Keyless +	Keyless +	---	Keyless +	Keyless +
	437.9	Keyless +	Keyless +	Keyless +	---	---	---
	536.3	---	Keyless +	Keyless +	---	---	---

+ The outer bearing of the shaft assembly is not removable.

14. CLEANHOUSING, HEADS AND ATTACHMENTS.

A. Remove gasket material from sealing surfaces.

B. Remove all burrs.

C. Clean oil chamber and all internal revolving elements with kerosene or solvent.

D. Coat pipe plug threads with Permatex #3 before installing.

15. SEALS

A. Drive out old seals and remove old sealing compound from seal cage bores. DO NOT replace seals at this time.

16. BEARINGS

A. Wash the bearings in clean kerosene or solvent and then dry. Do not spin bearings for they may score due to lack of lubricant.

B. Inspect bearings carefully and replace all that are worn.

C. Use a wheel puller or press to remove the bearings. Apply force to the inner race only.

D. DO NOT mount bearings next to intermediate shaft lock nuts until the shaft assembly has been installed into the high speed head. Then mount bearing per Step 16E.

E. Before mounting open ball or tapered roller bearings, heat in an oil bath or an oven to a maximum of 275°F (135°C) and then slide or press them tight against the shaft shoulder. CAUTION: Do not apply flame directly to bearings or rest them on the bottom of the heated container.

F. After cooling, thoroughly coat all bearings with lubricating oil.

17. **GEAR AND PINION REPLACEMENT**

A. Wash the pinions and gears in clean kerosene or solvent and inspect for damaged or worn teeth.

B. DO NOT mount pinions that had to be heated and removed (Step 9B) to permit removal of the shaft from the high speed head. Insert the assembled shaft (less pinion) into the head and then mount the pinion per Step 17C.

C. **KEYED ELEMENTS**--Assemble straight-bored pinions (with keys) to the shaft from the chamfered side. Preheat pinions in an oil bath or an oven to a maximum of 275°F (135°C) and then press the pinion tight against the shaft shoulder. Check with a feeler gauge to see that there is no clearance.

D. **KEYLESS ELEMENTS**--Replace keyless pinion shaft assemblies and straight bored gear shaft assemblies listed in Table 7 as a factory assembly if either the pinion, gear, shaft or non-removable bearing is worn or damaged. DO NOT mount taper-bored gear at this time.

18. FASTENERS

A. Remount lockwashers on external fasteners during reassembly. When replacing fasteners, use the identical grade and type as furnished in the original assembly. Note that the bevel pinion bearing cage fastener threads are coated with an adhesive.

B. Replace used lock nuts with new ones to ensure maximum holding capacity. Before mounting, dip the lock nut in SAE 20 or heavier oil.

19. SHIM-GASKETS

A. Replace the used shim-gaskets with new ones. Shim-gaskets with minimum compressibility (see Table 1), are available from the factory in thicknesses of .007,.009, .015 and .031 inches.

B. Always place the one .015" shim-gasket against the seal cage or end cover when the seal cage or end cover is a stamping or against the housing when it is a casting for positive sealing as explained in Step 8F.

20. CLEAN AND OIL PARTS

A. All parts must be clean. Pay particular attention to the inside of the housing to see that all foreign matter has been removed. Check to see that all worn parts have been replaced and that all gears and bearings are coated with oil.

REDUCER ASSEMBLY—PRELIMINARY

Steps 21 thru 23 are set forth here to eliminate repetition. As necessary the assembly instructions will refer back to these steps.

21. BEARING AXIAL FLOAT—Axial float measurements are not required if not shown in Table 3.

22. BEARING AXIAL FLOAT MEASUREMENT— Before checking axial float, torque fasteners to the appropriate value listed in Table 2. Determine the total shaft axial float with a dial indicator. Rotate shaft while applying axial force in both directions and measure axial float. Add or subtract shim gaskets from the shim pack until measured axial float is within the limits shown in Table 3.

23. TIGHTEN TAPERED SHAFT LOCKNUT

A. After dipping locknut in oil and mounting, torque as follows:

Hold the locknut with an open end wrench and turn the high speed shaft extension with a spanner wrench to the torque specified in Table 5. (If the nut is accessible for a torque wrench, torque to value shown in Table 6.)

HIGH SPEED HEAD REASSEMBLY

The following steps apply to the shaft assemblies entirely supported in the high speed head. Refer to Figure 2 (shaft assemblies).

DOUBLE REDUCTION

24. SIZES MB-54 THRU MB-59

A. For high speed shafts with pinion on shaft and with:

1. Ball bearings -- Simply slide the assembly into the high speed head. Mount the retaining ring on outer bearing and inner bearing, if so equipped.

2. Tapered roller bearings--Insert the inner bearing outer race into inner wall of high speed head. Then insert the high speed shaft assembly and outer bearing outer race.

B. For high speed shaft with unmounted pinion, follow preceding Step 1 or 2. Mount the bored pinion per Steps 17B and 17C.

C. For Sizes MB-54 and MB-55 units.

Install seal and seal cage with one .031" gasket as outlined in Steps 6D through 6J.

D. For Sizes MB-56 through MB-59 units

1. Mount seal cage (without seal) with a total of at least .062" of shim-gaskets.

2. Insert seal cage fasteners, torque to Table 2 values.

3. Adjust high speed shaft axial float per Step 22 and Table 3. Use only one .015" shim-gasket in the final shim pack. On Sizes MB-56 and MB-57, place the .015" shim-gasket against the seal cage. On Sizes MB-58 and MB-59, place the .015" shim-gasket against the unit housing.

4. Remove seal cage and install seal as outlined in Steps 6D through 6J and 6L. Tighten fasteners to torque shown in Table 2.

TRIPLE REDUCTION

25. SIZES MB-54 THROUGH MB-56

A. Insert high speed shaft assembly through the outer wall and into the inner wall of the high speed head.

B. Install seal and seal cage with one .031" gasket as outline in Steps 6D thru 6J. Tighten fasteners to torque shown in Table 2.

C. Dip the gear lock nut in SAE 20 or heavier oil.

D. See Figure 2. With the intermediate pinion and the adjacent bearing minus the bearing outer race retaining ring in place on intermediate #3 shaft (and key in taper), insert the shaft through (1) the inner wall of the high speed head, (2) bearing retaining ring, (3) taper-bored gear (and spacer for Size MB-54), (4) locknut (turn finger tight), (5) spacer, and (6) into the outer high speed head bearing bore.

E. Mount retaining ring on inner bearing.

F. Tap the outer bearing into the bore and onto the shaft. Temporarily mount spacer (Sizes MB-55 and MB-56) and end cover with two or three fasteners to hold shaft in place.

G. Tighten lock nut per Step 23.

H. Remove end cover and seat inner race of the outer bearing. Re-install bearing spacer (Sizes MB-55 and MB-56). Mount end cover with one .031 " gasket and tighten fasteners to torque shown in Table 2.

26. SIZES MB-57 THROUGH MB-59.

A. For Size MB-57, see Steps 25A and 25B for high speed shaft assembly into head.

B. For Sizes MB-58 and MB-59 high speed shaft assembly, first tap the high speed tapered bearing cup into the inner wall of the high speed head. Then insert the high speed shaft assembly and outer bearing outer race. Install seal cage (without seal) and sufficient shim-gaskets to obtain float. Tighten fasteners to torque shown in Table 2. Adjust high speed shaft axial float per Step 22 and Table 3. Use only one .015" shim-gasket in the final shim pack and place it against the high speed head. Remove seal cage and install seal as explained in Steps 6D thru 6J and 6L. Tighten fasteners to torque shown in Table 2.

C. Dip the gear lock nut in SAE 20 or heavier oil.

D. See Figure 2. Insert intermediate #3 shaft subassembly with key in taper (less inner bearing outer race) through the inner wall of high speed head, taper-bored gear and locknut into the outer bearing bore. Tighten locknut finger tight.

E. Insert inner bearing outer race into inner wall of high speed head and install keeper plate. Torque fasteners to Table 2 value.

F. Insert bearing into high speed head and temporarily hold it in place with the end cover and two or three fasteners .

G. Tighten locknut per Step 23.

H. Remove end cover and seat outer bearing. Remount end cover with sufficient shim-gaskets to obtain float and torque fasteners to the value shown in Table 2.

I. Adjust intermediate shaft axial float per Step 22 and Table 3. Use only one .015" shim-gasket in the final shim pack and place it against the high speed head.

QUADRUPLE REDUCTION

27. SIZES MB-54 THROUGH MB-55

A. Install #1 high speed shaft assembly per Steps 25A through 25B.

B. SIZE MB-54 -- Install #2 shaft as follows: Remove retaining ring from inner bearing OD. Insert key into the tapered shaft keyway. Hold the retaining ring, high speed gear and lock nut (dipped in oil) between the walls of the high speed head. Install these parts as #2 shaft is passed through the high.

speed head from the inner wall. Pass the shaft through the high speed head an additional distance to allow installation of the retaining ring on the bearing. After retaining ring is installed, move shaft back to seat the retaining ring against the housing wall. Install inner spacer, outer bearing and outer spacer. Install one .031" gasket and end cover. Torque fasteners to value shown in Table 2. Tighten locknut per Step 23.

C. Install #3 intermediate shaft assembly per Steps 25C thru 25H.

28. SIZE MB-56

A. Install #1 high speed shaft assembly per Steps 25A thru 25B.

B. Install #2 shaft as follows: Install the inner bearing and in .015" shim-gasket and end cover. Torque fasteners to value shown in Table 2. Install and tighten lock nut per Step 23.

C. Install #3 intermediate shaft assembly per Steps 25C thru 25H.

29. SIZES MB-57 THROUGH MB-59

A. Install #1 high speed shaft assembly per Steps 25A thru 25B.

B. Taper inner bearing outer race of 1st intermediate #2 shaft assembly into the inner wall of the high speed head (inner and outer race of bearing and inner bearing sleeve on Size MB-57.

C. Dip gear locknut in SAE 20 or heavier oil.

D. Insert 1st intermediate #2 shaft assembly with key in taper through high speed head, taper-bored gear, lock nut and into inner bearing. Tighten locknut finger tight.

E. Insert bearing, outer race (and spacer on Size MB-57) into high speed head and temporarily hold in place with end cover and two or three fasteners.

F. Tighten lock nut per Step 23.

G. Remove end cover and seat inner bearing onto shaft. Remount end cover with sufficient shimgaskets to obtain float and tighten fasteners to the value show in Table 2.

H. Adjust intermediate shaft axial float per Step 22 and Table 3. Use only one .015" shim-gasket in the final shim pack and place it against the high speed head.

I. Install 2nd intermediate #3 shaft assembly per Steps 26C thru 26H.

LOW SPEED END ASSEMBLY & INSTALLATION

30. BEVEL PINION ASSEMBLY AND INSTALLATION -- Figures 2 & 5

A. ASSEMBLY

Assemble both bearing cups to bearing cage. Heat and assemble inner bearing cone with rollers large end towards pinion. Stand bevel pinion on end and assemble bearing cage onto pinion. Heat outer bearing cone, assemble to pinion shaft and allow assembly to cool. Install keyed washer, lockwasher and bearing locknut. Tighten locknut until shaft axial float of .001" to .003" is achieved. Check outer bearing cone back face runout (must be .001" or less, tap high side to adjust) and recheck axial float. Lock bearing lockwasher when bearing setting is correct.

B. INSTALLATION

1. If original bevel pinion is being reassembled into unit, use same steel shimpack as removed at disassembly. If new bevel pinion is used, add or subtract shims from old shimpack (add if mounting distance of new pinion is greater) equal in thickness to change in mounting distance (etched on bevel gear). Use uncoated cage fasteners for temporary assembly (mounting distance adjustment may be required).

2. Wire tie shimpack to bearing cage flange, sling bevel pinion from eye nut and lower into housing bore (pinion assembly moves sideways in housing to engage bore after cage bolting flange clears housing front face). Remove shimpack wire ties, install cage fasteners, release sling load and tighten fasteners (temporary assembly).

31. LOW SPEED (BEVEL GEAR) SHAFT ASSEMBLY AND INSTALLATION.

A. ASSEMBLY -- Figure 6.

Assemble oil dam umbrella and gear key to shaft (if removed). Heat bevel gear (275°F max) and assemble to shaft. Seat with press. Assemble shaft spacer and grease retainer to shaft. Heat upper bearing cone, assemble to shaft and seat bearing (grease retainer and shaft spacer must not be free to rotate). Heat and assemble lower bearing cone to shaft.

B. INSTALLATION

1. Assemble lower seal cage or end cover to housing with shimpack of equal compressed thickness to that removed. Install and tighten fasteners to torque specified in Table 2.

2. Position housing upright. Assemble oil dam (if previously removed) with new gasket to housing. Coat sealing surfaces of gasket inside of bolt circle (both sides) with Permatex #3 or equivalent sealant before assembly. Install and tighten oil dam fasteners to specified torque in Table 3. DO NOT overtighten.

3. Position housing upright, sling and carefully lower shaft assembly into housing. Assemble upper end cover or seal cage to unit with a shimpack of equal compressed thickness to that Removed plus one additional .007" and .009" shim-gasket (to ensure shaft axial float on first bearing setting check). Install and tighten cage fasteners to specified torque.

4. Check low speed shaft axial float and remove shim-gaskets from upper cage shimpack to obtain 001" to .004" bearing preload. Reinstall cage, cage fasteners and tighten to specified torque.

32. BEVEL GEARSET BACKLASH AND CONTACT ADJUSTMENT.

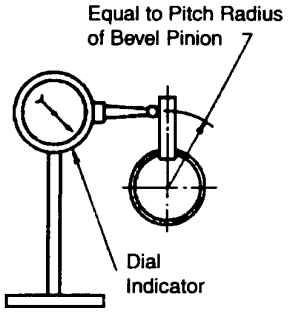
A. Measure bevel gearset backlash at the pinion pitch radius (Table 8).

TABLE 8 - BEVEL PINION PITCH RADIUS

Unit Size	Pitch Radius - Inches
MB-53	1.22
MB-54	1.47
MB-55	1.67
MB-56	1.86
MB-57	2.20
MB-58	2.39
MB-59	2.70

1. To measure backlash, wedge a key into the bevel pinion shaft helical gear keyseat as shown in Figure 7. Place a dial indicator squarely against the side of the key at the pinion pitch radius (Table 8).

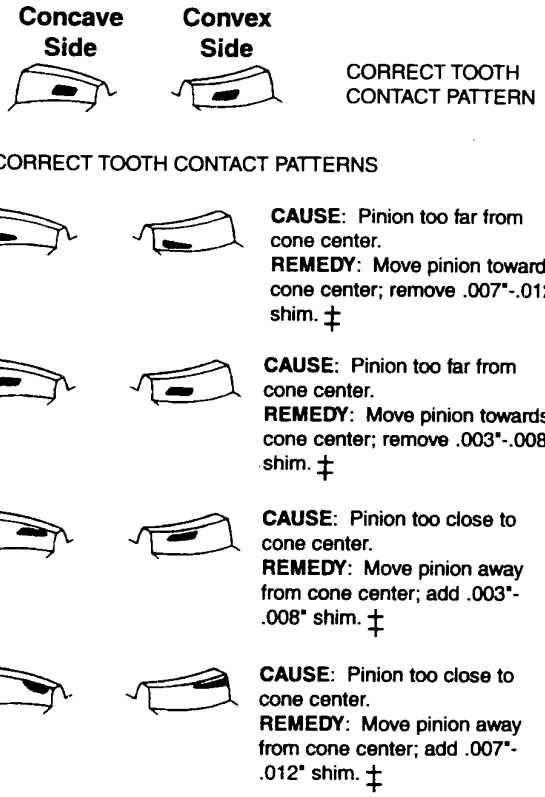
Figure 7 BEVEL PINION BACKLASH MEASUREMENT



2. Rotate the bevel pinion shaft back and forth while holding the bevel gear shaft immobile. Read the backlash (tooth clearance) on indicator. Required backlash is etched on outer diameter of the bevel gear. Measure at three locations, 120° apart on the gear and use the minimum measured value for reference at adjustment.

B. Coat a few adjacent bevel pinion teeth with bluing. Roll blued pinion teeth into mesh and oscillate pinion to transfer contact pattern onto gear teeth while rolling blued pinion teeth through gear mesh. Refer to Figure 8 for correct tooth contact patterns and steps to be taken to obtain correct tooth contact (remove or add shims to bevel pinion cage shimpack). Recheck backlash.

Figure 8 BEVEL PINION TOOTH CONTACT PATTERNS



+Use the smaller tolerances for gear diameters in the 6"-8" range. Use the larger tolerances for gear diameters over 20". If correct tooth contact pattern cannot be achieved, consult factory.

C. With correct bevel gearset contact pattern and backlash settings, reinstall bevel pinion bearing cage fasteners with Loctite high strength thread locking compound (not needed if new coated fasteners are used at final assembly) and tighten to specified torque.

D. Install low speed shaft oil seals, refer to Step 6. The lower seal cage must be removed from the unit to install the oil seal. This is best accomplished with the unit upside down.

HIGH SPEED END INSTALLATION

33. SIZE MB-53 - ALL REDUCTIONS.

A. Stand unit on end (properly supported) with high speed end up.

B. Insert key into tapered shaft keyway of bevel pinion shaft.

C. Install the taper-bored gear and all of the high speed end shaft assemblies simultaneously.

D. Dip the gear locknut in SAE 20 or heavier oil and turn it onto the shaft.

E. Tighten the locknut per one of the following methods:

1. Use a torque wrench to tighten locknut to the value specified in Table 6.

2. Hold the locknut with the "short wrench" (Table 1). Temporarily assemble high speed bearing plate to housing (Steps H through K) and turn the high speed shaft extension with a spanner wrench to the torque specified in Table 5. Turn high speed shaft clockwise on double reduction and counterclockwise on triple reduction to tighten nut.

F. Position one gasket on the housing face.

G. On double reduction units, remove the retaining ring from the outer high speed shaft bearing.

H. Tap the high speed bearing plate into position on the high speed bearing and the housing dowels.

I. Insert fasteners (with lockwashers) and crosstighten to torque specified in Table 2.

J. Replace double reduction high speed bearing retaining ring.

K. Replace high speed shaft oil seal and seal cage per Steps 6D thru 6K.

34. SIZES MB-54 through MB-59-ALL REDUCTIONS.

A. Install oil seals per Step 6 (if not previously installed). Reinstall dipstick.

B. Install high speed head gasket.

C. Install three or four eye bolts into the tapped holes around the high speed head flange.

D. Carefully lower the high speed head assembly into position on the housing and tap into place. Install threaded dowels in triple and quadruple reduction units. DO NOT damage gear teeth.

E. Insert fasteners and cross-tighten to the torque shown in Table 2.

35. MISCELLANEOUS ASSEMBLY.

A. Install oil seals per Step 6 (if not previously installed). Reinstall dipstick.

B. Position unit upright and pump specified quantity (Table 9) of NLG1 #2 bearing grease into grease lubricated low speed shaft bearings. Rotate high speed shaft while greasing bearings.

TABLE 9 - LOW SPEED SHAFT BEARING GREASE REQUIREMENTS - lbs

Unit Size	Bearing Location	Solid Output Seal Cage	Shaft End Cover
MB-53	Upper*	0.55	0.70
	Lower**	0.70	1.00
MB-54	Upper*	0.60	0.90
	Lower**	1.00	1.60
MB-55	Upper*	0.85	1.24
	Lower**	1.00	1.60
MB-56	Upper*	0.70	1.18
	Lower**	1.00	2.00
MB-57	Upper*	1.44	1.96
	Lower**	1.60	3.30
MB-58	Upper*	2.60	3.60
	Lower**	3.00	5.00
MB-59	Upper*	2.60	3.60
	Lower**	3.00	5.00

*Quantity required to fill bearing & grease chamber. Excess will be forced past grease seal into gear case.
**Quantity includes 50% reserve supply above bearing. Lower bearing with end cover is normally oil lubricated. Quantity listed is for grease lubrication option.

36. REDUCER INSTALLATION

A. Reinstall accessories (if so equipped). Tighten fasteners to specified torque in Table 2.

B. Turn gear train over by hand as a final check for internal or accessory interference. Readjust if necessary.

C. Reinstall reducer. Refer to the MB Installation and Maintenance Manual for installation instructions.

D. Fill reducer with oil to level indicated on dipstick. Refer to the MB Installation and Maintenance Manual for recommended lubricants and approximate oil quantities.

E. Run reducer without load. If reducer temperature rises more than 75°F above ambient temperature in four hours, recheck shimming of bearings.

F. After reducer runs satisfactorily, apply load. Inspect periodically until operation is deemed satisfactory. Follow preventive maintenance instructions in the MB Installation and Maintenance Manual.

MB Series Mixer Drives
Impeller Instructions

GENERAL

Impellers from Hayward Gordon Mixers are normally shipped with hubs mounted on the agitator shaft and with blades shipped loose. Blades should be installed in strict accordance with matchmarks, if any, and with bolts tightened to the torque listed below.

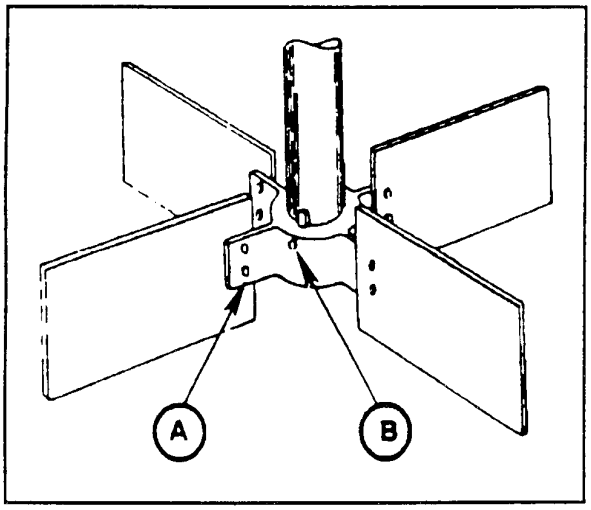
REPOSITIONING OR REMOVAL

Due to adjustment requirements or special installation procedures, it may be necessary to relocate or even remove the impeller hub from the shaft. Your Hayward Gordon impeller hub to shaft clearance is optimized to provide maximum adjustability and support with a minimum of fretting. therefore, even slight distortions and scratches may cause the hub to "hang-up".

If more than one hub is to be removed, check the shaft and hub for matchmarks. If none, mark clearly with a nonremovable indicator, noting which side of the hub is to face up.

It is safest to remove or relocate hubs while the shaft is in the horizontal position before installation. If they are to be moved while the shaft is hung vertically, a safety rope must be tied securely through one or more bolt holes and tethered from above to prevent dropping or sudden movement.

Before proceeding, remove all scratches and burrs from the shaft over which the hub must pass, as well as the hub bore. Do not use tools which might contaminate special agitator materials, such as metal files on stainless steel. Polish the shaft with emery cloth.



Liberally coat the shaft with lubricant such as molybdenum disulphide paste for ease of sliding.

Back off all setscrews. Rock the hub to loosen and firmly slide the hub away from pin applying an even load on opposite ears. The hub may be tapped lightly through a wooden block to aid in this movement. Heavier hammer blows may cause the bore to close in and grab the shaft. When hub slides clear, remove hook key.

Stop the hub at the first sign of binding on the shaft. Forcing the hub may induce galling in some materials. making removal even more difficult. Back off from the binding spot, determine the cause and correct it before continuing.

If needed, moderate heat of about 300-350°F (light straw temper color) may be applied to the hub O.D. which will expand the bore for removal over high spots. Heat concentrated on the thinner hub section over the keyslot is most effective. Never allow the temperature to rise above 450°F (dark straw to bluish temper color). When using heat, handle the hub only with heat protecting gloves.

REPLACEMENT AND SECURING

Before replacing the hub onto the shaft, check the bore for burrs or scratches. Coat the bore and shaft with molybdenum disulphide paste. If the shaft is hung vertically, attach a safety tether securely through one or more bolt holes in the hub and support from above. Install the hub with the side up as indicated by matchmarks. It is usually, although not necessarily, assembled chamferred side first.

Slide the hub to a point above its required position and replace the hook key onto the shaft. Gently lower the hub onto the key until it seats against the pin. Do not drop against the pin. Tighten set screws to torque listed below.

Install blades and tighten bolts to torques listed below.

Torque values shown are good for standard carbon and stainless steel hex head bolts as well as nickel, monel, inconel, and Alloys B,C, and 20 and are based on bolts lightly lubricated in the "as received" condition. If lubricated with molybdenum disulphide paste on threads and nut bearing face, bolt torques must be reduced to 75% of those tabulated.

All bolts should be tightened by turning nut side only.
All bolts should be re-tightened within 1 month after startup and at each scheduled shut-down.

Set Screw Torques (B)

Dia	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
Torque ft.lb	5.8	11	19	42	82	140	330	460

Impeller Blade Torques (A)

Dia	1/4	3/8	1/2	5/8	3/4	7/8	1	1-1/8	1-1/4	1-1/2
Torque ft.lb	4.8	17	43	85	130	200	270	400	500	730

MB Series Mixer Drives
Coupling Instructions

SERVICE

This section contains information for coupling alignment, trouble-shooting and tips for assembly and disassembly of the mixer drive.

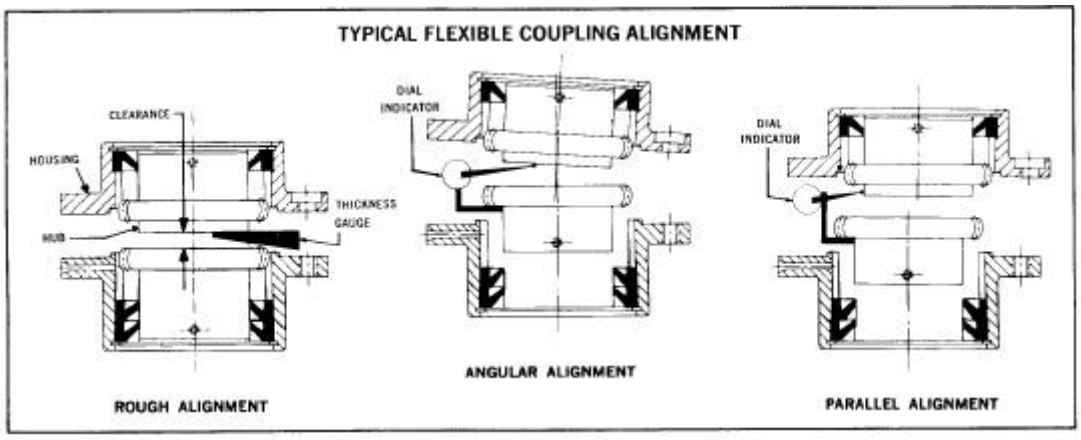
FLEXIBLE COUPLING ALIGNMENT

The MB mixer drive utilizes a flexible coupling to connect the motor shaft to the drive input shaft. Usually, the prime mover, (electric motor, hydraulic motor, etc.) is mounted by Hayward Gordon. THIS PROCEDURE FOR CHECKING AND CORRECTING COUPLING ALIGNMENT MUST BE FOLLOWED BY THE CUSTOMER EVEN IF THE MOTOR IS MOUNTED AT THE FACTORY, SINCE MISALIGNMENT MAY OCCUR DURING SHIPMENT OF THE ASSEMBLED MIXER. The coupling hubs must be separated and Steps 7 thru 11 followed. See illustration below and proceed as follows:

1. Clean unit and motor shafts and check for burrs.
2. Place key in coupling keyways to check for proper fit.
3. Place keys in shaft keyways
4. Place coupling housings on shafts.
5. Mount coupling hubs on proper shaft extensions. Check for snug fit.
6. Move prime mover into position with correct gap between coupling hubs, as shown on certified outline dimension drawing.
7. Check coupling proof diameter for run-out of the mixer drive input shaft hub.
8. Use a thickness gauge to make a preliminary rough alignment. Shim under motor as needed. Secure all mounting bolts around the base of motor.
9. CHECK ANGULAR ALIGNMENT by mounting dial indicator on the motor shaft coupling hub, with the indicator pin on the mixer drive shaft coupling hub face. Rotate the motor shaft and readings readings at 90° intervals. Shim under motor feet as necessary until the reading is a maximum of 0.003 inch Total Indicated Runout.
10. CHECK PARALLEL ALIGNMENT by relocating the dial indicator pin on the O.D. of the mixer drive shaft coupling hub Rotate the motor shaft and record dial indicator readings at 90° intervals. Shim under motor feet as necessary, until the reading is a maximum of 0.003 inches Total Indicated Runout.
11. Repeat steps 9 and 10 until both angular and parallel misalignment tolerances are satisfied. Then bolt motor securely.
12. Lubricate coupling in accordance with Section 5 and manufacturer's recommendations.
13. Recheck coupling alignment after 100 hours of mixer operation (Steps 9 and 10).

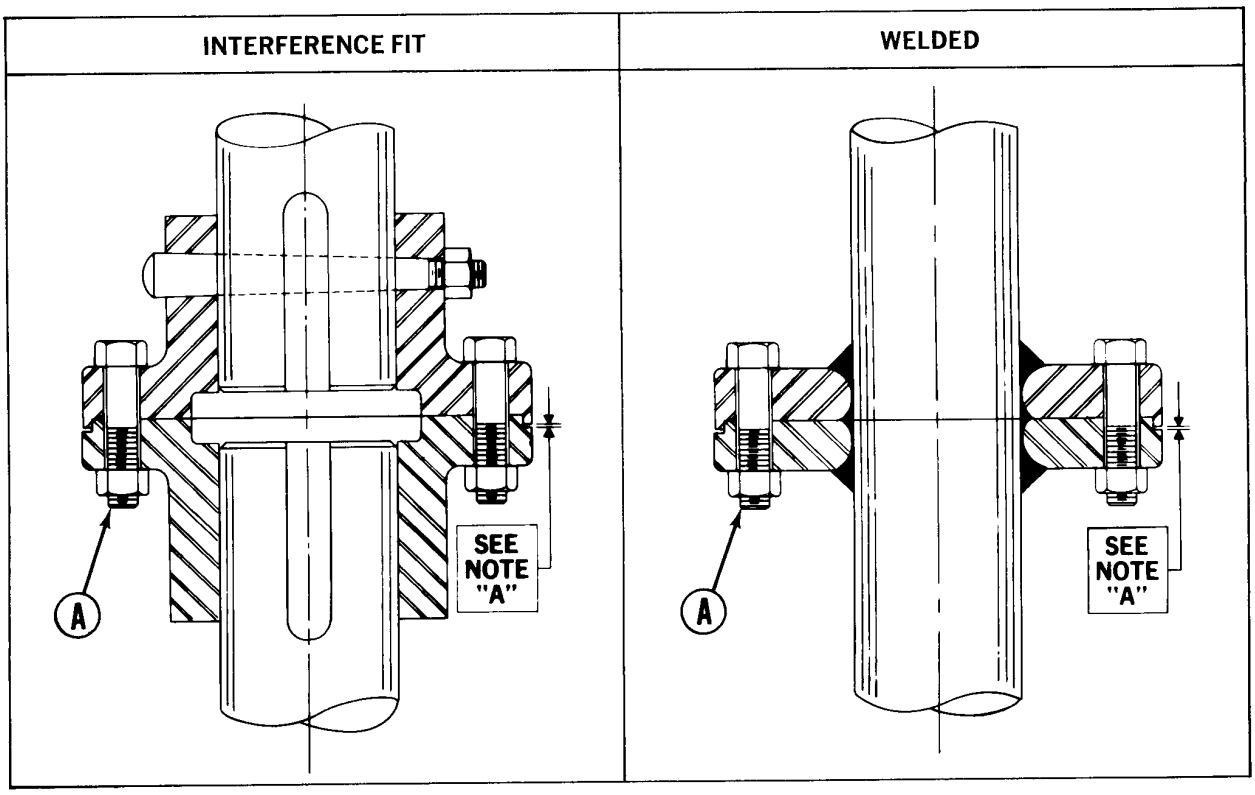
GRID AND RESILIENT TYPE COUPLINGS

See coupling manufacturer's installation and service instructions.



Rigid Couplings
(CARBON & STAINLESS STEEL)

Rigid Coupling—In many mixer applications, the lower agitator shaft as well as the mixer drive output shaft are shipped with rigid coupling halves fixed in their proper positions. Before assembly in tank, make certain that the rabbet faces of the rigid coupling are free of all foreign matter, nicks or burrs.



Note A:
A consistently even gap about the entire circumference of the coupling at this point will indicate that the mating faces are clamped even & squarely together. Gradually tighten opposing bolts until wrench torque specified in chart below fils to turn any bolt. These torques should be rechecked after three months of operation for tightness and at each scheduled shutdown

	COUPLING SIZES	2804	2806	2806S	2808	2810	2812	2816	2818	2818S	2820	2830	2830S
MAX.BORE (WELDED)	IN	2	3	3	3.5	4.5	5	5 3/4	6.25	6.25	7.25	8.5	8.5
MAX.BORE (INTER.)	IN	2	2.5	2.5	3	3.5	4	5	5.5	5.5	6.25	7	7
K.S. FOR MAX BORE	IN	1/2x3/16	5/8x7/32	5/8x7/32	3/4x1/4	7/8x5/16	1x3/8	1.25x7/16	1.25x7/16	1.25x7/16	1.25x1/2	1.75x5/8	1.75x5/8
TAPER PIN FOR MAX. BORE	NO	8	8	8	10	10	10	10	11	11	11	12	12
SIZE & NO. OF BOLTS	IN & NO	3/8-6	1/2-6	1/2-6	5/8-6	7/8-6	7/8-8	1-8	1-8	1-10	1.25-8	1.5-12	1.5-12
RECOMMENDED WRENCH TORQUE	(LB)(FT)	17.4	39	39	92	194	194	291	291	291	581	928	928

STUFFING BOX INSTRUCTIONS

GENERAL

The purpose of a stuffing box packing is NOT TO STOP leakage, but to limit it to a practical amount. If the gland is tightened to prevent leakage, packing life will be shortened and shaft damage may occur.

For best stuffing box performance, lubricant should be introduced CONTINUOUSLY at pressures between 5 to 15 psi above tank pressure.

If intermittent lubrication is provided by means of a grease gun, care must be taken to prevent over-lubrication. An amount of grease that fills the lubricant cavity and is distributed evenly throughout the packing area is sufficient for proper lubrication.

PACKING SPECIFICATIONS

The type packing furnished for this unit is specified on the main assembly drawing.

If the packing furnished is not satisfactory for the service conditions it should be replaced.

LUBRICATION

The stuffing box is shipped without lubricant because of federal regulations and the danger of using a lubricant that may contaminate the product.

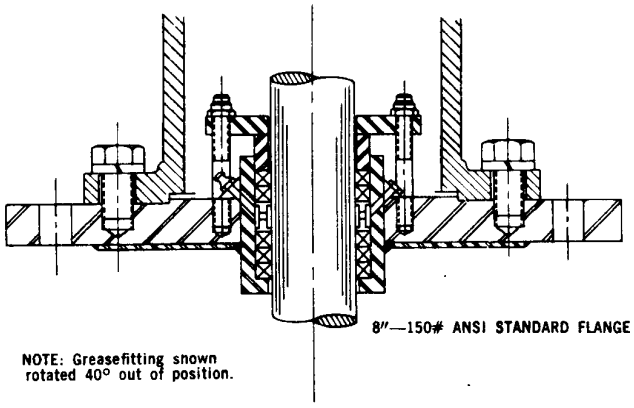
Low pressure stuffing boxes, 0-25 psi, have been impregnated with lubricant and are not supplied with lantern rings.

NOTE: Before using, please check that packing and lubricant is of high quality, physically and chemically suitable for the service conditions.

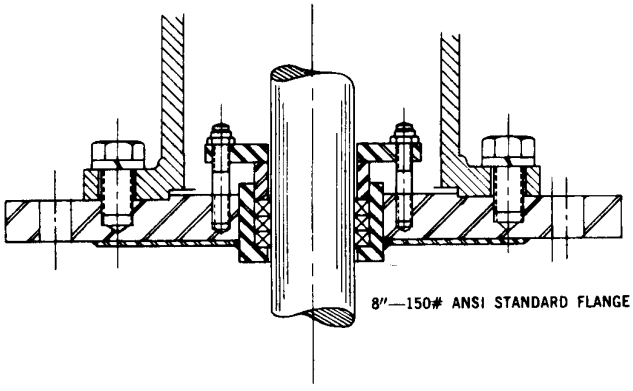
START UP INSTRUCTIONS—STUFFING BOXES

1. Prior to initial operation, all stuffing boxes should be carefully assembled in accordance with instruction on Packing Procedure, Section P1-SB, Page 2.01. In addition, the run-in procedure as outlined below should be followed to insure proper seal operation and increased packing life.

   a. Tighten the gland nuts to "finger tightness".
   b. Start the mixer and run it until the stuffing box has reached a constant operating temperature. Stop the mixer and tighten diagonally opposite gland nuts. (Note) When tightening the gland nuts, be careful to avoid cocking the gland. Even tightening of the gland will seat the packing while it is warm and plastic.
   c. Again, loosen gland nuts to finger tightness and restart the mixer. Leakage may be excessive, but do not take up on the gland nut for the first 20 to 30 minutes.
   d. If, after this initial run-in period, the leakage is still excessive, adjust the gland by tightening the nuts evenly one flat or a sixth of a turn at a time. This should be done every 30 minutes until leakage is reduced to a normal level.
   e. Adjustments must always be done gradually and held to a minimum tightness. This procedure may take several hours, but will pay dividends in increased packing and shaft life.



HIGH PRESSURE



LOW PRESSURE

MB Series Mixer Drives
Mechanical Seal Replacement

1. INTRODUCTION

a) Preparation: Lock out all electrical controls, depressurize vessel and disconnect sealant lines. Clean up area around mixer drive to keep parts clean and in proper order. Note any match marks that may affect reassembly. Provide wood skids for storing machined parts to prevent damage to machined surfaces.

2. SEAL REMOVAL

a) Remove two pedestal access covers (if applicable).

b) Disengage the rotating parts of the mechanical seal so that the shaft can slide freely thru the seal. On most single outside seals this is done by backing off the set screws in the seal locking collar located near the top of the seal. For cartridge type seals the set screws are accessed thru a port in the side of the seal cartridge.

c) Remove all but two coupling cap screws (#180), leaving 2 cap screws at 180°. Loosen these 2 screws slowly and evenly, permitting the shaft to move downward under its own weight until the shaft collar (#114) seats into flange (#129). Remove remaining cap screws.

d) Remove screws (#310) and spool shaft (#314) thru opening in pedestal (#129). Take care not to damage pilots in couplings and spool shaft.

e) Remove cap screws (#166), thrust plate (#142), coupling half (#313), and key (#167) from shaft (#140).

f) To prevent galling and to provide a lubricant between the mechanical sleeve and shaft, apply an anti galling compound such as Molykote to the shaft.

g) Remove the 4 cap screws (#162) from the seal cartridge or seal gland (#130) depending on the type of seal. The seal should now be free to slide up and off the end of the mixer shaft. DO NOT FORCE THE SEAL. If it does not slide with only a slight resistance, try spiraling the sleeve around the shaft. If it still does not move, determine the cause of hang-up before proceeding.

h) Remove the mechanical seal (#170) thru the opening in the pedestal (#129) and take to a clean room area before disassembly of seal components. A spare seal cartridge may now be installed. If the seal is to be rebuilt before replacement, cover the shaft end and vessel opening with a suitable cover to prevent vessel contamination.

3. REASSEMBLY PREPARATION

a) Inspect and clean the shaft (#150) end and remove any scratches, nicks, or burrs that may damage O-rings during reassembly. Special attention should be given to the area where the seal sleeve was previously set screwed to the shaft.

b) Inspect and clean the mating surfaces between the pedestal flange (#129) and the seal (#130) and remove any scratches, nicks, or burrs which would prevent proper sealing of the seal.

4. SEAL REASSEMBLY

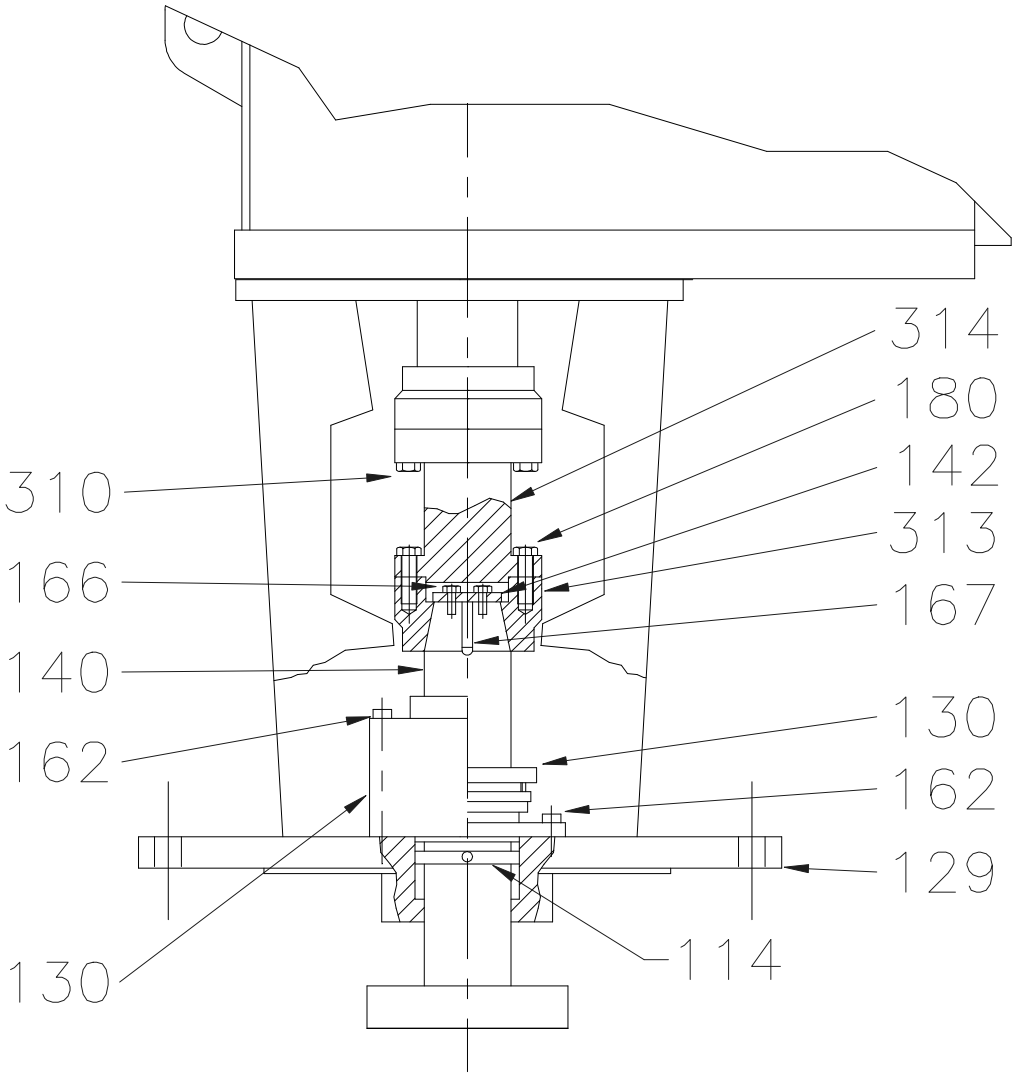
a) Apply a small amount of lubricant that is process compatible to the seal sleeve O-ring and to the shaft to facilitate sliding of the seal on the agitator shaft. Special care should be taken when sliding O-rings over keyways or other shaft features to prevent damage.

b) Lower the seal (#130) on the agitator shaft (#140) until it seats on the pedestal/flange (#120). Bolt the seal to the flange with 4 cap screws (#162). Torque the screws to the value shown in Service Instructions, Table 4, Page 4.

c) Assemble the coupling (#313) and key (#167) to the agitator shaft (#140). Assemble thrust plate (#142), using cap screws (#166). Torque screws to the value shown in Service Instructions, Table 4.

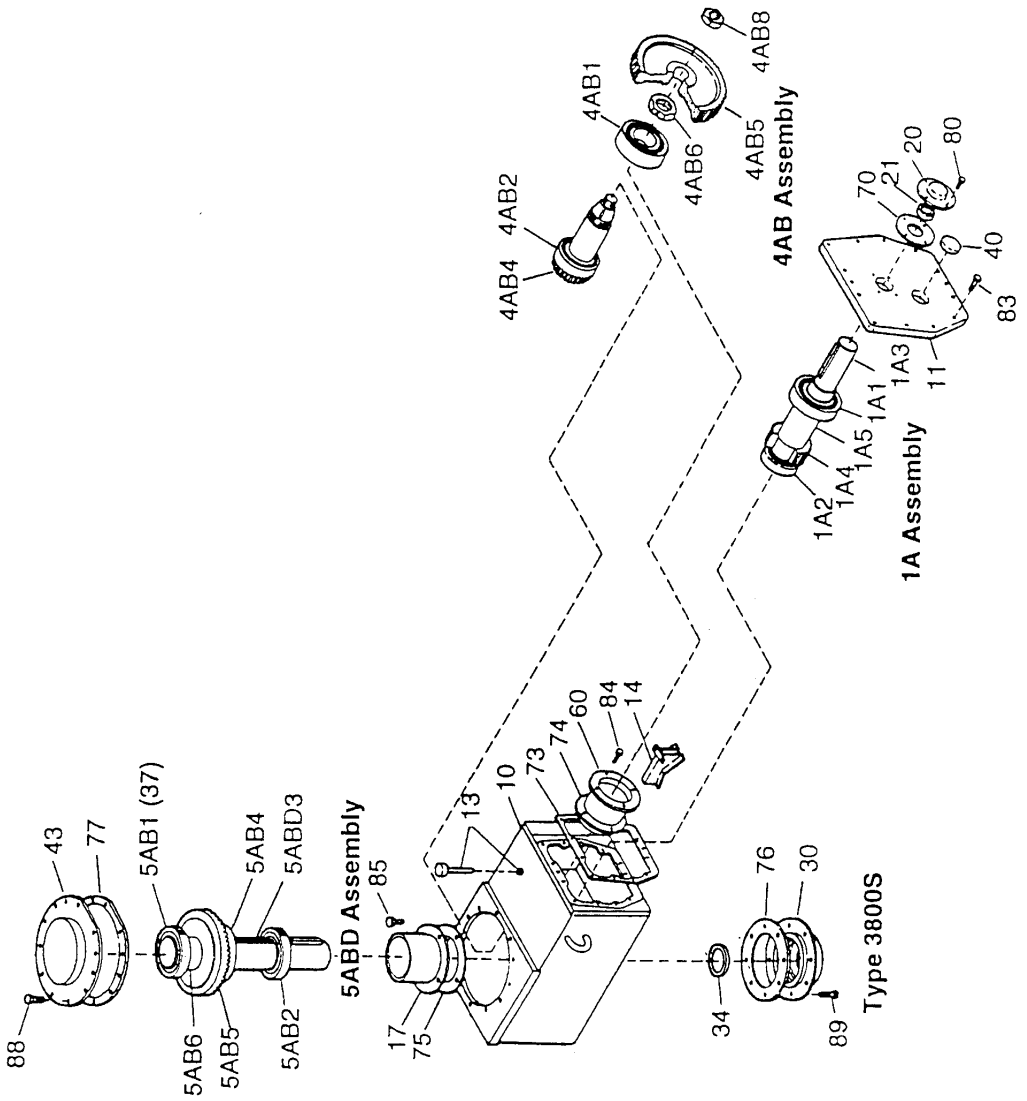
d) Insert spool shaft (#314) between removable couplings and bolt to the upper coupling half using cap screws (#310). Torque screws to the value shown in service instructions, Table 4.

e) Install all cap screws (#180) loosely in position. Draw the shaft up by tightening 180° opposite screws 1/2 turn at a time until the coupling half (#313) engages spool shaft (#314). Tighten and torque all screws to the value shown in Table 4.
f) Set the seal compression to the seal manufacturer's recommendation. Tighten the driving set screws.
g) Reconnect and test sealant lines and electrical lockout. Confirm direction of rotation and that there are no in-tank obstacles.
h) Replace the pedestal/flange access covers.
i) Check drive oil and grease levels. Check all fasteners, fittings, vents, plugs and connections that may have loosened during maintenance

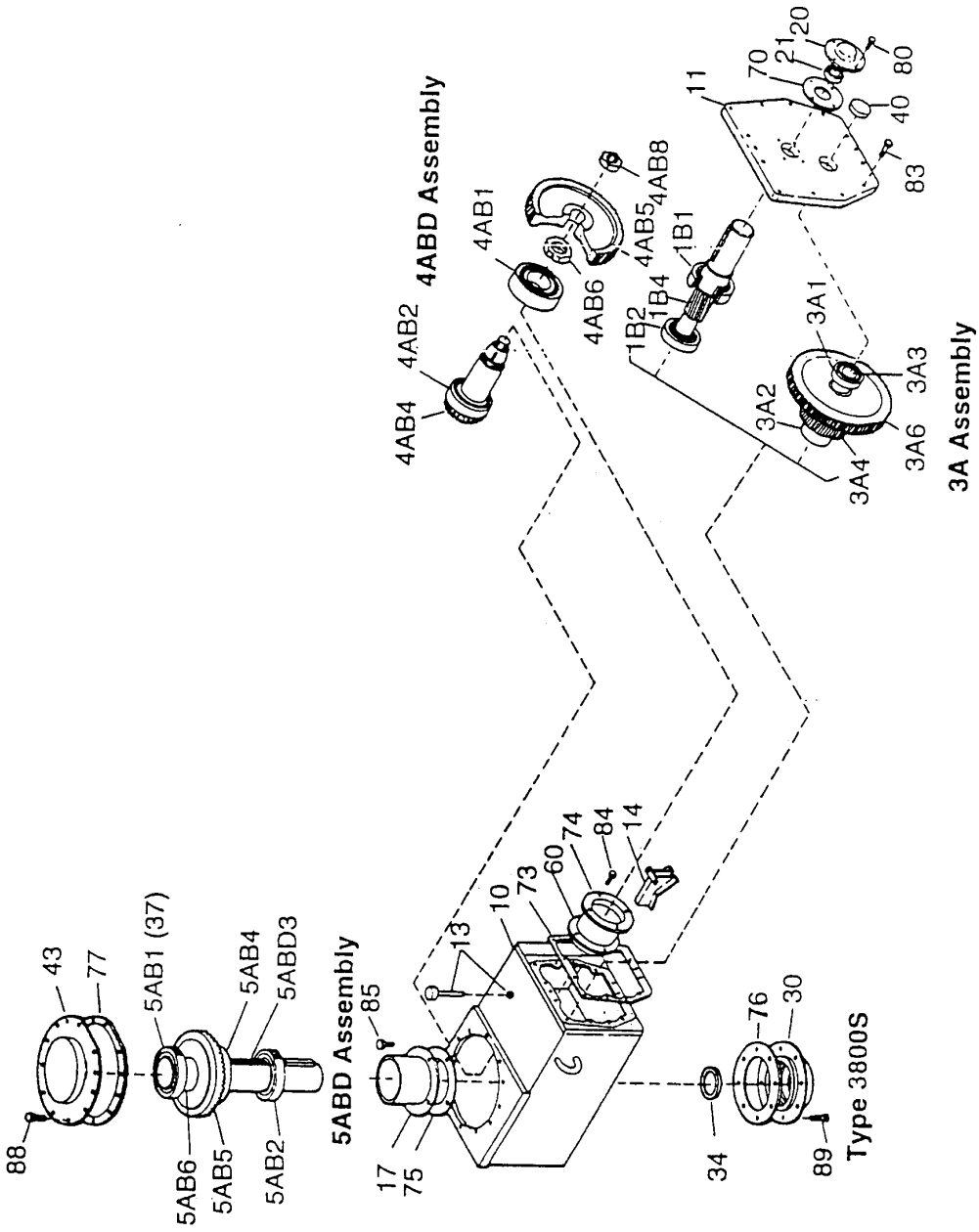


ITEM	DESCRIPTION	ITEM	DESCRIPTION
114	SUPPORT COLLAR	166	CAP SCREWS
129	MOUNTING FLANGE	167	KEY
130	MECHANICAL SEAL	180	CAP SCREWS
140	STUB SHAFT	310	CAP SCREWS
142	THRUST PLATE	313	COUPLING
162	CAP SCREWS	314	SPOOL SHAFT

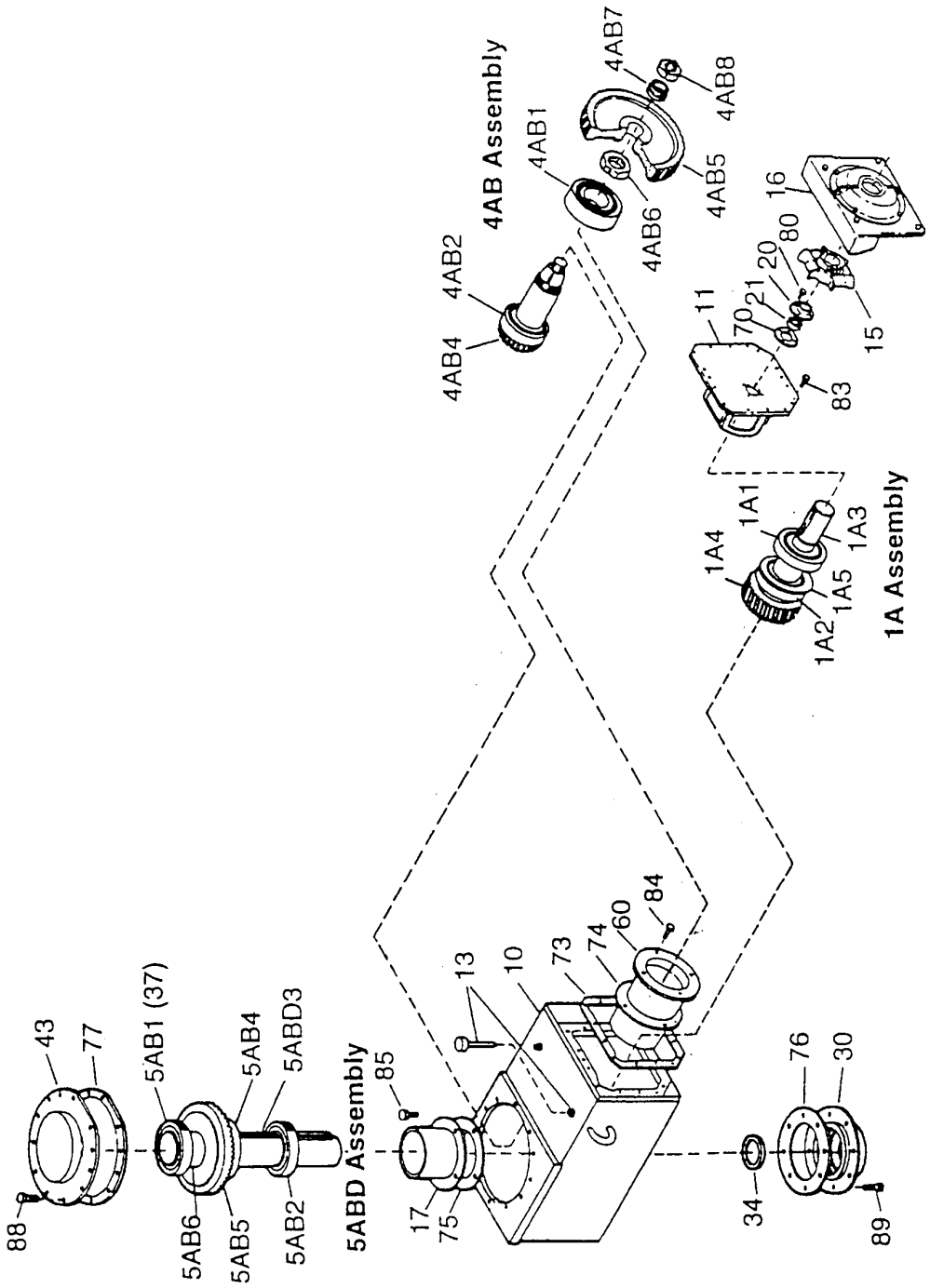
MB Series Mixer Drives
MB-53 Double Reduction Assembly



MB Series Mixer Drives
MB-53 Triple Reduction Assembly



MB Series Mixer Drives
MB-54-59 Double Reduction Assembly



MB Series Mixer Drives
MB-54 59 Triple Reduction Assembly